POLIRURAL plus

ENHANCE CALL

Financial Support for Third Parties

Final Report
Part A (Public)

FloodAI+ - Validating the JackDaw GeoAI chatbot for rural-urban flood resilience

Disclaimer

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Organisation	*Porvalor - Ativos de Engenharia, Lda.*
Author(s)	*Ana Silva, Oliver Crespo, Nuno Almeida*
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Executive Summary

FloodAI+ explored how JackDaw, the PoliRuralPlus conversational GeoAI platform, could make complex flood-risk information easier to access, understand and communicate. Using Lisbon, Valencia and Dresden as pilot contexts, the project aimed to apply JackDaw to real rural-urban flood-risk questions, assess its usability and decision-support potential, engage relevant stakeholders, and produce transferable tools and lessons. The work focused on preliminary information, awareness and planning support; it was not intended to replace official warnings, professional judgement or detailed engineering assessments.

During the reporting period, the project assessed and prepared heterogeneous geospatial information, developed and tested three complementary tools within the JackDaw/Raven environment, and refined them using stakeholder feedback. Technical validation combined automated testing, functional checks and integration testing. Two online workshops were also completed: the first introduced the use case, demonstrated JackDaw and collected stakeholder priorities, while the second provided a one-hour hands-on validation session. Feedback was gathered through Mentimeter, forms, discussions and an asynchronous response channel, and the results were translated into technical and communication improvements.

The project's main result is an integrated pilot-level suite comprising a Flood Hazard Connector, a Flood Exposure Connector and a Multilingual Flood Glossary. The Hazard Connector summarises available flood information for a selected area. The Exposure Connector screens potentially affected populations, buildings, roads, infrastructure and land uses, depending on the data available for each pilot city. The Glossary explains 30 flood-risk concepts in English, Spanish, Portuguese and German, with explanations adapted to citizens, farmers, and planners or emergency managers. Together, these tools demonstrate how conversational access can connect users with multiple geospatial sources while communicating data coverage, provenance and limitations.

Stakeholder evidence indicated strong interest in faster and clearer access to flood-risk information. In the second workshop, the ability to find or understand information faster than through traditional maps or GIS received an average rating of 4.2 out of 5, and 10 of 13 respondents reported greater confidence after the session. Participants particularly valued map-based localisation, understandable explanations and information about exposed assets. Their feedback also highlighted the need for clearer sources, uncertainty statements, improved visual outputs and more actionable information. Because the validation sample was small and uneven, these findings represent useful design signals rather than statistically representative evidence.

Overall, FloodAI+ delivered a credible pilot-level contribution to the PoliRuralPlus ecosystem. It produced reusable tools, data-integration methods, multilingual communication resources and practical validation lessons that can support awareness, training, preliminary screening and resilience-planning discussions. The approach can be extended to other territories and could provide the foundation for future vulnerability and integrated flood-risk analysis tools. Further development will require stable data services, broader stakeholder validation, stronger visualisation and provenance, and formal assessment with responsible authorities before operational adoption.

1. Project Overview

1.1 Context and rationale

FloodAI+ was designed as a JackDaw-centred validation experiment for rural-urban flood resilience. The project addresses a practical and increasingly urgent challenge: flood-risk information is becoming richer, more spatial and more data-driven, but it remains difficult for many local and regional actors to interpret and use in everyday decision-making.

Flood-risk management often relies on complex geospatial information, including hazard maps, satellite imagery, GIS layers, exposure data, vulnerability indicators and resilience planning datasets. These resources are essential for evidence-based decision-making, but they are frequently designed for technical users. As a result, municipalities, civil protection authorities, infrastructure managers, farmers, SMEs, NGOs and citizens may face difficulties translating spatial flood-risk information into clear decisions, communication messages or adaptation priorities.

FloodAI+ responds to this gap by validating JackDaw, the PoliRuralPlus GeoAI chatbot, as a multilingual conversational interface that can help users ask natural-language questions about flood-risk information and receive clearer, more accessible and context-aware answers. The project rationale is that conversational GeoAI can act as a mediator between complex spatial datasets and practical stakeholder needs, supporting the interpretation, comparison and communication of flood-risk information across rural and urban territories.

Floods were selected as the validation domain because they are among the most frequent and damaging natural hazards in Europe and because their impacts cross administrative and sectoral boundaries. Floods affect rural and urban systems together, including agriculture, food supply chains, roads, critical infrastructure, public services, vulnerable communities and emergency response. This makes flood resilience a demanding and policy-relevant testbed for validating JackDaw's usability, reliability, trustworthiness and added value for decision-making. The proposal explicitly framed FloodAI+ as a project to validate and enhance JackDaw in real flood-risk contexts, generating structured evidence on its usefulness for rural-urban resilience planning

1.2 Alignment with the call objectives

FloodAI+ is directly aligned with the objectives of the PoliRuralPlus Enhance Call because it applies JackDaw in a real European use case and generates structured validation feedback for the PoliRuralPlus technical ecosystem.

The project contributes to the call objectives in the following ways:

- **Application of JackDaw in real European contexts:** FloodAI+ applies JackDaw to rural-urban flood-risk management, with reference to three European pilot contexts: Lisbon, Valencia and Dresden. These contexts provide a practical validation frame for exploring how JackDaw can support users in retrieving, interpreting and communicating spatial flood-risk information. The approved proposal identified these pilot areas as the basis for connecting JackDaw to flood hazard datasets and for testing spatially contextualised conversations.
- **Structured validation feedback:** The project is designed to produce structured evidence on JackDaw's usability, reliability, trustworthiness and added value for decision-making. Feedback is collected through workshops, participant forms, Mentimeter feedback, asynchronous validation inputs, and internal technical review. This directly supports the Enhance Call objective of gathering validation evidence on the performance and usefulness of JackDaw and related PoliRuralPlus ecosystem components.
- **Stakeholder engagement and empowerment:** FloodAI+ involves stakeholder groups that are directly affected by, or responsible for, flood-risk management, including municipalities, civil protection authorities, infrastructure managers, SMEs, farmers and farmers' organisations, NGOs, researchers and citizens. This aligns with the call's emphasis on engaging diverse actors and strengthening their ability to use digital and GeoAI-supported tools for territorial decision-making.

- **Capacity building:** The project contributes to capacity building by introducing non-technical and semi-technical users to JackDaw, GeoAI and map-based flood-risk interpretation. The workshops are not designed as one-way presentations only, but as validation and learning sessions where participants can understand the tool, test it, and provide feedback on its practical usefulness.
- **Visibility and dissemination of JackDaw and PoliRuralPlus:** FloodAI+ supports the visibility of the PoliRuralPlus ecosystem through news items, blog posts, workshop flyers, public communication materials and stakeholder engagement activities. The Part A report template requires reporting on obligatory media outputs, including news articles, blog posts, social media summaries and visibility requirements.
- **Replicability:** FloodAI+ is designed to produce transferable lessons for future use of JackDaw in other regions, hazards and languages. The project focuses on a validation methodology that can be replicated: stakeholder question collection, hands-on testing, structured feedback, user journey analysis, improvement recommendations and guidance for adapting JackDaw to other geospatial decision-support contexts.

1.3 Description of selected use case(s)

The selected use case is rural-urban flood-risk information and resilience planning. This case was selected because it combines complex spatial data, diverse stakeholder needs and high relevance for climate adaptation and territorial resilience. The use case focuses on how JackDaw can support stakeholders in asking and answering practical flood-risk questions such as:

- Which areas of a municipality or rural territory are most exposed to flooding?
- What roads, buildings, access routes or critical infrastructure may be affected?
- How can flood-hazard maps be explained in plain language to non-specialist users?
- How can different locations be compared in terms of hazard, exposure or vulnerability?
- What information is missing when stakeholders try to understand flood risk?
- What would make AI-generated flood-risk answers clearer, more trustworthy and more useful for decisions?

FloodAI+ uses these questions to validate whether JackDaw can support the transition from complex flood-risk datasets to practical answers. The first workshop confirmed that stakeholders are not simply asking for more data; they want flood-risk information that is visual, understandable and connected to action. The first workshop blog summarised this as a need to turn flood maps into decisions, with participants prioritising maps that explain risk, risk summaries, short text explanations and comparisons between areas.
The use case is structured around three complementary validation levels:

- **User question level:** FloodAI+ identifies the flood-risk questions that stakeholders actually want JackDaw to answer. This supports the project's objective of grounding the validation process in real user needs rather than generic AI testing.
- **Tool interaction level:** Participants are invited to observe, use or test JackDaw in relation to realistic flood-risk questions. The second workshop moves the validation from demonstration to hands-on use, allowing participants to interact directly with JackDaw and provide practical feedback on clarity, usefulness and trust.
- **Improvement level:** Feedback is translated into actionable improvement recommendations for JackDaw, including better explanation templates, clearer glossary entries, stronger uncertainty cues, improved map-based outputs, and better adaptation to different stakeholder profiles.

1.4 Target users and stakeholders

FloodAI+ targets a broad and diverse set of stakeholders involved in rural–urban flood resilience. The main target groups are:

- municipalities and local authorities;
- civil protection authorities;
- infrastructure managers and utilities;

- SMEs and local businesses;
- farmers and farmers' organisations;
- NGOs and community organisations;
- researchers and academic institutions;
- citizens and local community representatives.

These target groups were selected because flood-risk information is used across multiple functions: planning, emergency preparedness, infrastructure protection, agricultural continuity, public communication, local awareness and resilience policy. The approved proposal explicitly identified municipalities, SMEs, infrastructure managers, farmers' organisations, NGOs, civil protection bodies and citizen groups as the relevant stakeholder base for testing and evaluating JackDaw in rural and urban settings.

The stakeholder engagement approach recognises that different users need different forms of explanation. A civil protection authority may need operationally relevant information on access routes or emergency response. A municipality may need planning and communication support. An infrastructure manager may need to identify exposed assets. A farmer may need to understand the risk to fields, roads or supply routes. A citizen may need a clear explanation of what a flood-risk map means for their area.

For this reason, FloodAI+ does not validate JackDaw only as a technical tool. It validates JackDaw as a potential decision-support mediator that must adapt the tone, level of detail and format of answers to different stakeholder profiles.

1.5 Role of JackDaw GeoAI chatbot in the project

JackDaw is the central technology validated in FloodAI+. Its role is to act as a GeoAI conversational interface between users and flood-risk information. Instead of requiring users to navigate complex geospatial datasets, JackDaw allows them to ask natural-language questions and receive responses that combine location context, stakeholder needs and flood-risk data interpretation.

In FloodAI+, JackDaw has five main roles:

i. **Conversational access to geospatial information:** JackDaw provides a natural-language entry point for users who may not be GIS experts. This supports the project's goal of making flood-risk information easier to understand and use.

ii. **Interpretation of flood-hazard maps and spatial summaries:** Through the Flood Hazard Connector and the additional Flood Exposure Connector, JackDaw helps translate flood-hazard layers, inundation characteristics and exposure indicators into plain-language explanations. The tools provide spatial summaries for user-selected areas, including flood extent, depth, hazard classes and, where available, flow velocity, as well as information on potentially affected population, buildings, roads, land uses, agriculture and critical infrastructure. By bringing together hazard and exposure evidence, JackDaw supports the interpretation of flood risk and the development of decision-relevant insights for rural-urban contexts.

iii. **Adaptation to stakeholder profiles:** FloodAI+ validates whether JackDaw can provide answers that are relevant to different users, such as citizens, farmers, planners, emergency managers or infrastructure managers. This is linked to the proposed stakeholder-specific explanation templates.

iv. **Support for decision-making and participation:** JackDaw is assessed in terms of its added value for rural-urban decision-making and stakeholder participation. The project examines whether JackDaw can support clearer understanding, better communication and more confident use of flood-risk information.

v. **Source of validation evidence for PoliRuralPlus:** FloodAI+ generates structured feedback on JackDaw's usability, functionality, limitations and improvement needs. This evidence contributes to the PoliRuralPlus technical validation process and supports future development of the JackDaw ecosystem. The Part A template includes a PoliRuralPlus Technical Validation Questionnaire that specifically asks which ecosystem technologies were tested, how they were validated, what feedback was received, and what improvements would make the ecosystem more useful.

1.6 Short description of the solution, service and methodology

FloodAI+ combines a pilot-level suite of specialised MCP tools integrated into Raven/JackDaw with a structured stakeholder validation methodology. Rather than creating a standalone flood-risk platform, FloodAI+ extended the existing JackDaw environment with tools for flood-hazard analysis, exposure screening and multilingual explanation of flood-risk terminology. These technical developments were combined with stakeholder workshops and feedback activities to assess how conversational GeoAI can support flood-risk interpretation and decision-relevant communication in rural-urban contexts.

The methodology includes the following components:

- **Flood-risk use case configuration:** FloodAI+ frames JackDaw around rural–urban flood resilience, with reference to Lisbon, Valencia and Dresden. The configuration focuses on practical flood-risk questions and the types of answers stakeholders need, including maps, risk summaries, short explanations, comparisons between areas and recommendations for improvement.
- **Flood Hazard and Exposure Connectors and geospatial context:** The approved proposal envisaged a Flood Hazard Connector linking JackDaw to geospatial flood-hazard services and providing spatial summaries for user-selected areas. During implementation, FloodAI+ designed, developed, integrated and tested this connector as an executable MCP tool within the Raven/JackDaw environment. It processes flood-hazard information such as inundation extent, water depth, hazard classes and, where available, flow velocity. To strengthen the use case, FloodAI+ also developed the Flood Exposure Connector as an additional result. This tool relates hazard information to potentially exposed population, buildings, roads, land uses, agriculture and critical infrastructure. Together, the connectors provide the geospatial evidence needed to support flood-risk interpretation through JackDaw.
- **Stakeholder-oriented communication requirements:** FloodAI+ considered how the terminology, level of detail, practical emphasis and decision context of flood information may vary across different stakeholder groups. The broader use-case design and validation methodology considered citizens, farmers, planners, emergency managers and infrastructure managers. These stakeholder categories informed the assessment of communication needs and the formulation of recommendations for JackDaw. They should not be interpreted as five independently implemented explanation templates.
- **Multilingual Flood Glossary and executable style profiles:** FloodAI+ implemented the Multilingual Flood Glossary as an executable MCP tool that can be invoked through the Raven/JackDaw environment using explain_flood_term. It provides consistent explanations of flood-related terminology in English, Portuguese, Spanish and German. Audience adaptation is implemented within this tool through three executable style profiles: citizens, farmers, and planners/emergency managers. The executable audience adaptation is currently applied within the Multilingual Flood Glossary, complementing the analytical outputs provided by the Flood Hazard and Flood Exposure Connectors.
- **Workshops and stakeholder feedback:** The validation methodology included online workshops, demonstration sessions, hands-on testing, participant forms and Mentimeter-based feedback. The first workshop introduced FloodAI+, presented JackDaw and collected stakeholder input on the flood-related questions users most wanted the chatbot to answer. The second workshop provided a hands-on validation session in which participants tested JackDaw directly and assessed its clarity, usefulness, trustworthiness and potential contribution to decision support.
- **Feedback-to-improvement mapping:** Feedback is analysed and translated into improvement recommendations. Typical feedback signals are mapped to actionable changes, for example: misunderstood hazard classes → glossary entry and simpler explanation template; generic answers → use stakeholder profile and location context; hard-to-interpret maps → improve labels, examples and default views; low trust → add data provenance and confidence cues; unanswered questions → identify data or connector requirements for the roadmap.

- **Reporting and contribution to PoliRuralPlus:** The final outputs include the Part A public report, Part B confidential report, Validation Feedback Form, supporting evidence, dissemination links, user journey insights, JackDaw AI chatbot use cases, stakeholder group feedback and recommendations for improvement. This directly responds to the final reporting requirements communicated by the funding entity and to the structure of the official templates. The Part A template explicitly asks for project overview, progress against objectives, technical results, stakeholder engagement, communication and dissemination, impact assessment, lessons learned, sustainability and conclusions.

2. Progress Against Objectives and Work Plan

This chapter explains how FloodAI+ was implemented during the reporting period and how execution compared with the approved objectives and work plan. The project retained its central objective of validating JackDaw as a GeoAI conversational environment for accessing and interpreting flood-related information in rural-urban contexts. However, the initial assessment of the Raven/JackDaw environment available to the project showed that it did not yet include an operational flood-specific analytical tool capable of answering the area-based hazard and exposure questions envisaged in the proposal. Initial flood-related prompts did not produce usable, spatially grounded responses.

Consequently, FloodAI+ could not proceed directly from use-case configuration to stakeholder validation. The implementation sequence had to be adapted to include the selection and harmonisation of geospatial data, technical design, development, integration and functional testing of specialised MCP tools. Within the existing Raven/JackDaw architecture, Porvalor implemented the Flood Hazard Connector, developed the Flood Exposure Connector as an additional project result, and implemented the Multilingual Flood Glossary with four languages and three executable audience profiles.

These developments enabled the project to progress from an initially unavailable flood-specific capability to a pilot-level suite that could be tested through automated tests, MCP Inspector, the Raven/JackDaw environment and stakeholder activities. The approved objectives remained unchanged, but the additional technical workload affected the planned balance between development and validation within the limited implementation period. FloodAI+ therefore combined functional technical validation with stakeholder workshops, feedback analysis and recommendations for the further development of the JackDaw ecosystem.

This approach is consistent with the approved proposal, which defined FloodAI+ as a JackDaw-centred validation experiment for rural–urban flood resilience and explicitly focused on usability, reliability, added value for decision-making, stakeholder-specific explanations, the Flood Hazard Connector, multilingual glossary and style profiles, and structured feedback for future JackDaw improvements.

2.1 Restatement of project objectives and expected outputs

FloodAI+ was approved as a **JackDaw-centred validation experiment for rural–urban flood resilience**. Its main purpose is to validate and enhance JackDaw, the PoliRuralPlus GeoAI chatbot, as a multilingual conversational interface that helps different stakeholders interpret, compare and communicate flood-risk information.

The project objectives remained unchanged throughout implementation and were structured around four specific objectives.

