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D4.2 - CENTAUR Demonstration Plan v2 (hot case)

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TABLE OF CONTENTS

1 EXECUTIVE SUMMARY 6

2 INTRODUCTION 6
2.1 Scope of the Document 6
2.2 Definition, abbreviations and acronyms 7
2.3 Applicable and reference documents 10

3 Design of hot case demonstrators 12
3.1 Demonstrators objectives 13
3.1.1 Common objectives with cold case demonstrators 13
3.1.2 Objectives specific to hot case demonstrators 13
3.2 Demonstrator cycles 14
3.2.1 Risk phases in the demonstrator cycles 14
3.2.2 Steps in the demonstrator cycles 15
3.2.3 Demonstrator time plan 15
3.3 Urban Flood demonstrator scenarios 16
3.3.1 Spanish scenario (Ebro basin) 17
3.3.2 Italian scenario (Piedmont region) 20
3.3.3 French scenario (Landes) 27
3.4 Water and Food Security demonstrator scenarios 30
3.4.1 Somalian scenario 30
3.4.2 Malian scenario 33
3.5 Cross-cutting demonstrator scenario: the Mozambique cold case 36
3.6 Challenges, limitations and proposed solutions 41
3.6.1 Challenges in the preparation of scenarios 42
3.6.2 Challenges in the execution of scenarios 43
3.6.3 Challenges in the evaluation of scenarios 44

4 DEMONSTRATORS ASSESSMENT 45
4.1 Definition of validation criteria for products 45
4.1.1 Assessment reliability (thematic quality) 46
4.1.2 Consistency assessment 51
4.1.3 Usability assessment, metadata consistency 52
4.1.4 Summarised validation table 53
4.1.5 Parameters under validation for each product/indicator 54
4.2 Platform validation 55
4.3 User and service providers satisfaction evaluation questionnaires 55
4.3.1 End-user questionnaire 56
4.3.2 Service provider questionnaire 57
4.3.3 Analysis of the Questionnaires 58
4.4 Assessment steps and timeline 59

5 CONCLUSIONS 61

APPENDIX A CENTAUR User Questionnaire 62

APPENDIX B CENTAUR Service Provider Questionnaire 74

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LIST OF FIGURES

Figure 1: Structure of WP4 and its relationship to other work packages. 7
Figure 2: Selection of use cases assessed in CENTAUR during the hot phase demonstration. 12
Figure 3: Simplified view of a demonstrator cycle. 14
Figure 4: Hot cases general workflow. 60

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LIST OF TABLES

Table 1: Applicable and reference documents. 10
Table 2: Sample scenario structure for hot case scenarios. This structure applies to all three risk phases of the demonstrator cycle, including early warning, event monitoring, and product and service assessment. 15
Table 3: Mapping between use cases and CEMS RM activations. 16
Table 4: Early warning phase for the Spanish scenario (Ebro basin). 17
Table 5: Event monitoring phase for the Spanish scenario (Ebro basin). 18
Table 6: Product and service assessment phase for the Spanish scenario (Ebro basin). 20
Table 7: Early warning phase for the Italian scenario (Turin Centre – Meisino). 21
Table 8: Event monitoring phase for the Italian scenario (Turin Centre – Meisino). 21
Table 9: Product and service assessment for the Italian scenario (Turin Centre – Meisino). 23
Table 10: Early warning phase for the Italian scenario (Ceva Centre). 24
Table 11: Event monitoring phase for the Italian scenario (Ceva Centre). 24
Table 12: Product and service assessment for the Italian scenario (Ceva Centre). 26
Table 13: Early warning phase for the French scenario (Landes). 27
Table 14: Event monitoring phase for the French scenario (Landes). 28
Table 15: Product and service assessment phase for the French scenario (Landes). 30
Table 16: Early warning phase for the Somalian scenario. 31
Table 17: Event monitoring phase for the Somalian scenario. 32
Table 18: Product and service assessment phase for the Somalian scenario. 33
Table 19: Early warning phase for the Malian scenario. 33
Table 20: Event monitoring phase for the Malian scenario. 35
Table 21: Product and service assessment phase for the Malian scenario. 35
Table 22: Early warning phase the Mozambique scenario. 36
Table 23: Event monitoring phase for the Mozambique scenario. 39
Table 24: Product and service assessment phase for the Mozambique scenario. 41
Table 25: Types of attribute to be validated. 46
Table 26: Types of validation data. 46
Table 27: Confusion matrix for a binary classification (two categories). 48
Table 28: Confusion matrix for a multiclass classification (> two categories). 48
Table 29: Validation parameters applied per raster (R) or vector (V) CENTAUR indicator/index. 53
Table 30: Validation plan for UF – Reliability assessment. 54
Table 31: Tentative validation plan for UF – Consistency assessment. 54
Table 32: Tentative validation plan for UF – Usability assessment. 55
Table 33: General description of the end-user questionnaire. 56
Table 34: A tentative list of users that could be engaged in filling out the questionnaire. 57
Table 35: General description of the service provider questionnaire. 57

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1 EXECUTIVE SUMMARY

This document serves as a preliminary version of the final release for D4.2.

The present document corresponds to deliverable *D4.2 – CENTAUR Demonstration Plan v2 (hot case)* of the CENTAUR project. It falls under Work Package *WP4 – Climate change crisis and natural disaster demonstrators*, under Task *T4.1 – Demo design, performance identification and validation criteria/EMS Urban Flood* and Task *T4.2 - Demo design, performance identification and validation criteria/SEA Water & Food security*.

Herein, the document describes:

- Hot case objectives.
- Hot case cycles.
- Hot case scenarios.
- Validation criteria for hot cases.
- Questionnaires for users and service providers.

The information provided in this document will be the **basis for all the demonstrators in the hot case phase**, where the CENTAUR system will run in a pre-operational mode on future crises occurring during the project's lifetime, and will be assessed in terms of effectiveness.

The goal of this document is to prepare the hot case phase, that will span months 22 to 33 of the project. Thus, it is the basis for *T4.3 – Demo execution* and *T4.4 – Demo assessment*. Finally, D4.2 will further be built upon with the release of *D4.4 – CENTAUR demonstration operational report and validation result v1 - hot cases (intermediate)* [RD01] and *D4.5 – CENTAUR demonstration operational report and validation result v2 - hot cases (final)* [RD02], focusing on the analysis of results from the hot case phase, assessing the effectiveness of the CENTAUR services and providing recommendations for the medium and/or long terms.

2 INTRODUCTION

2.1 SCOPE OF THE DOCUMENT

This document is produced under *WP4 – Climate Change Crisis and Natural Disaster Demonstrators*. The work package aims at **testing the CENTAUR system on real-life scenarios**. Its goal is to initiate the work on demonstrating the strengths of indicators, indexes and other services provided through the project. To assess CENTAUR's potential, the demonstrations are set to occur following a **dual-phase scheme** (Figure 1).

The first phase spans months 16 to 21 of the project, during which the CENTAUR system is deployed on **cold cases**. They correspond to well-known past or ongoing Copernicus CEMS and SESA crisis events. Each Copernicus service has its own track within the project:

- Urban Floods (UF) for Copernicus CEMS [RD03].
- Water & Food Security (WFS) for Copernicus SESA [RD04].

The second phase spans months 22 to 33 of the project. During this period, the system is tested in real-time on **hot cases**. They correspond to extreme events that are likely to unfold during the lifetime of the project.

This document describes the activities of T4.1 and T4.2, in which the **demonstrator scenarios have been designed**, as well as **performance** and **validation criteria**. Both tasks aim at highlighting the effects of climate change on urban

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flooding and food & water security, respectively. More specifically, this deliverable targets the hot phase, that spans months 22 to 33 of the project and will directly leverage the findings drawn from cold cases.

Figure 1: Structure of WP4 and its relationship to other work packages.

To cover the above objectives, the document has been structured into the following chapters:

- Chapter 1: Executive summary.
- Chapter 2: Introduction, including scope of the document, definitions, abbreviations, acronyms, and reference documents.
- Chapter 3: Hot case demonstrator design.
- Chapter 4: Demonstrator assessment.
- Chapter 5: Conclusions.

WP4 draws from other **past or ongoing work packages**. Indeed, D4.2 is the continuation of *D1.2 - Report on CENTAUR Use Cases and Indexes definition* [RD05], which provides a comprehensive description of the selected use cases, as well as of *D4.1 – CENTAUR Demonstration Plan v1 (cold case)* [RD06], which describes the cold case demonstration scenarios, as well as performance and validation criteria. Moreover, hot case demonstrators will be based on the experience acquired during the execution of cold cases, leveraging user and service provider feedback, as well as validation results. They will provide actionable hindsight, resulting in **iterative improvements of the methodologies** developed within the project, *WP2 – Thematic Product Engineering* in particular. This is likely to have consequences on input and output data, described in *D2.1 – Catalogue of CENTAUR data and related specifications* [RD07]. The output data in question will be part of the crisis packages delivered to end-users during demonstrators. Several deliverables, some already available, describe their design and corresponding workflows, including *D2.2 – Urban Flood and Water & Food Security design* [RD08] and *D2.3 – Urban Flood and Water & Food Security service pipelines v1 (baseline set up)* [RD09]. Finally, demonstrators will also integrate into the CENTAUR platform, developed as part of *WP3 – Service deployment*.

2.2 DEFINITION, ABBREVIATIONS AND ACRONYMS

Acronym	Description
ACLED	Armed Conflict Location & Event Data Project
AEMET	Spanish Meteorological Agency
AOI	Area Of Interest

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Acronym	Description
API	Application Programming Interface
ARPA	Regional Agency for the Protection of the Environment
CCR	French Public Reinsurance Company
CEMS	Copernicus Emergency Mapping Service
CENTAUR	Copernicus ENhanced Tools for Anticipative response to climate change in the emergency and secURity domain
CHE	Ebro Hydrographic Confederation
CNIG	Spanish National Geographic Information Centre
CNR IRPI	Research Institute for Geo-Hydrological Protection
D	Deliverable
DIFI	Drought Impact Forecast Index
DSM	Digital Surface Model
DTM	Digital Terrain Model
DWD	German Weather Service
EM	Event Monitoring
EMS	Emergency Mapping Service
EO	Earth Observation
EPRI	Preliminary Flood Risk Assessment
EU	European Union
EW	Early Warning
FAO	Food and Agriculture Organization of the United Nations
FEWSNET	Famine Early Warning Systems Network
FEWI	Flood Early Warning Index
FII	Flood Impact Index
GDB	GeoDataBase
GPCC	Global Precipitation Climatology Center
GPS	Global Positioning System
GT	Ground Truth
HR	High Resolution

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Acronym	Description
ID	Indicator
IDP	Internally Displaced Persons
INE	Spanish National Statistics Institute
InSAR	Interferometric SAR
IX	Index in the context of Urban Floods High-level service in the context of Water & Food Security
KPI	Key Performance Indicator
LiDAR	Light Detection And Ranging
LST	Land Surface Temperature
LULC	Land Use and Land Cover
MASE	Italian Ministry of the Environment and Energy Security
ML	Machine Learning
MMU	Minimum Mapping Unit
NDVI	Normalized Difference Vegetation Index
NDWI	Normalized Difference Water Index
NRT	Near Real Time
OSM	Open Street Map
PNOA	Spanish National Aerial Orthophotography Plan
PSA	Product and Service Assessment
QC	Quality Control
RD	Reference Document
RM	Rapid Mapping
RMSE	Root Mean Square Error
SAR	Synthetic Aperture Radar
SatCen	European Union Satellite Centre
SEA	Copernicus Service in Support to EU External Action
SESA	Copernicus Service in Support to EU External and Security Actions
SIGEA	Italian Society of Environmental Geology
SNCZI	Spanish National Flood Zone Mapping System

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Acronym	Description
SWOT	Strengths, Weaknesses, Opportunities and Threats
T	Task
TRI	Territory at significant Risk of Flooding
UF	Urban Floods
UNSOS	United Nations Support Office in Somalia
UTC	Coordinated Universal Time
VHR	Very High Resolution
WFS	Water & Food Security
WP	Work Package

2.3 APPLICABLE AND REFERENCE DOCUMENTS

Table 1: Applicable and reference documents.

ID	Document name
[RD01]	D4.4 – CENTAUR demonstration operational report and validation result v1 - hot cases (intermediate)
[RD02]	D4.5 – CENTAUR demonstration operational report and validation result v2 - hot cases (final)
[RD03]	Copernicus Emergency Management Service – Rapid Mapping and Risk & Recovery: https://emergency.copernicus.eu/
[RD04]	Copernicus Service on Support to EU External and Security Actions: https://sesa.security.copernicus.eu/
[RD05]	D1.2 – Report on CENTAUR use cases and indexes definition
[RD06]	D4.1 – CENTAUR Demonstration Plan v1 (cold case)
[RD07]	D2.1 – Catalogue of CENTAUR data and related specifications
[RD08]	D2.2 – Urban flood and Water & Food Security design
[RD09]	D2.3 – Urban Flood and Water & Food Security service pipelines v1 (baseline set up)
[RD10]	D4.3 – CENTAUR demonstration report and validation result - cold cases
[RD11]	D1.1 – Report on Urban Flood and Water & Food security indicators
[RD12]	D6.1 – Communication Strategy and Action Plan
[RD13]	CENTAUR Project Proposal

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ID	Document name
[RD14]	D4.4 – CENTAUR demonstration operational report and validation result v1 - hot cases (intermediate)
[RD15]	D2.5 – Multi-Criteria Indexes Design
[RD16]	D4.5 – CENTAUR demonstration operational report and validation result v2 - hot cases (final)
[RD17]	D3.5 – CENTAUR Integrated platform test document v1 (baseline)

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3 DESIGN OF HOT CASE DEMONSTRATORS

The **selection of demonstrators** in the CENTAUR project was guided by the analysis of several factors. It was performed in WP1, and detailed in D1.2 [RD05]. The project deploys its innovative tools in seven distinct use cases in Spain, Italy, France, Somalia, Mali, and Mozambique (Figure 2). Notably, Mozambique serves a dual role as a cross-cutting demonstrator. These cases have been developed to answer challenges associated with the **monitoring of urban floods** and **water & food security**, addressing one or both issues as needed.

In contrast to the cold case phase, the hot case demonstrators will not include the German use case previously highlighted in D4.1 [RD06] and D4.3 [RD10]. This decision stems from the low likelihood of Germany experiencing another extreme event within the project's lifecycle. Consequently, greater emphasis will be placed on advancing the other demonstrators.

Figure 2: Selection of use cases assessed in CENTAUR during the hot phase demonstration.

Although **use cases for the hot phase were strategically chosen based on the likelihood of crises occurring during the project's lifespan**, there remains **uncertainty about the occurrence of such events**, and thus the feasibility of assessing the CENTAUR system in a pre-operational context. To address this, several optional use cases have been identified as backups. Nonetheless, data collection and preparation for these additional cases would entail significant effort. Given that comprehensive national datasets have already been compiled for the designated use cases, one potential strategy could be to leverage these existing resources should a relevant event arise within the same country, albeit outside the specific areas of the demonstrators. This approach would optimize the use of already available data, reducing the need for extensive new data gathering. In any case, it is no longer planned to support optional use cases.

A thorough review of D1.2 [RD05] and D4.1 [RD06] is recommended to gain a comprehensive understanding of each demonstrator, including the criteria behind their selection and their importance to the project. Additionally, D4.3 [RD10] offers valuable insights into the outcomes of the cold case phase.

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3.1 DEMONSTRATORS OBJECTIVES

Like their cold case counterparts, the hot cases demonstrators were designed to **highlight the potential of CENTAUR to support the evolution of Copernicus EMS and SESA portfolios** with reliable and robust products. They aim to demonstrate the contribution of CENTAUR to advancing technological solutions, addressing key socio-economic and ecological challenges, and guide stakeholders and policymakers to make well-informed decisions regarding urban flood and water & food security management.

Generally speaking, the primary objective of hot case demonstrators is to **provide end-users with products describing crisis events that might occur between months 22 (September 2024) and 33 (August 2025) of the project**. However, several other objectives have also been identified, and described in subsections 3.1.1 and 3.1.2.

3.1.1 Common objectives with cold case demonstrators

Several objectives identified for the cold case phase also apply to hot case demonstrators. This subsection includes an overview of these objectives, while a more thorough description is available in D4.1 [RD06].

Technological innovation: Integrate new technological components based on remote sensing, data analytics, and predictive modelling to address climate change and security challenges. Use case demonstrators aim to showcase the performance of the CENTAUR system in real-world scenarios, providing reliable and actionable information. These demonstrators will validate innovations that enhance early warning and risk analysis capabilities, ensuring scalability and adaptability across diverse urban, rural and climatic contexts.

Socio-economic and environmental impact: Provide reliable indicators and services to evaluate and predict the socio-economic and environmental impacts of these hazardous events. Testing during the demonstrator phase will ensure the validity and robustness of these products.

Stakeholder engagement and policy support: Involvement of government bodies and stakeholders to integrate local knowledge and validate services and data. The demonstrator cycle plans seeking for feedback and support, and facilitating data sharing. Additionally, it aims to enhance end-user capacities through access to new services, demo sessions, and training, with workshops planned after month 21, once the cold case phase is finished.

3.1.2 Objectives specific to hot case demonstrators

The purpose of **hot cases** is to **test the operational readiness of products and services** by delivering them on a tighter schedule, in line with end-user operational needs. This contrasts with cold case demonstrators, corresponding to longer-term and low-intensity scenarios that allow for more in-depth analysis and preparation.

The hot case demonstrators aim to **enhance real-time risk assessments and early warning systems** to effectively address urban floods and water and food security challenges. By leveraging current weather data, flood models, and predictive analytics, the demonstrators will **inform near-immediate response actions**. The deployment and testing of advanced early warning systems, leveraging remote sensing technologies and data analytics, will ensure timely alerts during active flood events and potential threats to water and food security. Real-time data from remote sensing and media will be used to create high-level products, providing accurate and actionable information to mitigate the impact of these crises.

To **support rapid and effective relief and recovery efforts**, the hot case demonstrators will conduct immediate socio-economic and environmental impact assessments. In the future, these assessments could inform both short-term responses and long-term planning, ensuring that affected communities receive the necessary support. Collaboration with authorities will be key to streamline response procedures during active emergencies. By working closely with local and regional stakeholders, the demonstrators aim to enhance the efficiency and coordination of response efforts.

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Finally, the CENTAUR platform will **facilitate real-time data sharing among stakeholders during live crises**, enabling coordinated and informed decision-making. Additionally, the demonstrators will promote rapid interdisciplinary collaboration to address urgent challenges, bringing together thematic products from various fields to enhance response strategies. Continuous monitoring and evaluation of crisis impact will allow for the adjustment and improvement of strategies, ensuring the robustness of the proposed system. These efforts collectively aim to improve early warning, risk analysis, and response capabilities, addressing both urban floods and water and food security.

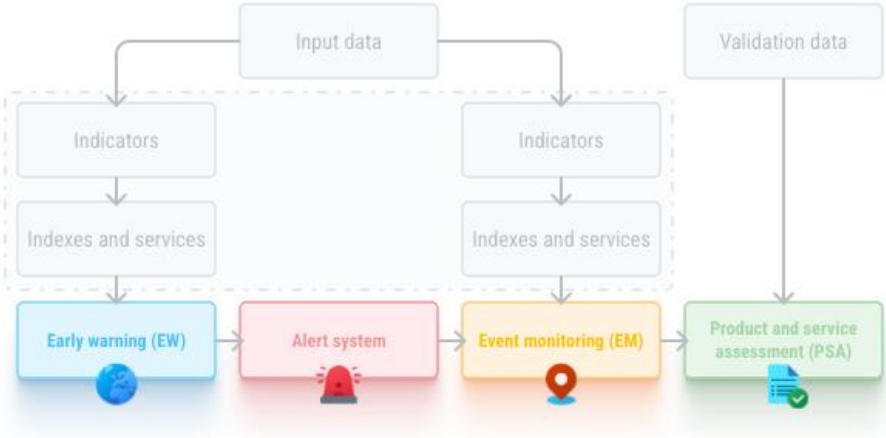
3.2 DEMONSTRATOR CYCLES

To **ensure continuous improvement and scalability** of the CENTAUR system, **demonstrator cycles** were designed to provide a structured approach to implementing, assessing, and refining indicators, indexes, and services. Each phase builds upon the previous, allowing for iterative development, based on real-world testing and end-user feedback. During the hot phase specifically, the CENTAUR system will be deployed in a pre-operational manner, drawing from the findings of the cold case phase, spanning months 16 to 21.

3.2.1 Risk phases in the demonstrator cycles

The **demonstrator cycle for hot cases** was adapted from the one established for cold cases, as detailed in D4.1 [RD06]. Despite these adaptations, the core structure remains unchanged, consisting of **three risk phases** including (a) early warning, (b) event monitoring and (c) product and service assessment. While the sequence of steps in each phase mirrors those of cold cases, they have been reordered to better align with the dynamic requirements of live crises. This reconfiguration ensures that the CENTAUR system is both responsive and effective in real-time operational contexts.

Figure 3: Simplified view of a demonstrator cycle.



The **first risk phase** is the **early warning (EW)** component of CENTAUR, where the system engages in a continuous, global-level monitoring. To perform this task, it leverages a specific set of indicators, designed to identify areas susceptible to crisis events, ensuring timely and effective responses.

The **second risk phase** is centred on the **event monitoring (EM)** component of CENTAUR. Either triggered by a user, or by an alert from the early warning system, this phase narrows its focus to a high-stakes area, corresponding to the extent of our use cases. It aims to provide the stakeholders with comprehensive indicators that describe the full scope and impact of the event, taking into account physical, social and economic factors.

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Finally, the **third risk phase** corresponds to the **product and service assessment (PSA)**, ensuring that indicators, indexes and services comply with Copernicus EMS and SESA requirements and quality standards. Two main channels are explored to perform this assessment, including:

(1) **Collection of end-user and service provider feedback** through questionnaires. This task depends on stakeholder engagement.
(2) **Validation of generated products with independent data**. This particular task depends on the availability of validation data.

3.2.2 Steps in the demonstrator cycles

Each risk phase within the CENTAUR project consists of several steps, organized into four distinct categories that encapsulate the lifecycle of a given product, including:

(1) **Preparation:** This initial category involves steps that were mostly executed during WP1. It includes the creation, collection, and preparation of all necessary input data for developing an indicator, index, or service. This category also encompasses the preparation of validation data, which was carried out in T4.1 and T4.2.
(2) **Production:** During these steps, service providers leverage the prepared input data to generate indicators, indexes, and services, adhering to the thematic product engineering guidelines established in WP2.
(3) **Delivery:** The completed thematic products are uploaded to the CENTAUR platform. Both end-users and service providers are notified about the product's availability. For service providers, this notification facilitates the integration of the product as a potential input for their own indicator, index or service. For end-users, it provides access to high-level data essential for assessing the impact of specific crisis events.
(4) **Validation:** The final category involves gathering feedback from end-users and service providers, assessing the effectiveness of indicators, indexes, and services using independent validation data, and compiling an inventory of recommendations for future improvements. This phase also includes the dissemination of results, lessons learned, and recommendations to ensure continual enhancement of the project.

3.2.3 Demonstrator time plan

A **standard scenario** was developed to ensure **uniformity** across hot cases. Its structure is directly inspired by the scenario developed for the cold phase but was adapted to better reflect the real-time processing of crisis events. Table 2 provides a generic view of the proposed time plan, regarding these considerations.

Table 2: Sample scenario structure for hot case scenarios. This structure applies to all three risk phases of the demonstrator cycle, including early warning, event monitoring, and product and service assessment.

Step	Risk phase	Category	Delivery date	Description	Roles and responsibilities
1	EW	Production	T_{-m}	Example of step related to the early warning monitoring	Partner 1
2	EM	Delivery	T_0	Example of step related to the event-driven monitoring	Partner 2: Subtask 1 Partner 3: Subtask 2
3	PSA	Validation	T_{+n}	Example of step related to the product and service assessment phase	Partner 1

All the data used in these steps were initially gathered during the preparation phase for the cold cases and are detailed extensively in D2.1 [RD07]. Several data sets and indicators not related to a specific crisis are also unlikely to change between the cold and hot phases, unless there are updates to the original data set itself, the processing pipeline or area of interest. These so-called **static data sets** are indicated by a pin 📌 icon in scenario tables. However, additional data that was not initially planned may be used for tasks such as validation. This will be outlined in subsequent deliverables when applicable.

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The listed **delivery dates** serve as targets for completing specific tasks or producing deliverables. These dates are not fixed but rather indicate the sequence of execution steps, which may require varying amounts of time; some tasks might take less than a day, while others could take longer or be carried out simultaneously. Therefore, these delivery dates offer a structured overview of the process, illustrating the expected sequence in which products will be developed and delivered. In any case, delivery dates are structured around the shift between the early warning and the event monitoring components, as follows:

- T_{-m}: Early warning component.
- T_0: Transition from the early warning component to the event monitoring component. When applicable, it might correspond to an alert system, indicating hazardous conditions over a given area of interest.
- T_{+n}: Event monitoring component. Product and service assessment is performed after all preparation, production and delivery steps have been performed.

Each step identifies **key stakeholders**, playing critical roles in production, validation, delivery, notification and feedback provision. This structured approach not only enhances project management efficiency but also ensures stakeholder engagement and accountability throughout the project lifecycle.

Finally, through several **quality checks and validation stages**, this standard scenario incorporates a mechanism for **continuous feedback and iterative refinement**. During this process, service providers will solicit end-users to collect feedback on their respective use cases. This will possibly result in improvements to the system, in relation to other work packages, especially WP2 and WP3. The process ensures that all the scenarios remain responsive to real-world complexities, by allowing the service providers to fine-tune their pipelines and workflows, as they will also answer questionnaires to provide feedback on production.

The CENTAUR hot case scenarios are described in subsections 3.3, 3.4 and 3.5, focusing on the UF, WFS and cross-cutting use cases respectively. Scenarios are split into in 3 tables each – early warning, event monitoring and evaluation –, which depict the lifecycle of a demonstration through different risk phases. The entire demonstration package for hot case scenarios will span months 22 to 33. A more fine-grained schedule cannot be provided, due to the uncertain nature of crisis events.

3.3 URBAN FLOOD DEMONSTRATOR SCENARIOS

Scenarios for urban floods draw from **historical Copernicus EMS activations**, with detailed information provided in Table 3, including specifics about the areas of interest and hyperlinks for accessing related crisis information. Further details are available in D1.2 [RD05].

Table 3: Mapping between use cases and CEMS RM activations.

Use case	AOI	Responsible entity	CEMS activation
Spain	Zaragoza, Ebro basin	Tracasa	EMSR555 https://emergency.copernicus.eu/mapping/list-of-components/EMSR555
Italy	Turin Centre – Meisino	Ithaca	EMSR192 https://emergency.copernicus.eu/mapping/list-of-components/EMSR192
Italy	Ceva Centre	Ithaca	EMSR468 https://emergency.copernicus.eu/mapping/list-of-components/EMSR468
France	Dax, Landes	CLS	EMSR492 https://emergency.copernicus.eu/mapping/list-of-components/EMSR492
Mozambique	Beira	e-GEOS	EMSR348 https://emergency.copernicus.eu/mapping/list-of-components/EMSR348

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During the cold phase, the CENTAUR system was deployed on these past activations. The corresponding insights and outcomes are described in D4.1 [RD06] and D4.3 [RD10]. The hot phase will continue **to focus on the same areas of interest**, aiming to provide insights into ongoing crises. As previously stated, **backup strategies** are still under discussion to account for the potential absence of floods over these areas during the hot phase.

3.3.1 Spanish scenario (Ebro basin)

The Spanish hot case scenario will focus on potential future flooding events within the same Area of Interest (AOI) defined for the cold case. This AOI is located in Zaragoza, within the Ebro River basin. This choice was influenced by the abundance of available data and established relationships with local authorities. The availability of open national datasets allows for a comprehensive description of the Ebro Basin hot case. Furthermore, the Spanish National Geographic Information Centre (CNIG), the Ebro Hydrographic Confederation (CHE), and the Spanish Meteorological Agency (AEMET) could provide crucial information to help generate a significant portion of UF indicators and indexes.

The scenario for the Spanish hot case is detailed in Table 4, Table 5 and Table 6, describing early warning, event monitoring, and product and service assessment respectively. If there is any flood over the area, the Spanish end-users – **Dirección General de Protección Civil y Emergencias**, **Red de Información Ambiental de Andalucía** – will be notified of upcoming product delivery, and invited to provide feedback on their experience with CENTAUR.

Table 4: Early warning phase for the Spanish scenario (Ebro basin).

Step	Risk phase	Category	Delivery date	Description	Roles and responsibilities
1	EW	Preparation	T-4	Collection of meteorological observations and forecasts	ECWMF
2	EW	Production	T-3	Generation of UF-ID-1 "Historical 6 hours return period static precipitation maps"	ECWMF: Production e-GEOS: Quality control
3	EW	Delivery	T-3	Upload of UF-ID-1 product and availability notification to end-users and service providers	ECWMF: Upload GMV: Notification and delivery checks
4	EW	Production	T-2	Generation of UF-ID-2 "ML data driven forecast of return period-based precipitation events in urban areas"	ECWMF: Production e-GEOS: Quality control
5	EW	Delivery	T-2	Upload of UF-ID-2 product and availability notification to end-users and service providers	ECWMF: Upload GMV: Notification and delivery checks
6	EW	Production	T-1	Generation of UF-ID-3 "Urban inundation probability maps and water depth defined by return period at a spatial resolution in the order of < 10 m"	e-GEOS: Production ECWMF: Quality control
7	EW	Delivery	T-1	Upload of UF-ID-3 product and availability notification to end-users and service providers	e-GEOS: Upload GMV: Notification and delivery checks
8	EW	Production	T+0	Generation of "Aggregate Early Warning Impact Indexes"	Cherrydata: Production ECMWF: Quality control
9	EW	Delivery	T+0	Upload of "Aggregate Early Warning Impact Indexes" product and availability notification to end-users and service providers	Cherrydata: Upload GMV: Notification and delivery checks
10	EW	Production	T+0	Generation of "Early Warning Forecast Index"	ECWMF: Production e-GEOS: Quality control
11	EW	Delivery	T+0	Upload of "EW Forecast Index" product and availability notification to end-users and service providers	ECWMF: Upload GMV: Notification and delivery checks

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Step	Risk phase	Category	Delivery date	Description	Roles and responsibilities
12	EW	Delivery	T+0	Alert notification to service providers and end-users	ECWMF: Alert sent to GMV, end-users and service providers

Table 5: Event monitoring phase for the Spanish scenario (Ebro basin).

Step	Risk phase	Category	Delivery date	Description	Roles and responsibilities
13	EM	Preparation	T+1	Collection of pre- and post-event EO-data - Satellite tasking - Freely available imagery	e-GEOS: Tasking, free crisis imagery UNISTRA-SERTIT: Sentinel-1
14	EM	Preparation	T+1	Request for national data to the authorized user - DTM - Water gauges	Tracasa
15	EM	Preparation	T+1	Preparation and QC of pre- and post-event EO data (optical and radar imagery)	e-GEOS: Free crisis imagery UNISTRA-SERTIT: InSAR-compatible S1 triplet (2 pre- and 1 post-event)
16	EM	Preparation	T+1	Collection and preparation of topographic base layers (elevation, hydrography, buildings, facilities, transportation networks, land use and land cover)	Tracasa
17	EM	Preparation	T+1	Collection and preparation of ancillary data (built-up 2D and 3D, population)	DLR
18	EM	Preparation	T+1	Production of crisis information (water extent delineation)	e-GEOS: Production Tracasa: Quality control
19	EM	Production	T+2	Generation of UF-ID-4 "Inferred InSAR urban flood extent"	UNISTRA-SERTIT: Production e-GEOS: Quality control
20	EM	Delivery	T+2	Upload of UF-ID-4 product and availability notification to end-users and service providers	UNISTRA-SERTIT: Upload GMV: Notification and delivery checks
21	EM	Production	T+3	Generation of UF-ID-5 "Urban flooding map based on geomorphological and InSAR approach for an enhanced damage" - Flood extent - Damage assessment on transportation and buildings - Damage assessment on facilities	e-GEOS: Flood extent, flood depth, damage assessment (transportation, buildings) UNISTRA-SERTIT: Damage assessment (facilities) e-GEOS, UNISTRA-SERTIT: Quality control
22	EM	Delivery	T+3	Upload of UF-ID-5 product and availability notification to end-users and service providers	e-GEOS: Upload GMV: Notification and delivery checks
23	EM	Preparation	T+4	Collection and integration of media information related to the event over affected areas	Hensoldt
24	EM	Preparation	T+4	Collection and integration of media information related to economic impact of the event over affected areas	Hensoldt
25	EM	Production	T+5	Generation of UF-ID-6 "Social and traditional media indicators for urban flooding maps"	e-GEOS: Initialisation (flood extent inputs) Hensoldt: Production
26	EM	Delivery	T+5	Upload of UF-ID-6 product and availability notification to end-users and service providers	Hensoldt: Upload GMV: Notification and delivery checks
27	EM	Production	T+6	Generation of UF-ID-7 "Hazard web sources indicator "	e-GEOS: Production Adelphi: Quality control
28	EM	Delivery	T+6	Upload of UF-ID-7 product and availability notification to end-users and service providers	e-GEOS: Upload GMV: Notification and delivery checks

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Step	Risk phase	Category	Delivery date	Description	Roles and responsibilities
29	EM	Preparation	T+7	Collection and preparation of input data for socio-economic components (responders, shelters, healthcare, restaurants, hotels)	Tracasa
30	EM	Preparation	T+7	Preparation of transportation data for network analysis	Tracasa
31	EM	Production	T+8	Generation of UF-ID-9 "Assets and financial resources"	Tracasa: Initialisation, quality control Adelphi: Production
32	EM	Delivery	T+8	Upload of UF-ID-9 product and availability notification to end-users and service providers	Adelphi: Upload GMV: Notification and delivery checks
33	EM	Production	T+9	Generation of UF-ID-10 "Public services and government support"	Tracasa: Initialisation, quality control Adelphi: Production
34	EM	Delivery	T+9	Upload of UF-ID-10 product and availability notification to end-users and service providers	Adelphi: Upload GMV: Notification and delivery checks
35	EM	Production	T+10	Generation of UF-ID-13 "Ability to flee"	Tracasa: Initialisation, quality control Adelphi: Production
36	EM	Delivery	T+10	Upload of UF-ID-13 product and availability notification to end-users and service providers	Adelphi: Upload GMV: Notification and delivery checks
37	EM	Production	T+11	Generation of UF-ID-14 "Economic impact of floods"	e-GEOS: Initialisation, quality control Hensoldt: Production
38	EM	Delivery	T+11	Upload of UF-ID-14 product and availability notification to end-users and service providers	Hensoldt: Upload GMV: Notification and delivery checks
39	EM	Production	T+12	Generation of “Aggregate Natural Crisis Impact Indexes”	Cherrydata: Production Hensoldt, e-GEOS, Adelphi, UNISTRA-SERTIT: Quality control
40	EM	Delivery	T+12	Upload of “Aggregate Natural Crisis Impact Indexes” product and availability notification to end-users and service providers	Cherrydata: Upload GMV: Notification and delivery checks
41	EM	Production	T+12	Generation of “Flood Impact Index”	e-GEOS: Production Hensoldt, e-GEOS, Adelphi, UNISTRA-SERTIT: Quality control
42	EM	Delivery	T+12	Upload of “Flood Impact Index” product and availability notification to end-users and service providers	e-GEOS: Upload GMV: Notification and delivery checks

Table 6 describes all the steps for a thorough evaluation of products and services for the hot case demonstration, if any. The validation will start once the products are created. Datasets that could support validation efforts include:

- **Optical images** acquired during the flood event. If the flood event is extreme, is likely to trigger CEMS activation. In such a case, acquired optical images are likely to be available, and a search for them will be conducted.
- A **time series of pluviometry data**, ranging 30 years over 7 stations within the Ebro basin. They could be provided by AEMET. In addition, NRT data of the flood event under study could be obtained.
- **Aerial images.** Local authorities, such as CHE, will be contacted to determine if they have this information.
- **Flood mask.** Local authorities, such as CHE, will be contacted to determine if they have this information.

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- **Flood risk and hazard masks** of the Spanish National Flood Zone Mapping System (*Sistema Nacional de Cartografía de Zonas Inundables*, SNCZI) for different return periods. They have already been downloaded for cold case.
- **In-situ river gauges**, describing river levels over multiple stations in the AOI. CHE conducts the collection of these observations, and are freely available in http://www.saihebro.com/saihebro/index.php.
- **Very High Resolution DTM**, provided by the Spanish Ministry for Ecological Transition. It contains artefacts in the Zaragoza city area, which could render it unusable. They have already been downloaded for cold case.
- **Household income distribution atlas** (*Atlas de distribución de renta de los hogares*) provided by the Spanish National Statistics Institute (*Instituto Nacional de Estadística*, INE). They have already been downloaded for cold case. It will be checked for any updates.
- **Institutional documents** that could be published by the Government Delegation in Zaragoza could provide important information about damages produced by the event. It will be checked for any interesting information on this matter.

Table 6: Product and service assessment phase for the Spanish scenario (Ebro basin).

Step	Risk phase	Category	Delivery date	Description	Roles and responsibilities
43	PSA	Validation	T+13	Collection of feedback through end-user and service provider questionnaires	Tracasa: Share questionnaires Participants: End-users, service providers
44	PSA	Validation	T+14	Notification of completed end-user questionnaire reception	SpaceTec to UNISTRA-SERTIT
45	PSA	Validation	T+14	Delivery of completed service provider questionnaire	Service providers to UNISTRA-SERTIT
46	PSA	Validation	T+15	Product and service validation	Tracasa
47	PSA	Validation	T+16	Data analysis, conclusion and inventory of recommendations and actions to be implemented in short and medium terms	Tracasa: Validation UNISTRA-SERTIT: Questionnaire analysis e-GEOS: Review
48	PSA	Validation	T+17	Dissemination of results, lessons learnt, recommendations	UNISTRA-SERTIT and Tracasa

3.3.2 Italian scenario (Piedmont region)

Italian urban flood use cases focus on the Piedmont Region, specifically the Turin Centre - Meisino area along the Po River, and the Ceva area along the Tanaro River. The urban flood demonstration scenarios are provided in their respective parts below, and will focus on potential future flood events within the same AOIs defined for the cold phase.

Turin Centre – Meisino

The scenario for the Italian hot case in Turin Centre – Meisino is detailed in Table 7, Table 8 and Table 9, describing early warning, event monitoring, and product and service assessment respectively. If there is any flood over the area, the Italian end-user – **Municipality of Turin** – will be notified of upcoming product delivery, and invited to provide feedback on their experience with CENTAUR.

The comprehensive analysis of the Piedmont cold case is facilitated by the availability of regional and municipal geospatial datasets. Notable sources such as the ARPA Piemonte, the Piedmont Regional Geoportal, and the Geoportal of Turin provide invaluable information. These resources play a significant role in computing a considerable portion of the UF indicators and indexes planned for this case.

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Table 7: Early warning phase for the Italian scenario (Turin Centre – Meisino).

Step	Risk phase	Category	Delivery date	Description	Roles and responsibilities
1	EW	Preparation	T-4	Collection of meteorological observations and forecasts	ECWMF
2	EW	Production	T-3	Generation of UF-ID-1 "Historical 6 hours return period static precipitation maps"	ECWMF: Production e-GEOS: Quality control
3	EW	Delivery	T-3	Upload of UF-ID-1 product and availability notification to end-users and service providers	ECWMF: Upload GMV: Notification and delivery checks
4	EW	Production	T-2	Generation of UF-ID-2 "ML data driven forecast of return period-based precipitation events in urban areas"	ECWMF: Production e-GEOS: Quality control
5	EW	Delivery	T-2	Upload of UF-ID-2 product and availability notification to end-users and service providers	ECWMF: Upload GMV: Notification and delivery checks
6	EW	Production	T-1	Generation of UF-ID-3 "Urban inundation probability maps and water depth defined by return period at a spatial resolution in the order of < 10 m"	e-GEOS: Production ECWMF: Quality control
7	EW	Delivery	T-1	Upload of UF-ID-3 product and availability notification to end-users and service providers	e-GEOS: Upload GMV: Notification and delivery checks
8	EW	Production	T+0	Generation of "Aggregate Early Warning Impact Indexes"	Cherrydata: Production ECMWF: Quality control
9	EW	Delivery	T+0	Upload of "Aggregate Early Warning Impact Indexes" product and availability notification to end-users and service providers	Cherrydata: Upload GMV: Notification and delivery checks
10	EW	Production	T+0	Generation of "Early Warning Forecast Index"	ECWMF: Production e-GEOS: Quality control
11	EW	Delivery	T+0	Upload of "EW Forecast Index" product and availability notification to end-users and service providers	ECWMF: Upload GMV: Notification and delivery checks
12	EW	Delivery	T+0	Alert notification to service providers and end-users	ECWMF: Alert sent to GMV, end-users and service providers

Table 8: Event monitoring phase for the Italian scenario (Turin Centre – Meisino).

Step	Risk phase	Category	Delivery date	Description	Roles and responsibilities
13	EM	Preparation	T+1	Collection of pre- and post-event EO-data - Satellite tasking - Freely available imagery	e-GEOS: Tasking, free crisis imagery UNISTRA-SERTIT: Sentinel-1
14	EM	Preparation	T+1	Request for national data to the authorized user and Regional Environmental Agency - DTM - Water gauges	Ithaca
15	EM	Preparation	T+1	Preparation and QC of pre- and post-event EO data (optical and radar imagery)	e-GEOS: Free crisis imagery UNISTRA-SERTIT: InSAR-compatible S1 triplet (2 pre- and 1 post-event)
16	EM	Preparation	T+1	Collection and preparation of topographic base layers (elevation, hydrography, buildings, facilities, transportation networks, land use and land cover)	Ithaca
17	EM	Preparation	T+1	Collection and preparation of ancillary data (built-up 2D and 3D, population)	DLR, Ithaca

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Step	Risk phase	Category	Delivery date	Description	Roles and responsibilities
18	EM	Preparation	T+1	Production of crisis information (water extent delineation)	e-GEOS: Production Ithaca: Quality control
19	EM	Production	T+2	Generation of UF-ID-4 "Inferred InSAR urban flood extent"	UNISTRA-SERTIT: Production e-GEOS: Quality control
20	EM	Delivery	T+2	Upload of UF-ID-4 product and availability notification to end-users and service providers	UNISTRA-SERTIT: Upload GMV: Notification and delivery checks
21	EM	Production	T+3	Generation of UF-ID-5 "Urban flooding map based on geomorphological and InSAR approach for an enhanced damage" - Flood extent - Damage assessment on transportation and buildings - Damage assessment on facilities	e-GEOS: Flood extent, flood depth, damage assessment (transportation, buildings) UNISTRA-SERTIT: Damage assessment (facilities) e-GEOS, UNISTRA-SERTIT: Quality control
22	EM	Delivery	T+3	Upload of UF-ID-5 product and availability notification to end-users and service providers	e-GEOS: Upload GMV: Notification and delivery checks
23	EM	Preparation	T+4	Collection and integration of media information related to the event over affected areas	Hensoldt
24	EM	Preparation	T+4	Collection and integration of media information related to economic impact of the event over affected areas	Hensoldt
25	EM	Production	T+5	Generation of UF-ID-6 "Social and traditional media indicators for urban flooding maps"	e-GEOS: Initialisation (flood extent inputs) Hensoldt: Production
26	EM	Delivery	T+5	Upload of UF-ID-6 product and availability notification to end-users and service providers	Hensoldt: Upload GMV: Notification and delivery checks
27	EM	Production	T+6	Generation of UF-ID-7 "Hazard web sources indicator "	e-GEOS: Production Adelphi: Quality control
28	EM	Delivery	T+6	Upload of UF-ID-7 product and availability notification to end-users and service providers	e-GEOS: Upload GMV: Notification and delivery checks
29	EM	Preparation	T+7	Collection and preparation of input data for socio-economic components (responders, shelters, healthcare, restaurants, hotels)	Ithaca
30	EM	Preparation	T+7	Preparation of transportation data for network analysis	Ithaca
31	EM	Production	T+8	Generation of UF-ID-9 "Assets and financial resources"	Ithaca: Initialisation, quality control Adelphi: Production
32	EM	Delivery	T+8	Upload of UF-ID-9 product and availability notification to end-users and service providers	Adelphi: Upload GMV: Notification and delivery checks
33	EM	Production	T+9	Generation of UF-ID-10 "Public services and government support"	Ithaca: Initialisation, quality control Adelphi: Production
34	EM	Delivery	T+9	Upload of UF-ID-10 product and availability notification to end-users and service providers	Adelphi: Upload GMV: Notification and delivery checks
35	EM	Production	T+10	Generation of UF-ID-13 "Ability to flee"	Ithaca: Initialisation, quality control Adelphi: Production
36	EM	Delivery	T+10	Upload of UF-ID-13 product and availability notification to end-users and service providers	Adelphi: Upload GMV: Notification and delivery checks
37	EM	Production	T+11	Generation of UF-ID-14 "Economic impact of floods"	e-GEOS: Initialisation, quality control Hensoldt: Production

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Step	Risk phase	Category	Delivery date	Description	Roles and responsibilities
38	EM	Delivery	T+11	Upload of UF-ID-14 product and availability notification to end-users and service providers	Hensoldt: Upload GMV: Notification and delivery checks
39	EM	Production	T+12	Generation of "Aggregate Natural Crisis Impact Indexes"	Cherrydata: Production Hensoldt, e-GEOS, Adelphi, UNISTRA-SERTIT: Quality control
40	EM	Delivery	T+12	Upload of "Aggregate Natural Crisis Impact Indexes" product and availability notification to end-users and service providers	Cherrydata: Upload GMV: Notification and delivery checks
41	EM	Production	T+12	Generation of "Flood Impact Index"	e-GEOS: Production Hensoldt, e-GEOS, Adelphi, UNISTRA-SERTIT: Quality control
42	EM	Delivery	T+12	Upload of "Flood Impact Index" product and availability notification to end-users and service providers	e-GEOS: Upload GMV: Notification and delivery checks

Table 9 describes all the steps for a thorough evaluation of products and services for the hot case demonstration, if any. The validation will start once the products are created. Datasets that could support validation efforts include:

- **Databases related to the ground effects induced by rains**, which could be provided by ARPA Piemonte, Regione Piemonte, or CNR IRPI.
- Official publications by ARPA Piemonte and Regione Piemonte, describing the **processes and effects caused by the event** through a summary of the survey activities, as well as comparisons with past events or detailed analysis of the areas deemed to be of greatest interest.
- **Additional VHR optical imagery** to assess the consequences of the event, provided by local stakeholders or European institutions.
- **Additional social and traditional media markers**, to help collect more information on damages and possibly water depths.

Table 9: Product and service assessment for the Italian scenario (Turin Centre – Meisino).

Step	Risk phase	Category	Delivery date	Description	Roles and responsibilities
43	PSA	Validation	T+13	Collection of feedback through end-user and service provider questionnaires	Ithaca: Share questionnaires Participants: End-users, service providers
44	PSA	Validation	T+14	Notification of completed end-user questionnaire reception	SpaceTec to UNISTRA-SERTIT
45	PSA	Validation	T+14	Delivery of completed service provider questionnaire	Service providers to UNISTRA-SERTIT
46	PSA	Validation	T+15	Product and service validation	CLS, Tracasa
47	PSA	Validation	T+16	Data analysis, conclusion and inventory of recommendations and actions to be implemented in short and medium terms	Tracasa: Validation UNISTRA-SERTIT: Questionnaire analysis e-GEOS: Review
48	PSA	Validation	T+17	Dissemination of results, lessons learnt, recommendations	UNISTRA-SERTIT and Ithaca

Ceva Centre

The scenario for the Italian hot case in Ceva Centre is detailed in Table 10, Table 11 and Table 12, describing early warning, event monitoring, and product and service assessment respectively.

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The comprehensive analysis of the Piedmont cold case is facilitated by the availability of regional and municipal geospatial datasets. Notable sources such as the ARPA Piemonte and the Piedmont Regional Geoportal provide invaluable information. These resources play a significant role in computing a considerable portion of the UF indicators and indexes planned for this case.

Unfortunately, the **Italian Civil Protection—Piedmont Regional Department (IT)** will not be able to contribute to the demo execution and user feedback phase for this hot case, due to internal commitments. They will not be sent any notification or product. However, another entity might serve as a replacement if there is any flood over the area, such as the Joint Research Centre. The strategy for end-user feedback will be confirmed by the second release of the present deliverable.