- **SO1 | Deploy JackDaw in real European flood-risk contexts -** FloodAI+ aimed to configure and apply JackDaw in real European flood-risk contexts, with reference to the pilot areas of Lisbon, Valencia and Dresden. The expected role of JackDaw was to support spatially contextualised conversations around flood-risk information, including hazard, exposure, vulnerability and resilience planning questions. Under this

objective, the project focused on the Flood Hazard Connector concept and on the practical requirements needed for JackDaw to support bounded and evidence-based flood-hazard queries. Given the maturity of the available JackDaw environment, the work produced both direct validation evidence and validation-readiness evidence on what is required for more robust future connector-based testing.

- **SO2 | Validate JackDaw's usability, reliability and trustworthiness -** FloodAI+ aimed to generate structured evidence on how clearly and intuitively JackDaw translates flood-risk information into understandable insights. The validation process was designed to collect both quantitative indicators and qualitative perceptions related to usability, clarity, reliability, trust and usefulness. This objective was addressed through workshop-based feedback, stakeholder question collection, Mentimeter feedback, asynchronous feedback channels, and internal assessment of JackDaw's current capacity to support flood-risk interaction. The assessment focused on what could be credibly tested during the reporting period: user interaction, clarity of answers, perceived usefulness, stakeholder needs, trust requirements, and requirements for future decision-support validation.
- **SO3 | Assess JackDaw's added value for rural–urban decision-making and participation -** FloodAI+ aimed to involve stakeholders in realistic flood-related questions and assess whether JackDaw could support better-informed, more transparent and more inclusive decision-making. This objective was addressed through workshops, demonstrations, hands-on testing and structured feedback on the clarity, usefulness, trustworthiness and decision relevance of JackDaw's answers, maps, explanations and contextual information. The broader use-case design considered the communication needs of citizens, farmers, municipal planners, civil protection authorities and infrastructure managers. These needs informed the assessment and the recommendations for future JackDaw improvements. Executable audience adaptation was implemented specifically within the Multilingual Flood Glossary through three style profiles: citizens, farmers, and planners/emergency managers.
- **SO4 | Produce transferable validation evidence and replication guidance -** FloodAI+ aimed to document user journeys, technical and stakeholder testing results, feedback, improvement needs and lessons relevant to the replication of the approach in other regions, hazards and languages. This objective was addressed through structured reporting outputs, dissemination materials, feedback-to-improvement mapping, documented testing evidence and recommendations for the further development of JackDaw. The project also implemented the **FloodAI+ Multilingual Flood Glossary** as an executable MCP tool, providing explanations of 30 flood-related terms in English, Portuguese, Spanish and German through three audience profiles. Together with the Flood Hazard and Flood Exposure Connectors, this provides a transferable pilot-level technical and methodological basis that can be extended with additional terms, languages, stakeholder profiles, datasets and geographical contexts.

2.2 Implementation approach and clarification of validation scope

At the beginning of implementation, Porvalor assessed the Raven/JackDaw environment made available to FloodAI+. This assessment identified the need to extend the available configuration with the operational flood-specific analytical capabilities required to address the area-based flood-hazard and related risk-information questions envisaged in the approved proposal. This finding concerned the flood-specific functionality available to FloodAI+ at that time, rather than the JackDaw platform as a whole.

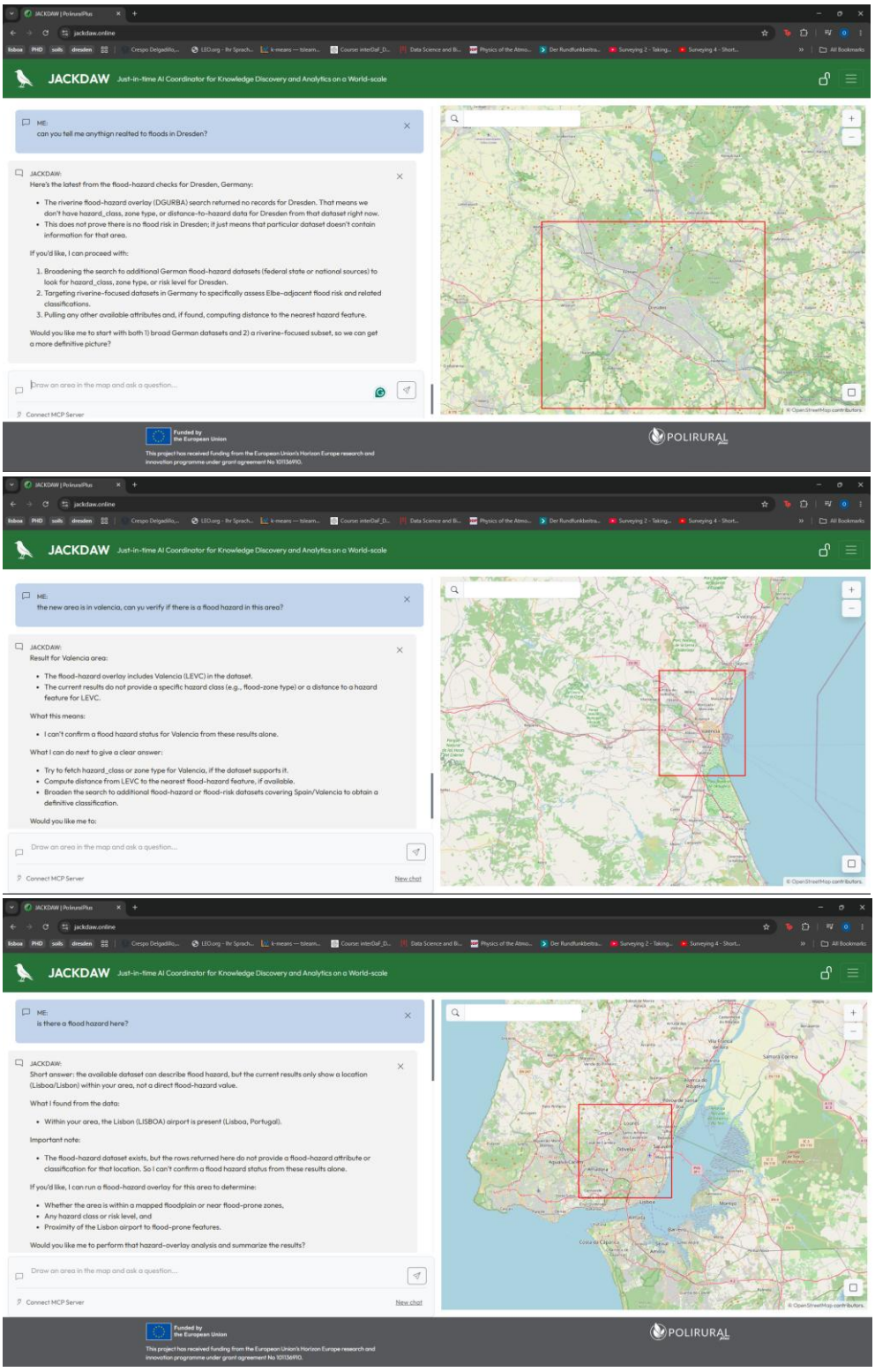

Figure 1. Raven/JackDaw environment during the initial FloodAI+ assessment

Screenshot of the Raven/JackDaw conversational interface available at the beginning of FloodAI+ implementation for Dresden, Valencia and Lisbon, before the integration of the project's flood-specific MCP tools. The existing environment provided the technological basis that FloodAI+ subsequently extended to support the planned flood-related use cases.

The implementation sequence was therefore expanded within the existing Raven/JackDaw architecture. In addition to the planned stakeholder and validation activities, the project incorporated:

- identification, selection and harmonisation of relevant geospatial datasets;
- technical design, development, integration and testing of the Flood Hazard Connector;

- development of the Flood Exposure Connector as an additional project result;
- implementation of the Multilingual Flood Glossary in four languages and with three executable audience profiles;
- automated testing and functional verification through MCP Inspector and the Raven/JackDaw environment;
- stakeholder question collection, demonstrations and hands-on testing;
- structured feedback on clarity, usability, trustworthiness, usefulness and decision relevance; and
- preparation of technical evidence, replication lessons and recommendations for further development.

Through this adapted approach, FloodAI+ established an integrated pilot-level suite of specialised MCP tools supporting flood-hazard analysis, exposure screening and multilingual explanation of flood-related terminology. The approved objectives remained unchanged, while the balance of the work plan was adjusted to accommodate the technical development and integration required to support meaningful testing.

The validation evidence must be interpreted according to its scope. Functional technical validation was completed at pilot level through automated tests, MCP Inspector and testing within Raven/JackDaw. Stakeholder validation included demonstrations, hands-on interaction with the flood-analysis capabilities available during the workshops and structured feedback, but was conducted with a limited and uneven participant sample. The Multilingual Flood Glossary was implemented after the second workshop in response to the communication and language needs identified during stakeholder engagement; it was functionally tested but was not validated directly by the workshop participants.

Accordingly, FloodAI+ provides evidence that the implemented tools function within the pilot environment and that stakeholders were able to assess relevant aspects of JackDaw's clarity, usefulness and potential decision-support value. It does not treat the limited stakeholder activities as a broad quantitative validation of decision-making outcomes or of the benefits of the complete final tool suite. This distinction ensures that the reported achievements remain proportionate to the evidence collected.

The correspondence with the PoliRuralPlus team concerning the initial assessment, implementation adjustments and reporting expectations is included in Part B – Confidential as supporting evidence of transparent communication and responsible implementation management

2.3 Expected outputs and implementation status

Table 1 summarises progress against the expected outputs defined in the approved proposal and reporting template. The status descriptions distinguish between pilot-level technical implementation, stakeholder validation and outputs prepared as part of the final reporting process.

Table 1 - Expected FloodAI+ outputs and implementation status.

Expected output	Status	Evidence / notes
JackDaw applied to rural–urban flood-risk use cases	Achieved at pilot level	JackDaw was applied to flood-related use cases with reference to Lisbon, Valencia and Dresden. Application included flood-hazard analysis, exposure screening, technical testing, demonstrations and hands-on stakeholder interaction with the capabilities available during the workshops.
Flood Hazard Connector concept and bounded flood-hazard interaction logic	Achieved and extended	The proposed connector concept was developed, integrated and functionally tested as an executable MCP tool within Raven/JackDaw. It supports spatially bounded queries and produces summaries of flood extent, depth, hazard classes and, where available, flow velocity. The Flood Exposure Connector was developed as an additional project result.

Stakeholder-specific explanation templates	Achieved at pilot level	The communication needs of citizens, farmers, municipal planners, civil protection authorities and infrastructure managers informed the use-case design and recommendations. Executable audience adaptation was implemented within the Multilingual Flood Glossary through three consolidated profiles: citizens, farmers, and planners/emergency managers. The analytical outputs of the Flood Hazard and Flood Exposure Connectors do not independently apply these profiles.
Multilingual flood-risk glossary and style profiles	Achieved and implemented as v1.0	The Multilingual Flood Glossary was implemented as an executable MCP tool through explain_flood_term. It provides explanations of 30 flood-related terms in English, Portuguese, Spanish and German, adapted through three audience profiles. The tool was functionally tested after its implementation.
Structured stakeholder feedback on usability, reliability, trust and added value	Achieved within the pilot validation scope	Two stakeholder workshops were completed, including demonstrations, hands-on interaction and Mentimeter-based feedback. Evidence was collected on clarity, usefulness, trustworthiness, expected functionality and potential decision-support value. An asynchronous feedback channel was also made available.
Stakeholder question set for JackDaw	Achieved	Flood-related questions and information needs were collected through the first and second workshops and documented as inputs for tool development, testing and improvement recommendations.
Improvement recommendations for JackDaw	Achieved	Technical testing and stakeholder feedback informed recommendations concerning audience-appropriate explanations, improved maps and visual outputs, clearer uncertainty and provenance information, more actionable answers, and stronger data and connector capabilities.
Communication and dissemination outputs	Achieved	Project news articles and two FloodAI+ blogposts were published. The corresponding links and dissemination evidence are documented in the communication and dissemination section.
Final Validation Report and Replication Guidelines	Completed	A standalone 12-page Validation Report, including Annex A – Replication Guidelines, was prepared as a separate final-delivery document.
User Tip Sheet	Completed	A concise User Tip Sheet was prepared as a standalone final-delivery document. It introduces the Flood Hazard Connector, Flood Exposure Connector and Multilingual Flood Glossary; provides representative user questions; covers the Lisbon, Valencia and Dresden pilot areas; and explains key data, interpretation and operational limitations.
Impact-to-Improvement Map	Completed	The Impact-to-Improvement Map is included in Final Report Part A, in Table 2, Section 2.8, Table 5. It links stakeholder needs, workshop feedback and technical observations to implemented improvements or recommendations concerning bounded flood analysis, exposure information, multilingual explanations, reliability controls, explicit result statuses, uncertainty and data provenance

2.4 Implementation progress against the approved work plan

The approved work plan followed a lean three-phase logic: **preparation and setup; validation activities; and analysis, dissemination and reporting**. This overall structure was maintained during implementation. However, the activities within the phases were expanded to incorporate the technical development, integration and testing needed to establish the flood-specific capabilities required for meaningful validation.

2.4.1 Phase 1 | Preparation and setup

The preparation phase focused on organising the validation process, assessing the Raven/JackDaw environment and preparing the flood-risk use cases and supporting materials. Activities included:

- reviewing the approved FloodAI+ scope, objectives and expected outputs;
- assessing the Raven/JackDaw environment available to the project and identifying the need for additional flood-specific analytical capabilities;
- communicating early implementation concerns to the PoliRuralPlus team;
- defining a proportionate validation logic around rural–urban flood-risk information;
- identifying and preparing relevant geospatial data sources;
- defining the initial technical and user journey from stakeholder question to JackDaw response and feedback;
- initiating the design and development of the flood-specific MCP tools;
- preparing workshop materials, participant forms and feedback instruments;
- preparing the first workshop presentation and narrative;
- aligning validation questions with the official reporting structure and PoliRuralPlus technical validation requirements;
- preparing communication materials, including the first workshop flyer and news item; and
- establishing the initial feedback-to-improvement mapping logic.

This phase remained aligned with the approved work plan while incorporating early technical and methodological risk management. The emphasis was on establishing the conditions for a structured validation process that could collect stakeholder questions, assess JackDaw's usefulness and identify improvement needs, while also preparing the technical capabilities required to support the planned flood-related interactions.

2.4.2 Phase 2 | Validation activities

The validation phase began with the first FloodAI+ online workshop. The workshop introduced the FloodAI+ project, presented JackDaw and collected feedback on the flood-related questions stakeholders would most like JackDaw to answer. It combined project presentation, live demonstration and structured feedback collection.

The first workshop provided an early validation checkpoint. It confirmed stakeholder interest in JackDaw as a tool for accessing and interpreting flood-risk information, while also identifying the need for more decision-ready outputs. The first workshop blogpost summarised this as a need to move from "maps first" to "decisions next", with stakeholders requesting information that was visual, understandable and connected to action. The participant group was compact but relevant and included representatives or perspectives associated with municipalities, infrastructure management, SMEs and research/academia. Infrastructure protection, emergency planning, land-use and agricultural planning, and other practical decision needs emerged as important areas for JackDaw support.

Between and alongside the stakeholder activities, FloodAI+ continued the development, integration and functional testing of the Flood Hazard and Flood Exposure Connectors. This technical work enabled the second workshop to move from an introductory demonstration towards direct interaction with the flood-analysis capabilities available in Raven/JackDaw.

The second validation workshop was conducted as a hands-on session. Participants accessed JackDaw, tested practical flood-related questions and provided feedback on the clarity, usefulness, trustworthiness and decision relevance of the responses. The workshop strengthened the project's evidence base, while the size and composition of the participant group were considered when interpreting the results.

2.4.3 Phase 3 | Analysis, dissemination and reporting

The final phase consolidated the technical and stakeholder evidence generated during implementation. Activities included:

- consolidating and analysing feedback from both workshops;
- implementing and functionally testing the FloodAI+ Multilingual Flood Glossary with four languages and three executable audience profiles;

- organising evidence for the Part A public report and Part B confidential report;
- completing the Validation Feedback Form annex;
- documenting user-journey insights;
- documenting JackDaw AI chat agent use cases;
- preparing stakeholder-group feedback summaries;
- translating technical findings and stakeholder feedback into recommendations for improvement;
- compiling dissemination outputs, including news items, blogposts, flyers and social-media evidence;
- documenting implementation constraints, corrective actions and lessons learned; and
- preparing the final reporting package and replication guidance.

The Multilingual Flood Glossary was implemented after the second workshop in response to the communication and language needs identified during stakeholder engagement. It was functionally tested as part of the final technical suite but was not directly evaluated by workshop participants. The final analysis therefore distinguishes between functional testing of the implemented MCP tools and the stakeholder evidence collected through the workshops.

2.5 Status of milestones and deliverables

At the conclusion of the implementation period, the principal FloodAI+ milestones and expected outputs had been completed. The project delivered two stakeholder workshops, structured feedback activities, technical and dissemination outputs, and the final reporting package. It also progressed beyond the initially envisaged connector concept by implementing and functionally testing a pilot-level suite comprising the Flood Hazard Connector, the additional Flood Exposure Connector and the Multilingual Flood Glossary.

As detailed in Sections 2.3 and 2.4, completion of the planned outputs does not imply that all results reached the same level of validation. The Flood Hazard and Flood Exposure Connectors supported the technical and stakeholder activities according to their respective development stages, while the Multilingual Flood Glossary was implemented and functionally tested after the second workshop. Stakeholder validation was completed within the available pilot scope and participant sample, whereas broader quantitative assessment of decision-making outcomes would require further testing.

2.6 Description of use case and testing context

The selected use case is **rural-urban flood-risk information and resilience planning**. This use case was selected because flood resilience requires complex geospatial information to be interpreted and applied by different types of users, including technical and non-technical stakeholders. The testing context focused on the practical questions that stakeholders may need to ask about flood risk, including questions concerning:

- exposed areas;
- roads, buildings and access routes;
- critical infrastructure;
- vulnerable populations;
- flood-hazard zones;
- agricultural areas;
- prevention and adaptation measures;
- historical flood events;
- future scenarios; and
- communication of risk to non-specialist audiences.