Table 10: Early warning phase for the Italian scenario (Ceva Centre).

Step	Risk phase	Category	Delivery date	Description	Roles and responsibilities
1	EW	Preparation	T-4	Collection of meteorological observations and forecasts	ECWMF
2	EW	Production	T-3	Generation of UF-ID-1 "Historical 6 hours return period static precipitation maps"	ECWMF: Production e-GEOS: Quality control
3	EW	Delivery	T-3	Upload of UF-ID-1 product and availability notification to end-users and service providers	ECWMF: Upload GMV: Notification and delivery checks
4	EW	Production	T-2	Generation of UF-ID-2 "ML data driven forecast of return period-based precipitation events in urban areas"	ECWMF: Production e-GEOS: Quality control
5	EW	Delivery	T-2	Upload of UF-ID-2 product and availability notification to end-users and service providers	ECWMF: Upload GMV: Notification and delivery checks
6	EW	Production	T-1	Generation of UF-ID-3 "Urban inundation probability maps and water depth defined by return period at a spatial resolution in the order of < 10 m"	e-GEOS: Production ECWMF: Quality control
7	EW	Delivery	T-1	Upload of UF-ID-3 product and availability notification to end-users and service providers	e-GEOS: Upload GMV: Notification and delivery checks
8	EW	Production	T+0	Generation of "Aggregate Early Warning Impact Indexes"	Cherrydata: Production ECMWF: Quality control
9	EW	Delivery	T+0	Upload of "Aggregate Early Warning Impact Indexes" product and availability notification to end-users and service providers	Cherrydata: Upload GMV: Notification and delivery checks
10	EW	Production	T+0	Generation of "Early Warning Forecast Index"	ECWMF: Production e-GEOS: Quality control
11	EW	Delivery	T+0	Upload of "EW Forecast Index" product and availability notification to end-users and service providers	ECWMF: Upload GMV: Notification and delivery checks
12	EW	Delivery	T+0	Alert notification to service providers and end-users	ECWMF: Alert sent to GMV, end-users and service providers

Table 11: Event monitoring phase for the Italian scenario (Ceva Centre).

Step	Risk phase	Category	Delivery date	Description	Roles and responsibilities
13	EM	Preparation	T+1	Collection of pre- and post-event EO-data - Satellite tasking - Freely available imagery	e-GEOS: Tasking, free crisis imagery UNISTRA-SERTIT: Sentinel-1

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Step	Risk phase	Category	Delivery date	Description	Roles and responsibilities
14	EM	Preparation	T+1	Request for national data to the authorized user - DTM - Water gauges	Ithaca
15	EM	Preparation	T+1	Preparation and QC of pre- and post-event EO data (optical and radar imagery)	e-GEOS: Free crisis imagery UNISTRA-SERTIT: InSAR-compatible S1 triplet (2 pre- and 1 post-event)
16	EM	Preparation	T+1	Collection and preparation of topographic base layers (elevation, hydrography, buildings, facilities, transportation networks, land use and land cover)	Ithaca
17	EM	Preparation	T+1	Collection and preparation of ancillary data (built-up 2D and 3D, population)	DLR, Ithaca
18	EM	Preparation	T+1	Production of crisis information (water extent delineation)	e-GEOS: Production Ithaca: Quality control
19	EM	Production	T+2	Generation of UF-ID-4 "Inferred InSAR urban flood extent"	UNISTRA-SERTIT: Production e-GEOS: Quality control
20	EM	Delivery	T+2	Upload of UF-ID-4 product and availability notification to end-users and service providers	UNISTRA-SERTIT: Upload GMV: Notification and delivery checks
21	EM	Production	T+3	Generation of UF-ID-5 "Urban flooding map based on geomorphological and InSAR approach for an enhanced damage" - Flood extent - Damage assessment on transportation and buildings - Damage assessment on facilities	e-GEOS: Flood extent, flood depth, damage assessment (transportation, buildings) UNISTRA-SERTIT: Damage assessment (facilities) e-GEOS, UNISTRA-SERTIT: Quality control
22	EM	Delivery	T+3	Upload of UF-ID-5 product and availability notification to end-users and service providers	e-GEOS: Upload GMV: Notification and delivery checks
23	EM	Preparation	T+4	Collection and integration of media information related to the event over affected areas	Hensoldt
24	EM	Preparation	T+4	Collection and integration of media information related to economic impact of the event over affected areas	Hensoldt
25	EM	Production	T+5	Generation of UF-ID-6 "Social and traditional media indicators for urban flooding maps"	e-GEOS: Initialisation (flood extent inputs) Hensoldt: Production
26	EM	Delivery	T+5	Upload of UF-ID-6 product and availability notification to end-users and service providers	Hensoldt: Upload GMV: Notification and delivery checks
27	EM	Production	T+6	Generation of UF-ID-7 " Hazard web sources indicator "	e-GEOS: Production Adelphi: Quality control
28	EM	Delivery	T+6	Upload of UF-ID-7 product and availability notification to end-users and service providers	e-GEOS: Upload GMV: Notification and delivery checks
29	EM	Preparation	T+7	Collection and preparation of input data for socio-economic components (responders, shelters, healthcare, restaurants, hotels)	Ithaca
30	EM	Preparation	T+7	Preparation of transportation data for network analysis	Ithaca
31	EM	Production	T+8	Generation of UF-ID-9 "Assets and financial resources"	Ithaca: Initialisation, quality control Adelphi: Production
32	EM	Delivery	T+8	Upload of UF-ID-9 product and availability notification to end-users and service providers	Adelphi: Upload GMV: Notification and delivery checks

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Step	Risk phase	Category	Delivery date	Description	Roles and responsibilities
33	EM	Production	T+9	Generation of UF-ID-10 "Public services and government support"	Ithaca: Initialisation, quality control Adelphi: Production
34	EM	Delivery	T+9	Upload of UF-ID-10 product and availability notification to end-users and service providers	Adelphi: Upload GMV: Notification and delivery checks
35	EM	Production	T+10	Generation of UF-ID-13 "Ability to flee"	Ithaca: Initialisation, quality control Adelphi: Production
36	EM	Delivery	T+10	Upload of UF-ID-13 product and availability notification to end-users and service providers	Adelphi: Upload GMV: Notification and delivery checks
37	EM	Production	T+11	Generation of UF-ID-14 "Economic impact of floods"	e-GEOS: Initialisation, quality control Hensoldt: Production
38	EM	Delivery	T+11	Upload of UF-ID-14 product and availability notification to end-users and service providers	Hensoldt: Upload GMV: Notification and delivery checks
39	EM	Production	T+12	Generation of “Aggregate Natural Crisis Impact Indexes”	Cherrydata: Production Hensoldt, e-GEOS, Adelphi, UNISTRA-SERTIT: Quality control
40	EM	Delivery	T+12	Upload of “Aggregate Natural Crisis Impact Indexes” product and availability notification to end-users and service providers	Cherrydata: Upload GMV: Notification and delivery checks
41	EM	Production	T+12	Generation of “Flood Impact Index”	e-GEOS: Production Hensoldt, e-GEOS, Adelphi, UNISTRA-SERTIT: Quality control
42	EM	Delivery	T+12	Upload of “Flood Impact Index” product and availability notification to end-users and service providers	e-GEOS: Upload GMV: Notification and delivery checks

Table 12 describes all the steps for a thorough evaluation of products and services for the hot case demonstration, if any. The validation will start once the products are created. Datasets that could support validation efforts include:

- **Databases related to the ground effects induced by rains**, which could be provided by ARPA Piemonte, Regione Piemonte, or CNR IRPI.
- Official publications by ARPA Piemonte and Regione Piemonte, describing the **processes and effects caused by the event** through a summary of the survey activities, as well as comparisons with past events or detailed analysis of the areas deemed to be of greatest interest.
- **Additional VHR optical imagery** to assess the consequences of the event, provided by local stakeholders or European institutions.
- **Additional social and traditional media markers**, to help collect more information on damages and possibly water depths.

Table 12: Product and service assessment for the Italian scenario (Ceva Centre).

Step	Risk phase	Category	Delivery date	Description	Roles and responsibilities
43	PSA	Validation	T+13	Collection of feedback through end-user and service provider questionnaires	Ithaca: Share questionnaires Participants: End-users, service providers
44	PSA	Validation	T+14	Notification of completed end-user questionnaire reception	SpaceTec to UNISTRA-SERTIT

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Step	Risk phase	Category	Delivery date	Description	Roles and responsibilities
45	PSA	Validation	T+14	Delivery of completed service provider questionnaire	Service providers to UNISTRA-SERTIT
46	PSA	Validation	T+15	Product and service validation	CLS, Tracasa
47	PSA	Validation	T+16	Data analysis, conclusion and inventory of recommendations and actions to be implemented in short and medium terms	Tracasa: Validation UNISTRA-SERTIT: Questionnaire analysis e-GEOS: Review
48	PSA	Validation	T+17	Dissemination of results, lessons learnt, recommendations	UNISTRA-SERTIT and Ithaca

3.3.3 French scenario (Landes)

The French hot case will focus on major flood events potentially occurring between M22 and M33 in the same area as the French cold case. The area of interest spans between Dax and Mont-de-Marsant, in the Landes department, along the courses of the Adour and Midouze. It has a relatively modest elevation, with several cities and villages aggregated along the Adour and large flood plains.

Extreme flood events in the middle Adour and Midouze sub-bassins are usually caused by a generalized flood of all tributaries, and geological formations that favor on one hand a rapid increase of water levels and a slow recess, and on the other hand in the Midouze sub-bassin a sudden increase in flood levels once the soils are saturated. The entire territory is thus subject to intense flood episodes that are likely to happen during CENTAUR hot cases demonstration.

The area was also selected due to the availability of very high resolution national datasets (BD Topo, RGE Alti, LiDAR HD) that will support the demonstration and validation activities.

The scenario for the French hot case is detailed in Table 13, Table 14 and Table 15, describing early warning, event monitoring, and product and service assessment respectively. If there is any flood over the area, the French end-user – the **French Public Insurance Company** (*Caisse Centrale de Réassurance*, CCR) – will be notified of upcoming product delivery, and invited to provide feedback on their experience with CENTAUR.

Table 13: Early warning phase for the French scenario (Landes).

Step	Risk phase	Category	Delivery date	Description	Roles and responsibilities
1	EW	Preparation	T-4	Collection of meteorological observations and forecasts	ECWMF
2	EW	Production	T-3	🔑 Generation of UF-ID-1 "Historical 6 hours return period static precipitation maps"	ECWMF: Production e-GEOS: Quality control
3	EW	Delivery	T-3	🔑 Upload of UF-ID-1 product and availability notification to end-users and service providers	ECWMF: Upload GMV: Notification and delivery checks
4	EW	Production	T-2	Generation of UF-ID-2 "ML data driven forecast of return period-based precipitation events in urban areas"	ECWMF: Production e-GEOS: Quality control
5	EW	Delivery	T-2	Upload of UF-ID-2 product and availability notification to end-users and service providers	ECWMF: Upload GMV: Notification and delivery checks
6	EW	Production	T-1	🔑 Generation of UF-ID-3 "Urban inundation probability maps and water depth defined by return period at a spatial resolution in the order of < 10 m"	e-GEOS: Production ECWMF: Quality control
7	EW	Delivery	T-1	🔑 Upload of UF-ID-3 product and availability notification to end-users and service providers	e-GEOS: Upload GMV: Notification and delivery checks

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Step	Risk phase	Category	Delivery date	Description	Roles and responsibilities
8	EW	Production	T+0	Generation of "Aggregate Early Warning Impact Indexes"	Cherrydata: Production ECMWF: Quality control
9	EW	Delivery	T+0	Upload of "Aggregate Early Warning Impact Indexes" product and availability notification to end-users and service providers	Cherrydata: Upload GMV: Notification and delivery checks
10	EW	Production	T+0	Generation of "Early Warning Forecast Index"	ECWMF: Production e-GEOS: Quality control
11	EW	Delivery	T+0	Upload of "EW Forecast Index" product and availability notification to end-users and service providers	ECWMF: Upload GMV: Notification and delivery checks
12	EW	Delivery	T+0	Alert notification to service providers and end-users	ECWMF: Alert sent to GMV, end-users and service providers

Table 14: Event monitoring phase for the French scenario (Landes).

Step	Risk phase	Category	Delivery date	Description	Roles and responsibilities
13	EM	Preparation	T+1	Collection of pre- and post-event EO-data - Satellite tasking - Freely available imagery	e-GEOS: Tasking, free crisis imagery UNISTRA-SERTIT: Sentinel-1
14	EM	Preparation	T+1	Request for national data to the authorized user - 🔑 DTM - Water gauges	CLS
15	EM	Preparation	T+1	Preparation and QC of pre- and post-event EO data (optical and radar imagery)	e-GEOS: Free crisis imagery UNISTRA-SERTIT: InSAR-compatible S1 triplet (2 pre- and 1 post-event)
16	EM	Preparation	T+1	🔑 Collection and preparation of topographic base layers (elevation, hydrography, buildings, facilities, transportation networks, land use and land cover)	CLS
17	EM	Preparation	T+1	🔑 Collection and preparation of ancillary data (built-up 2D and 3D, population)	DLR
18	EM	Preparation	T+1	Production of crisis information (water extent delineation)	e-GEOS: Production CLS: Quality control
19	EM	Production	T+2	Generation of UF-ID-4 "Inferred InSAR urban flood extent"	UNISTRA-SERTIT: Production e-GEOS: Quality control
20	EM	Delivery	T+2	Upload of UF-ID-4 product and availability notification to end-users and service providers	UNISTRA-SERTIT: Upload GMV: Notification and delivery checks
21	EM	Production	T+3	Generation of UF-ID-5 "Urban flooding map based on geomorphological and InSAR approach for an enhanced damage" - Flood extent - Damage assessment on transportation and buildings - Damage assessment on facilities	e-GEOS: Flood extent, flood depth, damage assessment (transportation, buildings) UNISTRA-SERTIT: Damage assessment (facilities) e-GEOS, UNISTRA-SERTIT: Quality control
22	EM	Delivery	T+3	Upload of UF-ID-5 product and availability notification to end-users and service providers	e-GEOS: Upload GMV: Notification and delivery checks
23	EM	Preparation	T+4	Collection and integration of media information related to the event over affected areas	Hensoldt
24	EM	Preparation	T+4	Collection and integration of media information related to economic impact of the event over affected areas	Hensoldt

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Step	Risk phase	Category	Delivery date	Description	Roles and responsibilities
25	EM	Production	T+5	Generation of UF-ID-6 "Social and traditional media indicators for urban flooding maps"	e-GEOS: Initialisation (flood extent inputs) Hensoldt: Production
26	EM	Delivery	T+5	Upload of UF-ID-6 product and availability notification to end-users and service providers	Hensoldt: Upload GMV: Notification and delivery checks
27	EM	Production	T+6	Generation of UF-ID-7 "Hazard web sources indicator"	e-GEOS: Production Adelphi: Quality control
28	EM	Delivery	T+6	Upload of UF-ID-7 product and availability notification to end-users and service providers	e-GEOS: Upload GMV: Notification and delivery checks
29	EM	Preparation	T+7	Collection and preparation of input data for socio-economic components (responders, shelters, healthcare, restaurants, hotels)	CLS
30	EM	Preparation	T+7	Preparation of transportation data for network analysis	CLS
31	EM	Production	T+8	Generation of UF-ID-9 "Assets and financial resources"	CLS: Initialisation, quality control Adelphi: Production
32	EM	Delivery	T+8	Upload of UF-ID-9 product and availability notification to end-users and service providers	Adelphi: Upload GMV: Notification and delivery checks
33	EM	Production	T+9	Generation of UF-ID-10 "Public services and government support"	CLS: Initialisation, quality control Adelphi: Production
34	EM	Delivery	T+9	Upload of UF-ID-10 product and availability notification to end-users and service providers	Adelphi: Upload GMV: Notification and delivery checks
35	EM	Production	T+10	Generation of UF-ID-13 "Ability to flee"	CLS: Initialisation, quality control Adelphi: Production
36	EM	Delivery	T+10	Upload of UF-ID-13 product and availability notification to end-users and service providers	Adelphi: Upload GMV: Notification and delivery checks
37	EM	Production	T+11	Generation of UF-ID-14 "Economic impact of floods"	e-GEOS: Initialisation, quality control Hensoldt: Production
38	EM	Delivery	T+11	Upload of UF-ID-14 product and availability notification to end-users and service providers	Hensoldt: Upload GMV: Notification and delivery checks
39	EM	Production	T+12	Generation of “Aggregate Natural Crisis Impact Indexes”	Cherrydata: Production Hensoldt, e-GEOS, Adelphi, UNISTRA-SERTIT: Quality control
40	EM	Delivery	T+12	Upload of “Aggregate Natural Crisis Impact Indexes” product and availability notification to end-users and service providers	Cherrydata: Upload GMV: Notification and delivery checks
41	EM	Production	T+12	Generation of “Flood Impact Index”	e-GEOS: Production Hensoldt, e-GEOS, Adelphi, UNISTRA-SERTIT: Quality control
42	EM	Delivery	T+12	Upload of “Flood Impact Index” product and availability notification to end-users and service providers	e-GEOS: Upload GMV: Notification and delivery checks

Table 15 describes all the steps for a thorough evaluation of products and service for to the demonstration on the French use case. Starting after the delivery of the Early Warning and Event Monitoring components, this phase aims at estimating the quality and reliability of the delivered products. This phase will be supported by additional datasets if available:

- **Comparable optical images** acquired during the flood event, from freely available or commercial missions.

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- **Ground observations** on the location (GPS coordinates, description and pictures) and **flood height** published in the *Repères de crues* database[1] if available.
- **Institutional documents** delivered by local and national authorities, including *Territoire à Risque important d'Inondation* (TRI) and *Evaluation Préliminaire des Risques d'Inondation* (EPRI). They provide important information about the hydrology of the AOI, as well as some geospatial layers describing simulated maximum flood extent and depth over the municipality of Dax.
- **River gauges**, corresponding to in-situ recorded levels of the rivers, with multiple stations available over the AOI. They are available in the HydroEau database[2].
- Information about the event published by the **impacted municipalities, regional or national institutions** if available.

Table 15: Product and service assessment phase for the French scenario (Landes).

Step	Risk phase	Category	Delivery date	Description	Roles and responsibilities
43	PSA	Validation	T+13	Collection of feedback through end-user and service provider questionnaires	CLS: Share questionnaires Participants: End-users, service providers
44	PSA	Validation	T+14	Notification of completed end-user questionnaire reception	SpaceTec to UNISTRA-SERTIT
45	PSA	Validation	T+14	Delivery of completed service provider questionnaire	Service providers to UNISTRA-SERTIT
46	PSA	Validation	T+15	Product and service validation	CLS, Tracasa
47	PSA	Validation	T+16	Data analysis, conclusion and inventory of recommendations and actions to be implemented in short and medium terms	Tracasa: Validation UNISTRA-SERTIT: Questionnaire analysis e-GEOS: Review
48	PSA	Validation	T+17	Dissemination of results, lessons learnt, recommendations	UNISTRA-SERTIT and CLS

3.4 WATER AND FOOD SECURITY DEMONSTRATOR SCENARIOS

Just as in the cold case phase, **hot demonstrators for WFS include all administrative units within a given country** (i.e. Somalia, Mali, and Mozambique). It is important to note that since most WFS indicators, indexes and services perform a long-term country-scale analysis to detect hazardous situations, most steps actually fall into the early warning component, and overlap with the event monitoring component. Only a small subset of tasks exclusively belongs to the event monitoring risk phase.

Water and food security demonstrators are under the responsibility of SatCen, with contributions from other partners as well.

3.4.1 Somalian scenario

The Somalian hot case scenario will focus on the continuous monitoring of water and food insecurity in Somalia, encompassing forecasts and predictions of potential alerts. Unlike the cold case, which examined specific historical events, the hot case addresses the ongoing and dynamic situation within the country. Somalia, a nation heavily impacted by consecutive failed rainy seasons, droughts, political instability, extremism, and civil unrest, continues to experience severe vulnerabilities.

This demonstrator was selected for the hot case phase due to the critical need to monitor and respond to water and food insecurity across all regions. Continuous monitoring will enable a comprehensive and real-time

[1] Online database for Repères de Crues – https://www.reperesdecrues.developpement-durable.gouv.fr/
[2] Online portal to access the HydroEau database – https://hydro.eaufrance.fr/

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assessment of the situation, facilitating timely interventions to mitigate the adverse effects of water and food insecurity.

The insights gained from the Somali hot case are crucial for understanding and managing climate security risks not only in Somalia but also across the broader Horn of Africa region. The continuous monitoring approach aims to provide a proactive framework for anticipating and addressing emerging crises.

The scenario for the Somalian hot case is detailed in Table 16, Table 17 and Table 18, describing early warning, event monitoring, and product and service assessment respectively. The end-user participating to this demonstrator – UNSOS – will be notified of upcoming product delivery, and invited to provide feedback on their experience with CENTAUR.

Table 16: Early warning phase for the Somalian scenario.

Step	Risk phase	Category	Delivery date	Description	Roles and responsibilities
1	EW	Preparation	T-1	Precipitation from reanalysis (ERA5) and/or from a gridded observational product (GPCC)	ECMWF
2	EW	Preparation	T-1	Precipitation from three ECMWF forecasts: ensemble forecast (ENS), extended-range ensemble forecast (ENS–ER) and seasonal forecasts (SEA)	ECMWF
3	EW	Preparation	T-1	Collection of different indicators: - NDVI, NDWI, LST, root zone soil moisture, land cover - ERA5 air temperature and precipitation data	VITO, UNISTRA-TRIO
4	EW	Preparation	T-1	Collection of auxiliary and media data: - HOT OSM / road data - ACLED - FEWSNET - FAO Wapor - Social and traditional media markers	Adelphi GMV (livestock heat stress, rangeland cover change, main Roads) Hensoldt (media data)
5	EW	Production	T+0	Generation of WFS-ID-1 "Meteorological drought (monitoring product)"	ECWMF: Production WFS partners: Quality control
6	EW	Delivery	T+0	Upload of WFS-ID-1 product and availability notification to end-users and service providers	ECWMF: Upload GMV: Notification and delivery checks
7	EW	Production	T+0	Generation of WFS-ID-2 "Meteorological drought (forecast)"	ECWMF: Production WFS partners: Quality control
8	EW	Delivery	T+0	Upload of WFS-ID-2 product and availability notification to end-users and service providers	ECWMF: Upload GMV: Notification and delivery checks
9	EW	Production	T+0	Generation of WFS-ID-3 "Meteorological drought (danger levels)"	ECWMF: Production WFS partners: Quality control
10	EW	Delivery	T+0	Upload of WFS-ID-3 product and availability notification to end-users and service providers	ECWMF: Upload GMV: Notification and delivery checks
11	EW	Production	T+0	Generation of WFS-ID-4 "Agricultural drought monitoring (near real-time)"	VITO, UNISTRA-TRIO: Production WFS partners: Quality control
12	EW	Delivery	T+0	Upload of WFS-ID-4 product and availability notification to end-users and service providers	VITO, UNISTRA-TRIO: Upload GMV: Notification and delivery checks
13	EW	Production	T+0	Generation of WFS-ID-5 "Agricultural drought (forecast)"	VITO, UNISTRA-TRIO: Production WFS partners: Quality control
14	EW	Delivery	T+0	Upload of WFS-ID-5 product and availability notification to end-users and service providers	VITO, UNISTRA-TRIO: Upload GMV: Notification and delivery checks
15	EW	Production	T+0	Generation of WFS-ID-6 "Agricultural drought risk zone map"	VITO, UNISTRA-TRIO: Production WFS partners: Quality control

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Step	Risk phase	Category	Delivery date	Description	Roles and responsibilities
16	EW	Delivery	T+0	Upload of WFS-ID-6 product and availability notification to end-users and service providers	VITO, UNISTRA-TRIO: Upload GMV: Notification and delivery checks
17	EW	Production	T+0	Generation of all relevant media-based indicators: WFS-ID-11 "Food Security", WFS-ID-12 "Economic Security", WFS-ID-13 "Displaced Persons", WFS-ID-14 "Crime and illicit activities", WFS-ID-15 "Radicalisation and polarisation", WFS-ID-17 "Humanitarian Aid", WFS-ID-18 "Resource capture", WFS-ID-19 "Climate sensitivity of agri-food systems", WFS-ID-21 "Public services and infrastructure", WFS-ID-23 "State-citizen relations", WFS-ID-24 "Dispute resolution mechanisms", and WFS-ID-25 "Social cohesion"	Hensoldt: Production Adelphi: Quality control
18	EW	Delivery	T+0	Upload of media-based indicators: WFS-ID-11 "Food Security", WFS-ID-12 "Economic Security", WFS-ID-13 "Displaced Persons", WFS-ID-14 "Crime and illicit activities", WFS-ID-15 "Radicalisation and polarisation", WFS-ID-17 "Humanitarian Aid", WFS-ID-18 "Resource capture", WFS-ID-19 "Climate sensitivity of agri-food systems", WFS-ID-21 "Public services and infrastructure", WFS-ID-23 "State-citizen relations", WFS-ID-24 "Dispute resolution mechanisms", and WFS-ID-25 "Social cohesion"	Hensoldt: Upload GMV: Notification and delivery checks
19	EW	Production	T+0	Generation of all relevant socioeconomic indicators: WFS-ID-11 "Food Security", WFS-ID-12 "Economic Security", WFS-ID-14 "Violent conflict", WFS-ID-17 "Humanitarian Aid", WFS-ID-18 "Resource capture", WFS-ID-19 "Climate sensitivity of agri-food systems", WFS-ID-21 "Public services and infrastructure"	Adelphi: Production Cherrydata: Quality control
20	EW	Delivery	T+0	Upload of socioeconomic indicators: WFS-ID-11 "Food Security", WFS-ID-12 "Economic Security", WFS-ID-14 "Violent conflict", WFS-ID-17 "Humanitarian Aid", WFS-ID-18 "Resource capture", WFS-ID-19 "Climate sensitivity of agri-food systems", WFS-ID-21 "Public services and infrastructure"	Adelphi: Upload GMV: Notification and delivery checks
21	EW	Production	T+0	Generation of "Drought Impact Forecast Index" (DIFI)	Cherrydata: Production Adelphi: quality control
22	EW	Delivery	T+0	Upload of "Drought Impact Forecast Index (DIFI)"	Cherrydata: Upload GMV: Notification and delivery checks
23	EW	Delivery	T+0	Alert notification to service providers and end-users with credentials for access to data viewer dashboard	WFS partners: Alert sent to GMV, end-users and service providers GMV: Notification check

Table 17: Event monitoring phase for the Somalian scenario.

Step	Risk phase	Category	Delivery date	Description	Roles and responsibilities
24	EM	Preparation	T+1	Collection of pre- and post-event EO-data - Satellite tasking - Freely available imagery	e-GEOS
25	EM	Production	T+2	Generation of WFS-ID-7 "IDPs camp status indicator"	e-GEOS: Production Cherrydata: Quality control

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Step	Risk phase	Category	Delivery date	Description	Roles and responsibilities
26	EM	Delivery	T+2	Upload of WFS-ID-7 product and availability notification to end-users and service providers	e-GEOS: Upload GMV: Notification and delivery checks
27	EM	Delivery	T+2	Alert notification to service providers and end-users with credentials for access to updated data viewer dashboard	WFS partners: Alert sent to GMV, end-users and service providers GMV: Notification check

Table 18: Product and service assessment phase for the Somalian scenario.

Step	Risk phase	Category	Delivery date	Description	Roles and responsibilities
28	PSA	Validation	T+3	Collection of feedback through end-user and service provider questionnaires	SatCen: Share questionnaires Participants: End-users, service providers
29	PSA	Validation	T+4	Notification of completed end-user questionnaire reception	SpaceTec to UNISTRA-SERTIT
30	PSA	Validation	T+4	Delivery of completed service provider questionnaire	Service providers to UNISTRA-SERTIT
31	PSA	Validation	T+5	Product and service validation	Tracasa
32	PSA	Validation	T+6	Data analysis, conclusion and inventory of recommendations and actions to be implemented in short and medium terms	Tracasa: Validation UNISTRA-SERTIT: Questionnaire analysis SatCen: Review
33	PSA	Validation	T+7	Dissemination of results, lessons learnt, recommendations	UNISTRA-SERTIT and SatCen

3.4.2 Malian scenario

The Malian hot case scenario will focus on the ongoing monitoring of water and food insecurity throughout the country, incorporating forecasts and predictions of potential alerts. Unlike the cold case, which analysed specific historical events, the hot case addresses the current and evolving challenges within Mali. Positioned in the climate-vulnerable Sahel region, Mali continues to grapple with periodic water shortages, erratic rainfall patterns, and increasing communal tensions.

The Area of Interest (AOI) for the hot case encompasses the entire nation, acknowledging the widespread nature of the crisis. This AOI was chosen to ensure a comprehensive and timely response to water and food insecurity across various regions. Continuous monitoring will facilitate a real-time evaluation of the situation, allowing for swift and effective interventions to address emerging issues.

Mali's hot case scenario is pivotal for understanding and managing climate security risks within the Sahel region. By maintaining an ongoing assessment, the approach aims to identify and mitigate crises related to water and food insecurity, thus enhancing resilience against these persistent challenges.

The scenario for the Malian hot case is detailed in Table 19, Table 20 and Table 21, describing early warning, event monitoring, and product and service assessment respectively. The end-user participating to this demonstrator – **German Foreign Office - Data Science Division** – will be notified of upcoming product delivery, and invited to provide feedback on their experience with CENTAUR.

Table 19: Early warning phase for the Malian scenario.

Step	Risk phase	Category	Delivery date	Description	Roles and responsibilities
1	EW	Preparation	T-1	Precipitation from reanalysis (ERA5) and/or from a gridded observational product (GPCC)	ECMWF

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Step	Risk phase	Category	Delivery date	Description	Roles and responsibilities
2	EW	Preparation	T-1	Precipitation from three ECMWF forecasts: ensemble forecast (ENS), extended-range ensemble forecast (ENS–ER) and seasonal forecasts (SEA)	ECMWF
3	EW	Preparation	T-1	Collection of different indicators: - NDVI, NDWI, LST, root zone soil moisture, land cover - ERA5 air temperature and precipitation data	VITO, UNISTRA-TRIO
4	EW	Preparation	T-1	Collection of auxiliary and media data: - HOT OSM / road data - ACLED - FEWSNET - FAO Wapor - Social and traditional media markers	Adelphi GMV (livestock heat stress, rangeland cover change, main Roads) Hensoldt (media data)
5	EW	Production	T+0	Generation of WFS-ID-1 "Meteorological drought (monitoring product)"	ECWMF: Production WFS partners: Quality control
6	EW	Delivery	T+0	Upload of WFS-ID-1 product and availability notification to end-users and service providers	ECWMF: Upload GMV: Notification and delivery checks
7	EW	Production	T+0	Generation of WFS-ID-2 "Meteorological drought (forecast)"	ECWMF: Production WFS partners: Quality control
8	EW	Delivery	T+0	Upload of WFS-ID-2 product and availability notification to end-users and service providers	ECWMF: Upload GMV: Notification and delivery checks
9	EW	Production	T+0	Generation of WFS-ID-3 "Meteorological drought (danger levels)"	ECWMF: Production WFS partners: Quality control
10	EW	Delivery	T+0	Upload of WFS-ID-3 product and availability notification to end-users and service providers	ECWMF: Upload GMV: Notification and delivery checks
11	EW	Production	T+0	Generation of WFS-ID-4 "Agricultural drought monitoring (near real-time)"	VITO, UNISTRA-TRIO: Production WFS partners: Quality control
12	EW	Delivery	T+0	Upload of WFS-ID-4 product and availability notification to end-users and service providers	VITO, UNISTRA-TRIO: Upload GMV: Notification and delivery checks
13	EW	Production	T+0	Generation of WFS-ID-5 "Agricultural drought (forecast)"	VITO, UNISTRA-TRIO: Production WFS partners: Quality control
14	EW	Delivery	T+0	Upload of WFS-ID-5 product and availability notification to end-users and service providers	VITO, UNISTRA-TRIO: Upload GMV: Notification and delivery checks
15	EW	Production	T+0	Generation of WFS-ID-6 "Agricultural drought risk zone map"	VITO, UNISTRA-TRIO: Production WFS partners: Quality control
16	EW	Delivery	T+0	Upload of WFS-ID-6 product and availability notification to end-users and service providers	VITO, UNISTRA-TRIO: Upload GMV: Notification and delivery checks
17	EW	Production	T+0	Generation of all relevant media-based indicators: WFS-ID-11 "Food Security", WFS-ID-12 "Economic Security", WFS-ID-13 "Displaced Persons", WFS-ID-14 "Crime and illicit activities", WFS-ID-15 "Radicalisation and polarisation", WFS-ID-17 "Humanitarian Aid", WFS-ID-18 "Resource capture", WFS-ID-19 "Climate sensitivity of agri-food systems", WFS-ID-21 "Public services and infrastructure", WFS-ID-23 "State-citizen relations", WFS-ID-24 "Dispute resolution mechanisms", and WFS-ID-25 "Social cohesion"	Hensoldt: Production Adelphi: Quality control

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Step	Risk phase	Category	Delivery date	Description	Roles and responsibilities
18	EW	Delivery	T+0	Upload of media-based indicators: WFS-ID-11 "Food Security", WFS-ID-12 "Economic Security", WFS-ID-13 "Displaced Persons", WFS-ID-14 "Crime and illicit activities", WFS-ID-15 "Radicalisation and polarisation", WFS-ID-17 "Humanitarian Aid", WFS-ID-18 "Resource capture", WFS-ID-19 "Climate sensitivity of agri-food systems", WFS-ID-21 "Public services and infrastructure", WFS-ID-23 "State-citizen relations", WFS-ID-24 "Dispute resolution mechanisms", and WFS-ID-25 "Social cohesion"	Hensoldt: Upload GMV: Notification and delivery checks
19	EW	Production	T+0	Generation of all relevant socioeconomic indicators: WFS-ID-11 "Food Security", WFS-ID-12 "Economic Security", WFS-ID-14 "Violent conflict", WFS-ID-17 "Humanitarian Aid", WFS-ID-18 "Resource capture", WFS-ID-19 "Climate sensitivity of agri-food systems", WFS-ID-21 "Public services and infrastructure"	Adelphi: Production Cherrydata: Quality control
20	EW	Delivery	T+0	Upload of socioeconomic indicators: WFS-ID-11 "Food Security", WFS-ID-12 "Economic Security", WFS-ID-14 "Violent conflict", WFS-ID-17 "Humanitarian Aid", WFS-ID-18 "Resource capture", WFS-ID-19 "Climate sensitivity of agri-food systems", WFS-ID-21 "Public services and infrastructure"	Adelphi: Upload GMV: Notification and delivery checks
21	EW	Production	T+0	Generation of "Drought Impact Forecast Index" (DIFI)	Cherrydata: Production Adelphi: quality control
22	EW	Delivery	T+0	Upload of "Drought Impact Forecast Index (DIFI)"	Cherrydata: Upload GMV: Notification and delivery checks
23	EW	Delivery	T+0	Alert notification to service providers and end-users with credentials for access to data viewer dashboard	WFS partners: Alert sent to GMV, end-users and service providers GMV: Notification check

Table 20: Event monitoring phase for the Malian scenario.

Step	Risk phase	Category	Delivery date	Description	Roles and responsibilities
24	EM	Preparation	T+1	Collection of pre- and post-event EO-data - Satellite tasking - Freely available imagery	e-GEOS
25	EM	Production	T+2	Generation of WFS-ID-7 "IDPs camp status indicator"	e-GEOS: Production Cherrydata: Quality control
26	EM	Delivery	T+2	Upload of WFS-ID-7 product and availability notification to end-users and service providers	e-GEOS: Upload GMV: Notification and delivery checks
27	EM	Delivery	T+2	Alert notification to service providers and end-users with credentials for access to updated data viewer dashboard	WFS partners: Alert sent to GMV, end-users and service providers GMV: Notification check

Table 21: Product and service assessment phase for the Malian scenario.

Step	Risk phase	Category	Delivery date	Description	Roles and responsibilities
28	PSA	Validation	T+3	Collection of feedback through end-user and service provider questionnaires	SatCen: Share questionnaires Participants: End-users, service providers

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Step	Risk phase	Category	Delivery date	Description	Roles and responsibilities
29	PSA	Validation	T+4	Notification of completed end-user questionnaire reception	SpaceTec to UNISTRA-SERTIT
30	PSA	Validation	T+4	Delivery of completed service provider questionnaire	Service providers to UNISTRA-SERTIT
31	PSA	Validation	T+5	Product and service validation	Tracasa
32	PSA	Validation	T+6	Data analysis, conclusion and inventory of recommendations and actions to be implemented in short and medium terms	Tracasa: Validation UNISTRA-SERTIT: Questionnaire analysis SatCen: Review
33	PSA	Validation	T+7	Dissemination of results, lessons learnt, recommendations	UNISTRA-SERTIT and SatCen

3.5 CROSS-CUTTING DEMONSTRATOR SCENARIO: THE MOZAMBIQUE COLD CASE

Mozambique is characterized by a multifaceted landscape of climate vulnerability, heightened disaster risk, and escalating threats from violent extremism. This coastal lowland region, particularly urban areas such as Beira, is highly vulnerable to climate-induced changes, including rising temperatures, sea levels, and the frequency of cyclones and tropical storms. The case of Tropical Cyclone Idai in March 2019 underscores these challenges, causing widespread devastation across several provinces and highlighting the acute vulnerabilities faced by urban slums.

The agricultural sector, which is a cornerstone of Mozambique's economy and the primary livelihood for over 80% of its population, is significantly impacted by climatic extremes. Flooding events, often resulting from cyclones and storms, compromise food security by damaging arable land and disrupting food storage, thereby posing challenges to both water availability and food production.

An integrated analysis of Mozambique's situation reveals critical intersections between urban flooding, food security, and water scarcity. The challenges are compounded by limited access to clean water, inadequate disaster preparedness, high poverty rates, and a strong dependence on agriculture. Climatic disasters, particularly during the lean season, exacerbate food insecurity by affecting food production and storage capabilities.

In addressing Mozambique's complex challenges, it is imperative to adopt comprehensive approaches that consider the interplay between climate change, disaster risk, and socio-economic vulnerabilities. Strategies should aim at enhancing resilience and sustainability, focusing on improving water management, agricultural practices, and urban planning to safeguard against future climatic shocks and to support the well-being of vulnerable populations. Understanding the dynamics at play and their implications is crucial for stakeholders to develop effective mitigation and adaptation measures.

The scenario for the Mozambique hot case is detailed in Table 22, Table 23 and Table 24, describing early warning, event monitoring, and product and service assessment respectively. The end-user participating to this demonstrator scenario – **Helpcode** – will be notified of upcoming product delivery, and invited to provide feedback on their experience with CENTAUR.

Table 22: Early warning phase the Mozambique scenario.

Step	Risk phase	Category	Delivery date	Description	Roles and responsibilities
1	EW	Preparation	T-4	Collection of meteorological observations and forecasts over Beira specifically	ECWMF
2	EW	Production	T-3	Generation of UF-ID-1 "Historical 6 hours return period static precipitation maps"	ECWMF: Production e-GEOS: Quality control

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Step	Risk phase	Category	Delivery date	Description	Roles and responsibilities
3	EW	Delivery	T-3	Upload of UF-ID-1 product and availability notification to end-users and service providers	ECWMF: Upload GMV: Notification and delivery checks
4	EW	Production	T-2	Generation of UF-ID-2 "ML data driven forecast of return period-based precipitation events in urban areas"	ECWMF: Production e-GEOS: Quality control
5	EW	Delivery	T-2	Upload of UF-ID-2 product and availability notification to end-users and service providers	ECWMF: Upload GMV: Notification and delivery checks
6	EW	Production	T-1	Generation of UF-ID-3 "Urban inundation probability maps and water depth defined by return period at a spatial resolution in the order of < 10 m"	e-GEOS: Production ECWMF: Quality control
7	EW	Delivery	T-1	Upload of UF-ID-3 product and availability notification to end-users and service providers	e-GEOS: Upload GMV: Notification and delivery checks
8	EW	Preparation	T-1	Precipitation from reanalysis (ERA5) and/or from a gridded observational product (GPCC)	ECMWF
9	EW	Preparation	T-1	Precipitation from three ECMWF forecasts: ensemble forecast (ENS), extended-range ensemble forecast (ENS–ER) and seasonal forecasts (SEA)	ECMWF
10	EW	Preparation	T-1	Collection of different indicators: - NDVI, NDWI, LST, root zone soil moisture, land cover - ERA5 air temperature and precipitation data	VITO, UNISTRA-TRIO
11	EW	Preparation	T-1	Collection of auxiliary and media data: - HOT OSM / road data - ACLED - FEWSNET - FAO Wapor - Social and traditional media markers	Adelphi GMV (livestock heat stress, rangeland cover change, main Roads) Hensoldt (media data)
12	EW	Production	T+0	Generation of WFS-ID-1 "Meteorological drought (monitoring product)"	ECWMF: Production WFS partners: Quality control
13	EW	Delivery	T+0	Upload of WFS-ID-1 product and availability notification to end-users and service providers	ECWMF: Upload GMV: Notification and delivery checks
14	EW	Production	T+0	Generation of WFS-ID-2 "Meteorological drought (forecast)"	ECWMF: Production WFS partners: Quality control
15	EW	Delivery	T+0	Upload of WFS-ID-2 product and availability notification to end-users and service providers	ECWMF: Upload GMV: Notification and delivery checks
16	EW	Production	T+0	Generation of WFS-ID-3 "Meteorological drought (danger levels)"	ECWMF: Production WFS partners: Quality control
17	EW	Delivery	T+0	Upload of WFS-ID-3 product and availability notification to end-users and service providers	ECWMF: Upload GMV: Notification and delivery checks
18	EW	Production	T+0	Generation of WFS-ID-4 "Agricultural drought monitoring (near real-time)"	VITO, UNISTRA-TRIO: Production WFS partners: Quality control
19	EW	Delivery	T+0	Upload of WFS-ID-4 product and availability notification to end-users and service providers	VITO, UNISTRA-TRIO: Upload GMV: Notification and delivery checks

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Step	Risk phase	Category	Delivery date	Description	Roles and responsibilities
20	EW	Production	T+0	Generation of WFS-ID-5 "Agricultural drought (forecast)"	VITO, UNISTRA-TRIO: Production WFS partners: Quality control
21	EW	Delivery	T+0	Upload of WFS-ID-5 product and availability notification to end-users and service providers	VITO, UNISTRA-TRIO: Upload GMV: Notification and delivery checks
22	EW	Production	T+0	Generation of WFS-ID-6 "Agricultural drought risk zone map"	VITO, UNISTRA-TRIO: Production WFS partners: Quality control
23	EW	Delivery	T+0	Upload of WFS-ID-6 product and availability notification to end-users and service providers	VITO, UNISTRA-TRIO: Upload GMV: Notification and delivery checks
24	EW	Production	T+0	Generation of all relevant media-based indicators: WFS-ID-11 "Food Security", WFS-ID-12 "Economic Security", WFS-ID-13 "Displaced Persons", WFS-ID-14 "Crime and illicit activities", WFS-ID-15 "Radicalisation and polarisation", WFS-ID-17 "Humanitarian Aid", WFS-ID-18 "Resource capture", WFS-ID-19 "Climate sensitivity of agri-food systems", WFS-ID-21 "Public services and infrastructure", WFS-ID-23 "State-citizen relations", WFS-ID-24 "Dispute resolution mechanisms", and WFS-ID-25 "Social cohesion"	Hensoldt: Production Adelphi: Quality control
25	EW	Delivery	T+0	Upload of media-based indicators: WFS-ID-11 "Food Security", WFS-ID-12 "Economic Security", WFS-ID-13 "Displaced Persons", WFS-ID-14 "Crime and illicit activities", WFS-ID-15 "Radicalisation and polarisation", WFS-ID-17 "Humanitarian Aid", WFS-ID-18 "Resource capture", WFS-ID-19 "Climate sensitivity of agri-food systems", WFS-ID-21 "Public services and infrastructure", WFS-ID-23 "State-citizen relations", WFS-ID-24 "Dispute resolution mechanisms", and WFS-ID-25 "Social cohesion"	Hensoldt: Upload GMV: Notification and delivery checks
26	EW	Production	T+0	Generation of all relevant socioeconomic indicators: WFS-ID-11 "Food Security", WFS-ID-12 "Economic Security", WFS-ID-14 "Violent conflict", WFS-ID-17 "Humanitarian Aid", WFS-ID-18 "Resource capture", WFS-ID-19 "Climate sensitivity of agri-food systems", WFS-ID-21 "Public services and infrastructure"	Adelphi: Production Cherrydata: Quality control
27	EW	Delivery	T+0	Upload of socioeconomic indicators: WFS-ID-11 "Food Security", WFS-ID-12 "Economic Security", WFS-ID-14 "Violent conflict", WFS-ID-17 "Humanitarian Aid", WFS-ID-18 "Resource capture", WFS-ID-19 "Climate sensitivity of agri-food systems", WFS-ID-21 "Public services and infrastructure"	Adelphi: Upload GMV: Notification and delivery checks
28	EW	Production	T+0	Generation of "Drought Impact Forecast Index" (DIFI)	Cherrydata: Production Adelphi: quality control
29	EW	Delivery	T+0	Upload of "Drought Impact Forecast Index (DIFI)"	Cherrydata: Upload GMV: Notification and delivery checks
30	EW	Production	T+0	Generation of “Aggregate Early Warning Impact Indexes”	Cherrydata: Production ECMWF: Quality control

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Step	Risk phase	Category	Delivery date	Description	Roles and responsibilities
31	EW	Delivery	T+0	Upload of "Aggregate Early Warning Impact Indexes" product and availability notification to end-users and service providers	Cherrydata: Upload GMV: Notification and delivery checks
32	EW	Production	T+0	Generation of "Early Warning Forecast Index"	ECWMF: Production e-GEOS: Quality control
33	EW	Delivery	T+0	Upload of "EW Forecast Index" product and availability notification to end-users and service providers	ECWMF: Upload GMV: Notification and delivery checks
34	EW	Delivery	T+0	Alert notification to service providers and end-users to indicate floods in Beira	ECWMF: Alert sent to GMV, end-users and service providers
35	EW	Delivery	T+0	Alert notification to service providers and end-users with credentials for access to data viewer dashboard at country scale	WFS partners: Alert sent to GMV, end-users and service providers GMV: Notification check

Table 23: Event monitoring phase for the Mozambique scenario.