The stakeholder feedback collected during the validation activities confirmed that participants did not only need access to flood-risk data. They needed information that was easier to understand, more visual and more directly connected to practical decisions. Within the pilot sample, participants prioritised maps, risk summaries, short textual explanations and comparisons between areas as useful response formats. They also indicated that the highest-priority

information concerned exposed buildings, roads, access routes and critical infrastructure, followed by flood-hazard zones and vulnerable populations.
The open responses showed that stakeholder questions were practical, local and often time-sensitive. Participants asked whether they were living in a safe area, which locations had been affected by flooding, what maximum flood depth and flow velocity had been identified, what the outlook could be over the next 10, 30 or 50 years, whether flood conditions could affect the safe use of agricultural land, and which prevention measures could help protect critical infrastructure.
The testing context was therefore structured around the following validation question:

Can JackDaw help stakeholders move from complex flood-risk maps and spatial data to clearer, more useful and more decision-relevant answers?

This framing remained aligned with the approved work plan and with JackDaw's role as a GeoAI conversational interface for accessing and interpreting flood-risk information.

2.7 JackDaw application and validation

During the reporting period, JackDaw was applied and assessed as a conversational GeoAI environment for accessing and interpreting flood-related information. The validation combined two complementary components: functional technical validation of the MCP tools implemented through FloodAI+ and stakeholder validation of the flood-analysis capabilities available during the workshops.
The functional technical validation covered:

- integration and execution of the Flood Hazard Connector within Raven/JackDaw;
- processing of spatially bounded flood-hazard queries;
- generation of flood-extent, depth, hazard-class and, where available, flow-velocity information;
- integration and execution of the Flood Exposure Connector as an additional project result;
- generation of exposure information concerning population, buildings, roads and land use, subject to the datasets available for each pilot area;
- automated testing and functional verification through MCP Inspector and the Raven/JackDaw environment;
- functional testing of the Multilingual Flood Glossary following its implementation after the second workshop.

Stakeholder validation focused on:

- natural-language interaction with practical flood-related questions;
- interpretation of maps and spatially grounded responses;
- clarity, usefulness, trustworthiness and potential decision relevance;
- the need for answers adapted to the user's location, role and level of technical knowledge;
- explanation of flood-related concepts in accessible language;
- identification of useful response formats, including maps, summaries, short explanations and comparisons between areas;
- identification of additional data and connector requirements; and
- collection of practical improvement needs for the Raven/JackDaw interaction and analytical workflow.

The validation evidence must be interpreted in relation to the project's pilot scope. The technical testing demonstrated that the implemented connectors and glossary could operate within the pilot environment according to their respective development stages. The stakeholder activities provided evidence concerning participants' perceptions of clarity, usefulness, trustworthiness and potential decision-support value. However, the participant sample, geographical coverage and time available after technical implementation were not sufficient for a broad quantitative assessment of decision-making outcomes or for direct stakeholder validation of the complete final tool suite.
The Multilingual Flood Glossary was implemented after the second workshop in response to the communication and language needs identified during stakeholder engagement. It was therefore functionally tested but not directly assessed by workshop participants. Similarly, the three executable audience profiles; citizens, farmers, and

planners/emergency managers, apply specifically to the glossary and should not be interpreted as profiles already implemented across all JackDaw responses.
The issues identified through technical testing and stakeholder feedback were treated as actionable improvement signals for the further development of JackDaw and the FloodAI+ tools.

Table 2 - Key validation issues identified and corresponding improvement directions for JackDaw.

Issue identified	Interpretation	Improvement direction
Some answers were too generic	More context is needed	Use location, user role and decision context.
Technical terms may be unclear	Explanations must match user knowledge	Integrate and expand the Multilingual Flood Glossary.
Maps require clearer interpretation	Maps need supporting explanations	Improve legends, labels and textual summaries.
Trust depends on transparency	Users need to understand the underlying information	Show data sources, dates, limitations and uncertainty.
Answers were not always actionable	Information must connect to decisions	Provide practical next steps and appropriate cautions.
Some questions require additional data	The pilot does not cover every requested use case	Prioritize new datasets and connector functions.
Stakeholder participation was limited	Results are useful but not representative	Test with broader and more diverse participant groups.
The final suite was not available throughout validation	Participants tested different development stages	Validate the complete integrated suite in future sessions.
Decision-making outcomes were not assessed	Outcome validation requires longer-term testing	Use defined scenarios, comparisons and outcome indicators.

2.8 Feedback and improvements

Stakeholder feedback was collected through two workshops, participant interaction, Mentimeter activities and follow-up communication. These activities provided focused pilot-level validation evidence on user needs, perceived clarity, usefulness, trustworthiness and priorities for improvement. The findings are interpreted within the scope of the participating stakeholder group and provide a practical basis for the project's conclusions and recommendations.

The first workshop focused primarily on expectations, information needs and preferred response formats. Participants expressed interest in JackDaw as a tool for making flood-risk maps and geospatial information easier to understand. They described the interface using positive terms such as "interesting", "friendly", "simple", "intuitive" and "attractive", while also identifying areas requiring further development.
Participants requested practical and locally relevant answers, clearer map interpretation and information more directly connected to action. Their questions covered exposed buildings, roads and critical infrastructure; hazard zones and vulnerable populations; historical events and future scenarios; agricultural and land-use decisions; and measures for prevention and infrastructure protection. Maps, risk summaries, short explanations and comparisons between areas were identified as useful response formats.

The second workshop moved from introductory demonstration towards hands-on interaction with the flood-analysis capabilities available in Raven/JackDaw. It provided additional feedback on the clarity, usefulness, trustworthiness and potential decision relevance of the responses. The results supported the project's central validation premise: JackDaw has potential to mediate between complex geospatial data and practical flood-resilience questions, but further refinement and broader testing are required before its decision-support impact can be demonstrated.

Across the two workshops, the main feedback signals were:

- answers should be practical, local and connected to specific decisions;
- maps require clear legends, summaries and explanations of their practical meaning;
- historical information, future scenarios and prevention measures remain important information needs;
- responses should consider the user's role and level of technical knowledge;
- data provenance, coverage, limitations and uncertainty are important for trust;
- both operational questions and longer-term planning needs should be supported;
- exposed assets and infrastructure are priority topics; and
- technical flood terminology should be made more accessible to non-specialist users.

Feedback from the first validation workshop informed the preparation and delivery of the second phase. The principal iterative improvements were:

i. **More hands-on workshop designs:** The first workshop combined presentation, demonstration and question collection. The second workshop placed greater emphasis on direct participant interaction with practical flood-related questions.
ii. **Question-driven validation:** Stakeholder questions and information priorities were used to structure the practical testing, keeping the validation connected to real use cases.
iii. **Feedback-to-improvement mapping:** Comments were organised into actionable categories covering response relevance, maps, terminology, user context, trust, data requirements and connector development.
iv. **Technical capability development:** The Flood Hazard and Flood Exposure Connectors were developed, integrated and functionally tested to support spatially grounded flood-hazard and exposure questions.
v. **Broader feedback channels and communication:** Asynchronous feedback opportunities and additional outreach complemented the live workshops. Communication materials for the second workshop emphasised hands-on testing and practical feedback.
vi. **Multilingual and audience-adapted terminology:** Following the second workshop, the Multilingual Flood Glossary was implemented in English, Portuguese, Spanish and German, with three executable audience profiles. This responded to the need for clearer and more accessible terminology identified during stakeholder engagement. The glossary was functionally tested after implementation but was not directly validated by workshop participants.

Based on the combined technical and stakeholder evidence, the main recommendations are to:

- strengthen location-aware and stakeholder-appropriate responses;
- improve map legends, default views and accompanying explanations;
- communicate data sources, dates, coverage, limitations and uncertainty more clearly;
- connect analytical outputs to practical decisions and appropriate next steps;
- support comparisons between areas;
- expand support for exposed assets and infrastructure-protection questions;
- improve access to historical flood information and future-scenario data;
- prioritise additional datasets and connector functions according to stakeholder needs;
- integrate and extend the Multilingual Flood Glossary and its audience profiles within the wider conversational workflow; and
- validate the complete integrated tool suite with broader participant groups and defined decision scenarios.

These recommendations are aligned with the approved proposal's emphasis on targeted technical configurations and actionable feedback for the further development of JackDaw

2.9 Deviations from the work plan and corrective actions

FloodAI+ remained aligned with the approved objectives, scope and budget throughout implementation. No formal change to the approved objectives was made. During execution, two implementation constraints required

management attention: the maturity of the available JackDaw environment and the level of stakeholder participation in the workshops.

During the early implementation phase, Porvalor assessed the available JackDaw environment and identified that the flood-specific analytical workflow was not yet sufficiently mature to support the full end-to-end decision-support validation originally envisaged. This was communicated to the PoliRuralPlus team at an early stage. Following the guidance received, the approved objectives were maintained, while implementation was adjusted to ensure transparent reporting, methodological robustness and useful results for the next maturity phase of JackDaw.

As a result, FloodAI+ focused on what could be credibly tested and documented within the project timeframe: stakeholder interaction with JackDaw, usability, clarity, trustworthiness, perceived usefulness, user journey insights, co-created requirements and recommendations for improvement. Where full technical validation was not yet possible, the project generated validation-readiness evidence and documented the conditions required for future robust validation.

A second constraint related to stakeholder participation. The first workshop was implemented as a compact online validation session and generated useful early feedback, but participation was below the cumulative target defined in the proposal. This risk had been anticipated in the original risk management approach. Corrective actions were therefore implemented, including targeted outreach, asynchronous feedback collection and a second hands-on validation workshop.

The second workshop was completed on 13 July 2026 and strengthened the evidence base by enabling direct interaction with JackDaw and additional feedback on clarity, usefulness, trust and decision-support potential. The results from the first workshop, second workshop and asynchronous feedback were consolidated into the final reporting package.

These constraints did not affect the approved budget or the overall project timeline. The final allocation across cost categories is reported in Part B (Confidential). They also did not prevent FloodAI+ from delivering its core contribution to the Enhance Call: structured stakeholder feedback, JackDaw use case insights, validation-readiness evidence, improvement recommendations, dissemination outputs and supporting documentation for future JackDaw development.

3. Solution Developed and Technical Results

FloodAI+ produced a pilot-level technical extension of the Raven/JackDaw environment for accessing and interpreting flood-risk information. Rather than creating a separate flood-risk platform, the project integrated three custom Model Context Protocol (MCP) tools that allow JackDaw to connect natural-language questions and map-selected areas with geospatial analysis and audience-appropriate explanations.

The developed solution combines flood-hazard analysis, exposure screening and multilingual terminology support for the pilot contexts of Lisbon, Valencia and Dresden. It uses internally configured raster and vector sources, spatial processing methods and structured outputs designed for interpretation through the JackDaw conversational interface.

The technical contribution also included the preparation of supporting geospatial data. Porvalor prepared pilot-specific population rasters and a flood-flow-velocity raster for Lisbon. With support from PoliRuralPlus, these prepared datasets were published as interoperable Web Coverage Service (WCS) layers, replacing the temporary use of local files and enabling their operational retrieval by the MCP tools. The underlying datasets, their providers and the respective contributions to data preparation and publication are documented in Chapter 4.

This chapter describes the implemented applications, technical architecture, outputs, maturity, technologies and access arrangements. Stakeholder activities are referenced only where feedback materially influenced the technical design, since the validation process and its results have already been addressed in Chapter 2.

3.1 Description of the developed solution and outputs

The developed solution consists of three complementary MCP tools integrated into Raven/JackDaw. For geospatial questions, a user selects an area of interest through the map interface and asks a question in natural language. JackDaw passes the selected geometry to the relevant tool as Well-Known Text (WKT), together with its coordinate reference system (CRS). The connector then identifies the applicable pilot context, queries the configured data services, performs the required spatial analysis and returns a structured result for JackDaw to explain.

The three implemented tools are:

I. **Flood Hazard Connector (analyze_flood_hazard)** – analyses the configured 100-year flood scenario for a selected area in Lisbon, Valencia or Dresden. Depending on the source available for each pilot, it reports flood extent, flooded area, water-depth statistics, hazard classes and, for Lisbon, available flow-velocity evidence.

II. **Flood Exposure Connector (analyze_flood_exposure)** – screens the population, buildings, roads, land use, agricultural areas, critical infrastructure and vulnerability information available for the selected pilot. It distinguishes between assets located within the area of interest and assets that intersect the identified flood extent. It can also produce indicative, non-monetary damage signals. The available components differ by city and underlying source coverage.

III. **Multilingual Flood Glossary (explain_flood_term)** – explains 30 configured flood-related terms in English, Portuguese, Spanish and German. Explanations can be adapted to three audience profiles: citizens, farmers, and planners/emergency managers. Unlike the geospatial connectors, this tool uses a controlled local vocabulary and does not depend on external data services or a selected area.

At the data-access layer, the solution combines WCS raster coverages, WFS vector features, ArcGIS REST services and GeoJSON sources. Lisbon and Valencia flood-depth rasters are accessed through WCS, while the Dresden hazard analysis uses the official Saxon HQ100 vector layer. The Porvalor-prepared population rasters for the three pilots and the Lisbon flow-velocity raster are also retrieved through WCS services published with the support of PoliRuralPlus.

The tools return structured outputs containing a processing status, user-facing content, key metrics, source information, warnings and limitations. The Hazard and Exposure Connectors also distinguish successful results from unavailable sources, partial results and components that were not calculated. This prevents missing information from being presented as zero exposure and allows available components to continue when an external source is slow or unavailable.

The resulting output is therefore not limited to software code. It comprises an integrated three-tool suite, supporting geospatial raster products, interoperable data-access arrangements and reusable response structures for connecting spatial evidence with conversational explanations. The solution is intended for preliminary exploration, screening and communication; it does not replace official flood warnings, detailed hydraulic studies, engineering assessments or authoritative loss evaluations.

3.2 Developed applications and practical outputs

FloodAI+ delivered three executable MCP tools together with the supporting data, methodological and communication outputs required for their application and validation. Table 3 distinguishes between implemented technical applications and complementary project outputs. Detailed data provenance is provided in Chapter 4, while stakeholder feedback and validation results are addressed in Chapter 2.

Table 3 – FloodAI+ technical and practical outputs

Output	Description	Maturity / status
Flood Hazard Connector	Analyses bounded 100-year flood scenarios for Lisbon, Valencia and Dresden, including flood extent, depth, hazard classes and available flow-velocity information.	Implemented and functionally tested at pilot level
Flood Exposure Connector	Screens available population, buildings, roads, land use, agricultural areas, critical infrastructure and vulnerability information against the selected area and flood extent.	Implemented and functionally tested at pilot level; additional project output
Multilingual Flood Glossary and audience profiles	Provides controlled explanations for 30 flood-related terms in EN/PT/ES/DE, adapted to citizens, farmers and planners/emergency managers.	Implemented and functionally tested after Workshop 2
Supporting raster products and WCS access	Porvalor prepared population rasters for the three pilots and a Lisbon flow-velocity raster. PoliRuralPlus supported their publication as WCS coverages for operational connector access.	Prepared, published and integrated at pilot level
Flood-risk use-case framework and JackDaw user use cases	Defines relevant flood-risk questions, user groups, information needs and conversational interaction scenarios.	Completed methodological output
Validation methodology and feedback-to-improvement map	Combines workshop testing, Mentimeter feedback and structured mapping of findings to technical and communication improvements.	Applied and completed
Communication and dissemination materials	Includes news items, two blogposts, flyers and public visibility materials presenting the project activities and results.	Completed and published

3.3 Technical maturity

At the reporting cut-off date, the three FloodAI+ MCP tools had reached pilot-level technical maturity. Table 4 summarises their implementation status and the main boundaries of their validation.

Table 4 – Technical maturity of the FloodAI+ components

Component	Status	Main validation boundary
Flood Hazard Connector	Implemented and functionally validated at pilot level	Tested with the configured 100-year flood scenario for Lisbon, Valencia and Dresden. Results depend on the coverage and availability of the underlying services.
Flood Exposure Connector	Implemented and functionally validated at pilot level	Exposure categories and data coverage vary between pilot cities. Damage-related outputs remain indicative and non-monetary.
Multilingual Flood Glossary	Implemented and functionally tested	Includes 30 terms in four languages and three audience profiles. It was developed after Workshop 2 and was therefore not directly evaluated by workshop participants.

Component	Status	Main validation boundary
Integrated FloodAI+ suite	Pilot-level integration completed	Verified through automated tests, MCP Inspector and Raven/JackDaw integration checks. It has not been validated as an operational decision-support system by responsible authorities.

3.4 Technical architecture

FloodAI+ followed a lightweight, modular architecture based on the Model Context Protocol. The solution was implemented as an extension of the existing Raven/JackDaw environment rather than as a separate flood-risk platform. JackDaw provided the conversational interface, Raven supported MCP tool invocation, and the three FloodAI+ tools supplied the specialised analytical or explanatory functions.
For map-based requests, the operational flow was:

Natural-language question and map-selected area → JackDaw/Raven → MCP tool selection → source retrieval and spatial processing → structured result → conversational response

JackDaw/Raven selected the relevant tool according to the user's request:

- the **Flood Hazard Connector** received the selected geometry as WKT and its CRS;
- the **Flood Exposure Connector** received the WKT geometry, CRS and the specific exposure components requested; and
- the **Multilingual Flood Glossary** received a term, language and audience profile and did not require a selected area.

The Hazard and Exposure Connectors automatically identified the applicable pilot context and accessed the internally configured geospatial sources. Their processing layer handled geometry validation, coordinate transformation, raster clipping and masking, vector intersection and the calculation of bounded spatial summaries. The Exposure Connector internally reused the Hazard Connector's analysis logic to obtain a consistent hazard context, avoiding duplication of the hazard-processing workflow, allowing it to distinguish between assets located within the selected area and assets intersecting the identified flood extent.
The Glossary followed a separate text-only route. It retrieved definitions from a controlled local vocabulary and adapted them to the selected language and audience profile without calling external geospatial services.
At code level, each FloodAI+ tool is exposed through a dedicated MCP entry-point module and supported by internal modules that separate tool registration and input validation from data access, geospatial processing and response construction. The Flood Hazard Connector delegates pilot-specific source retrieval and hazard calculations to its internal processing package. The Flood Exposure Connector follows a component-based structure for population, buildings, roads, land use, agriculture, critical infrastructure, vulnerability and indicative damage analysis. It also reuses the bounded hazard result produced by the Hazard Connector instead of duplicating the hazard-processing workflow. The Multilingual Flood Glossary separates the MCP interface from the controlled terminology and audience-style definitions.
This modular organisation allows individual components and data sources to be tested independently, isolates source-specific logic and supports the future addition of datasets, pilot locations, languages and analytical components without redesigning the complete solution.
All three tools returned structured results to Raven/JackDaw. Depending on the request, these results included:

- processing status and user-facing content;
- key hazard or exposure metrics;
- source and coverage information;
- warnings and limitations; and
- distinctions between calculated, unavailable, omitted and partially completed components.

During integration testing, it was identified that the transport-level timeouts used by the MCP adapter did not provide a hard end-to-end deadline for tool invocations. A configurable application-owned timeout was subsequently added

at the PRP API–Raven boundary, allowing a stalled external tool call to return a structured error instead of leaving the chat run pending. Additional request and MCP lifecycle tracing was also introduced to support future diagnosis. These changes strengthened integration resilience, although a complete post-change validation dataset was not produced within the reporting period.

3.5 Key technologies and interoperability mechanisms

FloodAI+ combined the existing Raven/JackDaw environment with open geospatial standards, Python-based spatial processing and the Model Context Protocol. Table 5 summarises the principal technologies and mechanisms used in the implemented pilot solution. Data sources and service configurations are documented in Chapter 4.

Table 5 – Key technologies and interoperability mechanisms used in FloodAI+

Technology / mechanism	Role in FloodAI+
Raven/JackDaw GeoAI environment	Provided the conversational and map-based environment in which the FloodAI+ tools were invoked and their results interpreted.
Model Context Protocol (MCP)	Enabled the integration of the Flood Hazard Connector, Flood Exposure Connector and Multilingual Flood Glossary as specialised tools.
LLM-supported natural-language interaction	Connected user questions with the appropriate flood-analysis or terminology function.
Python geospatial processing stack	Supported raster and vector processing through libraries including GeoPandas, Rasterio, Shapely and PyProj.
WKT geometries and coordinate reference systems	Transferred map-selected areas to the connectors and supported validation and coordinate transformation.
OGC Web Coverage Service (WCS)	Provided interoperable access to flood-depth, population and flow-velocity raster coverages used by the connectors.
OGC Web Feature Service (WFS)	Provided interoperable access to selected vector datasets used in hazard and exposure analysis.
ArcGIS REST services	Supplied additional official vector information where OGC services were not the configured source.
GeoJSON	Supported access to and exchange of selected vector datasets in a widely used geospatial format.
Raster clipping and vector intersection	Limited analysis to the selected area and calculated bounded hazard and exposure summaries.
Structured MCP responses	Returned metrics, source information, warnings, limitations and processing status in a consistent form for JackDaw.
Controlled multilingual terminology and audience profiles	Adapted glossary explanations across EN/PT/ES/DE for citizens, farmers and planners/emergency managers.
Automated tests and MCP Inspector	Supported repeatable functional verification of tool inputs, processing behaviour and outputs before integration.

3.6 Access and evidence

The FloodAI+ solution and its dissemination outputs can be accessed through the points listed below. Access to the Raven/JackDaw environment requires an authorised PoliRuralPlus account, while the workshop and blog materials are publicly available.

Table 6 - Public access points and supporting evidence for FloodAI+.

Item	Link
JackDaw login	https://jackdaw.online/login
FloodAI+ 1st workshop announcement	https://www.poliruralplus.eu/news/upcoming-webinar-floodai-1-st-workshop/
FloodAI+ 1st workshop results news	https://www.poliruralplus.eu/news/floodai-holds-its-first-workshop-to-present-jackdaw-and-collect-stakeholder-feedback/
FloodAI+ 2nd workshop news	https://www.poliruralplus.eu/news/floodai-2nd-workshop-hands-on-validation-of-jackdaw/
First workshop blogpost	https://www.poliruralplus.eu/knowledge-transfer/blog/maps-first-decisions-next-lessons-from-jackdaws-first-floodai-workshop/
Second workshop blogpost	https://www.poliruralplus.eu/knowledge-transfer/blog/testing-jackdaw-in-practice-lessons-from-the-second-floodai-workshop/
First social media post	https://www.linkedin.com/posts/porvalor_maps-first-decisions-next-lessons-from-activity-7480917309923000320-Gs3e?utm_source=share&utm_medium=member_desktop&rcm=ACoAAAEH2NYBmDJ9QYFKK6U53ItJ5mtfCF0ok4U
Second social media post	https://www.linkedin.com/posts/porvalor_testing-jackdaw-in-practice-lessons-from-activity-7487471946834542594-kY2m?utm_source=share&utm_medium=member_desktop&rcm=ACoAADI41wsBDoNmBKJiTEoMIaaRCYsAPiCZxxo

Confidential evidence supporting workshop delivery, validation and technical implementation, including participant-level attendance information, workshop screenshots, Mentimeter results, consent-related evidence within the scope documented in Section 6.5, and internal technical testing documentation, is provided in Part B – Confidential. This separation follows the reporting template's requirement that personal, sensitive and internal supporting information be kept outside the public report.

3.7 Summary of technical results

FloodAI+ delivered an integrated pilot-level extension of Raven/JackDaw for flood-risk analysis and communication. Its principal technical, data and methodological results were:

- three executable MCP tools: the Flood Hazard Connector, Flood Exposure Connector and Multilingual Flood Glossary;
- bounded flood-hazard analysis for the configured 100-year scenarios in Lisbon, Valencia and Dresden;
- screening of available population, buildings, roads, land use, agricultural areas, critical infrastructure and vulnerability information;
- controlled explanations of 30 flood-related terms in English, Portuguese, Spanish and German, adapted to three audience profiles;

- pilot-specific population rasters and a Lisbon flow-velocity raster prepared by Porvalor and published through WCS with support from PoliRuralPlus;
- interoperable access to raster and vector information through WCS, WFS, ArcGIS REST and GeoJSON sources;
- structured MCP outputs incorporating metrics, data provenance, warnings, limitations and partial-result handling;
- functional verification through automated tests, MCP Inspector and integration testing within Raven/JackDaw;
- pilot-level stakeholder evidence from two workshops and follow-up feedback;
- flood-risk use cases, user-journey insights and feedback-to-improvement recommendations; and
- communication outputs supporting the visibility of FloodAI+, JackDaw and PoliRuralPlus.

The principal technical result is a functional pilot foundation connecting natural-language questions and map-selected areas with flood-hazard analysis, exposure screening and audience-adapted terminology. The solution demonstrates the feasibility of integrating heterogeneous geospatial sources into Raven/JackDaw while identifying the data, interface and validation requirements for broader deployment.

4. Integration and Contribution to PoliRuralPlus

FloodAI+ contributed to PoliRuralPlus by extending the Raven/JackDaw ecosystem with an a functional pilot-level suitefor flood-risk analysis and communication. The contribution combined three executable MCP tools, the integration of heterogeneous geospatial sources, the preparation of pilot-specific raster products, interoperable data publication and structured stakeholder evidence.

The collaboration between Porvalor and PoliRuralPlus was particularly relevant at the data-access layer. Porvalor identified, processed and prepared service-ready raster products for the connectors, including the Lisbon and Valencia flood-depth coverages, population rasters for the three pilots and a Lisbon flood-flow-velocity raster. PoliRuralPlus supported the publication of these products as WCS layers, allowing the tools to retrieve them through the shared platform infrastructure rather than from local files. These processing and publication activities did not change the ownership or authority of the underlying source data.

This chapter explains how these technical, data and knowledge outputs were incorporated into the PoliRuralPlus ecosystem, what they contribute to its shared resources and how the approach can be reused or extended. The functionality and architecture of the tools are not repeated here, as they are documented in Chapter 3.

4.1 Data generated or used

FloodAI+ combined existing geospatial information from European, national, regional and municipal sources with project-prepared raster products and stakeholder-validation evidence. The source datasets were not treated as homogeneous: they differed between pilot cities in spatial format, resolution, thematic coverage and service type. The connectors harmonised these differences at runtime through coordinate transformation, raster masking, vector intersection and structured source reporting.

Geospatial data used and prepared

Table 7 – Principal geospatial data used or prepared in FloodAI+

Pilot / theme	Dataset or source	Provider or project contribution	Use in FloodAI+
Lisbon and Valencia flood hazard	Configured 100-year/T100 flood-depth coverages at 5 m resolution	Made available through the PoliRuralPlus GeoServer WCS	Calculation of flood extent, flooded area, water-depth statistics and hazard classes within the selected area
Dresden flood hazard	Official *Gefährdung bei HQ100* polygons and water-depth classes	Saxon State Office for Environment, Agriculture and Geology, accessed through the LUIS Sachsen WFS	Analysis of the HQ100 flood extent and classified water depth
Population – all three pilots	JRC-ESTAT Census Population Grid 2021, 100 m	Original data: European Commission Joint Research Centre/Eurostat; pilot rasters prepared by Porvalor and published through WCS with PoliRuralPlus support	Estimation of population within the selected area and population intersecting the flood extent
Lisbon flow velocity	T100 flow-velocity raster at 5 m resolution, expressed in m/s	Raster prepared by Porvalor and published through WCS with PoliRuralPlus support	Calculation of area-weighted velocity statistics and high-value percentiles within the selected area
Valencia exposure	Roads, hospitals, educational facilities, fire-service assets, hydrants and neighbourhood vulnerability data	Ajuntament de València open-data and geospatial services	Screening of transport, critical infrastructure and available social-vulnerability information
Valencia land use	COSCV 2024 land-cover and land-use information	Generalitat Valenciana / Institut Cartogràfic Valencià, accessed through WFS	Land-use classification, agricultural-area identification and hazard–exposure overlay
Lisbon exposure	Roads and health, emergency, security and educational facilities	Câmara Municipal de Lisboa ArcGIS services	Screening of roads and critical infrastructure within the area and flood extent
Lisbon land use	Carta de Uso e Ocupação do Solo 2023 – Série 2	Direção-Geral do Território, accessed through an ArcGIS service	Land-use classification, agricultural-area identification and hazard–exposure overlay

Pilot / theme	Dataset or source	Provider or project contribution	Use in FloodAI+
Dresden exposure	Buildings and land-use information from the simplified ALKIS service	GeoSN / Saxony, accessed through WFS	Screening of buildings, land use and agricultural areas
Dresden roads and infrastructure	Public road network and industrial-installation information	Landeshauptstadt Dresden and LUIS Sachsen	Screening of roads and available critical-infrastructure assets
Indicative damage relationships	Adapted representative relative depth–damage ratios based on Huizinga, De Moel and Szewczyk (2017), as presented in the JRC global flood depth–damage methodology and referenced by the CLIMAAX CRA Handbook. The ratios were simplified and configured locally for non-monetary screening indicators; official maximum-damage values were not applied.	Configured by Porvalor as analytical reference values	Production of relative, non-monetary damage indicators for exposed land use and roads

Agricultural exposure was derived from the available land-use classifications rather than from a separate agricultural dataset. Social-vulnerability information was available only for Valencia and was reported as contextual evidence; the project did not implement a standalone or harmonised vulnerability analysis across the three pilots.
The population and flow-velocity products prepared by Porvalor are project-specific processing outputs derived from underlying source information. They should not be interpreted as new official census or hydraulic datasets. Their publication through the PoliRuralPlus WCS infrastructure created an interoperable access route for the connectors while preserving the attribution and limitations of the underlying information.

Data and evidence generated by the project

In addition to the geospatial inputs, FloodAI+ generated the following project data and evidence:

- structured flood-risk questions collected from stakeholders;
- workshop participation and interaction records;
- Mentimeter response summaries and form-based feedback;
- stakeholder assessments of clarity, usefulness, trustworthiness and potential decision relevance;
- user needs and preferred response formats;
- functional test results for the three MCP tools; and
- structured runtime outputs containing hazard and exposure metrics, source information, warnings, limitations and processing status.

The hazard and exposure metrics are generated dynamically for each selected area. They are derived analytical summaries rather than a new persistent or authoritative flood-risk dataset. The project did not generate observed flood impacts, official warnings, casualty records or verified economic-loss estimates.
Personal and potentially identifiable information, including names, email addresses and participant-level attendance records, is excluded from the public report. Workshop-related supporting evidence containing personal or potentially identifiable information is treated as restricted documentation and is not reproduced in this public report.

4.2 Integration into the PoliRuralPlus ecosystem

FloodAI+ was integrated into the PoliRuralPlus ecosystem at pilot level through a combination of technical implementation, shared data infrastructure, stakeholder validation and knowledge transfer. The project did not create a separate platform; it extended the existing Raven/JackDaw environment with flood-specific capabilities.

The main integration elements were:

- implementation of three executable MCP tools within Raven/JackDaw: the Flood Hazard Connector, Flood Exposure Connector and Multilingual Flood Glossary;
- use of JackDaw's conversational and map-based interface to connect natural-language questions and selected areas with flood-risk analysis;
- publication of project-prepared population and flow-velocity rasters through PoliRuralPlus WCS infrastructure;
- application and stakeholder testing of JackDaw in rural-urban flood-risk contexts;
- structured recommendations concerning usability, explanations, maps, terminology, uncertainty communication and data requirements; and
- dissemination of FloodAI+ activities and findings through PoliRuralPlus communication channels.

This contribution is consistent with the approved proposal, which positioned FloodAI+ as a JackDaw-centred validation experiment using flood resilience as a demanding rural–urban use case. Beyond validation evidence, the project delivered reusable technical components and interoperable data-access arrangements that can support subsequent development within the PoliRuralPlus ecosystem.

4.3 Contribution to shared datasets and knowledge base

FloodAI+ did not create a new authoritative standalone geospatial dataset. However, it contributed project-prepared data products and reusable technical and methodological knowledge to the PoliRuralPlus ecosystem.
The principal contributions were:

- population rasters prepared for Lisbon, Valencia and Dresden;
- a flood-flow-velocity raster prepared for Lisbon;
- publication of these products through the PoliRuralPlus WCS infrastructure;
- structured stakeholder questions and JackDaw flood-risk use cases;
- feedback on clarity, usefulness, trustworthiness and potential decision relevance;
- identification of information gaps and future data requirements;
- reusable hazard- and exposure-analysis workflows implemented through the MCP tools;
- the Multilingual Flood Glossary and audience profiles; and
- recommendations for the further development and validation of JackDaw.

These outputs can support future JackDaw configuration, prompt and response design, multilingual communication, stakeholder-specific explanations, geospatial source integration and broader GeoAI validation activities. The prepared rasters remain derived pilot products and should not be interpreted as replacements for their original authoritative sources.

4.4 Synergies with other projects and initiatives

FloodAI+ was designed to create synergies with flood-risk and resilience initiatives, especially **FLOODWISE project (https://oscars-project.eu/projects/floodwise-open-geoai-repository-flood-risk-management)**.
FloodAI+ built on methodological and informational groundwork developed through FLOODWISE. In particular, the project used the FLOODWISE working framework for analysing and managing flood-risk information and drew on data sources and other relevant information that had been preliminarily collected or identified through that initiative. This foundation supported the initial framing of the FloodAI+ use case, the identification of relevant flood-risk information and data sources, and the definition of practical questions for the pilot areas.
During the FloodAI+ reporting period, however, no direct technical integration with the FLOODWISE repository or systematic comparison with FLOODWISE reference products was completed. The relationship therefore involved the practical reuse of methodological groundwork and preliminary information, while direct interoperability and comparative validation remain potential areas for future collaboration.

Porvalor's wider networks and experience in infrastructure asset management, flood-risk analysis, risk advisory, resilience planning and stakeholder engagement also supported stakeholder outreach, workshop design, use-case framing and the identification of practical flood-risk questions.

4.5 Reusability and interoperability aspects

FloodAI+ was designed as a modular pilot solution that can be extended to additional locations and stakeholder contexts. Its main reusable elements are:

- the three MCP tool patterns for hazard analysis, exposure screening and terminology support;
- the modular approach to source access and spatial processing;
- the validation methodology and stakeholder question set;
- the feedback-to-improvement mapping approach;
- the multilingual glossary and audience profiles; and
- the structured response format for metrics, sources, warnings and limitations.

At the interoperability level, the solution used MCP for tool integration, WKT and CRS information for spatial inputs, WCS and WFS for OGC-compliant data access, and ArcGIS REST and GeoJSON for additional sources. These mechanisms allowed Raven/JackDaw to work with heterogeneous raster and vector information across the three pilots.

Extension to another region would require suitable data sources, source-specific configuration, schema and CRS mapping, and functional testing. The same architectural and validation approach could also support other hazards, but new hazard-specific datasets and analytical logic would be required. The outputs should therefore be considered reusable building blocks rather than a universally deployable solution without adaptation.

5. Stakeholder Engagement and User Involvement

FloodAI+ used stakeholder engagement as a central element of pilot validation. Two online workshops supported this process: the first combined project presentation, a JackDaw demonstration and structured feedback, while the second provided a one-hour hands-on testing session. Because participation was limited and uneven across stakeholder groups, the findings are presented as descriptive pilot evidence rather than representative survey results.

5.1 Stakeholder groups involved

The approved stakeholder scope included:

- municipalities and regional authorities;
- civil protection and emergency-management actors;
- infrastructure managers and utilities;
- SMEs and local businesses;
- farmers and rural organisations;
- NGOs and community organisations;
- researchers and academic institutions; and
- citizens and local community representatives.

The actual response profiles were narrower and differed between workshops.