Step	Risk phase	Category	Delivery date	Description	Roles and responsibilities
36	EM	Preparation	T+1	Collection of pre- and post-event EO-data - Satellite tasking - Freely available imagery	e-GEOS: Tasking, free crisis imagery UNISTRA-SERTIT: Sentinel-1
37	EM	Preparation	T+1	Request for national data to the authorized user - 🔑 DTM - Water gauges	e-GEOS
38	EM	Preparation	T+1	Preparation and QC of pre- and post-event EO data (optical and radar imagery)	e-GEOS: Free crisis imagery UNISTRA-SERTIT: InSAR-compatible S1 triplet (2 pre- and 1 post-event)
39	EM	Preparation	T+1	🔑 Collection and preparation of topographic base layers (elevation, hydrography, buildings, facilities, transportation networks, land use and land cover)	e-GEOS
40	EM	Preparation	T+1	🔑 Collection and preparation of ancillary data (built-up 2D and 3D, population)	DLR
41	EM	Preparation	T+1	Production of crisis information (water extent delineation)	e-GEOS: Production UNISTRA-SERTIT: Quality control
42	EM	Production	T+2	Generation of WFS-ID-7 "IDPs camp status indicator"	e-GEOS: Production Cherrydata: Quality control
43	EM	Delivery	T+2	Upload of WFS-ID-7 product and availability notification to end-users and service providers	e-GEOS: Upload GMV: Notification and delivery checks
44	EM	Delivery	T+2	Alert notification to service providers and end-users with credentials for access to updated data viewer dashboard	WFS partners: Alert sent to GMV, end-users and service providers GMV: Notification check
45	EM	Production	T+2	Generation of UF-ID-4 "Inferred InSAR urban flood extent"	UNISTRA-SERTIT: Production e-GEOS: Quality control
46	EM	Delivery	T+2	Upload of UF-ID-4 product and availability notification to end-users and service providers	UNISTRA-SERTIT: Upload GMV: Notification and delivery checks
47	EM	Production	T+3	Generation of UF-ID-5 "Urban flooding map based on geomorphological and InSAR approach for an enhanced damage" - Flood extent - Damage assessment on transportation and buildings - Damage assessment on facilities	e-GEOS: Flood extent, flood depth, damage assessment (transportation, buildings) UNISTRA-SERTIT: Damage assessment (facilities) e-GEOS, UNISTRA-SERTIT: Quality control

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Step	Risk phase	Category	Delivery date	Description	Roles and responsibilities
48	EM	Delivery	T+3	Upload of UF-ID-5 product and availability notification to end-users and service providers	e-GEOS: Upload GMV: Notification and delivery checks
49	EM	Preparation	T+4	Collection and integration of media information related to the event over affected areas	Hensoldt
50	EM	Preparation	T+4	Collection and integration of media information related to economic impact of the event over affected areas	Hensoldt
51	EM	Production	T+5	Generation of UF-ID-6 "Social and traditional media indicators for urban flooding maps"	e-GEOS: Initialisation (flood extent inputs) Hensoldt: Production
52	EM	Delivery	T+5	Upload of UF-ID-6 product and availability notification to end-users and service providers	Hensoldt: Upload GMV: Notification and delivery checks
53	EM	Production	T+6	Generation of UF-ID-7 "Hazard web sources indicator"	e-GEOS: Production Adelphi: Quality control
54	EM	Delivery	T+6	Upload of UF-ID-7 product and availability notification to end-users and service providers	e-GEOS: Upload GMV: Notification and delivery checks
55	EM	Preparation	T+7	Collection and preparation of input data for socio-economic components (responders, shelters, healthcare, restaurants, hotels)	UNISTRA-SERTIT
56	EM	Preparation	T+7	Preparation of transportation data for network analysis	UNISTRA-SERTIT
57	EM	Production	T+8	Generation of UF-ID-9 "Assets and financial resources"	UNISTRA-SERTIT: Initialisation, quality control Adelphi: Production
58	EM	Delivery	T+8	Upload of UF-ID-9 product and availability notification to end-users and service providers	Adelphi: Upload GMV: Notification and delivery checks
59	EM	Production	T+9	Generation of UF-ID-10 "Public services and government support"	UNISTRA-SERTIT: Initialisation, quality control Adelphi: Production
60	EM	Delivery	T+9	Upload of UF-ID-10 product and availability notification to end-users and service providers	Adelphi: Upload GMV: Notification and delivery checks
61	EM	Production	T+10	Generation of UF-ID-13 "Ability to flee"	UNISTRA-SERTIT: Initialisation, quality control Adelphi: Production
62	EM	Delivery	T+10	Upload of UF-ID-13 product and availability notification to end-users and service providers	Adelphi: Upload GMV: Notification and delivery checks
63	EM	Production	T+11	Generation of UF-ID-14 "Economic impact of floods"	e-GEOS: Initialisation, quality control Hensoldt: Production
64	EM	Delivery	T+11	Upload of UF-ID-14 product and availability notification to end-users and service providers	Hensoldt: Upload GMV: Notification and delivery checks
65	EM	Production	T+12	Generation of “Aggregate Natural Crisis Impact Indexes”	Cherrydata: Production Hensoldt, e-GEOS, Adelphi, UNISTRA-SERTIT: Quality control
66	EM	Delivery	T+12	Upload of “Aggregate Natural Crisis Impact Indexes” product and availability notification to end-users and service providers	Cherrydata: Upload GMV: Notification and delivery checks
67	EM	Production	T+12	Generation of “Flood Impact Index”	e-GEOS: Production Hensoldt, e-GEOS, Adelphi, UNISTRA-SERTIT: Quality control

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Step	Risk phase	Category	Delivery date	Description	Roles and responsibilities
68	EM	Delivery	T+12	Upload of "Flood Impact Index" product and availability notification to end-users and service providers	e-GEOS: Upload GMV: Notification and delivery checks

Table 24 describes all the steps for a thorough evaluation of products and service for to the demonstration on the Mozambique use case. Starting after the delivery of the Early Warning and Event Monitoring components, this phase aims at estimating the quality and reliability of the delivered products. This phase will be supported by additional datasets if available:

- A **time series of pluviometry data**: NRT data of the flood event under study could be obtained.
- **Optical images** acquired during the flood event. If the flood event is extreme, is likely to trigger CEMS activation. In such a case, acquired optical images are likely to be available, and a search for them will be conducted.
- **Aerial images.** Local authorities will be contacted to determine if they have this information.
- **Flood mask.** Local authorities will be contacted to determine if they have this information.
- JBA Risk Management's **flood risk and hazard masks** of the National Flood Zone Mapping System for different return periods[3].
- **In-situ river gauges**, describing river levels over multiple stations in the AOI could be obtained.
- **Literature**, including scientific papers, institutional documents from the Red Cross and government, as well as web news sources. They can provide crucial information on the damage caused by the event in the analysed area.

Table 24: Product and service assessment phase for the Mozambique scenario.

Step	Risk phase	Category	Delivery date	Description	Roles and responsibilities
69	PSA	Validation	T+13	Collection of feedback through end-user and service provider questionnaires	e-GEOS: Share questionnaires Participants: End-users, service providers
70	PSA	Validation	T+14	Notification of completed end-user questionnaire reception	SpaceTec to UNISTRA-SERTIT
71	PSA	Validation	T+14	Delivery of completed service provider questionnaire	Service providers to UNISTRA-SERTIT
72	PSA	Validation	T+15	Product and service validation	Tracasa
73	PSA	Validation	T+16	Data analysis, conclusion and inventory of recommendations and actions to be implemented in short and medium terms	Tracasa: Validation UNISTRA-SERTIT: Questionnaire analysis e-GEOS, SatCen: Review
74	PSA	Validation	T+17	Dissemination of results, lessons learnt, recommendations	UNISTRA-SERTIT and e-GEOS

3.6 CHALLENGES, LIMITATIONS AND PROPOSED SOLUTIONS

Service providers have identified a series of steps that might be challenging during the preparation, execution or evaluation of the hot case demonstrators. Preliminary solutions have been proposed for some, but further investigation is required within WP2 and WP4.

[3] Cylone Idai causes extensive flooding across Mozambique, Malawi and Zimbabwe, 2019 – https://www.jbarisk.com/products-services/event-response/cyclone-idai/

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It is essential to address the most significant challenge faced by hot case demonstrators: **the possibility that no urban flood or water and food security crises may occur** to effectively test the system in a pre-operational context. The selection of use cases was strategically based on the likelihood of encountering a crisis event within the project's lifetime. For the urban flood track, factors like inundation risk and frequency were considered, illustrated by the nearly annual cyclones and sea surges in Mozambique. Similarly, for the water and food security track, regions with ongoing instability were chosen, such as Somalia, which has experienced prolonged droughts compounded by civil unrest.

These criteria guided the definition of areas of interest, ensuring that the extensive preliminary efforts in data collection and static dataset preparation remain relevant throughout the project. This strategic planning aims to maximize the utility and applicability of outputs, safeguarding against the potential absence of live crisis events to test the system. However, this uncertainty still poses itself as a challenge and limitation, despite mitigation efforts.

3.6.1 Challenges in the preparation of scenarios

During the hot case phase, the **preparation of scenarios** has two main goals: **collection of input data** and **generation of indicators, indexes and services**. Several potential challenges could arise, including data availability and accuracy challenges, challenges related to the temporal dynamics of variables of interest, limitations in the development of indicators limitations, as well as limitations of predictive models.

Data availability and accuracy

Accurate and relevant analysis is constrained by the **quality of reference input data**, in terms of thematic, spatial (positional), or temporal accuracy. As these data contribute to assessing different components of the risk system, a comprehensive knowledge of their specifications is key to account for possible measurement or estimation errors. Collecting different data sets serving the same purpose or additional information sources, where possible, could help determine whether CENTAUR products align with generally observed trends and patterns.

Moreover, precise **information** on **where** issues discussed in the **media** occur are often difficult to obtain. Only a fraction of social media posts contain precise location information and reports in traditional media rarely include precise location information, unless an event occurs near a well-known landmark. Changes in the policy of key social media platforms, like X/Twitter, have further complicated the situation. Unannounced and sudden changes to social media APIs further complicate matters. Hot case demonstrators could mitigate this by expanding media, sources and language coverage. In addition, indicator and index design needs to reflect the presence or absence or certain media-based elements.

Temporal dynamics of variables of interest

Proper estimation of flood extents depends on the **availability of EO images acquired during flood peak**. However, there is no guarantee such conditions are met during an event. This may lead to the underestimation of several indicators, including flood depth and damage assessment. Even though the impact is limited to the UF track generally speaking, it also impedes on the potential for a cross-cutting analysis, as unmapped flooded areas could result in local crop failure for example. Considering the high costs of HR to VHR imagery, the only reasonable solution is to harvest and integrate as much free EO data as possible.

In larger AOIs, **flood peak times vary along the river course**, implying that a single EO acquisition may not accurately capture the maximum water extent across different sections of the analysed region. In the context of this demonstration cycle, this challenge only concerns France and Spain, which were riverine flooding caused by intense precipitation over a large area upstream of the affected cities.

In addition, **some indicators may require several occurrences of the same crisis event to provide robust results**. This is especially the case for UF-ID-7. The collection of additional crisis information from alternative channels could prove useful to mitigate this risk.

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Limitations to indicator development

Population and buildings do **not adequately capture the variables of interest** for the generation of UF-ID-9, 10 and 13, over several use cases. When applicable, available information drawn from census data or OSM data will be used. The same is true for many of the socioeconomic and political indicators of the Water and Food Security (WFS) track (e.g., WFS-ID-23, 24, 25), where available data only allows for developing **proxy indicators** for the variables of interest. (Un-)Availability of media-derived indicators may limit the computation of complex indicators/indices.

Limitations to predictive models

Weather forecast models face different challenges in accurately predicting precipitation over extended lead times. To enable realistic predictions and account for these specificities, seasonal ensemble forecasts will be employed to assess drought occurrence probabilities and severities within the coming six months.

The **interaction between current drought conditions and future meteorological scenarios** is highly variable and dependent on local environmental conditions. Developing a universally effective threshold-based system across Africa poses a significant challenge.

Finally, a major challenge lies in **converting EO-based change detection products into quantitative characterizations** of settlement extents, population estimates and other actionable features. This is currently being addressed as part of WP2.

3.6.2 Challenges in the execution of scenarios

The execution of hot cases could also lead to technical difficulties, communication challenges, or operational inadequacies, outlined in more detail below.

Data availability and accuracy

During execution, **media coverage may be limited** and only provide information regarding a subset of (media-based) indicators; the volume of content available may be limited due to the number of available sources, their angles of coverage of events or by the fact that certain aspects of events simply are not covered by the media (or only covered to a very limited extent). This in turn may lead to only a small number of relevant documents not allowing to generate robust indicators.

Technical difficulties

Technical issues may **disable the ability to share and upload indicators or indexes** with the end-users, crucial for the demonstration's success. This requires robust troubleshooting protocols and backup solutions to ensure continuity, which are points discussed between partners.

Communication challenges

There is a risk of **end-users not receiving notifications correctly**, which could result in disengagement or missing out on valuable feedback. Mitigation strategies include pre-emptive communication with users to confirm the execution phase, notify deliveries, and validate contact information. The goal is to ensure effective and reliable communication channels.

Operational inadequacies

Failing to provide one or more critical indicators could compromise the demonstration's success and added value for end users. This underscores the importance of comprehensive planning and the inclusion of all necessary data points in the demonstration's design. Unfortunately, the current planning cannot consider possible delays that may occur. This issue mostly concerns the computation of high-level indices, like the Flood Early Warning Index (FEWI), or Flood Impact Index (FII) (described in D2.5 [RD15]).

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The reliability of demonstration results could be compromised by **inaccuracies or inconsistencies in input data**. Rigorous data validation and cross-verification methods are essential to maintain the integrity of the demonstration's outcomes. However, **missing validation data** could also be a limiting factor. This is particularly true for WFS indicators and services, as there is often no proper equivalent to what is being designed. Thus, partners remain on the lookout for additional information that could be used to certify the quality of crisis packages delivered to end-users.

3.6.3 Challenges in the evaluation of scenarios

During the hot case phase, the **evaluation of scenarios** is set to provide information on the entire demonstration process, including **validation of indicators and indices**, **analysis of stakeholder feedback** and **dissemination of results** within the consortium and towards external parties. Services providers have identified several challenges, which also overlap with the ones from the execution phase in subsection 3.6.2. They include:

- **Missing validation data**, especially on areas with little to no funding for the development of environmental and socioeconomic databases, or with limited coverage by open-source data projects.
- **Lack of engagement by end-users**, which is key in the validation of CENTAUR components.
- **Issues during the preparation and execution phases**, resulting in the absence of one or more components to validate.

Chapter 4 covers these challenges in more detail.

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4 DEMONSTRATORS ASSESSMENT

Evaluating CENTAUR demonstrators involves assessing the technical robustness of CENTAUR's system and solutions, as well as evaluating users' and service providers' satisfaction and compliance with their needs and requirements.

The technical soundness of the systems and solutions undergoes an evaluation by consortium members who were not involved in their development. This external evaluation includes assessing new products, such as indicators and indices, along with the web platform created for sharing them. Section 4.1 shows the CENTAUR products validation protocol, defined based on the CEMS RM[4] validation protocol and ISO 19157[5], to assess the indices and indicators developed by the project.

The satisfaction of users and service providers related to the new products and the platform developed by CENTAUR will be evaluated by analyzing their feedback, gathered through questionnaires created by the CENTAUR consortium. Questionnaires are relevant to assess the general usefulness of CENTAUR products and services from the users' and the service providers' perspectives. Subsections 4.3.1 and 4.3.2 explain how they have been created and the main aspects that will be evaluated. The satisfaction of users and service providers is assessed in WP4.

4.1 DEFINITION OF VALIDATION CRITERIA FOR PRODUCTS

This section defines the framework for the CENTAUR products validation assessment. The validation principles, methods, rules and guidelines in this document aim to provide a structure that guarantees the overall documented and continuous quality of the CENTAUR products. The goal is to ensure that all products meet the required levels of accuracy, availability and affordability requested and expected by the end-users.

The validation of CENTAUR products relies on a set of quantitative as well as qualitative parameters that are grouped into three main categories:

- Reliability assessment.
- Consistency assessment.
- Usability assessment.

Each category requires a specific set of validation parameters, tools, and methods. In the following, the three main categories are described with the concerning attributes to be validated. These attributes have been selected from the CEMS RM validation protocol and ISO 19157 quality data standard to evaluate the specific requirements of CENTAUR products and services.

This subsection is organized as follows. First, for each validation category, (1) a definition is provided, (2) subsequently, the different attributes and some indications of the metrics used for assessing these attributes are given, and (3) the methodologies that can be used to estimate these parameters are proposed. This subsection explains all the parameters assessed during the validation phase. Table 29, located at the end of the subsection, summarizes the parameters to be assessed per CENTAUR product.

[4] Broglia, Marco & Corbane, Christina & Carrion, Daniela & Lemoine, G & Pesaresi, Martino. (2010). Validation Protocol for Emergency Response Geo-information Products. 10.2788/63690.
[5] ISO (2013). ISO 19157:2013 Geographic information - Data quality

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4.1.1 Assessment reliability (thematic quality)

Reliability is generally defined as the degree to which the information contained in a product is similar to a reference. From the user's point of view, reliability is a statement about how much the user can trust in a product given its purpose.

In the CENTAUR context, the reliability assessment will be limited to analysing the thematic quality of the designed indicators and indexes. The general approach to assess the thematic quality of the CENTAUR indicators and indexes is to compare them with independent information sources. The comparison approach to be applied depends on (1) the nature of the attribute under evaluation and (2) the availability of validation data. Therefore, to define the appropriate thematic assessment method per indicator in the CENTAUR context, it is necessary to identify 1) the **type of attribute each indicator/index represents** and 2) the **validation data available per Use Case for each indicator.**

The **CENTAUR indicators and indexes** can be grouped into two main categories: A) categorical and B) quantitative; while, according to the CEMS validation protocol, **validation data** can be classified into three main categories: A) Ground truth measures, B) Reference data sources, C) Other products containing similar information. Table 25 and Table 26 describe the types of attributes to be validated and the types of validation data respectively.

Table 25: Types of attribute to be validated.

TYPE OF ATTRIBUTE[6]	EXAMPLES OF VARIABLE
Categorical Categorical variables are descriptions of groups or things. This includes rankings, classifications, and binary outcomes.	Flood Extent (e.g., Flood/ Not Flood)
Quantitative Quantitative variables are any variables where the data represent amounts.	Flood Depth

Table 26: Types of validation data.

TYPE OF VALIDATION DATA	EXAMPLES OF VALIDATION DATA
Ground truth measures. Ground truth data regarding an event are collected at the location of the event, at event time or in a temporal range during which the situation object of interest does not change. This source usually allows the best performances in terms of *accuracy* of the validation process.	• Control points collected in a **field mission.** • **Independent measurements** of the event of interest like, for example, water level records in the case of floods or field reports like UNHCR refugee camps' register.
Reference data sources. When ground truth data is unavailable, a comparison with independent reference data is needed to determine *consistency.* Key to any consistency assessment is the provision of representative, independent reference data that is inherently more accurate than the product to be evaluated.	• **VHR satellite images or airborne images**. In general, imagery of higher spatial resolution than the satellite data used to generate a product and/or better spectral and radiometric resolution.

[6] https://www.statisticshowto.com/quantitative-variables-data/#definition

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TYPE OF VALIDATION DATA	EXAMPLES OF VALIDATION DATA
Reference data should also encompass the same period as the information product under validation.	• **Models**: e.g. hydrological models for flood area estimation.
Other products containing similar information. Inter-comparison takes as inputs products coming from different providers with information contents similar to the product's contents under validation. Inter-comparison only results in a measure of consistency between the compared products. Analysing the degree of difference between the product under validation and other similar ones, insights into the reasons for such differences and consequent identification of the possible weak points of the product. This data type can be beneficial when access to reference data is difficult.	• Previously **validated products** considered as suitable for validation purposes.

Depending on validation data availability (A) an accuracy or (B) consistency **quantitative thematic** assessment will be carried out. If there is insufficient data to quantitatively assess thematic quality of the CENTAUR products, a **qualitative consistency** evaluation is proposed. When there are multiple data sources available for validation, they will be chosen according to the following priority order: 1) Ground truth measurements, 2) Reference data sources, and 3) Other products that contain similar information.

Based on the current availability of data for validation purposes, a tentative validation plan has been described (see subsection 4.1.5).

4.1.1.1 Quantitative thematic assessment

Thematic accuracy

In essence, **thematic accuracy** evaluates the **correctness** of the information represented in CENTAUR products by comparing the value/category assigned to features in the products with their value/category in **ground truth (GT)**. The CENTAUR validation protocol proposes to validate the correctness of (A) **categorical indicators/indices** using metrics derived from a confusion matrix and (B) derived from linear regression or the Root Mean Square Error (RMSE) for the **quantitative ones**. Quality metrics can be estimated for different strata that may affect the quality homogeneity of the indicator/index across the territory (e.g., LULC).

General approach/parameters

Thematic accuracy of categorical products

Thematic accuracy of categorical products will be assessed using metrics derived from a confusion matrix. This matrix is a simple cross-tabulation of the class labelled in the CENTAUR product against the ground truth data. Different measures and statistics can be derived from the values in the matrix.

The following confusion matrix is proposed for binary classifications (e.g., Flood/ Not Flood). Quality measures such as Overall accuracy, User's accuracy, Producer's accuracy, Commission error, and Omission error will be calculated at a minimum. Additionally, quality measures of the union of the crisis layers will be provided. This helps to prevent any impact that the disproportion between the AOI and the area classified as a crisis might have on the results.

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Table 27: Confusion matrix for a binary classification (two categories).

		GT				
		Positive(p)	*Negative (n)*	TOTAL	User's acc. %	Commission error %
CENTAUR	*Positive(p)*	n_{pp}	n_{pn}	$n_{pp}+n_{pn}$	$(n_{pp}/(n_{pp}+n_{pn}))$ *100	$(n_{pn}/(n_{pp}+n_{pn}))$ *100
	Negative (n)	n_{np}	n_{nn}	$n_{np}+n_{nn}$	$(n_{nn}/(n_{np}+n_{nn}))$ *100	$(n_{np}/(n_{np}+n_{nn}))$ *100
	TOTAL	$n_{pp}+n_{np}$	$n_{pn}+n_{nn}$	N		
	Producer's acc. %	$(n_{pp}/(n_{pp}+n_{np}))$*100	$(n_{nn}/(n_{pn}+n_{nn}))$ *100			
	Omission error %	$(n_{np}/(n_{pp}+n_{np}))$*100	$(n_{pn}/(n_{pn}+n_{nn}))$ *100			

Overall accuracy %	$((n_{pp}+n_{nn})/N)$ *100
Overall accuracy of crisis information %	$(n_{pp}/(n_{np}+n_{pp}+n_{pn}))$ *100

When there are multiple categories in the legend of a classification (e.g., Building Damage Grading Assessment), we will use the following confusion matrix template.

Table 28: Confusion matrix for a multiclass classification (> two categories).

		GT						
		Class 1	*Class 2*	…	*Class* k	TOTAL	User's acc. %	Commission error %
CENTAUR	*Class 1*	n_{11}	n_{12}		n_{1k}	n_{1+}	(n_{11}/n_{1+})*100	$((n_{1+} - n_{11})/n_{1+})$*100
	Class 2	n_{21}	n_{22}		n_{2k}	n_{2+}	(n_{22}/n_{2+})*100	$((n_{2+} - n_{22})/n_{2+})$*100
	…					…	…	
	Class k	n_{k1}	n_{k2}		n_{kk}	n_{k+}	(n_{kk}/n_{k+})*100	$((n_{k+} - n_{kk})/n_{k+})$*100
	TOTAL	n_{+1}	n_{+2}		n_{+k}	N		
	Producer's acc. %	(n_{11}/n_{+1}) *100	(n_{22}/n_{+2}) *100		(n_{kk}/n_{+k}) *100			
	Omission error %	$((n_{+1} - n_{11})/n_{+1})$ *100	$((n_{+2} - n_{22})/n_{+2})$ *100		$((n_{+k} - n_{kk})/n_{+k})$ *100			
	Conditional kappa	$(N* n_{11} - n_{1+}* n_{+1})/(N* n_{1+} - n_{1+}* n_{+1})$	$(N* n_{22} - n_{2+}* n_{+2})/(N* n_{2+} - n_{2+}* n_{+2})$		$(N*n_{kk} - n_{k+}*n_{+k})/(N*n_{k+} - n_{k+}*n_{+k})$			

Overall accuracy %	$((n_{11}+…+n_{kk})/N)$*100

If the complete AOI cannot be checked (i.e., only selected elements can be cross-compared) a sampling strategy that ensures statistical significance and representativeness will be performed. The sample size n required to validate a categorical product by means of a confusion matrix is defined by a binomial (two categories in the legend) or multinomial (more than two categories in the legend) function-based approach; see the equations below.

Multinomial $$n = \frac{z_{\alpha/k} \cdot \mathrm{p}\,(1-\mathrm{p})}{\varepsilon^2}$$

Binomial $$n = \frac{{z_{\alpha/2}}^2 \cdot p(1-p)}{\varepsilon^2}$$

This approach provides the sample size n needed for the validation of K categories, under the requirement of population proportion interval estimated at (1 – α) confidence, margin of error ε, planned proportion p and z following a χ2 distribution with one degree of freedom in multinomial or a normal in a binomial. The planned proportion will be the expected quality of the product in each case.

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Sample allocation will be done through a **stratified random sampling** within the limits of the AOI, which is a design that satisfies the basic accuracy assessment objectives and most of the desirable design criteria[7].

Thematic accuracy of quantitative products

Thematic accuracy of quantitative products (e.g., Flood depth) will be assessed using metrics derived from linear regression and error metrics.

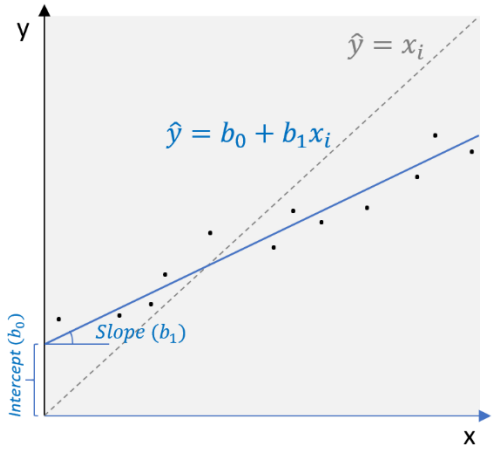
Root Mean Square Error, RMSE, is proposed to measure differences between the ground truth data and the CENTAUR products under validation. RMSE is the square root of the average of squared errors and is one of the most used error-based measure. The effect of each error on RMSE is proportional to the size of the squared error; thus, more significant errors have a more significant effect on RMSE[8,9].

$$RMSE = \sqrt{\frac{1}{n}\sum_{i-1}^{n}(x_i - \hat{y}_i)^2}$$

Where:

- x_i is the value obserbed in GT
- $\hat{y}_i$ is the value predicted by the indicator
- n is the number of observations

The products under validation and the ground truth data can be also cross-compared by analysing the **slope and the intercept derived from a simple linear regression** (one predictor variable, least squares method)[10].



Where:

- x_i is the value obserbed in GT
- $\hat{y}_i$ is the value predicted by the indicator
- b_0 is the intercept
- b_1 is the slope

The slope (b1) represents the change in the value of the layer under control corresponding to the unit change in the reference data. The intercept (b_0) is the value that the layer takes when the reference data is zero. Therefore, values of slope (b_1) close to one and intercept (b_0) close to zero are desirable (dotted grey diagonal line in the

[7] Olofsson, P., Foody, G. M., Herold, M., Stehman, S. V., Woodcock, C. E., & Wulder, M. A. (2014). Good practices for estimating area and assessing accuracy of land change. Remote sensing of Environment, 148, 42-57. Available at: https://www.sciencedirect.com/science/article/abs/pii/S0034425714000704

[8] Pontius, R., Thontteh, O., and Chen, H. 2008. Components of information for multiple resolution comparison between maps that share a real variable. Environmental Ecological Statistics. 15 (2): 111–142. Available at: https://doi.org/10.1007/s10651-007-0043-y

[9] Willmott, C., and Matsuura, K. 2006. On the use of dimensioned measures of error to evaluate the performance of spatial interpolators. International Journal of Geographical Information Science. 20: 89–102. Available at: https://www.tandfonline.com/doi/full/10.1080/13658810500286976

[10] Pesaresi, M., Politis, P., and Kemper, T. 2021. Advances on the GHS-BUILT data set for the epochs 2018, 2014, 2000, 1990, and 1975, Joint assessment of Sentinel MSI, Landsat ETM, TM, and MSS satellite imagery, European Commission, Ispra, JRC127999. Available at: https://joint-research-centre.ec.europa.eu/index_en

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figure). Slope and intercept values different to the cited would indicate trends and systematic errors of underestimation and overestimation in the layer under control.

If the event constrains permits to check the complete AOI, the validation team will perform a sampling strategy that ensures statistical significance and representativeness. The sample size (n) per stratum of interest must be sufficient and appropriate to the validation technique, i.e., by means of measures based on regression or error measures. The bibliography is unclear about the minimum admissible sample size but emphasises the importance of ensuring the selected sample is normally distributed.. The central limit theorem states that the distribution of sample means approximates a normal distribution, as the sample size gets larger, regardless of the population's distribution[11]. Jenkins and Quitana-Asencio (2019)[12] recommend that research based on regression should use n≥25 to guarantee normal distribution of data and avoid inaccurate inference results due to possible high variance. Given that the sample characteristics in terms of variance are unknown until allocating the random samples, a conservative approach would consider at least 50 samples per stratum.

Pass/fail criteria

According to CEMS specifications.

Thematic consistency

Thematic consistency is based on validation data different from ground truth measures, i.e., reference data sources or other products containing similar information can be used to check the thematic consistency of information when in-situ data is unavailable.

Parameters used for measuring thematic consistency

As for thematic accuracy assessment, the thematic consistency of categorical indicators/indices will use metrics (A) derived from a confusion matrix and (B) derived from linear regression or the Root Mean Square Error (RMSE) for the quantitative ones. The approach described for the calculation of thematic accuracy will be followed.

Pass/fail criteria

According to CEMS specifications.

4.1.1.2 Qualitative thematic assessment

Although evaluating thematic quality through a complete population comparison or probability sampling is the most reliable method, there are other approaches that can also contribute to understanding errors and improving map consistency. In situations where there is a lack of cartographic data or insufficient data for statistical analysis, a qualitative analysis will be conducted by comparing existing data sources.

General approach/ parameters

The method involves visually comparing CENTAUR indicators with the available validation data and analysing the differences in origin and reasons. The plausibility of the results will be assessed.

Parameters used for measuring thematic consistency

N/A

[11] Field, A. 2013. Discovering statistics using IBM SPSS statistics. Sage. Available at: https://uk.sagepub.com/en-gb/eur/discovering-statistics-using-ibm-spss-statistics/book257672 [Last access 17/06/2023]

[12] Jenkins, D. G., Quintana-Ascencio, P. F. 2020. A solution to minimum sample size for regressions. Plos One, 15(2), e0229345. Available at: https://journals.plos.org/plosone/article?id=10.1371/journal.pone.0229345 [Last access 17/09/2023]

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Pass/fail criteria

Based on the expert knowledge. The results will be reported using a categorical ordinal scale including **three pertinence levels** (i.e., Bad, fair, good).

> The thematic assessment will be checked in the CENTAUR indices and indicators. The thematic validation of each product will be subject to the validation data availability in each Use Case. The comparison approach to be applied depend on (1) the nature of the variable under evaluation and (2) the validation data availability. It will be set per indicator/index and Use Case in the Thematic Validation Plan.

4.1.2 Consistency assessment

Traditionally, consistency checks internal contradictions of a product, between different components of a map or with respect to specific set requirements. Consistency validation requires as input the product under validation and the requirements; **no reference source is required**.

The CEMS RM validation protocol defines a list of quality checks that allow controlling the internal consistency of the data included in the CEMS printable maps, as well as the relationships between them. These checks will be selected and adapted to assess the consistency aspects of the CENTAUR indexes and indicators uploaded to the platform.

4.1.2.1 Relative positional consistency

This attribute describes consistency between spatial information contained in a map. There are features with expected positional relation between themselves, e.g. adjacency of municipality/county/state boundaries, containment of bridges in transport networks. In the CENTAUR context, the relative positional consistency will be qualitatively checked across the different products and a selected basemap.

General approach/ parameters

The attribute is visually checked.

Pass/fail criteria

The lack of positional coherence between the product and the selected basemap will imply failure. The results will be reported using a categorical ordinal scale including **three pertinence levels** (i.e., bad, fair, good). The judgment will be based on the expert knowledge.

4.1.2.2 Topological consistency

This check aims to test the topological consistency of indicators/indexes. The importance of topological consistency lies in the fact that it increases the effective usability of data: every geo-data can be printed, but the area can be calculated only for closed polygons and the minimum path can be calculated only for connected networks. Thus, the respect of topological properties can be very important for specific geo-information products, depending on their expected use. In addition, topological relations can help to detect content errors, e.g. a dam should be contained in the boundary of water bodies.

The following topological rules will be analysed:

- **Adjacency:** Features sharing perimeters should be adjacent.
- **Presence of gaps:** Gaps might not be a topological error, depending on their size and the layer under evaluation. However, gaps might be an error if their size is under a given Minimum Mapping Unit (MMU).
- **Overlapping:** Features of crisis information layers should not overlap, partially nor completely, unless they correspond to monitoring products.
- **Cover/Inclusion:** Some features should be completely covered or included in others.

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General approach

Topology will be automatically checked using a series of python-based scripts for ArcGIS. They can be executed over the GDB or over shapefiles. As a result, the number of errors for each topological rule will be obtain.

Pass/fail criteria

Topological consistency is achieved when the required properties are respected per CENTAUR index/indicator. Depends on the rule. In general, one error means Fail:

- **Adjacency:** 1 polygon with adjacency problem means Fail
- **Gaps:** 1 gap with area below MMU means Fail
- **Overlaps**: 1 overlap in input data means Fail
- **Cover/Inclusion:** input data not completely covered means Fail

4.1.2.3 Attributes consistency

Attribute consistency refers to data types and values that an attribute can have. This property is also known as domain consistency. The importance of attribute consistency lies in the fact that it increases the effective usability of data as alphanumeric attributes and they are also an important source of information.

Attribute consistency will be described through:

- **Data type compliance:** the data types contained in the product must be compliant with the expected data types, e.g. number, character, date.
- **Value range**: the attribute values must be included into expected (or anyway reasonable) ranges.
- **Filling of required fields**: some fields could be required for further computing and they must be filled.

General approach

Attributes consistency will be checked visually.

Pass/fail criteria

Attributes consistency is achieved when the required properties are respected per CENTAUR indicator and index. Depends on the rule. In general, one error means fails:

- **Data type compliance:** 1 data type not compliant means Fail
- **Value range**: 1 value range not compliant means Fail
- **Filling of required fields:** the not filling of required fields means Fail

4.1.3 Usability assessment, metadata consistency

Using a map requires reading, interpreting, analysing, and eventually integrating the information contained in it. Therefore, it is crucial to eliminate any misunderstandings and ambiguities. The CEMS RM validation protocol defines a list of quality checks that allow controlling the usability of CEMS printable maps and their data. In the CENTAUR context, the usability assessment of the products will be limited to the analysis of the **metadata consistency of the indicators and indexes,** and the CEMS RM validation protocol checks defined to control printable maps will be adapted to assess the platform usability from a cartographic point of view, see 4.2.

Spatial metadata is a critical part of any spatial data infrastructure, which enables the organising, sharing, discovery and use of spatial data. It contains information about geographic or spatial dataset descriptions, e.g., contents,

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structure, quality, and reference system that will help spatial data users to discover and determine the suitability of the data for their purposes through networked spatial data catalogue systems[13].

Validation of metadata consistency in the CENTAUR context focuses on confirming **metadata presence** and its **compliance with CENTAUR's pre-defined structure and INSPIRE requirements** based on ISO 19115 and ISO 19119.

General approach

Metadata will be automatically checked using INSPIRE validator[14].

Pass/fail criteria

Metadata consistency is achieved when an indicator or index has associated metadata archive that complies with CENTAUR's predefined structure and INSPIRE requirements.

4.1.4 Summarised validation table

Table 29 summaries the parameters that will be assessed per CENTAUR vector and raster product, together with the approach that will be follow in each case.

Table 29: Validation parameters applied per raster (R) or vector (V) CENTAUR indicator/index.

RELIABILITY ASSESSMENT						
CHECK	ATTRIBUTES	PARAMETERS	RESULTS	V	R	Approach
1a	Thematic accuracy	Depends of attribute type (Overall accuracy or RMSE)	Number			Calculation of metrics
1b	Thematic consistency	Depends of attribute type (Overall accuracy or RMSE)	Number			Calculation of metrics
1c	Qualitative thematic assessment	Pertinence	☐ Bad ☐ Fair ☐ Good			Visual check
CONSISTENCY ASSESSMENT						
	ATTRIBUTES	PARAMETERS	RESULTS	V	R	Approach
2	Relative positional consistency	Pertinence	☐ Bad ☐ Fair ☐ Good			Visual check
3	Topological consistency	Adjacent of features	☐ Correct ☐ Incorrect		NA	Automatic tool (script)
		Cover/inclusion	☐ Correct ☐ Incorrect			
		Presence of gaps	☐ Correct ☐ Incorrect			
		Overlapping	☐ Correct ☐ Incorrect			
		Closure of polygons	☐ Correct ☐ Incorrect			
		Connection of networks	☐ Correct ☐ Incorrect			
		Presence of dangle	☐ Correct ☐ Incorrect			
		Continuity of features	☐ Correct ☐ Incorrect			
4	Attributes consistency	Data type compliance	☐ Correct ☐ Incorrect		NA	Visual check
		Value range	☐ Correct ☐ Incorrect			
		Filling of required fields	☐ Correct ☐ Incorrect		NA	

[13] Kalantari, M.; Syahrudin, S.; Rajabifard, A.; Subagyo, H.; Hubbard, H. Spatial Metadata Usability Evaluation. ISPRS Int. J. Geo-Inf. 2020, 9, 463. https://doi.org/10.3390/ijgi9070463

[14] https://inspire.ec.europa.eu/validator/home/index.html

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USABILITY ASSESSMENT						
	ATTRIBUTES	PARAMETERS	RESULTS	V	R	Approach
5	Metadata consistency	Presence of metadata	☐ Correct ☐ Incorrect			Inspire validator
		Compliancy with INSPIRE	☐ Correct ☐ Incorrect			
		Compliancy with CENTAUR structure	☐ Correct ☐ Incorrect			

As mentioned earlier, the **Consistency and Usability assessment** will rely on the product under validation and the requirements, and no reference data will be required. Consistency assessments will depend on the format of each product (vector/raster) and will be conducted visually or using automatic tools, as appropriate. Usability assessments will be automatically checked using the INSPIRE validator.

On the other hand, the **Reliability assessment** (Thematic validation) of each product will depend on the availability of validation data in each Use Case. Depending on the type of available data, it will be assessed through metric calculations or visual checks.

The following section outlines the parameters of each product that could be evaluated.

4.1.5 Parameters under validation for each product/indicator

This section compiles the parameters of both UF and WFS products, which could be evaluated in the event of a flooding event (if any during the hot case time period) and upon the creation of the defined indicators.

If a flood occurs and the products are created, the parameters that could be assess will depend on (1) the availability of data to conduct thematic validation, and (2) the format of each indicator or product (vector/raster).

4.1.5.1 Urban Floods

The **reliability assessment** (Thematic validation) of the products will be carried out when data for validation purposes is available. In the table below, the cells highlighted in red indicate that validation may not be carried out, while those in orange indicate that validation will be conducted only if data for validation purposes is available. (in a hot case context, this data is unknown until the event occurs). Regarding the indexes, as for cold cases, note that these will be derived from the former indicators and correspond to novel products. There is no direct data with which these indexes can be compared, therefore, their reliability may not be possible to assess.

Table 30: Validation plan for UF – Reliability assessment.

Reliability assessment	UF-ID**							Socio-economic UF-ID**				Indexes UF-IX	
PARAMETERS	01_R	02_R	03_R	04_V	05_R	06_V	07_T	09_R	10_R	13_R	14_R	01	02
Thematic validation													

*R: raster / V: vector / T: table

As mentioned before, for the **Consistency and Usability assessment** no reference data is required. Based on the format of each UF-ID or UF-IX (vector/raster) under assessment, some parameters or others will be validated. The parameters corresponding to cells highlighted in green will be analysed. The cells highlighted in yellow are the ones to be discussed (TBD).

Table 31: Tentative validation plan for UF – Consistency assessment.

Consistency assessment			Data*		UF-ID**							Socio-economic UF-ID**				Indexes UF-IX	
ATTRIBUTES		PARAMETERS	V	R	01_R	02_R	03_R	04_V	05_R	06_V	07_T	09_R	10_R	13_R	14_R	01	02
2	Rel.position	Pertinence															
3	Topology	Adjacent of features		NA													

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		Cover/inclusion																
		Presence of gaps																
		Overlapping																
4	Attributes	Data type compliance		NA														
		Value range																
		Filling of required fields		NA														

*NA: Not applicable **R: raster / V: vector / T: table

Table 32: Tentative validation plan for UF – Usability assessment.

Usability assessment			Data*		UF-ID**							Socio-economic UF-ID**				Indexes UF-IX	
ATTRIBUTES		PARAMETERS	V	R	01_R	02_R	03_R	04_V	05_R	06_V	07_T	09_R	10_R	13_R	14_R	01	02
5	Metadata	Presence of metadata															
		Compliancy INSPIRE															
		Compliancy CENTAUR															

*NA: Not applicable **R: raster / V: vector / T: table

4.1.5.2 Water and Food Security

The **thematic validation** of these products, if any, will depend on the availability of the data to conduct this activity.

The **Consistency and Usability assessment** of the different WFS indicators will be carried out analysing the same parameters than the ones used for UF and will also depend on the format of each product (raster/vector).

4.2 PLATFORM VALIDATION

The platform assessment is carried out in two stages. First, the CENTAUR partners evaluate the usability of the services from **a theoretical point of view** to bridge any gap between the services and the intended users. This assessment was conducted during the cold case. Second, the users give feedback through a customised questionnaire prepared by the CENTAUR consortium. These questionnaires are carried out in both hot and cold cases. Analysing their feedback will help verify the usability of the CENTAUR product from a ***fit-for-purpose* point of view**. The questionnaire provided to users can be found in APPENDIX A, and the methodology to create it is detailed in subsection 4.3.1. The criteria used for theoretical assessment is described in deliverable *D3.5 – CENTAUR Integrated Platform Test Document* [RD17].

4.3 USER AND SERVICE PROVIDERS SATISFACTION EVALUATION QUESTIONNAIRES

Questionnaires are relevant to assess the general usefulness of CENTAUR products and platform from (1) the Users' and (2) the Service Providers' (SP) perspectives. The following subsections explain how they have been created and the main aspects that will be evaluated (subsections 4.3.1 and 4.3.2), together with how they will be analysed (subsection 4.3.3).

It would be interesting for the leaders of each use case to contact the end user and give the option of completing the questionnaire together (the leader and the user) through a previously agreed interview. The email templates for requesting (1) user feedback or (2) feedback from the CENTAUR technical partners have already been developed.

It will be assessed whether it's possible to share the questionnaires through the platform during the hot case phase, but it is not a priority as it's not part of the project's requirements.

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4.3.1 End-user questionnaire

The **Users' oriented questionnaire** has been elaborated based on the **user's requirements and gaps** gathered in CENTAUR deliverable *D1.1 – Report on Urban Flood and Water & Food security indicators* [RD11] that according to Table 3 in deliverable D1.2 [RD05] are considered as short-term priority developments. Additionally, questions related to (i) medium-term priority developments, as stated in D1.1 [RD11] "Must Have" been developed, (ii) interesting KPIs presented in the CENTAUR offer [RD13], and (iii) other questions based on Tracasa's previous experience and knowledge in this subject have been added.

This user's questionnaire contains the sections shown and described in Table 33. The questionnaire also includes a brief introduction about the context and aims of the questionnaire that is not included in the table below. The entire questionnaire that will be provided to stakeholders during the cold case phase can be found in APPENDIX A.

Table 33: General description of the end-user questionnaire.

USER'S QUESTIONNAIRE			
Section		Overall description of the questions	
	Consent to use personal data	Consent to the treatment of personal data and to collect information related to CENTAUR project for statistical and management purposes.	
1	Interviewee details and use case	Personal information of the interviewee; previous experience with Copernicus CEMS/SESA products, use case on which the user has been involved…	
2	Copernicus SESA/CEMS Service Portfolio	General questions regarding the Copernicus CEMS/SESA new portfolio; if it has been improved…	Fit-for-purpose
3	CEMS Early Warning Component	General questions regarding the CEMS Early Warning Component; if it has been improved…	
4	CENTAUR platform	Questions gathering how well the new platform fits the user's requirements. The aim will be to assess its usability from the users' perspective.	
5	CENTAUR products	Questions gathering the user's opinion about the CENTAUR products from a perspective of the user's operational use (integrity, adequacy, compliance).	
6	Impact of CENTAUR products on users' workflow	Questions gathering the positive/negative impacts expected with these CENTAUR products in the user's workflow.	
7	Overall evaluation	Overall perception of the platform developed and CENTAUR products, in terms of strengths, weaknesses, added value… (free text)	

As shown in the table above, the first two sections compile personal information from the interviewee. Collecting this information to analyse the results based on the different user profiles is interesting. The following 5 sections (2 to 6) focus on questions for assessing the fit-for-purpose of the CENTAUR project from the user's perspective, so their satisfaction about different aspects will be checked, i.e., the new Service Portfolio (2), the CEMS Early Warning Component (3), the CENTAUR platform, (4) the CENTAUR products (5), and the impact of these products on user's workflow (6). The last section will gather an overall evaluation of the CENTAUR project, where the users could freely express their opinions.

The questions focus on assessing the completeness of the crisis package, regarding the user's knowledge of the event, and the quality and importance of each of the products from the user's perspective. The section integrates free text questions for the user to provide non-guided feedback about the most and least useful indicators, indices and services.

The general participation of the users (Authorised Users and Potential Future Users) will be crucial in evaluating the CENTAUR products and platform since their experience and knowledge are of great relevance. This user feedback collection will (i) help to assess their satisfaction with the CENTAUR products and the platform developed, (ii) identify factors that may limit the operational use of the CENTAUR products and/or may negatively

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impact on users' workflows, and (ii) identify possible improvements suggested by them from a practical point of view. Overall, learning from users' feedback is necessary to improve the Copernicus EMS [RD03] and SESA [RD04] services.

Therefore, within the CENTAUR project framework, it is expected that two main groups of users will complete this questionnaire:

- Users/Potential Users of the Copernicus Emergency Mapping Service (Urban Flooding).
- Users/Potential Users of the Copernicus SESA Service (Water and Food Security).

The following table gathers a tentative list of users who could fill out the questionnaire. It includes end-users directly related to the use case selection, as well as any other stakeholder that showed interest in validating the results.

Table 34: A tentative list of users that could be engaged in filling out the questionnaire.

Users/Potential Users	Copernicus Service Interest
European External Action Service - EEAS (Situation Room)	Copernicus SESA Authorized User
European Commission (EC) Joint Research Centre (Unit E1-Disaster Risk Management)	Copernicus Emergency Authorized User Copernicus SESA Potential Future User
CCR (Department R&D Cat & Agriculture)	Copernicus Emergency Potential Future User Copernicus SESA Potential Future User
Dirección General de Protección Civil y Emergencias	
Red de Información Ambiental de Andalucía	
Municipality of Turin	
Italian Civil Protection	
German Foreign Office – Data Science Division	
CCR	
United Nations Support Office in Somalia	
UN Environment Programme (Disasters and Conflicts Division)	
German Federal Foreign Office (S05 crisis early warning)	
WAVE (IoT)	
Helpcode (NGO)	
Danish Refugee Council (Evidence, Knowledge and Learning Division)	
International Commission for the Protection of the Danube River (ICPDR)	Copernicus Emergency Potential Future User
Environment and Water Agency (REDIAM)	

4.3.2 Service provider questionnaire

The **Service Providers' questionnaire** has been elaborated based on the **KPIs** defined in the CENTAURs offer as well as the user's technical short-term priority requirements gathered in Table 3 of D1.2 [RD05], and other questions based on Tracasa's previous experience and knowledge in this subject.

This service provider's questionnaire is structured in the following sections shown and described in Table 35. As the previous questionnaire, this questionnaire also includes a brief introduction about the context and aims of the questionnaire that is not included in the table below. The entire questionnaire provided to service providers can be found in APPENDIX B.

Table 35: General description of the service provider questionnaire.

SERVICE PROVIDER'S QUESTIONNAIRE		
Section		Description
	Consent to use personal data	Consent to the treatment of personal data and to collect information related to CENTAUR project for statistical and management purposes.

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SERVICE PROVIDER'S QUESTIONNAIRE		
Section		Description
1	Interviewee details	Personal information of the interviewee and the Copernicus Service on which it is involved.
2	Compliance with user requirements (technical aspects)	Questions gathering how well the new services fit the user's technical requirements defined in D1.2 and to be developed in a short-term priority. These questions are divided into different categories: - General requirements (related to general aspects that the service should consider) - Accessibility requirements (related to specific requirements needed to ensure correct and simple access to the data) - Operational requirements (related to the type of information, products and services the system should provide) - Data/Indicators integration, management and processing requirements (related to the type of data that CENTAUR should be able to analyse and how it should be managed by the system) - Platform requirements - Interoperability requirements (related to aspects to ensure the integration of the information into other systems and workflows)
3	Compliance of the proposed KPIs	Questions that gather how well the new services fit all the KPIs defined in the offer. These questions are divided into different categories according to the different objectives: - Copernicus SESA Service Portfolio - CEMS Early Warning component - CEMS Mapping component - End-to-end demonstrations - Copernicus EO-based downstream services - AI/ML techniques and datasets used - Understanding of cause-effect relation
4	Overall evaluation	Overall perception of the platform developed and CENTAUR products, in terms of strengths, weaknesses, added value… (free text)

As in the previous questionnaire, the first two sections compile personal information from the interviewee. The following two sections (2 and 3) gather questions for assessing how well the new services fit the user's technical requirements (2) and the KPIs defined in the offer (3). It will be noticed that this questionnaire evaluates much more technical aspects than the previous one. The last section will gather an overall evaluation of the CENTAUR project, where the service providers could freely express their opinions.