Table 8 – Stakeholder profiles reported in the two workshops

Workshop	Valid role responses	Reported stakeholder composition
Workshop 1	5 in 10 participants	40% municipalities; 20% infrastructure managers; 20% SMEs; and 20% research or academia
Workshop 2	20	35% researchers or technical experts (7); 20% students (4); 15% municipal or regional planners (3); 10% citizens (2); 10% other roles (2); 5% civil protection (1); and 5% SMEs or infrastructure operators (1)

These percentages describe responses to the stakeholder-role questions, not total attendance or unique participants across both workshops. They should therefore not be combined into a single overall distribution. The second workshop was weighted towards research and technical profiles, while important target groups, particularly farmers, rural organisations and NGOs, were not represented. This limitation is considered when interpreting the usability and acceptance evidence later in the chapter.

5.2 Engagement methods

FloodAI+ combined several engagement methods to collect both qualitative and quantitative feedback. Given the technical and validation-oriented nature of the project, stakeholder engagement prioritised relevance and quality of feedback rather than broad, non-targeted participation. The project team therefore focused on involving stakeholders with direct knowledge of flood-risk management, territorial resilience, infrastructure, planning, research or local decision-making. This approach ensured that the feedback collected was coherent, informed and directly useful for assessing JackDaw's usability, clarity, trustworthiness and potential added value in realistic flood-risk contexts.

Table 9 - Targeted stakeholder engagement methods used to collect relevant JackDaw validation feedback.

Engagement method	Purpose
First online workshop	Present FloodAI+, introduce JackDaw and collect initial stakeholder questions and feedback.
Second hands-on workshop	Allow participants to test JackDaw directly and provide practical feedback on usability, clarity, trust and usefulness.
Participant forms	Collect participant profile information, stakeholder type, expectations and consent for follow-up.
Mentimeter feedback	Collect structured and interactive feedback during the workshops.
Asynchronous feedback channel	Enable stakeholders who could not attend live sessions to provide feedback after watching the demo or reviewing materials.
Internal technical review	Assess how stakeholder feedback can be translated into JackDaw improvement recommendations.
Dissemination through PoliRuralPlus Hub	Broaden visibility and invite additional stakeholder participation.

The first workshop functioned as an early validation checkpoint, while the second workshop strengthened the process through hands-on interaction with JackDaw. This progression allowed FloodAI+ to move from initial stakeholder question collection to more practical testing and improvement-oriented feedback.

5.3 Feedback received

The feedback received confirmed that stakeholders see value in the concept of using JackDaw to support flood-risk information, while also identifying clear improvement needs.

The main feedback signals were:

- stakeholders want flood-risk information that is visual, understandable and connected to decisions;
- maps are highly valued, but users need maps that explain risk, not maps alone;
- users want short explanations, risk summaries and comparisons between areas;
- exposed buildings, roads, access routes and critical infrastructure are priority information needs;
- stakeholders need clearer explanations of uncertainty, data sources and confidence levels;
- answers should be adapted to different stakeholder profiles;
- JackDaw should provide more actionable outputs for planning, communication, emergency response, infrastructure protection and agricultural continuity;
- historical data, prevention measures and future scenarios are important information gaps.

The first workshop showed strong interest in the concept. Participants rated JackDaw's usefulness for their work, organisation or community at **4.3 out of 5**, and their willingness to use or test JackDaw at **4.6 out of 5**. The second, hands-on workshop provided more direct evidence: helping users find or understand information faster than traditional maps or GIS and willingness to use a similar tool in future activities both scored 4.2 out of 5 (n=12), while preliminary trust scored 4.0 out of 5 (n=12). Ten of 13 respondents reported greater confidence after the session. However, identifying exposed people, roads or assets received the lowest rating, at 3.4 out of 5 (n=12), reinforcing requests for better map-based localisation, visible data sources and clearer information on coverage and limitations. As response numbers were small and varied by question, these findings are descriptive rather than representative. Together, the two workshops informed the technical refinements and improvement recommendations included in the final reporting package.

5.4 How feedback influenced the work

Stakeholder feedback influenced the project in four main ways:

i. **Workshop design:** findings from the first workshop showed the need for more practical interaction with JackDaw. The second workshop was therefore designed as a hands-on validation session.
ii. **Priority use cases:** stakeholder questions helped refine relevant scenarios for municipal planning, infrastructure protection, emergency preparedness, agricultural continuity and risk communication.
iii. **Improvement recommendations:** comments were translated into recommendations for clearer explanations, better map-based interpretation, stronger communication of uncertainty, more visible data provenance and answers adapted to different stakeholder groups.
iv. **Multilingual and audience-adapted communication:** Feedback concerning clearer terminology, together with a participant's question about language accessibility during the second workshop, reinforced the multilingual objective already included in the proposal and informed the final implementation of the Multilingual Flood Glossary and audience profiles. The tool was implemented after Workshop 2 and was therefore not directly evaluated by workshop participants.

The first and fourth points describe changes made during the project. The remaining findings informed the recommendations for future development of Raven/JackDaw.

5.5 Evidence of usability and acceptance

The evidence collected indicates positive initial acceptance of JackDaw for flood-risk applications, while also identifying improvements required before broader decision-support validation.
The principal evidence includes:

- usefulness and willingness-to-use ratings from both workshops;
- preliminary trust and confidence results from the hands-on session;
- practical flood-risk questions submitted by participants;
- direct interaction with JackDaw during the second workshop;

- feedback on preferred answer formats and information needs; and
- identification of concrete priorities concerning maps, exposed assets, data sources, uncertainty and actionable recommendations.

Overall, the findings support JackDaw's potential as a conversational GeoAI interface for flood-risk information, particularly if future development improves map-based interpretation, source transparency, uncertainty communication, stakeholder-specific explanations and actionable decision support. Given the small and varying response samples, the results constitute descriptive pilot evidence rather than representative acceptance or full operational validation.

Identifiable workshop images, participant-level attendance information and raw feedback records are treated as restricted supporting evidence and are not reproduced in this public report. Consent-related evidence is described separately in Section 6.5 within the scope supported by the retained project documentation.

6. Communication, Dissemination and Visibility

FloodAI+ implemented communication, dissemination and visibility activities throughout the project to promote the project, increase awareness of JackDaw, invite stakeholders to validation activities, and share emerging results with the PoliRuralPlus community. These activities were aligned with the obligatory media outputs required in the reporting template, including news articles, blog posts, social media summaries, events, demonstrations, and GDPR-compliant visual evidence.

6.1 Progress towards obligatory media outputs

FloodAI+ achieved substantial progress towards the required communication and dissemination outputs. The project produced and disseminated public materials through the PoliRuralPlus Hub and prepared additional outputs to reflect the results of the second hands-on workshop.

Table 10 - FloodAI+ communication and dissemination outputs.

Output type	Requirement	FloodAI+ output	Status
News article	At least 1	Upcoming webinar: FloodAI+ 1st Workshop	Published
News article	Additional	FloodAI+ holds its first workshop to present JackDaw and collect stakeholder feedback	Published
News article	Additional	FloodAI+ 2nd Workshop: Hands-on validation of JackDaw	Published
Blog post	At least 2	Maps first, decisions next: lessons from JackDaw's first FloodAI+ workshop	Published
Blog post	At least 2	Second blogpost based on the second hands-on workshop results	Published
Social media summaries	Launch, mid-point, final	At least two public workshop-related updates were evidenced.	Completed
Visual materials	GDPR-compliant	Flyers, screenshots, infographics and workshop visuals. Identifiable workshop screenshots used as supporting evidence were redacted where personal identifiers were not necessary.	Completed
Funding visibility	Required	Official PoliRuralPlus / EU funding acknowledgement included in the final project documentation. Previously published LinkedIn posts were cross-checked against the corresponding PoliRuralPlus website publications as part of the visibility review.	Completed

6.2 Links to public materials

The public communication materials produced and published through PoliRuralPlus channels are listed in Table 6 – Public access points and supporting evidence for FloodAI+. These links include the JackDaw login page, FloodAI+ workshop announcements, workshop news items and blogposts. Together, these materials document the main communication milestones of the project: the promotion of the first workshop, dissemination of the first stakeholder feedback results, promotion of the second hands-on validation workshop, and publication of workshop lessons learned. The materials listed in Table 6 also support the communication outputs summarised in Table 10 – FloodAI+ communication and dissemination outputs, demonstrating progress towards the required news articles, blogposts and visibility actions. Where applicable, the public materials included PoliRuralPlus visibility elements and EU funding acknowledgement. Detailed supporting evidence, including screenshots, social media records and restricted workshop-related material, is included in Part B - Confidential.

6.3 Events, demonstrations and presentations

FloodAI+ organised two online workshops as the main stakeholder engagement and dissemination events:

- **First FloodAI+ Workshop:** The first workshop introduced the FloodAI+ project, presented JackDaw, and collected initial stakeholder feedback on the questions users would most like JackDaw to answer. The workshop combined project presentation, JackDaw demonstration and structured feedback collection. The related news item reported that the workshop aimed to collect feedback on usability, reliability, trust, usefulness and the added value of JackDaw for decision-making and stakeholder participation.
- **Second FloodAI+ Workshop:** The second workshop was implemented as a hands-on validation session. Participants were invited to access JackDaw, test practical flood-risk questions and provide feedback on clarity, usefulness, trustworthiness and decision-support potential. This workshop strengthened the validation evidence base and supported the final improvement recommendations for JackDaw.

Both workshops also contributed to capacity building by introducing participants to JackDaw, GeoAI-supported flood-risk information, and the potential role of conversational interfaces in rural–urban resilience planning.

6.4 Social media summaries

FloodAI+ was disseminated through multiple public LinkedIn posts during the project. These included posts communicating the preparation, delivery, stakeholder engagement, feedback and outcomes associated with the two FloodAI+ workshops, as well as broader project-related updates. The workshop posts provided the main documented evidence of social-media communication and supported the visibility of the project and its validation activities.

FloodAI+ prepared social media summaries to support the visibility of the project at different stages:

- **Launch stage:** announcement of FloodAI+ and invitation to the first workshop;
- **Mid-point stage:** communication of first workshop feedback and invitation to continue validation;
- **Second validation stage:** promotion of the hands-on JackDaw workshop;
- **Final stage:** dissemination of final insights, lessons learned and recommendations.

Where applicable, screenshots or links to social media materials are included in the supporting evidence package. Any identifiable personal data or participant information is handled only in the confidential annexes.

6.5 GDPR and Data Protection

FloodAI+ applied a data-minimisation approach to the organisation, documentation and reporting of its stakeholder and validation activities. Limited participant information was handled in connection with workshop organisation, participant follow-up and validation feedback. The categories involved included participant names, organisation, stakeholder role, country or municipality, optional contact details, attendance information and workshop feedback.

For Workshop 1, the workshop materials included a participant check-in requesting name, organisation, role or stakeholder type, country or municipality and an optional email address for follow-up. The same material included an explicit field for “Consent to use anonymised feedback”. Workshop 1 was not recorded. This consent request is interpreted within its specific documented scope and is not treated as general authorisation for publication or other reuse of identifiable participant information.

Workshop 2 was conducted online through Microsoft Teams and included hands-on interaction with JackDaw and Mentimeter-based feedback. Before the recording began, participants were orally informed that the session would be recorded. No AI-generated transcription or meeting-notes function was used, and no written record of individual affirmative consent was generated through the platform. The recording was made exclusively in the context of FloodAI+ for the purpose of documenting delivery of the workshop.

The Workshop 2 recording is treated as restricted project material and was shared only with PoliRuralPlus for project reporting and administrative verification. It has not been made publicly available or used for communication, promotional, commercial, social-media or other unrelated purposes. Its use is limited to the FloodAI+/PoliRuralPlus project-documentation requirement, and identifiable images, voices, statements or other personal information contained in the recording are not reused for other purposes.

Stakeholder findings presented in Part A are reported in aggregated or non-attributed form. Mentimeter response counts represent responses to individual questions and are not interpreted as counts of unique participants. Names, email addresses, participant-level attendance information, identifiable workshop images and recording-related material are not reproduced in this public report. Where visual evidence is retained for reporting purposes, redaction was applied where personal identifiers are not necessary to substantiate the project activity.

Access to participant-level and potentially identifiable supporting material is restricted. Such material is retained only for as long as necessary under the applicable project reporting, verification and audit requirements and is subsequently subject to secure deletion in accordance with the relevant retention rules. More detailed information concerning the treatment of restricted supporting material is provided in Part B – Confidential.

6.6 Compliance with EU funding visibility requirements

FloodAI+ communication and dissemination activities acknowledged the project’s connection to PoliRuralPlus and EU funding through the visibility elements used across project materials. Following the administrative review, the funding acknowledgement used in the final project documentation was standardised using the wording provided by PoliRuralPlus. Previously published LinkedIn posts were cross-checked against the PoliRuralPlus website as part of the project visibility review.

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7. Impact Assessment

7.1 Achieved impacts

7.1.1 Technical impact

FloodAI+ contributed to the technical development of Raven/JackDaw by progressing from the definition of flood-risk requirements to the implementation, testing and documentation of a functional pilot-level suite. The project delivered three executable MCP tools:

- the Flood Hazard Connector, supporting spatially bounded flood-hazard queries;
- the Flood Exposure Connector, generating exposure and potential-impact summaries for selected areas; and
- the Multilingual Flood Glossary, providing audience-adapted explanations of flood-risk terminology in English, Portuguese, Spanish and German.

These tools extended Raven/JackDaw with flood-specific analytical and communication capabilities. They enabled the integration of heterogeneous raster and vector sources through WCS, WFS, ArcGIS REST and GeoJSON across the Lisbon, Valencia and Dresden pilots. Their structured outputs include analytical metrics, data-source information, processing status, warnings and limitations. Functional and automated tests, together with MCP Inspector testing, provided evidence that the principal pilot workflows operated within the Raven/JackDaw environment.

In addition to the implemented tools, FloodAI+ produced a set of supporting technical and validation assets:

- JackDaw AI chat agent use cases for flood-risk contexts;
- a structured stakeholder question set;
- user-journey insights derived from the workshops;
- functional requirements and implementation knowledge for the hazard and exposure workflows;
- a reusable multilingual set of 30 flood-risk terms; and
- feedback-to-improvement recommendations connecting user observations with technical and communication priorities.

Together, these outputs provide both functional pilot-level components and reusable knowledge for further development. The project also identified priorities for increasing technical maturity, including broader and more reliable data coverage, improved map-based presentation, clearer communication of provenance and uncertainty, stronger resilience to external-service failures and validation with larger and more operationally representative user groups. FloodAI+ should therefore be understood as a functioning pilot integration rather than a production-ready or certified decision-support system.

7.1.2 Social impact

FloodAI+ supported stakeholder engagement and capacity building by introducing different user groups to JackDaw and demonstrating the potential of conversational GeoAI for accessing and interpreting flood-risk information. The workshops encouraged participants to formulate practical questions concerning exposed areas, roads, critical infrastructure, agricultural land, emergency planning and communication with citizens. They also promoted reflection on how complex geospatial information can be presented more clearly to non-specialist users.

Participants were generally receptive to the concept, despite JackDaw and its flood-risk capabilities being at an early pilot stage. Their feedback indicates significant potential for JackDaw to provide a more accessible entry point to flood-hazard and exposure information. By allowing users to ask questions in natural language and receive structured explanations linked to available geospatial data, the chatbot could reduce some of the technical barriers associated with conventional maps and GIS tools.

With further improvements in data coverage, map-based presentation, source transparency, uncertainty communication and actionable outputs, JackDaw could help municipalities, emergency-management actors, infrastructure managers, researchers and citizens understand flood-risk conditions, identify priority concerns and

communicate information more effectively. Its role should be to complement professional analysis and official decision-making processes rather than replace them.

7.1.3 Economic impact

FloodAI+ did not quantify direct economic benefits, avoided flood losses or return on investment. Its economic contribution at pilot level is therefore indirect and potential. Reusing available geospatial services and enabling conversational access to flood-risk information could reduce the time required for preliminary information retrieval and screening. However, any claim concerning cost savings, avoided damages or economic efficiency would require dedicated evaluation under operational conditions.

7.1.4 Environmental and resilience impact

FloodAI+ addressed flood resilience as a climate adaptation challenge. By exploring how JackDaw can help users interpret flood-risk information, the project contributes to the longer-term goal of improving preparedness, awareness and evidence-based resilience planning. The project did not directly implement physical adaptation measures. Its environmental contribution is indirect but relevant: it supports better interpretation and communication of flood-risk information, which can inform future prevention, preparedness and adaptation decisions.

7.1.5 Policy and decision-support impact

FloodAI+ contributed to policy and decision-support readiness by identifying how JackDaw could support municipalities, civil protection authorities, infrastructure managers and other stakeholders in using flood-risk information more effectively. The first workshop showed that stakeholders do not only need more data; they need flood-risk information that is visual, understandable and connected to decisions. This insight is important for future JackDaw development and for PoliRuralPlus because it shows that GeoAI tools should support interpretation, communication and decision relevance, not only access to data.

7.2 Evidence and indicators

Table 11 - Evidence sources used for the FloodAI+ impact assessment.

Evidence source	Contribution to impact assessment
First workshop feedback	Provided early evidence on stakeholder needs, answer formats and improvement priorities.
Second hands-on workshop	Strengthened validation evidence through direct interaction with JackDaw.
Mentimeter and forms	Collected structured feedback on usefulness, clarity, trust and improvement needs.
Stakeholder questions	Identified real flood-risk questions to guide JackDaw use cases.
Blogpost and news items	Disseminated results and increased visibility of FloodAI+ and JackDaw.
Glossary and style profiles	Provided reusable guidance for clearer and more inclusive communication.
Part B confidential evidence	Contains restricted workshop evidence, including participant-level attendance information, screenshots, feedback records and data-protection-related supporting material. Personal or potentially identifiable information is not reproduced in this public report. Consent-related evidence is described in Section 6.5 within the scope supported by the retained project documentation.

7.3 Contribution to PoliRuralPlus KPIs

The Enhance Call defined common expected results and mandatory outputs for funded projects, while the approved FloodAI+ proposal established additional project-specific quantitative targets. The assessment below therefore distinguishes between contribution to the Enhance Call's expected results and performance against the specific KPIs proposed by FloodAI+.

Table 12 – FloodAI+ contribution to Enhance Call expected results

Enhance expected result	FloodAI+ contribution	Assessment
Apply and validate JackDaw in a real European context	JackDaw was applied to rural–urban flood-risk questions concerning Lisbon, Valencia and Dresden and supported by three pilot-level MCP tools.	Achieved at pilot level
Provide structured validation feedback	Two workshops generated quantitative and qualitative feedback on usability, clarity, trust, confidence and potential usefulness.	Achieved with sample-size limitations
Demonstrate stakeholder engagement	Municipal, technical, research, civil-protection, SME and citizen profiles contributed, although participation was uneven and some target groups were not represented.	Partially achieved
Produce recommendations for improvement	Feedback was translated into recommendations concerning maps, exposed assets, data provenance, uncertainty, audience adaptation and actionable outputs.	Achieved
Support sustainability and replicability	The project produced modular MCP tools, reusable use cases, a multilingual glossary, audience profiles, a validation methodology and replication guidance.	Achieved at pilot level
Contribute to capacity building and visibility	Workshops introduced participants to conversational GeoAI, while news items, blogposts and social-media communication increased the visibility of FloodAI+, JackDaw and PoliRuralPlus.	Achieved

Table 13 – FloodAI+ proposal KPI target versus achieved evidence

Proposal KPI or output	Target	Achieved evidence	Assessment
Structured validation responses	At least 50	Mentimeter and workshop feedback were collected. Workshop 1 questions received up to 10 responses and Workshop 2 questions received up to 20 responses. Total of 30 responses.	Not fully achieved
Positive usability and clarity assessment	At least 70% positive	Both workshops produced positive usability evidence. Workshop 1 recorded mean scores of 4.3/5 for usefulness, 4.6/5 for willingness to use or test JackDaw and 3.7/5 for clarity. Workshop 2 recorded 4.2/5 for faster access to information, 3.8/5 for role-appropriate clarity and 3.9/5 for explanation of limitations and uncertainty.	Substantially achieved. The results consistently indicate positive perceptions, although the original percentage of respondents selecting positive categories cannot be reconstructed from the summarised mean scores.
Faster or more confident access to information	At least 60%	Faster access than conventional maps or GIS scored 4.2/5 (n=12), while 10 of 13 respondents reported greater confidence.	Partially achieved

Proposal KPI or output	**Target**	**Achieved evidence**	**Assessment**
Workshops and stakeholder participation	Two workshops and at least 60 participants	Both workshops were completed, but the proposed cumulative participation volume was not fully achieved.	Partially achieved
Improved ability to interpret risk maps	At least 20% pre/post increase	In Workshop 2, 10 of 13 respondents (76.9%) reported feeling slightly or significantly more confident interpreting flood-risk information or spatial indicators after the session.	Achieved in an adapted self-reported form. The result exceeds the target when interpreted as the proportion reporting improvement, although no separate numerical pre- and post-test was administered.
Confidence after training	At least 75%	Ten of 13 Workshop 2 respondents; 76.9%, reported feeling slightly or significantly more confident.	Achieved for the recorded sample, with limitations
Female participation	At least 40%	The Mentimeter gender question received 18 valid responses: 5 women and 13 men. Women therefore represented 27.8% of respondents.	Not achieved. Female participation was 12.2 percentage points below the target.
Communication outputs	Two blogposts, two social-media posts and one news article	At least two social-media posts and three PoliRuralPlus news items were evidenced.	Achieved
Validation report and replication guidance	10–15-page report and replication guidance	A standalone 12-page Validation Report has been produced for submission, including Annex A – Replication Guidelines.	Achieved
User Tip Sheet	Produced and distributed	The FloodAI+ User Tip Sheet was completed as a standalone supporting deliverable and included in the final submission package. It provides concise practical guidance for accessing JackDaw, using the FloodAI+ tools and interpreting their outputs.	Achieved
Logging, analytics and light annotation	Task time, errors and rated interactions	Runtime and MCP lifecycle logs were used to investigate an integration incident involving a long-running road-exposure request and a stalled population request. The investigation provided evidence of execution time, request status and transport behaviour, and resulted in additional timeout and tracing measures. However, no consolidated interaction-analytics or conversation-annotation dataset was produced.	Partially achieved

FloodAI+ therefore achieved the central technical and methodological contribution expected by the Enhance Call, while several proposal-specific quantitative targets were only partially achieved or could not be verified with the available measurement approach. These limitations mainly concern participation volume, unique response tracking, gender-disaggregated data and pre/post measurement.

At the same time, the project delivered technical results beyond the original KPI framework, particularly the separate Flood Exposure Connector and the implementation of the multilingual glossary as an executable MCP tool. These additional results strengthen the project's contribution but are not presented as substitutes for unmet quantitative targets.

7.4 New European Bauhaus principles

FloodAI+ addressed the New European Bauhaus principles of **sustainability, inclusion and aesthetics** in both process and outcome. **Sustainability** was addressed through the project's focus on flood resilience, climate adaptation and better use of existing geospatial information. FloodAI+ supports the idea that better communication of flood risk can contribute to more informed, preventive and resilient territorial decisions. **Inclusion** was addressed by focusing on non-technical and semi-technical users, including municipalities, farmers, infrastructure managers, NGOs, citizens and other stakeholders. The Multilingual Flood-Risk Glossary and Stakeholder Style Profiles v1.0 also support inclusion by helping translate technical flood-risk terminology into clearer language across different user groups and languages. **Aesthetics** was addressed through the emphasis on understandable, visual and user-friendly communication. Stakeholder feedback showed that maps are valuable when they help explain risk clearly. FloodAI+ therefore supports the development of GeoAI tools that are not only technically useful, but also accessible, readable and easer to interact with.

8. Challenges, Risks and Lessons Learned

8.1 Key challenges encountered

The first concerned the maturity of the available JackDaw environment. During early implementation, Porvalor identified that its flood-specific analytical capabilities were not yet sufficiently mature to support the full end-to-end decision-support validation originally envisaged. The project therefore had to develop and integrate essential flood-specific components while preparing the validation activities. This involved combining heterogeneous geospatial sources, addressing differences in data availability across the three pilot areas and managing dependencies on external data services.

These conditions increased the technical complexity and limited the scale and depth of operational validation achievable within the project timeframe. Nevertheless, FloodAI+ progressed to a functioning pilot integration comprising three MCP tools that were tested within the Raven/JackDaw environment. This represented a substantial technical advance, although not a production-ready or certified operational decision-support system.

The second challenge concerned stakeholder availability and representation. The first workshop was implemented successfully and generated useful feedback, but participation was limited. The second workshop provided broader hands-on evidence, although participation remained uneven across stakeholder groups and response numbers varied between questions. Certain intended groups were therefore less represented than originally planned. This was managed as an engagement and evidence limitation rather than a change in project scope.

Additional operational challenges included maintaining a realistic validation process, avoiding overstatement of JackDaw's current technical maturity and translating diverse stakeholder observations into concrete technical and communication recommendations.

8.2 Risk mitigation actions

Table 14 - Key project risks and mitigation actions.

Risk	Mitigation action
JackDaw maturity constraints	Development and integration of the required flood-specific MCP tools, transparent reporting, and focus on functions that could be credibly tested.
Limited first workshop participation	Targeted outreach, a second hands-on workshop and an asynchronous feedback channel.
Risk of weak validation conclusions	Clear distinction between functional testing, stakeholder feedback and operational validation.
Technical terminology too complex	Preparation of the Multilingual Flood-Risk Glossary and Stakeholder Style Profiles v1.0.
Risk of overclaiming decision-support performance	Clear distinction between validation evidence and validation-readiness evidence.
Long-running or stalled MCP requests	A configurable application-owned end-to-end timeout and structured error handling were added at the PRP API–Raven boundary. Additional request and MCP lifecycle tracing were introduced. Source-level timing instrumentation in Raven was recommended to identify delays during individual remote vector-data requests

These actions supported a transparent and proportionate approach to managing the project's technical and stakeholder-related risks.

8.3 Lessons learned

Based on stakeholder feedback and on the implementation and functional testing of the three flood-risk MCP tools, FloodAI+ identified several practical lessons for the future development of Raven/JackDaw:

- **Technical lessons:** Raven/JackDaw has strong potential as a conversational GeoAI interface, but the chatbot layer alone is not sufficient for credible flood-risk decision support. Responses need to be grounded in spatially bounded analyses, reliable geospatial data, transparent source information and clear communication of uncertainty and limitations. The project also showed the value of a modular connector approach, while highlighting its dependence on data availability, coverage and the reliability of external services.
- **Organisational and validation lessons:** Targeted engagement with participants who have relevant experience or interest can generate focused and technically useful feedback. However, a compact and unevenly represented stakeholder group cannot replace broader operational validation. Hands-on interaction with working tools is particularly valuable because it enables participants to assess actual outputs and identify concrete usability and information gaps.
- **Stakeholder-related lessons:** Stakeholders expect Raven/JackDaw to help them interpret flood risk rather than merely retrieve or present data. Maps and indicators are most useful when accompanied by explanations of what the results mean, which people, assets or activities may be affected, what the main limitations are and how the information may support practical action. Clear terminology, transparent sources, realistic examples and explanations adapted to different user roles are therefore essential.
- **Adoption-related lessons:** The generally positive initial reception observed during the workshops suggests meaningful potential for conversational GeoAI in flood-risk contexts. Nevertheless, willingness to use the tool depends on trust, clarity, data provenance and the ability to connect analytical results with users' real responsibilities. Future validation should therefore assess not only whether the system functions, but also whether different stakeholder groups can understand, trust and appropriately use its outputs.

8.4 Recommendations for future projects or scaling

Future work should build on the functioning FloodAI+ pilot by increasing its technical robustness, data coverage, usability and operational validation. The project demonstrated that Raven/JackDaw can provide a useful conversational entry point to flood-risk information, but its future value will depend on how effectively it can organise, select, analyse and explain geospatial data according to the user, location and purpose of each question.

Future projects should:

- Establish a clear technical and data-maturity baseline. Before defining validation activities, projects should assess the readiness of the Raven/JackDaw environment, MCP tools, interfaces, hosting arrangements, external data services and available datasets. This assessment should identify which workflows are demonstrable, which are technically functional and which are sufficiently mature for operational validation.
- Distinguish between different levels of validation. Demonstration, functional testing, usability validation and operational decision-support validation should have separate objectives and success criteria. A tool may operate correctly and be positively received without yet being suitable for high-stakes or real-time decision-making.
- Develop a more structured flood-risk data architecture. The experience of integrating WCS, WFS, ArcGIS REST, GeoJSON and locally prepared products showed that data organisation is central to the quality of the answers. Future development should maintain a curated catalogue of hazard, exposure, vulnerability and contextual datasets, organised by geographic coverage, temporal reference, resolution, source authority and intended analytical use.
- Expand and harmonise geospatial coverage. The existing bounded analyses and pilot datasets should be extended to additional locations, return periods, exposed assets and vulnerability indicators. Common schemas, metadata requirements, spatial-processing rules and fallback mechanisms would make results more consistent across cities and reduce dependence on individual external services.
- Adapt responses to the user and purpose of the question. Raven/JackDaw should determine, where possible, whether the user requires a technical analysis, an emergency-planning overview, an infrastructure assessment, a public explanation or an initial screening of local risk. Response detail, terminology, indicators, warnings and presentation formats should then be adjusted to the user’s role, knowledge level, geographic focus and intended use.
- Combine analytical results with interpretation. Users need more than retrieved data or isolated indicators. Responses should explain what the results mean, which people, assets or activities may be affected, why the information matters and what limitations must be considered. Maps, tables, comparisons and spatial summaries should be used when they make the results easier to understand and apply.
- Strengthen provenance, uncertainty and data-quality communication. Each response should clearly identify its sources, spatial and temporal coverage, processing status, relevant assumptions and known data gaps. Partial results and external-service failures should be communicated explicitly so that users can distinguish between missing evidence and an absence of risk.
- Continue developing multilingual and audience-adapted communication. The multilingual glossary and stakeholder-specific response profiles should be maintained and expanded using terminology validated by domain experts and local users. Future versions could connect glossary definitions, response style and analytical depth more dynamically to the language, expertise and responsibilities of each user.
- Use early and iterative hands-on testing. Users should interact with functioning tools as early as possible. Targeted groups can provide technically relevant feedback, but subsequent validation should include larger and more representative samples, including stakeholder categories and demographic groups that were underrepresented in FloodAI+.
- Maintain traceability between feedback and development. Feedback-to-improvement mapping should become a standard part of the development cycle, linking each observation to a technical, data, interface or

communication requirement. Runtime logs, interaction ratings, error patterns and recurring questions should also be analysed to identify where answers, datasets or processing workflows require improvement.

- Preserve appropriate human oversight. Raven/JackDaw should support access to and interpretation of flood-risk information while complementing, rather than replacing, professional analysis, official warnings and accountable decision-making processes.

9. Sustainability, Replicability and Next Steps

FloodAI+ was designed to generate results that remain useful beyond the project implementation period. Given the maturity of the available JackDaw environment, the project combined stakeholder-informed requirements and validation evidence with the implementation of reusable technical components. Its results therefore include both knowledge-based outputs and functioning pilot assets that can support the next maturity phase of Raven/JackDaw and future PoliRuralPlus activities.

The sustainability of FloodAI+ does not depend on maintaining a separate software platform developed by Porvalor. Instead, it depends on the continued maintenance and integration of the three MCP tools within the Raven/JackDaw ecosystem, the availability of the associated geospatial data services and the reuse of the methodology, documentation, stakeholder feedback and technical recommendations generated during the project. This approach is consistent with the scope of FloodAI+, which focused on applying, testing and improving Raven/JackDaw in rural–urban flood-risk contexts while delivering a functioning pilot rather than an independent production system.

9.1 Sustainability of results

FloodAI+ produced a combination of technical, methodological and stakeholder-related results that can support future Raven/JackDaw development, further validation and new flood-risk applications. The main sustainable outputs are:

- the rural–urban flood-risk use-case framework for Raven/JackDaw;
- the stakeholder question set collected through the workshops;
- the user-journey insights generated from stakeholder interaction;
- the Flood Hazard Connector;
- the Flood Exposure Connector;
- the Multilingual Flood Glossary MCP tool, including 30 flood-risk terms in four languages and three audience profiles applied within the glossary;
- the supporting source code, technical documentation and automated tests;
- the pilot raster products made available through WCS and the implementation knowledge generated from integrating WCS, WFS, ArcGIS REST and GeoJSON sources;
- the feedback-to-improvement mapping;
- the recommendations for future Raven/JackDaw configuration, maintenance and scaling;
- the communication and dissemination outputs produced through the PoliRuralPlus Hub; and
- the stakeholder-engagement methods and practical experience developed through the two workshops.

These outputs can continue to support Raven/JackDaw after the end of FloodAI+. The three MCP tools, their tests and their supporting geospatial products provide a technical foundation that can be maintained, extended and applied to additional locations and datasets. At the same time, the use cases, stakeholder questions, audience profiles and feedback mapping provide reusable guidance for designing future validation activities and adapting responses to different users and purposes.

The feedback collected during the two workshops provides practical evidence of what users expect from a conversational GeoAI tool in flood-risk contexts. These expectations include clearer terminology, map-based presentation, transparent data provenance, explicit communication of uncertainty and limitations, audience-adapted explanations and more actionable outputs. The second workshop added hands-on evidence concerning participants'

interaction with Raven/JackDaw and the flood-.risk tools available during the session. However, the Multilingual Flood Glossary and its audience profiles were implemented afterwards, and the complete final suite was therefore not evaluated collectively by workshop participants
The continued usefulness of these results will nevertheless require appropriate technical maintenance, reliable access to external data services and further validation with broader and more representative stakeholder groups.

9.2 Sustainability of tool usage, data and partnerships

FloodAI+ supports the future use of Raven/JackDaw by clarifying stakeholder expectations and delivering three reusable MCP tools for flood-risk analysis and communication. Their continued use will depend on appropriate technical maintenance, integration within the Raven/JackDaw environment and reliable access to the external geospatial services on which they depend.

The project did not create a new general-purpose geospatial dataset. It combined existing data sources with processed pilot raster products made available through WCS and generated a broader validation evidence base comprising stakeholder questions, feedback, use cases, glossary content, audience-adapted response profiles and improvement recommendations. These results can support future tool development and PoliRuralPlus validation activities.

From a partnership perspective, FloodAI+ strengthened links between Porvalor, the PoliRuralPlus ecosystem and stakeholders interested in flood-risk management, infrastructure resilience, territorial planning and GeoAI-supported decision-making. These relationships and engagement experience can support future testing, dissemination and adoption involving municipalities, infrastructure managers, researchers, civil-protection actors and other relevant users.

9.3 Replication potential

FloodAI+ has significant replication potential because its approach combines modular technical components, structured stakeholder validation and audience-adapted communication rather than being tied to a single location or user group. Although developed and tested with reference to Lisbon, Valencia and Dresden, the approach could be adapted to:

- other flood-prone municipalities and regions;
- other European rural–urban territories;
- infrastructure resilience, asset management and territorial-planning contexts;
- emergency preparedness, civil protection and risk-communication activities;
- participatory planning and public engagement; and
- other climate-risk domains, such as wildfire, drought, heatwaves or landslides, provided that appropriate hazard-specific data, analytical methods and terminology are developed.

The main reusable elements include:

- the modular MCP tool architecture and connector-development approach;
- the Flood Hazard and Flood Exposure workflows;
- the multilingual glossary framework and audience-adapted response profiles;
- the integration patterns for WCS, WFS, ArcGIS REST and GeoJSON sources;
- the structured outputs for metrics, sources, warnings, limitations and processing status;
- the Raven/JackDaw conversational use-case framework;
- the workshop structure, stakeholder-question collection method and participant feedback questions;
- the feedback-to-improvement mapping; and
- the distinction between demonstration, functional testing, usability validation and operational decision-support validation.