This service provider's feedback collection aims (i) to ensure compliance with the KPIs proposed in the technical offer, and (ii) to verify that the service meets the technical requirements requested.

A tentative list of service providers that could fill out the questionnaire includes Adelphi, Hensoldt, e-GEOS, VITO, UNISTRA-SERTIT, UNISTRA-TRIO, ECMWF, DLR, Cherrydata, SpaceTec, CLS, GMV, Tracasa, SatCen and ITHACA.

4.3.3 Analysis of the Questionnaires

Analysing the results of questionnaires involves several steps to gain meaningful insights from the data. Users' responses will be analysed to extract the main ideas (the users' main opinions and satisfaction level) about the aspects asked. In contrast, service providers' responses will be analysed in order to verify that the service meets the technical requirements.

For both questionnaires, all the answers received for each section or question block (see Table 33 and Table 35) will be analysed. The key ideas extracted from each type of questionnaire will be collected in tables or bullets. In

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both cases, an overall evaluation highlighting the strengths and weaknesses of CENTAUR products and services will be carried out. In the same way, threats and opportunities derived from the users' and service providers' key ideas will be collected. Based on all the information analyzed, main conclusions regarding Strengths, Weaknesses, Opportunities and Threats (SWOT) and recommendations will be derived. They will be relevant for further improvement of CENTAUR products and services.

Following, general steps that will be carried out to get a trustworthy and clear questionnaire assessment are defined.

1. **Data cleaning and preparation**. This first step is crucial to ensure the accuracy and reliability of the results. During this phase, questionnaires will be reviewed to (i) check for missing or incomplete responses and (ii) verify the consistency and accuracy of the data. Additionally, during this phase, open-ended responses could be categorized (e.g., they may be categorized focused on SWOT analysis).
2. **Descriptive statistics.** This step involves summarizing and describing the answers gathered for each question or question block. In cases where the answer corresponds to a **numerical value**, basic statistics such as mean, median, mode, and standard deviation will be calculated. On the other hand, if the answer corresponds to a **categorical value**, their frequency distribution will be assessed. All this information will be used to generate summary tables providing an overview of the data.
3. **Data visualization.** Visualization can help to view trends and patterns more effectively than raw numbers. Graphs and charts such as bar charts, pie charts, histograms, and scatter plots to visually represent the data will be created.
4. **Comparative analysis.** Based on the results obtained in the previous steps, the answers across different groups of interviewed persons (e.g., CEMS *vs*. SESA users) would be compared, looking for significant differences or trends that may provide insights into specific subgroups, if any.
5. **Qualitative analysis.** This analysis will involve examining open-ended questions to identify common themes and sentiments. For this aim, it is advisable to have categorized (in the first step) this type of responses to have a deeper understanding of participants' perceptions and experiences.
6. **Data interpretation.** The results will be interpreted in the context of CENTAUR objectives. Conclusions based on the patterns and insights revealed by the analysis will be drawn.
7. **Report and presentation.** The findings will be summarised clearly and concisely. It is advisable to use visual aids and graphics to enhance understanding. Furthermore, actionable recommendations based on the questionnaire assessment will be provided.

It would be advisable that once the users' and service providers' responses have been analysed, results will be shared with the consortium members, if possible, quantifying and assessing the impact of the CENTAUR products and indicating the method of quantification. Faithfully transmitting these results to the rest of the partners is of great relevance.

These results will also be documented in a specific section of deliverable *D4.3 – CENTAUR demonstration report and validation result v1 (cold cases)* [RD10].

4.4 ASSESSMENT STEPS AND TIMELINE

All created products must pass **internal quality controls (QCs)** at the time of production (WP2) to ensure they meet the defined quality requirements. Any errors encountered in the process are either eliminated or minimized. These QCs are extremely useful during the production phase, as they ensure that each product meets the specific characteristics.

Validation activities, if required, will be conducted independently of the demonstration exercises. It is believed that this evaluation could be performed once the emergency is over, and in parallel with the analysis of the questionnaires. By that time, more data will likely be available for validation, such as possible reports from official

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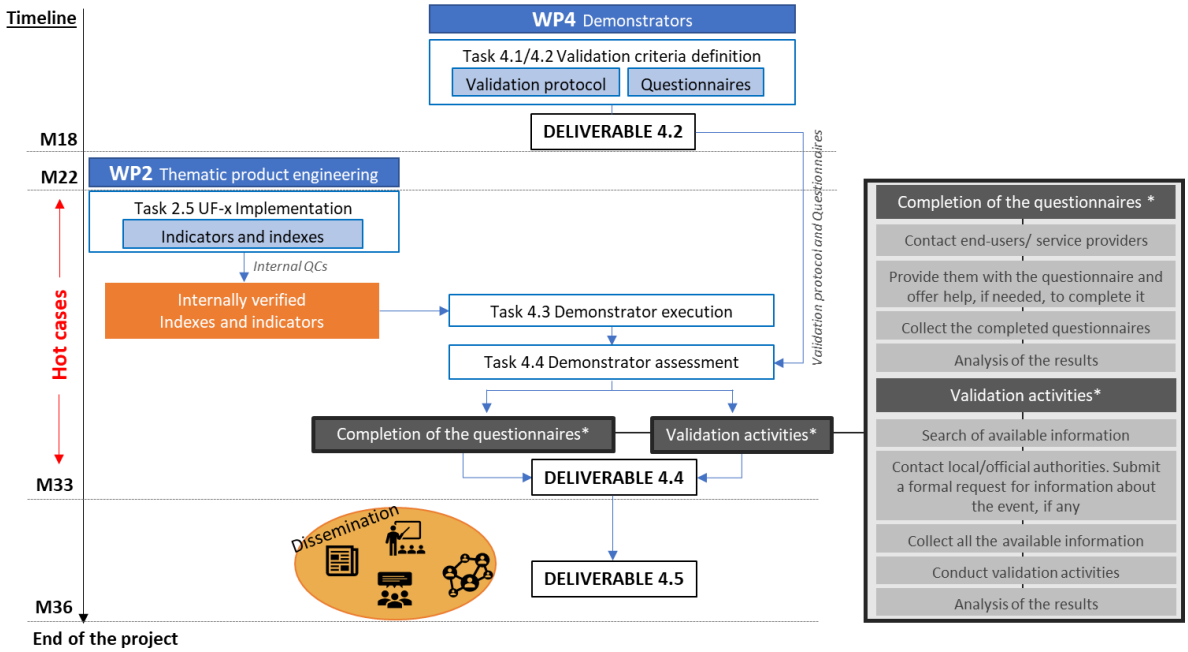
institutions and flood masks obtained by local authorities from aerial images. Figure 4 shows the general steps likely to be carried out in case a hot case occurs. The grey box on the right of the figure compiles the specific steps expected for the assessment activities.

Figure 4: Hot cases general workflow.



It is not possible to provide a detailed timeline for each hot use cases (i.e. Spanish, Italian, French, Somalian and Malian scenarios) since it is uncertain where or when they will occur. Additionally, it is possible that no extreme events will happen within the defined AOIs for each use case during the project's designated months (M22-M33).

On the other hand, the validation results obtained for each product and use case will be documented in a draft deliverable, *D4.4 – CENTAUR demonstration report and validation results v2 (hot cases)* [RD14] by the end of M28. The final version of the document (D4.5 [RD16]) will be provided by the end of M34.

The questionnaire results will aim to analyse the satisfaction level, verify that the technical requirements are met and formulate recommendations and actions to be implemented. All these results will be incorporated in deliverable D4.4 [RD14] and D4.5 [RD16].

Dissemination of the results, lessons learnt, and recommendations will be carried out following the roadmap defined in deliverable *D6.1 - Communication Strategy and Action Plan* [RD12] in which the strategies, activities, and tools to obtain an effective communication and dissemination activity are gathered. This activity is important to maximise its impact, raise awareness, and promote the benefits of CENTAUR scientific and technical advances for EMS and SESA services stakeholders. The dissemination of the final results (regarding hot cases, if any) is likely to be held at end of the project.

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5 CONCLUSIONS

This deliverable and the related WP4 tasks have outlined rigorous approach, methodologies, and evaluation recommendations employed to address urban flooding and water & food security challenges during the demonstration phase. Through a detailed examination of demonstrator design, assessment criteria, and stakeholder feedback, a robust foundation has been laid for the execution of both the cold and hot phases, that will span months 16 to 33 of the project.

The design and execution of hot case demonstrators, as detailed in Chapter 3, have provided invaluable insights into the complexities of urban flooding and water & food security scenarios. Moreover, by integrating a cross-cutting demonstrator, the project has underscored the importance of versatile and adaptable solutions capable of addressing diverse environmental and socio-economic contexts.

The assessment of demonstrators, as elaborated in Chapter 4, highlights the project's commitment to reliability, consistency, and usability. The validation criteria developed and the feedback gathered through comprehensive questionnaires ensure that the CENTAUR system is not only technically sound but also aligned with the needs and expectations of service providers and end-users of Copernicus services.

The hot case demonstrators will significantly benefit from the insights and progress made during the cold phase, which occurs between months 16 and 21. This initial phase is anticipated to yield several enhancements to the platform and processing pipelines, driven by the validation and feedback collected following this first round of production. Moreover, the collaboration with end-users throughout the cold phase has fostered engagement and cooperation, setting the stage for further refinements.

As we transition into the hot phase, there will be a focused effort to generate products in a more time-sensitive manner. This approach ensures that the outcomes can be swiftly integrated into production and included within the Copernicus services' portfolios by the project's conclusion. This streamlined process aims to leverage the foundational work of the cold phase to achieve efficient and impactful results during the hot phase, ultimately enhancing the overall performance and responsiveness of the CENTAUR system.

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APPENDIX A CENTAUR USER QUESTIONNAIRE

This questionnaire addresses the relevance, from the User's perspective, of the new platform developed and CENTAUR products in terms of assessing the added value and impact of those CENTAUR products on the user's workflow.

The general participation of Authorised Users and Potential Future Users is crucial in evaluating the CENTAUR products. Users' experience and knowledge are of great relevance for this purpose. Learning from users' feedback is necessary to further improve the Copernicus CEMS and SESA services.

This user feedback collection aims to ensure the usability of the new service components for both CEMS and SESA, developed within the CENTAUR project. Likewise, the usability of the developed platform will be assured.

*Fields marked with * are mandatory*

CONSENT TO USE PERSONAL DATA

I hereby declare my informed consent to the treatment of my personal data with the modalities indicated in the privacy statement for the following purposes:

*(1) Collect information related to the CENTAUR project user consultation process and communicate important information related to the user consultation process.	○ Yes ○ No
*(2) Dispatch of communications on important information regarding the consultation processes, invitations to CENTAUR events/meetings and other notifications.	○ Yes ○ No
*(3) Processing of data for statistical and management purposes.	○ Yes ○ No

CENTAUR Privacy Statement – 'CENTAUR_Privacy_statement_v3.pdf'

1. INTERVIEWEE DETAILS AND USE CASE

*Interviewee details:

Name of your organization	Add text
Group/Area/Division	Add text
Point of Contact. Complete name	Add text
Position within your organization	Add text
Contact details (email and/or phone)	Add text

1.1. Please select the option(s) that better summarizes the nature of the activity(ies) your department/unit undertakes:

☐ Strategy and policy development ☐ Decision making ☐ Programme and project management

☐ Risk assessment ☐ Field operations ☐ Preparedness and planning

☐ Other. Specify: Add text

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1.2. Please select the category(ies) that better describes your involvement

- ☐ Copernicus Emergency Authorized User
- ☐ Copernicus SEA Authorized User
- ☐ Copernicus Emergency Potential Future User
- ☐ Copernicus SEA Potential Future User

Previous experience:

1.3 Do you have previous experience with CEMS products?	○ Yes	○ No
If yes, how are they included in your workflow?	Add text	
1.4 Do you have previous experience with SEA products?	○ Yes	○ No
If yes, how are they included in your workflow?	Add text	

Use case:

1.5 Please select the use case in which you are involved:

- ☐ UF Spain
- ☐ UF France
- ☐ UF Germany
- ☐ UF Italy
- ☐ UF Mozambique
- ☐ WFS Somalia
- ☐ WFS Mali
- ☐ WFS Mozambique

The following questions address the fit-for-purpose assessment of the new (i) Copernicus SEA/CEMS Service Portfolio, (ii) CEMS Early Warning component, (iii) Platform developed, and (iv) CENTAUR products.

2. Copernicus SEA/CEMS Service Portfolio

2.1 Do you think the Copernicus SEA/CEMS service portfolio could be enhanced to better respond to climate security risks and effects?	○ Yes	○ No	
If necessary, elaborate	Add text		
2.2 Has the Copernicus SEA/CEMS portfolio integrated at least one new information layer that enriches the current product portfolio?	○ Yes	○ No	○ N/A
2.3 Has Copernicus SEA/CEMS portfolio adapted at least one information layer to better respond to climate security risks and effects?	○ Yes	○ No	○ N/A
If necessary, elaborate	Add text		
2.4 Do you think that the temporal and spatial resolutions of Copernicus EO-based downstream services have improved?	○ Yes	○ No	○ N/A

3. CEMS Early Warning Component

3.1 Regarding the CEMS Early Warning component, do you think it has been enhanced through the development of meteorological indicators in support of Urban Floods early detection?	○ Yes	○ No	○ N/A
3.2 Has the extreme intensity precipitation (above 95th percentile) been detected at least 48h prior to the event, and verified against local observations?	○ Yes	○ No	○ N/A
3.3 If necessary, elaborate any comments regarding CEMS Early Warning component	Add text		

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4. CENTAUR PLATFORM

The following questions gather how well the new platform fits with your requirements. The aim is to assess its usability.

Note: If the platform is developed, this section should be completed; otherwise, the next section should be addressed.

Platform Accessibility and Navigability:

4.1 How would you rate the overall intuitiveness and user-friendliness of the developed platform? *(1) Not intuitive and user-friendly at all, (2) Somewhat intuitive and user-friendly, (3) Moderately intuitive and user-friendly, (4) Very intuitive and user-friendly, (5) Extremely intuitive and user-friendly*	○ 1 ○ 2 ○ 3 ○ 4 ○ 5
If necessary, indicate possible improvements	Add text
4.2 How would you rate the navigation panel in terms of completeness and ease of exploration? *(1) Not complete and difficult to explore, (2) Partially complete and somewhat easy to explore, (3) Moderately complete and fairly easy to explore, (4) Very complete and quite easy to explore, (5) Extremely complete and very easy to explore*	○ 1 ○ 2 ○ 3 ○ 4 ○ 5
If necessary, indicate possible improvements	Add text
4.3 How would you rate the access speed to the CENTAUR platform information? *(1) very slow, if external device of authentication required (3) medium speed, if password required (5) very fast, no password required*	○ 1 ○ 2 ○ 3 ○ 4 ○ 5
If necessary, indicate possible improvements	Add text
4.4 Can you easily find an overview of platform components/sections? *(1) Not easy to find, components structure is not neat (3) Moderately easy to find (5) Very easy to find, components structure is clear*	○ 1 ○ 2 ○ 3 ○ 4 ○ 5
If necessary, indicate possible improvements	Add text
4.5 Can you easily find the available information on CENTAUR products? *(1) Not easy to find, product data are not neat (3) Moderately easy to find (5) Very easy to find, product data are clear*	○ 1 ○ 2 ○ 3 ○ 4 ○ 5
If necessary, indicate possible improvements	Add text
4.6 Can you easily find the information that you are looking for? *(1) Not easy to find the searched data, (3) Moderately easy to find the searched data, (5) Very easy to find the searched data*	○ 1 ○ 2 ○ 3 ○ 4 ○ 5
If necessary, indicate possible improvements	Add text
4.7 The platform is designed with a single access point, offering an overview of the complete service catalogue when landing on the homepage. Please rate your agreement with this feature. *(1) Strongly disagree, (2) Disagree, (3) Neutral, (4) Agree, (5) Strongly agree*	○ 1 ○ 2 ○ 3 ○ 4 ○ 5
If necessary, indicate possible improvements	Add text
4.8 Do the fields available for setting personal preferences within the Personal Area Component meet your requirements? *(1) Strongly disagree, (2) Disagree, (3) Neutral, (4) Agree, (5) Strongly agree*	○ 1 ○ 2 ○ 3 ○ 4 ○ 5
If necessary, indicate possible improvements	Add text

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Platform Features and Functions:

4.9 How would you rate in general the different features and functions of the CENTAUR platform? *(1) Very poor, does not meet expectations; (2) Poor, needs improvements; (3) Average, meets basic expectations; (4) Good, Meets/exceeds expectations, only room for minor improvements; (5) Very Good, surpasses expectations.*		Additional Comments
- Display, navigate, zoom in/out	○ 1 ○ 2 ○ 3 ○ 4 ○ 5	Add text
- Pan or overlay spatial data sets or layers	○ 1 ○ 2 ○ 3 ○ 4 ○ 5	Add text
- Measure areas and distances	○ 1 ○ 2 ○ 3 ○ 4 ○ 5	Add text
- Transparency control	○ 1 ○ 2 ○ 3 ○ 4 ○ 5	Add text
- Display legend information	○ 1 ○ 2 ○ 3 ○ 4 ○ 5	Add text
- The available base maps fit with your needs	○ 1 ○ 2 ○ 3 ○ 4 ○ 5	Add text
- The charts and graphs available to display different datasets (e.g., historical series of data) are easily customizable and fit your needs	○ 1 ○ 2 ○ 3 ○ 4 ○ 5	Add text
- The symbology used to visualize the different datasets is appropriate	○ 1 ○ 2 ○ 3 ○ 4 ○ 5	Add text
- The symbology displayed matches the legend	○ Yes ○ No	Add text
- The way to configure AOIs (draw, edit, save…) is appropriate	○ 1 ○ 2 ○ 3 ○ 4 ○ 5	Add text
- The Alerting Service is user-friendly and easily customizable	○ 1 ○ 2 ○ 3 ○ 4 ○ 5	Add text

4.10 Have you received the automatic notifications sent by the CENTAUR platform about the availability of indicators and indexes?	○ Yes ○ No
If not, please explain	Add text
If yes, were the notifications appropriate?	○ Yes ○ No
Please explain your answer	Add text
4.11 How would you rate the clarity and completeness of the user manual for the platform? *(1) is the lowest (not clear or incomplete) and (5) is the highest (very clear and comprehensive)*	○ 1 ○ 2 ○ 3 ○ 4 ○ 5
If necessary, indicate possible improvements	Add text

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5. CENTAUR PRODUCTS

5.1 URBAN FLOOD PRODUCTS: COMPLETE ONLY IF THE USE CASE IN WHICH YOU HAVE BEEN INVOLVED IS RELATED TO UF

5.1.1 Have you noticed areas identified as "flooded areas" in the CENTAUR UF products that do not correspond to real flooded areas?	○ Yes ○ No
5.1.2 Have you noticed real flooded areas that are not delineated in the CENTAUR UF products?	○ Yes ○ No
5.1.3 How would you qualify the quality of the flooded areas in urban areas in the CENTAUR UF products?	○ Accurate ○ Underestimated ○ Overestimated

5.1.4 Please rate the following three aspects of UF products;

- Timeliness of product availability.
- The easiness to understand the products according to the symbols, legends, attribute table, text, terminology… used.
- The different formats offered for downloading the products fit your needs (note that each product is downloaded in a specific format).

Place ticks for each CENTAUR product selecting one option for each aspect that is being assessed:

(1) Very poor, does not meet expectations; (2) Poor, needs improvements; (3) Average, meets basic expectations; (4) Good, Meets/exceeds expectations, only room for minor improvements; (5) Very good, surpasses expectations.

***Note**: some indicators may not have been produced for the UC under assessment. In that case, don't consider it.*

	Timeliness of Product Availability					Easiness to understand the product					Product format				
	(1)	(2)	(3)	(4)	(5)	(1)	(2)	(3)	(4)	(5)	(1)	(2)	(3)	(4)	(5)
UF-ID-1	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
UF-ID-2	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
UF-ID-3	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
UF-ID-4	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
UF-ID-5	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
UF-ID-6	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
UF-ID-7	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
UF-ID-9	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
UF-ID-10	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
UF-ID-13	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
UF-ID-14	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
UF-IX-01	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
UF-IX-02	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐

5.1.5 How do you rate the importance, compliance, and potential impact of the CENTAUR UF products? Place ticks for each CENTAUR product selecting one option for each column criteria: Importance, Compliance with the user's requirements and Impact on the workflow.

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(1) No or minimal importance / no compliance with user requirements / negligible impact on work; (2) Moderately important / generally or partially complies with user requirements / noticeable impact on work; (3) Very high, critically important / fully complies with user requirements/substantial and positive impact on work efficiency and effectiveness.

***Note**: some indicators may not have been produced for the UC under assessment. In that case, don't consider it.*

	Importance			Compliance			Impact on work		
	(1) Not important	(2) Important	(3) Essential	(1) Not compliant	(2) Partial	(3) Total	(1) Unusable	(2) Alternative use	(3) Intended use
UF-ID-1	☐	☐	☐	☐	☐	☐	☐	☐	☐
UF-ID-2	☐	☐	☐	☐	☐	☐	☐	☐	☐
UF-ID-3	☐	☐	☐	☐	☐	☐	☐	☐	☐
UF-ID-4	☐	☐	☐	☐	☐	☐	☐	☐	☐
UF-ID-5	☐	☐	☐	☐	☐	☐	☐	☐	☐
UF-ID-6	☐	☐	☐	☐	☐	☐	☐	☐	☐
UF-ID-7	☐	☐	☐	☐	☐	☐	☐	☐	☐
UF-ID-9	☐	☐	☐	☐	☐	☐	☐	☐	☐
UF-ID-10	☐	☐	☐	☐	☐	☐	☐	☐	☐
UF-ID-13	☐	☐	☐	☐	☐	☐	☐	☐	☐
UF-ID-14	☐	☐	☐	☐	☐	☐	☐	☐	☐
UF-IX-01	☐	☐	☐	☐	☐	☐	☐	☐	☐
UF-IX-02	☐	☐	☐	☐	☐	☐	☐	☐	☐

5.1.6 How would you rate in general the different CENTAUR products for UF use cases? Place ticks for each CENTAUR product selecting one option for the aspect that is being assessed:

(1) Very poor, does not meet expectations; (2) Poor, needs improvements; (3) Average, meets basic expectations; (4) Good, Meets/exceeds expectations, only room for minor improvements; (5) Very good, surpasses expectations.