Replication should not be understood as the direct transfer of the pilot without adaptation. Each new location or application would require verification of data availability, geographic coverage, source reliability, terminology, user needs and institutional context. Automated and functional testing would also need to be repeated for the selected datasets and services.
This distinction is particularly important when the tools are not yet sufficiently mature for formal operational validation. In such cases, the FloodAI+ methodology can still generate credible evidence concerning usability, clarity, stakeholder needs, technical performance and development requirements without overstating the maturity or decision-support readiness of the system.

9.4 Scalability of the solution

The FloodAI+ architecture provides a reusable basis that could be adapted to other territorial contexts. Replication would require configuring appropriate local data sources and services and repeating the relevant functional and stakeholder testing. FloodAI+ has the potential to scale in three complementary dimensions:

- **Geographical scalability:** The modular Flood Hazard and Flood Exposure workflows, together with the common validation methodology, can be adapted to other municipalities, regions and countries. The Lisbon, Valencia and Dresden pilots showed that a shared analytical and functional-testing structure can be maintained across different territorial contexts. However, each extension would require verification and configuration of local datasets, geospatial services, terminology, spatial coverage and user needs.
- **Thematic scalability:** The conversational use-case structure, MCP architecture, map-based outputs, multilingual support and feedback-to-improvement methodology could be extended to other hazards and geospatial decision-support domains. Applications concerning wildfire, drought, heatwaves, landslides or infrastructure resilience would nevertheless require hazard-specific datasets, analytical rules, indicators and terminology.
- **Technical and operational scalability:** The three MCP tools provide a modular foundation that can be expanded to additional datasets, locations, indicators, user profiles and question types. Scaling will require a more structured data architecture, standardised connector interfaces, efficient access to heterogeneous geospatial sources, reliable bounded queries and spatial summaries, stronger handling of external-service failures and continued automated testing. Clear provenance, uncertainty communication, map-based presentation and audience-adapted responses will also be necessary to maintain the usefulness and consistency of results as the system grows.

Scalability should therefore not be understood as deploying the current pilot unchanged. Each expansion will require appropriate data configuration, technical testing and validation with the intended users. FloodAI+ provides a scalable modular pilot architecture and validation framework rather than a final production-ready system. This is consistent with the project scope and with the maturity of the Raven/JackDaw environment during implementation

9.5 Exploitation opportunities

FloodAI+ creates several opportunities for the future exploitation of its technical, methodological and stakeholder-related results. Conversational GeoAI systems such as Raven/JackDaw have strong potential to become increasingly important tools for flood-risk management because of their versatility and their capacity to provide rapid access to different types of geospatial information through natural-language interaction.
With appropriate data, analytical components and safeguards, these systems could help users examine multiple stages of the flood-risk management cycle; from hazard and exposure assessment to prevention, preparedness, infrastructure resilience, emergency planning, risk communication and adaptation. Their principal value lies not only in retrieving data, but in organising, analysing and explaining information according to the user's role, location and decision-making purpose. This could allow municipalities, infrastructure managers, civil-protection actors, researchers and other stakeholders to explore different aspects of flood risk through a more integrated interface. However, FloodAI+

did not measure time savings, cost savings or comparative performance against existing data portals or specialist tools.

For PoliRuralPlus, FloodAI+ provides stakeholder-informed evidence and functioning pilot components that can support the next development phase of Raven/JackDaw. The results can inform improvements to connector architecture, data organisation, map-based outputs, explanation templates, multilingual guidance, provenance, uncertainty communication and audience-adapted responses.

For Porvalor, the project strengthens technical and organisational capacity in GeoAI development and validation, geospatial data integration, flood-risk communication, stakeholder engagement and resilience-oriented digital innovation. This knowledge is directly relevant to Porvalor's work in infrastructure asset management, risk advisory, resilience planning and collaborative innovation ecosystems.

FloodAI+ also provides a reusable approach for future projects involving flood-risk management, climate adaptation, territorial resilience and geospatial data services. Its tools, integration experience and validation methodology could support synergies with FLOODWISE and other initiatives, subject to appropriate adaptation and further operational validation.

Potential exploitation pathways include:

- further development and maintenance of the three FloodAI+ MCP tools;
- future Raven/JackDaw testing with municipalities, civil-protection actors and infrastructure managers;
- expansion of the hazard and exposure workflows to additional locations, assets, indicators and datasets;
- use of the Multilingual Flood Glossary MCP tool in future multilingual GeoAI configurations;
- development of audience-specific flood-risk analysis and explanation workflows;
- integration of FloodAI+ lessons into FLOODWISE-related and resilience-planning activities;
- adaptation of the technical and validation approach to other hazards;
- use of stakeholder feedback and interaction evidence to guide future decision-support workflows; and
- exploration of future services combining conversational GeoAI, geospatial analysis and professional flood-risk expertise.

Realising these opportunities will require reliable data access, continued technical maintenance, broader stakeholder validation and appropriate human oversight. FloodAI+ nevertheless demonstrates a credible foundation for a future generation of flexible and accessible tools capable of supporting faster and more integrated analysis across the flood-risk management cycle.

9.6 Contribution to future PoliRuralPlus development

FloodAI+ contributes to future PoliRuralPlus development by providing a concrete example of how Raven/JackDaw can be extended from a general conversational interface into a more specialised, data-grounded GeoAI tool. Its contribution is based not only on stakeholder feedback, but also on the practical experience gained from developing, integrating and testing three modular MCP tools with heterogeneous geospatial sources.

The main contributions are:

- a reusable technical reference comprising the Flood Hazard Connector, Flood Exposure Connector and Multilingual Flood Glossary MCP tool;
- practical experience in organising and processing heterogeneous flood-hazard, exposure and contextual data;
- stakeholder-informed requirements for clearer, more visual, transparent and audience-adapted answers;
- evidence concerning stakeholder perceptions of usefulness, clarity, trustworthiness and potential relevance to decision support;
- a structured approach for connecting stakeholder feedback with technical, data and communication improvements; and
- lessons for distinguishing functional testing, usability validation and operational decision-support validation.

Together, these results provide PoliRuralPlus with a practical development pathway for future Raven/JackDaw applications. They show that the value of conversational GeoAI lies in connecting natural-language questions with bounded spatial analysis, reliable data sources and explanations adapted to the user's role and purpose. With further

development, this approach could support faster and more integrated exploration of different stages of the flood-risk management cycle, including hazard and exposure assessment, prevention, preparedness, infrastructure resilience, risk communication and adaptation.

9.7 Next steps

Following the completion of FloodAI+, the recommended next steps are to:

- review the project findings and translate them into a prioritised development roadmap for Raven/JackDaw;
- define responsibilities for maintaining the three MCP tools, their documentation, tests and external data dependencies;
- strengthen data organisation, connector reliability, map-based outputs, source traceability, uncertainty communication and audience-adapted responses;
- maintain and expand the Multilingual Flood Glossary MCP tool as new terminology, languages and user profiles are introduced;
- conduct further hands-on validation with larger and more representative stakeholder groups;
- extend the technical approach to additional locations, datasets and flood-risk management applications; and
- explore its adaptation to other climate-risk and territorial-resilience contexts where suitable data and analytical methods are available.
- document the original providers, processing history, licensing conditions and long-term hosting responsibilities for the pilot raster products and WCS coverages;
- implement consolidated logging, analytics and structured conversation annotation if these functions are required in future validation activities.

10. Conclusions

FloodAI+ delivered a credible and useful application of Raven/JackDaw in rural–urban flood-risk contexts. By combining technical development, stakeholder engagement and hands-on validation, the project progressed beyond its initial validation-readiness focus and produced a functioning modular pilot. Early limitations in the maturity of the available environment and data services prevented full operational decision-support validation; the results should therefore be understood as a tested pilot foundation rather than a production-ready system.

The principal achievements were the implementation and testing of three MCP tools: the Flood Hazard Connector, Flood Exposure Connector and Multilingual Flood Glossary, the integration of heterogeneous geospatial sources, and the delivery of two stakeholder workshops, including a hands-on session. The project also generated structured evidence on usability, clarity, trustworthiness and perceived usefulness, together with practical recommendations for improving data organisation, map-based outputs, provenance, uncertainty communication and audience-adapted responses.

Stakeholder participation and representation remained limited, and some related targets were not fully achieved. This restricts the generalisability of the findings and confirms the need for broader future validation. Nevertheless, the available evidence consistently showed that users value conversational GeoAI when its answers are grounded in reliable spatial data, transparent about sources and limitations, and adapted to the user’s role and purpose.

The strategic value of FloodAI+ lies in connecting technical innovation with practical flood-risk management needs. It provides PoliRuralPlus with reusable technical components, implementation experience, stakeholder-informed evidence and a clear pathway for further Raven/JackDaw development. Overall, the project demonstrates the potential of conversational GeoAI to support faster, more accessible and integrated analysis across the flood-risk management cycle, while also identifying the technical maintenance, data quality and validation required for responsible future adoption.

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Annexes

Annex A - Multilingual Flood Glossary MCP Tool and Audience Style Profiles

This annex documents the multilingual terminology and audience-adaptation content implemented in the FloodAI+ Multilingual Flood Glossary MCP tool. The tool was developed and tested as one of the three MCP tools included in the Raven/JackDaw FloodAI+ pilot.
It provides 30 flood-risk concepts in English, Spanish, Portuguese and German, together with plain-language meanings intended to support clear and consistent explanations. It also includes audience-specific style profiles that allow responses to be adapted according to the user's knowledge, responsibilities and intended use of the information. The glossary supports multilingual flood-risk communication and consistent terminology within Raven/JackDaw. It is intended as a practical communication and interpretation resource rather than a certified technical taxonomy or a replacement for official national and local terminology.

Table A.1 - FloodAI+ multilingual flood-risk glossary in English, Spanish, Portuguese and German

English	Spanish	Portuguese	German	Plain-language meaning
Flood hazard	Peligrosidad de inundación	Perigo de inundação	Hochwassergefahr	The possibility that a place may be flooded in a given scenario and how severe that flooding could be. It describes the water itself, not who or what is affected.
Return period (100-year flood)	Periodo de retorno (avenida de 100 años)	Período de retorno (cheia centenária)	Wiederkehrintervall (Jahrhunderthochwasser)	A way of describing how rare a flood is. A 100-year flood has approximately a 1 in 100 chance of occurring in any given year. It does not mean that it happens only once a century.
HQ100	HQ100	HQ100	HQ100	The German term for the 100-year flood scenario. It is an official planning scenario used by the German federal states.
Flood extent	Extensión de la inundación	Extensão da inundação	Überflutungsfläche	The area covered by water in the modelled scenario, representing the footprint of the flood on the map.
Water depth	Calado (profundidad del agua)	Profundidade da água	Wassertiefe	How deep the water would be at a particular location. Water depth is an important indicator of the possible severity of flooding.

English	Spanish	Portuguese	German	Plain-language meaning
Wassertiefe	Wassertiefe	Wassertiefe	Wassertiefe	The German term for water depth. In the Saxon HQ100 dataset, it is an official attribute that expresses depth as a band rather than an exact value.
Flow velocity	Velocidad de flujo	Velocidade de escoamento	Fließgeschwindigkeit	How fast floodwater moves. Fast-moving water can endanger people and damage or undermine structures, even when it is relatively shallow.
Hazard class	Clase de peligrosidad	Classe de perigo	Gefahrenklasse	A simplified classification of flood severity, commonly expressed as low, medium, high or very high and derived from water depth.
Floodplain	Llanura de inundación	Leito de cheia	Überschwemmungsgebiet	Flat land next to a river that may naturally flood when the river level rises.
Exposure	Exposición	Exposição	Exposition	The people, buildings, roads, crops and services located within an area that may be affected by flooding.
Vulnerability	Vulnerabilidad	Vulnerabilidade	Verwundbarkeit	How severely exposed people, assets or systems could be affected because of their characteristics, condition, preparedness or capacity to respond.
Social vulnerability index	Índice de vulnerabilidad social	Índice de vulnerabilidade social	Sozialer Vulnerabilitätsindex	A combined indicator of social conditions that may make a community less able to prepare for, cope with or recover from flooding.
Risk	Riesgo	Risco	Risiko	The combination of hazard, exposure and vulnerability. A severe flood does not necessarily create high risk if few people or assets are exposed.
Exposed population	Población expuesta	População exposta	Betroffene Bevölkerung	An estimate of how many people live within the modelled flood footprint. It is a spatial estimate rather than a count of people who would actually be harmed.
Critical infrastructure	Infraestructura crítica	Infraestrutura crítica	Kritische Infrastruktur	Facilities and systems that are essential to a community, such as hospitals, health centres, fire

English	Spanish	Portuguese	German	Plain-language meaning
				and police stations, schools and civil-protection facilities.
Land use	Uso del suelo	Uso do solo	Landnutzung	The way land is used, such as for agriculture, housing, industry, transport, parks or water bodies.
Depth-damage curve	Curva calado-daño	Curva profundidade-dano	Schadensfunktion (Tiefe-Schaden-Kurve)	A relationship used to estimate the relative proportion of damage to an asset at different flood depths.
Indicative damage proxy	Indicador indicativo de daño	Indicador indicativo de dano	Indikativer Schadensindikator	A relative indicator of the possible severity of flood damage. It is not a monetary estimate or an observed loss and is intended primarily for comparison.
Area of interest (AOI)	Área de interés (AOI)	Área de interesse (AOI)	Untersuchungsgebiet (AOI)	The geographical area selected for analysis. The results produced by the tools refer specifically to this defined area.
Nodata	Nodata (sin datos)	Nodata (sem dados)	Nodata (kein Wert)	A value indicating that no information is recorded for a location. Depending on the dataset, it may indicate either no flooding or a location outside the available data coverage.
Feature limit	Límite de elementos	Limite de elementos	Objektlimit	The maximum number of geographical objects that a map service returns in one request. Reaching this limit may result in an incomplete response.
OGC standards	Estándares OGC	Normas OGC	OGC-Standards	Open international standards that allow geographic information to be published and accessed consistently by different systems.
WCS (Web Coverage Service)	WCS (Web Coverage Service)	WCS (Web Coverage Service)	WCS (Web Coverage Service)	An OGC service that provides gridded geographic data, such as flood-depth values, in a format that can be processed computationally.
WFS (Web Feature Service)	WFS (Web Feature Service)	WFS (Web Feature Service)	WFS (Web Feature Service)	An OGC service that provides individual geographic features, such as roads, buildings or hazard polygons, together with their attributes.
Raster data	Datos ráster	Dados raster	Rasterdaten	Geographic data stored as a grid of cells, with each cell

English	Spanish	Portuguese	German	Plain-language meaning
				containing a value such as water depth.
Vector data	Datos vectoriales	Dados vetoriais	Vektordaten	Geographic data represented as points, lines or polygons with associated attributes.
Coordinate reference system (CRS)	Sistema de referencia de coordenadas (CRS)	Sistema de referência de coordenadas (CRS)	Koordinatenreferenzsystem (CRS)	The system used to relate geographic coordinates to locations on Earth. Using an incorrect CRS can place data in the wrong location.
Population grid	Malla de población	Grelha populacional	Bevölkerungsraster	A map that distributes census population estimates across regular grid cells so that population information can be combined with other spatial data.
Adaptation measure	Medida de adaptación	Medida de adaptação	Anpassungsmaßnahme	An action intended to reduce flood risk or its consequences, including physical protection, preparedness, early warning, spatial planning and nature-based measures.
Resilience	Resiliencia	Resiliência	Resilienz	The ability of a community or system to absorb the effects of flooding, recover and adapt to future risk.

The MCP tool also applies one of three audience style profiles to each explanation. Each profile contains localized labels, introductory wording, contextual framing and response instructions in the four supported languages. Table A.2 presents the English configuration used to define the purpose of each profile.

Table A.2: Audience style profiles implemented in the MCP tool

Audience profile	Introductory wording	Contextual focus	Response instructions
Citizen	In simple terms	Why this matters in everyday life	Use short sentences and plain language. Explain technical terms and acronyms. Focus on practical meaning and personal safety. Avoid unnecessary technical detail. Do not replace official warnings or emergency advice.
Farmer	Practical meaning for farming	Possible implications for fields, livestock, roads and access	Use practical and action-oriented language. Relate information to crops, livestock, farm buildings and access roads. Highlight possible operational interruptions. State important uncertainties and missing data. Do not replace official warnings or professional advice.
Planner or emergency manager	Technical interpretation	Planning relevance, assumptions and limitations	Preserve metrics, units, scenarios and data sources. Distinguish hazard, exposure, vulnerability and risk. State assumptions, uncertainty, limitations and missing data. Avoid

Audience profile	Introductory wording	Contextual focus	Response instructions
			conclusions not supported by the available evidence. Present operational implications clearly.

Annex B - PoliRuralPlus Technical Validation Questionnaire

Participation in Webinars (initial Training Sessions)

1. Which PoliRuralPlus technical sessions did members of your project attend or review recordings of? Indicate: Attended live / Watched recording / Not reviewed.

Session	Participation
PoliRuralPlus Enhance Call Kick-off Meeting	Attended live
Technical onboarding session with Runar Bergheim on the MCP server, the creation of MCP tools and access to the GitHub repository	Attended live
Technical coordination sessions with Filip Leitner on data configuration, WCS creation, data merging and technical reviews	Attended live
Additional technical training recordings	Not reviewed

2. Which sessions were most relevant to your project?

The most relevant sessions were the technical onboarding session with Runar Bergheim and the technical coordination sessions with Filip Leitner. The first provided the necessary understanding of the MCP server architecture, MCP tool development and repository workflow. The sessions with Filip supported the configuration and integration of geospatial data services, including WCS creation, data merging and technical review. These sessions directly supported the development and testing of the three FloodAI+ MCP tools.

Awareness and Understanding of the PoliRuralPlus Ecosystem

3. Were you aware of the Jackdaw ecosystem and related tools before participating in the cascade funding activities in PoliRuralPlus?

Before participating in the PoliRuralPlus cascade funding activities, the FloodAI+ team had limited awareness of the JackDaw ecosystem and its related technical components. Practical understanding was developed during the project through the kick-off meeting, technical onboarding, direct interaction with the JackDaw environment and the development of the FloodAI+ MCP tools.