***Note**: some indicators may not have been produced for the UC under assessment. In that case, don't consider it.*

	General Rating					Additional comments (suggested improvements)
	(1)	(2)	(3)	(4)	(5)	
UF-ID-1	☐	☐	☐	☐	☐	Add text
UF-ID-2	☐	☐	☐	☐	☐	Add text
UF-ID-3	☐	☐	☐	☐	☐	Add text
UF-ID-4	☐	☐	☐	☐	☐	Add text
UF-ID-5	☐	☐	☐	☐	☐	Add text
UF-ID-6	☐	☐	☐	☐	☐	Add text
UF-ID-7	☐	☐	☐	☐	☐	Add text
UF-ID-9	☐	☐	☐	☐	☐	Add text
UF-ID-10	☐	☐	☐	☐	☐	Add text
UF-ID-13	☐	☐	☐	☐	☐	Add text
UF-ID-14	☐	☐	☐	☐	☐	Add text
UF-IX-01	☐	☐	☐	☐	☐	Add text
UF-IX-02	☐	☐	☐	☐	☐	Add text

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Where:

UF indicators:

- UF-ID-1: Static map of precipitation associated to return period
- UF-ID-2: Forecast of return period
- UF-ID-3: High-resolution urban flood risk maps for various return periods
- UF-ID-4: Inferred INSAR urban flood extent
- UF-ID-5: Enhanced Urban Flood Damage Assessment
- UF-ID-6: Social/Traditional media indicators for Urban Flood Map
- UF-ID-7: Hazard web sources indicator

Socio- economic impact and vulnerability to UF:

- UF-ID-9: Assets and financial resources
- UF-ID-10: Public services and government support
- UF-ID-13: Ability to evacuate
- UF-ID-14: Economic impact of floods

Indexes:

- UF-IX-01: Early warning forecast index
- UF-IX-02: Flood hazard index

5.2 WFS PRODUCTS: COMPLETE ONLY IF THE USE CASE IN WHICH YOU HAVE BEEN INVOLVED IS RELATED TO WFS

5.2.1 How have the products contributed to addressing water and food security challenges?	○ Significantly ○ Moderately ○ Slightly ○ Not at all
Please explain your answer	Add text
5.2.2 In what specific ways do the WFS products enhance access to useful information for your work?	○ Improved avalability ○ Enhanced quality ○ Streamlines distribution ○ Other (please specify)
Please explain your answer	Add text
5.2.3 Can you easily integrate the products into your workflow?	○ Yes, seamlessly ○ With some challenges ○ Difficulties encountered ○ Not applicable
Please explain your answer	Add text
5.2.4 How well do the products perform across different conditions or environments?	○ Yes, seamlessly ○ Moderately consistent ○ Difficulties encountered ○ Not applicable
Please explain your answer	Add text
5.2.5 Can you depend on the products to provide accurate and timely information about water and food resources?	○ Always ○ Often ○ Occasionally ○ Rarely-Never
Please explain your answer	Add text
5.2.6 Have the products ever experienced failures, and if it has, how were these problems resolved?	○ Rarely-Never ○ Occasionally ○ Frecuently ○ Not applicable
Please explain your answer	Add text
5.2.7 How confident do you feel in the products ability to predict potential crises related to water and food security?	○ Very confident ○ Moderately confident ○ Not very confident ○ Not sure

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Please explain your answer	Add text
5.2.8 Are you satisfied with the CENTAUR WFS Products in terms of its ability to provide early warnings or alerts for potential water or food-related crises?	○ Completely satisfied ○ Somewhat satisfied ○ Not very satisfied ○ Not sure
Please explain your answer	Add text
5.2.9 Do you have any concerns/doubts regarding the reliability of the information provided? (Their accuracy/consistency)	○ No concerns ○ Some concerns ○ Significant concerns ○ Not applicable
Please explain your answer	Add text

5.2.10 Please rate the following three aspects of WFS products:

- Timeliness of product availability.
- The easiness to understand the products according to the symbols, legends, attribute table, text, terminology… used.
- The different formats offered for downloading the products fit your needs (note that each product is downloaded in a specific format).

Place ticks for each CENTAUR product selecting one option for each aspect that is being assessed:

(1) Very poor, does not meet expectations; (2) Poor, needs improvements; (3) Average, meets basic expectations; (4) Good, Meets/exceeds expectations, only room for minor improvements; (5) Very good, surpasses expectations.

***Note**: some indicators may not have been produced for the UC under assessment. In that case, don't consider it.*

	Timeliness of Product Availability					Easiness to understand the product					Product format				
	(1)	(2)	(3)	(4)	(5)	(1)	(2)	(3)	(4)	(5)	(1)	(2)	(3)	(4)	(5)
WFS-ID-1	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
WFS-ID-2	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
WFS-ID-3	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
WFS-ID-4	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
WFS-ID-5	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
WFS-ID-6	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
WFS-ID-7	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
WFS-ID-8	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
WFS-ID-9	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
WFS-ID-10	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
WFS-ID-11	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
WFS-ID-12	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
WFS-ID-13	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
WFS-ID-14	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
WFS-ID-15	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
WFS-ID-17	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
WFS-ID-18	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
WFS-ID-19	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐

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WFS-ID-21	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
WFS-ID-23	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
WFS-ID-24	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
WFS-ID-25	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
WFS-IX-01	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
WFS-IX-02	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
WFS-IX-03	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐

5.2.11 Place ticks for each CENTAUR WFS product selecting one option for each column criteria: Importance, Compliance with the user's requirements and Impact on the workflow.

(1) Not or minimal importance / no compliance with user requirements / negligible impact on work; (2) Moderately important / generally or partially complies with user requirements / noticeable impact on work; (3) Very high, critically important / fully complies with user requirements/substantial and positive impact on work efficiency and effectiveness.

***Note**: some indicators may not have been produced for the UC under assessment. In that case, don't consider it.*

	Importance			Compliance			Impact on work		
	(1) Not important	(2) Important	(3) Essential	(1) Not compliant	(2) Partial	(3) Total	(1) Unusable	(2) Alternative use	(3) Intended use
WFS-ID-1	☐	☐	☐	☐	☐	☐	☐	☐	☐
WFS-ID-2	☐	☐	☐	☐	☐	☐	☐	☐	☐
WFS-ID-3	☐	☐	☐	☐	☐	☐	☐	☐	☐
WFS-ID-4	☐	☐	☐	☐	☐	☐	☐	☐	☐
WFS-ID-5	☐	☐	☐	☐	☐	☐	☐	☐	☐
WFS-ID-6	☐	☐	☐	☐	☐	☐	☐	☐	☐
WFS-ID-7	☐	☐	☐	☐	☐	☐	☐	☐	☐
WFS-ID-8	☐	☐	☐	☐	☐	☐	☐	☐	☐
WFS-ID-9	☐	☐	☐	☐	☐	☐	☐	☐	☐
WFS-ID-10	☐	☐	☐	☐	☐	☐	☐	☐	☐
WFS-ID-11	☐	☐	☐	☐	☐	☐	☐	☐	☐
WFS-ID-12	☐	☐	☐	☐	☐	☐	☐	☐	☐
WFS-ID-13	☐	☐	☐	☐	☐	☐	☐	☐	☐
WFS-ID-14	☐	☐	☐	☐	☐	☐	☐	☐	☐
WFS-ID-15	☐	☐	☐	☐	☐	☐	☐	☐	☐
WFS-ID-17	☐	☐	☐	☐	☐	☐	☐	☐	☐
WFS-ID-18	☐	☐	☐	☐	☐	☐	☐	☐	☐
WFS-ID-19	☐	☐	☐	☐	☐	☐	☐	☐	☐
WFS-ID-21	☐	☐	☐	☐	☐	☐	☐	☐	☐
WFS-ID-23	☐	☐	☐	☐	☐	☐	☐	☐	☐
WFS-ID-24	☐	☐	☐	☐	☐	☐	☐	☐	☐
WFS-ID-25	☐	☐	☐	☐	☐	☐	☐	☐	☐
WFS-IX-01	☐	☐	☐	☐	☐	☐	☐	☐	☐
WFS-IX-02	☐	☐	☐	☐	☐	☐	☐	☐	☐

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WFS-IX-03	☐	☐	☐	☐	☐	☐	☐	☐	☐

5.2.12 How would you rate in general the different CENTAUR products for WFS use cases?

Place ticks for each CENTAUR product selecting one option:

(1) Very poor, does not meet expectations; (2) Poor, needs improvements; (3) Average, meets basic expectations; (4) Good, Meets/exceeds expectations, only room for minor improvements; (5) Very good, surpasses expectations.

Note: some indicators may not have been produced for the UC under assessment. In that case, don't consider it.

	General Rating					Additional comments (suggested improvements)
	(1)	(2)	(3)	(4)	(5)	
WFS-ID-1	☐	☐	☐	☐	☐	Add text
WFS-ID-2	☐	☐	☐	☐	☐	Add text
WFS-ID-3	☐	☐	☐	☐	☐	Add text
WFS-ID-4	☐	☐	☐	☐	☐	Add text
WFS-ID-5	☐	☐	☐	☐	☐	Add text
WFS-ID-6	☐	☐	☐	☐	☐	Add text
WFS-ID-7	☐	☐	☐	☐	☐	Add text
WFS-ID-8	☐	☐	☐	☐	☐	Add text
WFS-ID-9	☐	☐	☐	☐	☐	Add text
WFS-ID-10	☐	☐	☐	☐	☐	Add text
WFS-ID-11	☐	☐	☐	☐	☐	Add text
WFS-ID-12	☐	☐	☐	☐	☐	Add text
WFS-ID-13	☐	☐	☐	☐	☐	Add text
WFS-ID-14	☐	☐	☐	☐	☐	Add text
WFS-ID-15	☐	☐	☐	☐	☐	Add text
WFS-ID-17	☐	☐	☐	☐	☐	Add text
WFS-ID-18	☐	☐	☐	☐	☐	Add text
WFS-ID-19	☐	☐	☐	☐	☐	Add text
WFS-ID-21	☐	☐	☐	☐	☐	Add text
WFS-ID-23	☐	☐	☐	☐	☐	Add text
WFS-ID-24	☐	☐	☐	☐	☐	Add text
WFS-ID-25	☐	☐	☐	☐	☐	Add text
WFS-IX-01	☐	☐	☐	☐	☐	Add text
WFS-IX-02	☐	☐	☐	☐	☐	Add text
WFS-IX-03	☐	☐	☐	☐	☐	Add text

Where:

WFS indicators:

- WFS-ID-1: Meteorological drought indicator (Monitoring)
- WFS-ID-2: Meteorological drought indicator (Forecast)
- WFS-ID-3: Meteorological drought indicator (danger levels)
- WFS-ID-4: Agricultural drought monitoring (near real-time)
- WFS-ID-5: Agricultural drought forecast

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- WFS-ID-6: Agricultural drought risk zone map

Fine-scale population distribution and exposure:

- WFS-ID-7: IDP camps status indicator
- WFS-ID-8: Populations at risk of food insecurity
- WFS-ID-9: Populations at risk of water insecurity
- WFS- ID-10: Number of people living in conflict-affected areas

Demographic and socio-economic stress, vulnerability:

- WFS-ID-11: Food security
- WFS-ID-12: Economic security
- WFS-ID-13: Displaced persons
- WFS-ID-14: Violent conflict
- WFS-ID-15: Radicalisation and polarisation
- WFS-ID-17: Humanitarian aid
- WFS-ID-18: Resource capture
- WFS-ID-19: Climate sensitivity of agri-food systems
- WFS-ID-21: Public services and infrastructures
- WFS-ID-23: State-citizen relations
- WFS-ID-24: Dispute resolution mechanisms
- WFS-ID-25: Social cohesion and trust

Indexes:

- WFS-IX-01: Risk monitor
- WFS-IX-02: Situation monitor
- WFS-IX-03: Data viewer

6. IMPACT OF CENTAUR PRODUCTS ON USERS' WORKFLOW

The following questions gather the positive/negative impacts you expect these CENTAUR products could have in your workflow.

6.1 Do you think that the CENTAUR products will be useful/beneficial for your operational procedure?	○ Yes ○ No
If yes, what are, in your opinion, the possible advantages/benefits introduced by CENTAUR products to your operational workflow?	Add text
6.2 Do you think that the CENTAUR products will have negative impacts on your workflow?	○ Yes ○ No
If yes, please elaborate	Add text
6.3 Would you like to highlight any inconsistencies (if any) that you have found in the CENTAUR products?	○ Yes ○ No
If yes, please elaborate	Add text
6.4 Would you share the CENTAUR products with other End-Users?	○ Yes ○ No
If yes, please, specify which kind (decision-makers, regional and local communities, regional and local authorities, public disaster management agencies, social media, researchers …).	Add text
6.5 Do you believe at least one of the CENTAUR pre-operational solutions could be adopted by security analysts and other security sector stakeholders in the EU and third countries?	○ Yes ○ No
If yes, please specify	Add text

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6.6 Has the understanding of the cause-effect relation between climate change indicators with, water and food insecurity, population displacements and crisis been improved?	○ Yes ○ No
6.7 If necessary, elaborate any comments regarding the impact of CENTAUR products on your workflow	Add text

7. Overall Evaluation

Under this section, we would like to know your overall perception of the platform and products developed within CENTAUR, in terms of:

7.1 Strengths	Add text
7.2 Weakness	Add text
7.3 Added value	Add text
7.4 Did you notice any technical issues? (e.g. bugs, dead links, etc.)	○ Yes ○ No ○ N/A
If yes, please explain	Add text
7.5 Would you recommend CENTAUR products?	○ Yes ○ No
Why? Why not?	Add text
If yes, what are, in your opinion, the possible advantages/benefits introduced by CENTAUR products to your operational workflow?	Add text
7.6 Regarding the Training sessions/Workshops. Have these sessions been useful?	○ Yes ○ No ○ N/A
7.7 Please feel free to include any other comment that you may have related to the CENTAUR platform and its products and services	Add text

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APPENDIX B CENTAUR SERVICE PROVIDER QUESTIONNAIRE

This questionnaire addresses the relevance, from the Service Provider's perspective, of the new Copernicus CEMS and SESA services developed within the CENTAUR project. This Service Provider's feedback collection aims at (i) ensuring compliance with the KPIs proposed in the technical offer, and (ii) to verify that the service meets the requested technical requirements.

*Fields marked with * are mandatory*

CONSENT TO USE PERSONAL DATA

I hereby declare my informed consent to the treatment of my personal data with the modalities indicated in the privacy statement for the following purposes:

*(1) Collect information related to the CENTAUR project user consultation process and communicate important information related to the user consultation process.	○ Yes ○ No
*(2) Dispatch of communications on important information regarding the consultation processes, invitations to CENTAUR events/meetings and other notifications.	○ Yes ○ No
*(3) Processing of data for statistical and management purposes.	○ Yes ○ No

CENTAUR Privacy Statement

1. INTERVIEWEE DETAILS AND USE CASE

*Interviewee details:

Name of your organization	Add text
Group/Area/Division	Add text
Point of Contact. Complete name	Add text
Position within your organization	Add text
Contact details (email and/or phone)	Add text
Please select the Copernicus Service in which you are involved: ☐ CEMS ☐ CSS-SEA	

2. COMPLIANCE WITH USER REQUIREMENTS

The following questions gather how well the new services fit the user's technical requirements gathered in D1.2. These questions focus mainly on requirements to be developed in short-term priority and they are divided into different categories.

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General requirements (related to general aspects that the service should consider):

2.1 Does the platform adheres to industry-standard security practices, such as vulnerability assessments, penetration testing, and regular security updates?	○ Yes ○ No
2.2 Have the end products been ingested by the platform properly, or were there bugs?	○ Yes ○ No
2.3 Has the system considered personal data protection and privacy issues?	○ Yes ○ No
2.4 Has the system been developed to notify the user through a notification inbox and by email when a relevant event occurs, like new alerts of the early warning system?	○ Yes ○ No
If necessary, elaborate any comments regarding general requirements	Add text

Accessibility requirements (related to specific requirements needed to ensure correct and simple access to the data):

2.5 Is the access to the platform regulated by providing identity and access management based on access control policies, roles, permissions, and attributes?	○ Yes ○ No
If necessary, elaborate any comments regarding accessibility requirements	Add text

Operational requirements (related to specific requirements needed to ensure correct and simple access to the data):

2.6 The catalogue of datasets covers the following areas:	
2.6.1 For Urban Flooding:	
- Real time data about flood extent during flood events	○ Yes ○ No
- Use of SAR and optical data for flood extent	○ Yes ○ No
- Flood model in urban areas and in the areas blind to SAR satellite sensors	○ Yes ○ No
- Flood assessment and climatic aspects	○ Yes ○ No
- Improved damage assessment based on exposure elements to floods risks	○ Yes ○ No
- Flood assessment based on ground truth (social-media makers)	○ Yes ○ No
2.6.2 For Water and Food Insecurity:	
- Seasonal projections of extreme weather events	○ Yes ○ No
- Geospatial human mobility data	○ Yes ○ No
- Near-real time and projected geospatial data not available at the moment (e.g. different types of migration, flooding, institutional capacity at a local level and access to it)	○ Yes ○ No
- Water availability	○ Yes ○ No
- Crop production monitoring	○ Yes ○ No
- Other socio-economic variables (e.g. hunger/malnutrition, incomes)	○ Yes ○ No
- Migration (e.g. border restrictions, flows)	○ Yes ○ No
- Population distribution and evolution	○ Yes ○ No
- Other biophysical parameters	○ Yes ○ No
- Food prices	○ Yes ○ No
- Social, political and security aspects	○ Yes ○ No

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- Pastoralism, transhumance, forced displacement, rural to urban migration, etc.	○ Yes	○ No
- Economic analysis (e.g. inequality)	○ Yes	○ No
- Food security	○ Yes	○ No
- Multi-hazard - so confluence of drought and conflict	○ Yes	○ No
If necessary, elaborate any comments regarding operational requirements		Add text

Data/Indicators integration, management and processing requirements (related to the type of data that CENTAUR should be able to analyse and how it should be managed by the system):

2.7 Was the system able to ingest and exploit large amounts of data during the demonstration?	○ Yes	○ No
2.8 Does the platform provide access to CENTAUR's online satellite imagery services?	○ Yes	○ No
2.9 Does the system provide systematic access to data, background information and time series?	○ Yes	○ No
If yes, which of the following data sources is offered?		
- EO data	○ Yes	○ No
- Non-EO data collected systematically (e.g. climate, socio-economic, crowdsourcing, and social media data)	○ Yes	○ No
- Products from other Copernicus services (e.g. Climate Change Service, Atmosphere Service, and Land Monitoring Service)	○ Yes	○ No
2.10 Do all products, services and datasets stored and managed by the system include metadata?	○ Yes	○ No
If yes,		
- Is the metadata INSPIRE compliant?	○ Yes	○ No
- Is the creation of the metadata automatized?	○ Yes	○ No
2.11 Does the system integrate a catalogue to explore, browse and access all the different products/services/datasets available and managed by the platform? (both internal and external products/services/datasets)	○ Yes	○ No
2.12 Does the system allow filtering and querying results during the demonstrations?	○ Yes	○ No
2.13 Is the platform able to process both synchronous and asynchronous requests?	○ Yes	○ No
2.14 Does the system allow the customization of simulation models that represent the dynamics of the water and food insecurity system?	○ Yes	○ No
If necessary, elaborate any comments regarding accessibility requirements		Add text

Platform requirements:

2.15 Is CENTAUR solution based on cloud architecture?	○ Yes	○ No
If necessary, elaborate any comments regarding platform requirements		Add text

Interoperability requirements (related to aspects to ensure the integration of the information into other systems and workflows):

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2.16 Is the data provided by the service available to the user by either a web service or on-line platform?	○ Yes ○ No
2.17 Is the system prepared to consume and display third-party geospatial web services and data? (e.g. sentinel imagery, other Copernicus issued products)	○ Yes ○ No
If necessary, elaborate any comments regarding interoperability requirements	Add text

3. COMPLIANCE WITH THE KPIs

The following questions gather how well the new services fit the KPIs defined in the offer. These questions are also divided into different categories.

Copernicus SEA service portfolio (This section must be completed only by SPs involved in SEA service)

3.1 Regarding the Copernicus SEA service portfolio, do you think it has been enhanced to better respond to climate security risks and effects?	○ Yes ○ No
3.2 Has Copernicus SEA portfolio integrated at least one new information layer that enrich the current product portfolio?	○ Yes ○ No ○ N/A
If yes, indicate	Add text
3.3 Has Copernicus SEA portfolio adapts at least one information layer to better respond to climate security risks and effects?	○ Yes ○ No ○ N/A
If yes, indicate	Add text
If necessary, elaborate any comments regarding Copernicus SEA service portfolio	Add text

CEMS Early Warning component (This section must be completed only by SPs involved in CEMS service)

3.4 Regarding the CEMS Early Warning component, do you think it has been enhanced through of developing meteorological indicators in support of Urban Floods early detection?	○ Yes ○ No
3.5 Has the extreme intensity precipitation (above 95th percentile) at leat 48h ahead been detected and verified against local observations?	○ Yes ○ No ○ N/A
3.6 Has the precipitation of OPERA network shown an error smaller than 20%?	○ Yes ○ No ○ N/A
3.7 Regarding the spatial correlation for 6 hours accumulation, has it been better than 60%?	○ Yes ○ No ○ N/A
3.8 Has CEMS pre-tasking success been of at least 75%, in terms of the number of pre-tasking alerts, timeliness and improvement in the definition of the AOIs for crisis-time satellite acquisitions?	○ Yes ○ No ○ N/A
If necessary, elaborate any comments regarding CEMS Early Warning component	Add text

CEMS Mapping component (This section must be completed only by SPs involved in CEMS service)

3.9 Regarding the CEMS Mapping component, in general terms, do you think it has been improved?	○ Yes ○ No
3.10 Has the use of precipitation data, combined with EO data, geomorphological models and ground observations extracted from sensors and social media improved the Urban Floods mapping obtained by running hydraulic models (Speedy Flood Tool)?	○ Yes ○ No ○ N/A

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3.11 Has the use of InSAR advanced applications (FLORIA) improved the Urban Floods mapping?	○ Yes ○ No ○ N/A
3.12 Has the Urban Floods mapping increased at least 75% by using of SAR and InSAR processing combined with urban flood modelling?	○ Yes ○ No ○ N/A
If necessary, elaborate any comments regarding CEMS Mapping component	Add text

End-to-end demonstrations (This section must be completed by all SPs)

3.13 Regarding the CEMS Mapping component, in general terms, do you think it has been improved?	○ Yes ○ No
If yes, indicate the scenarios	Add text
If yes, please, indicate also use cases	Add text
3.14 Has the suitability of the early warning system and foresight tool been demonstrate and validate over the proposed Hot Cases demonstrators in over 50% of them?	○ Yes ○ No ○ N/A
3.15 Regarding the collection of feedback through user questionnaires, has the user acceptance been at least 85%?	○ Yes ○ No ○ N/A
3.16 Has >80% of accuracy in flood extent over urban areas been obtained? (only for CEMS)	○ Yes ○ No ○ N/A
3.17 Do at least 80% of the products within CEMS & SEA fit the delivery-times according to the Service Level Agreements (SL1 or SL2 mode timeliness)?	○ Yes ○ No ○ N/A
3.18 Is it feasible to integrate CENTAUR products within the SEA and EMS operations by 2021-2027 time-horizon?	○ Yes ○ No ○ N/A
3.19 Do you know if at least one of the CENTAUR pre-operational solutions for the detection and analysis of climatic and environmental risks products (e.g. continuous monitoring system, crisis risk index, web simulator) has been adopted by security analysts and other security sector stakeholders in the EU and third countries?	○ Yes ○ No ○ N/A
If necessary, elaborate any comments regarding the end-to-end demonstrations	Add text

Copernicus EO-based downstream services (This section must be completed by all SPs)

3.20 Regarding the CEMS Mapping component, in general terms, do you think it has been improved?	○ Yes ○ No
3.21 Has the suitability of the early warning system and foresight tool been demonstrate and validate over the proposed Hot Cases demonstrators in over 50% of them?	○ Yes ○ No ○ N/A
If yes, indicate product/dataset/service	Add text
3.22 Regarding the collection of feedback through user questionnaires, has the user acceptance been at least 85%?	○ Yes ○ No ○ N/A
If yes, indicate	Add text
3.23 Has >80% of accuracy in flood extent over urban areas been obtained? (only for CEMS)	○ Yes ○ No ○ N/A
If yes, indicate	Add text

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3.24 Do at least 80% of the products within CEMS & SEA fit the delivery-times according to the Service Level Agreements (SL1 or SL2 mode timeliness)?	○ Yes ○ No ○ N/A
If necessary, elaborate any comments regarding the Copernicus EO-based downstream services	Add text

AI/ML techniques and datasets used (This section must be completed by all SPs)

3.25 Can the data driven approach based on AI/ML techniques be used to extract information and indicators from heterogeneous datasets?	○ Yes ○ No
3.26 Based on this approach, have multiple innovative forecasted crisis maps been developed?	○ Yes ○ No ○ N/A
If yes, indicate	Add text
3.27 Have the map quality indicators such as thematic accuracy, speed of delivery and resolution been improved due to more accurate input information and to more effective AI/ML modelling?	○ Yes ○ No ○ N/A
If necessary, elaborate any comments regarding the AI/ML techniques and datasets used	Add text

Understanding of cause-effect relation (This section must be completed by all SPs)

3.28 Has the understanding of the cause-effect relation between climate change indicators with, water and food insecurity, population displacements and crisis been improved?	○ Yes ○ No
3.29 Have at least 7 technical and scientific publications covering innovative methodological approaches to studying the climate-food-water-security nexus, as well as to key empirical results produced by the project been published?	○ Yes ○ No ○ N/A
3.30 Has this information been exchanged with at least 5 projects, initiatives or programmes dealing with climate security and its associated risks?	○ Yes ○ No ○ N/A
If yes, indicate	Add text
If necessary, elaborate any comments regarding the understanding of the cause-effect relation	Add text

4. Overall Evaluation

Under this section, we would like to know your overall perception of the platform developed and CENTAUR products, in terms of:

4.1 Strengths	Add text
4.2 Weakness	Add text
4.3 Added value	Add text
Other comments	Add text

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