4. Which ecosystem components are you familiar with

The FloodAI+ project developed direct familiarity with:

- the JackDaw GeoAI chatbot;
- the MCP server and MCP tool architecture;
- geospatial data integration and harmonisation workflows;
- OGC data services, particularly WFS and WCS;
- data publishing concepts for making geospatial information accessible to JackDaw;
- the GitHub-based development, testing and review workflow.

RAG/GeoRAG was considered at a conceptual level but was not directly implemented or validated. PoliRuralPlus Advisor and Vulture were not used or actively assessed within FloodAI+.

5. Briefly describe how you understand the purpose of the Jackdaw ecosystem within PoliRuralPlus.

The JackDaw ecosystem is understood as a GeoAI-enabled conversational environment within PoliRuralPlus that helps users access, combine and interpret territorial and geospatial information through natural-language questions. Its purpose is to reduce the gap between complex datasets and practical decision-making by connecting users with specialised data sources and analytical tools, including modular MCP tools. In FloodAI+, JackDaw was applied as a potential mediator between flood-hazard and exposure data and the information needs of municipalities, infrastructure managers, civil protection actors, farmers, researchers and citizens. Its value lies in making spatial information more accessible and understandable while preserving transparency about data sources, assumptions, uncertainty and limitations.

Actual Testing or Validation

6. Did your project test or experiment with any ecosystem technologies?

Yes. FloodAI+ tested the JackDaw GeoAI chatbot and developed three custom MCP tools to support flood-hazard analysis, exposure assessment and multilingual communication.

7. Which components were actively validated in your project work?

FloodAI+ delivered a pilot-level suite of three MCP tools integrated within the Raven/JackDaw environment: the Flood Hazard Connector, the Flood Exposure Connector, and the Multilingual Flood Glossary. The Flood Hazard and Flood Exposure Connectors were technically and functionally tested. The Multilingual Flood Glossary was implemented following feedback from Workshop 2 and was subsequently tested technically, but it was not directly validated by workshop participants. JackDaw served as the user-facing interface, while Raven provided the backend/runtime environment for the MCP tools.

8. Describe how the technologies were tested (internal testing, integration, stakeholder demos, pilot studies, evaluation exercises).

Testing combined technical verification, integration review and stakeholder validation. The three Python-based MCP tools were developed in VS Code on Ubuntu and tested through automated Python tests, Docker and the MCP Inspector before each GitHub push and pull request. Following technical review by Filip Leitner and the PoliRuralPlus technical team, the approved changes were merged and tested end-to-end in the deployed JackDaw environment.

User-facing validation was conducted using rural–urban flood-risk use cases in two online workshops. The first included a project presentation, JackDaw demonstration and stakeholder feedback, while the second provided hands-on interaction with the chatbot. Feedback was collected through Mentimeter, workshop and asynchronous forms, and stakeholder discussions. Stakeholder questions and feedback were subsequently analysed and mapped to potential improvements.

The validation focused on usability, clarity, trustworthiness, perceived usefulness, decision-support potential and future technical requirements.

Technical Implementation

9. Did you implement or configure any of the technologies provided in the form of services, custom plugins/services, local deployment, RAG/GeoRAG pipelines, data harmonization workflows, data cubes, pipelines, or data publishing?

Yes. FloodAI+ implemented three custom Python-based MCP tools and configured their connection to heterogeneous geospatial sources, including WFS, WCS and local datasets. Development and testing were performed in a containerised local environment before submission through GitHub for technical review and integration.
The project did not implement a standalone JackDaw deployment, RAG/GeoRAG pipeline, data cube or separate data-publishing platform.

10. If yes, describe the technical architecture used (local deployment, cloud deployment, integration with existing systems, API-based integration).

The architecture combined local development with integration into the existing Raven/JackDaw system. The MCP tools were implemented in Python and tested locally using Ubuntu, Docker, automated tests and the MCP Inspector. They accessed geospatial information through OGC WFS and WCS services, supplemented by local preprocessed datasets where required. The code was submitted through GitHub pull requests for technical review, merging and end-to-end testing in the deployed JackDaw environment. FloodAI+ did not operate a separate cloud or standalone JackDaw deployment.

11. Did you develop new services or extensions? If yes, describe.

Yes. FloodAI+ developed three custom MCP tools extending JackDaw's flood-risk capabilities:

- **Flood Hazard Connector:** retrieves and structures flood-hazard information for selected areas and scenarios.
- **Flood Exposure Connector:** combines hazard information with population, infrastructure, roads and land-use data to assess exposed elements and indicative impacts.
- **Multilingual Flood Glossary:** provides 30 flood-risk concepts in English, Spanish, Portuguese and German, with explanations adapted to citizen, farmer and planner or emergency-manager profiles.

These were developed as functional extensions of the existing MCP architecture, rather than as independent production services.

Use Cases and Policy Applications

12. In which domain did you apply Jackdaw ecosystem technologies (e.g., rural planning, agriculture, land management, climate monitoring, policy analysis, community participation, state your own sector as you see fit)?

FloodAI+ applied JackDaw ecosystem technologies to flood-risk management and climate resilience. The use cases covered rural–urban planning, civil protection, agriculture, land-use and infrastructure planning, and community participation.

13. Did the tools support policy intelligence or decision-making processes?

Yes. The tools supported evidence-informed decision-making by making flood-hazard and exposure information easier to retrieve, interpret and communicate. They can assist with identifying exposed populations, infrastructure, roads and land uses, as well as prioritising further assessment and adaptation actions. They were developed as decision-support tools and do not replace official risk assessments or policy decisions.

14. Did you use any of the technologies provided to analyse policy scenarios?

Not in the form of formal policy modelling. FloodAI+ did not model or compare specific policy alternatives or conduct a policy-impact assessment.

15. Did you use any of the provided concepts for collaborative planning or stakeholder interaction?

Yes. JackDaw was used in two online workshops involving demonstrations, hands-on interaction and stakeholder feedback.

16. Did you experiment with RAG or GeoRAG approaches for knowledge retrieval?

No dedicated RAG or GeoRAG pipeline was implemented or validated. Knowledge and geospatial information were retrieved through the custom MCP tools, structured glossary content and connections to WFS, WCS and local datasets. RAG/GeoRAG was considered relevant for future development but remained outside the implemented project scope.

Data and Knowledge Integration

17. Did your project publish any datasets?

Yes. FloodAI+ prepared and, in coordination with the PoliRuralPlus technical team, made selected preprocessed raster coverages available through the PoliRuralPlus GeoServer WCS. These included 5 m flood-hazard coverages for Valencia and Lisbon, a 5 m flood-flow-velocity coverage for Lisbon, and pilot-specific population coverages derived from the JRC-ESTAT 2021 100 m population grid.
These were service-ready versions of existing authoritative data, not new official datasets created by FloodAI+. Other sources, particularly the Dresden hazard and exposure layers, continued to be accessed directly from the original providers through WFS or ArcGIS services.

18. Did you perform data harmonization to make datasets compatible with the ecosystem?

Yes. FloodAI+ performed both pre-publication preprocessing and runtime harmonisation. The available data differed between cities in format, schema, coordinate reference system, spatial coverage, units and native resolution. Large raster datasets were clipped to the relevant pilot extents, merged where required, and optimised or compressed for service delivery while preserving the intended spatial resolution, including the 5 m Valencia flood-hazard grid.
Selected rasters were configured as WCS coverages. At runtime, the connectors validate and reproject geometries, request the required WCS data, interpret nodata values, clip and mask rasters, query and clip vector features, map source-specific attributes into common categories, and perform hazard–exposure overlays. The datasets were therefore made interoperable without necessarily resampling every source to one common resolution.

19. Did you create or use centrality datasets for rural network analysis?

No. FloodAI+ did not create or use centrality datasets for rural-network analysis.

20. Did you use the data cube or centrality measures approaches to process spatial or temporal data?

No. FloodAI+ did not use data cubes or centrality measures. Spatial processing was performed directly through source-specific raster and vector workflows, including WCS/WFS access, AOI subsetting, reprojection, clipping, masking and spatial overlays. The data were not organised as a multidimensional spatial–temporal data cube.

Evaluation and Feedback

21. What aspects of the technologies worked well?

Overall, the technologies performed well, particularly considering that the Raven/JackDaw environment was evolving alongside the MCP tools. The MCP architecture and development guidance provided a clear basis for implementing, testing and integrating the three Python-based tools. WFS and WCS services were especially useful for accessing external authoritative geospatial data without permanently storing large datasets within JackDaw. The

GitHub review workflow and close technical collaboration between Porvalor and the PoliRuralPlus team also worked effectively.

22. What limitations or challenges did you encounter?

The main challenge was the maturity and continuous evolution of the Raven/JackDaw environment, which occasionally produced configuration and integration errors and required repeated adaptations. External geospatial services also presented limitations: large or high-resolution datasets could be demanding to process, while WFS/WCS sources could occasionally be unavailable or return incomplete results. Differences in formats, resolutions, coordinate systems and data structures between pilot cities required additional preprocessing and harmonisation. Regular communication and technical support from the PoliRuralPlus team were essential for resolving these issues.

23. Did stakeholders or users provide feedback during testing? Summarize key insights.

Yes. Stakeholders provided feedback through the two online workshops, Mentimeter, forms, discussions and hands-on interaction with JackDaw. The first workshop showed strong interest in the technology: usefulness was rated 4.3/5 and willingness to continue using or testing JackDaw was rated 4.6/5. However, its support for decision-making and communication received a lower rating of 2.9/5.
Participants prioritised explanatory maps, followed by risk summaries, short explanations and comparisons between areas. They particularly wanted information about exposed buildings, roads, critical infrastructure and vulnerable populations. The main improvement needs were clearer and user-adapted answers, better visual outputs, explicit communication of uncertainty, historical and damage information, and more actionable support for prevention, emergency planning and infrastructure protection. These findings informed the multilingual glossary, audience style profiles and the project's feedback-to-improvement recommendations.

Evidence of Validation

24. Provide evidence *if available* (screenshots, demo videos, reports, evaluation results, prototypes, repositories – you may paste text or images here, supply links for documents or videos or web resources).

FloodAI+ validation is supported by public dissemination materials, technical test results, workshop evidence, stakeholder feedback, project reports and functional prototypes. The evidence covers the development and testing of the three MCP tools, their integration with JackDaw, stakeholder interaction during two online workshops and the translation of feedback into technical and communication improvements.

Public links

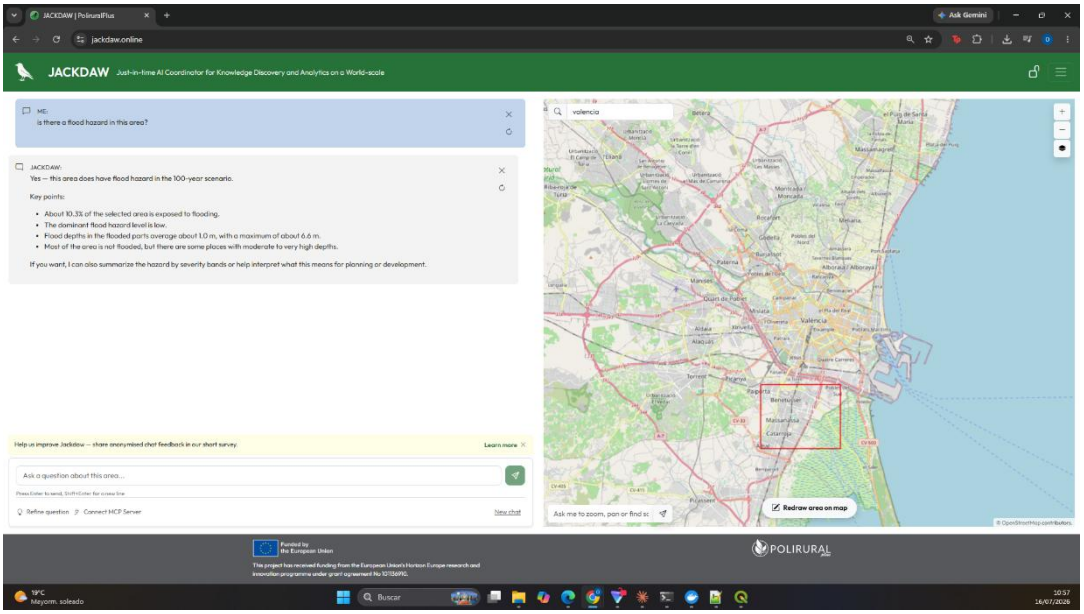
FloodAI+ 1st Workshop announcement:
https://www.poliruralplus.eu/news/upcoming-webinar-floodai-1-st-workshop/
FloodAI+ first workshop results news:
https://www.poliruralplus.eu/news/floodai-holds-its-first-workshop-to-present-jackdaw-and-collect-stakeholder-feedback/
FloodAI+ 2nd Workshop news:
https://www.poliruralplus.eu/news/floodai-2nd-workshop-hands-on-validation-of-jackdaw/
First workshop blogpost:
https://www.poliruralplus.eu/knowledge-transfer/blog/maps-first-decisions-next-lessons-from-jackdaws-first-floodai-workshop/
Second workshop blogpost:
https://www.poliruralplus.eu/knowledge-transfer/blog/testing-jackdaw-in-practice-lessons-from-the-second-floodai-workshop/
First social media post:

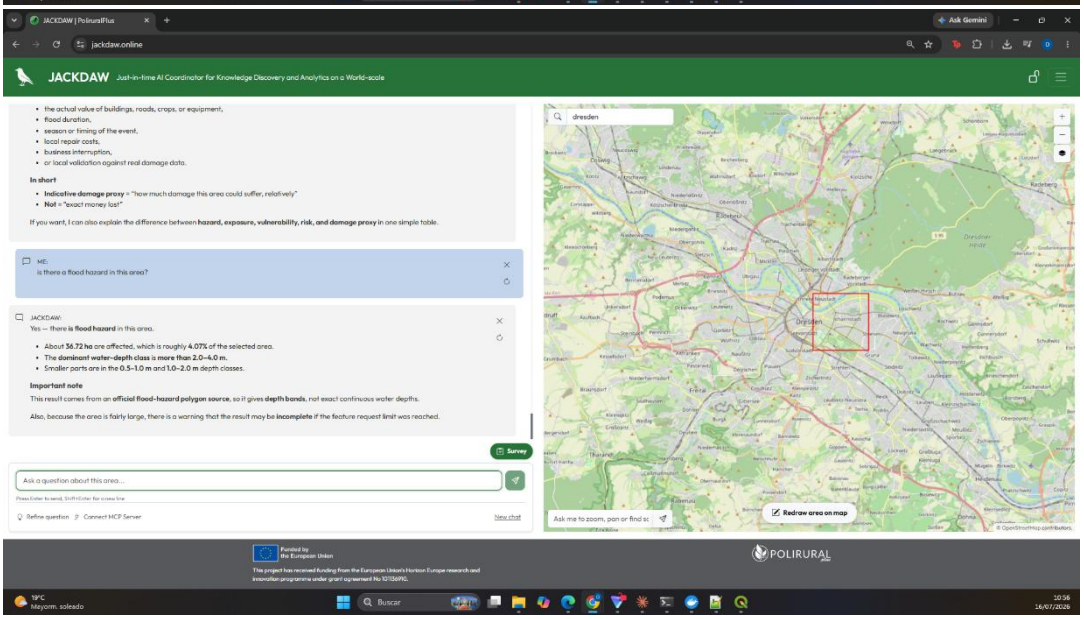
https://www.linkedin.com/posts/porvalor_maps-first-decisions-next-lessons-from-activity-7480917309923000320-Gs3e?utm_source=share&utm_medium=member_desktop&rcm=ACoAAAEH2NYBmDJ9QYFKK6U53ItJ5mtfCF0ok4U

Second social media post:

https://www.linkedin.com/posts/porvalor_testing-jackdaw-in-practice-lessons-from-activity-7487471946834542594-kY2m?utm_source=share&utm_medium=member_desktop&rcm=ACoAADI41wsBDoNmBKJiTEoMIaaRCYsAPiCZxxo

Technical validation screenshots





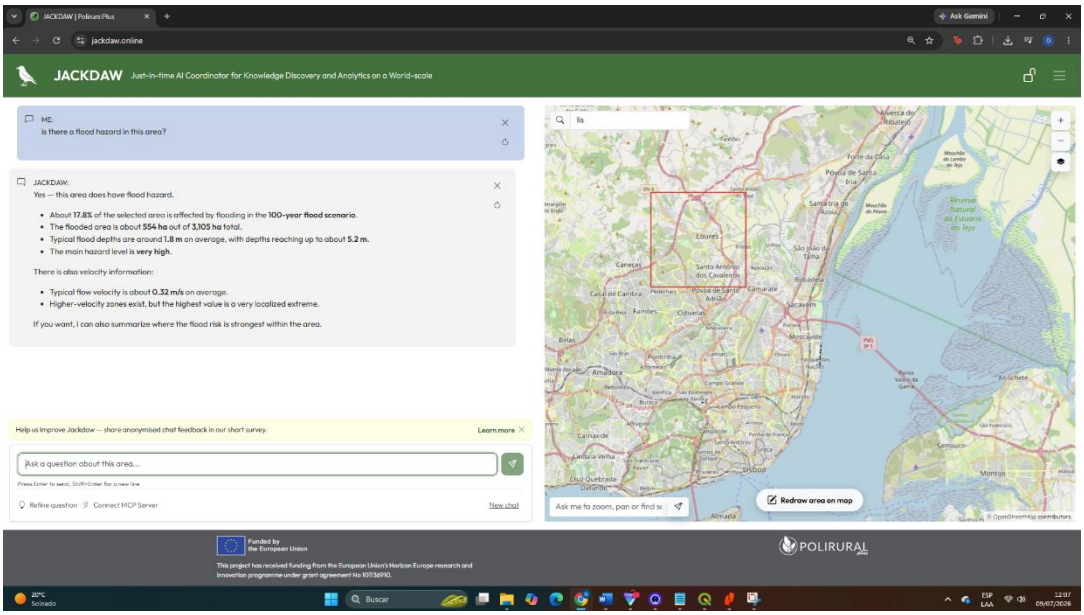
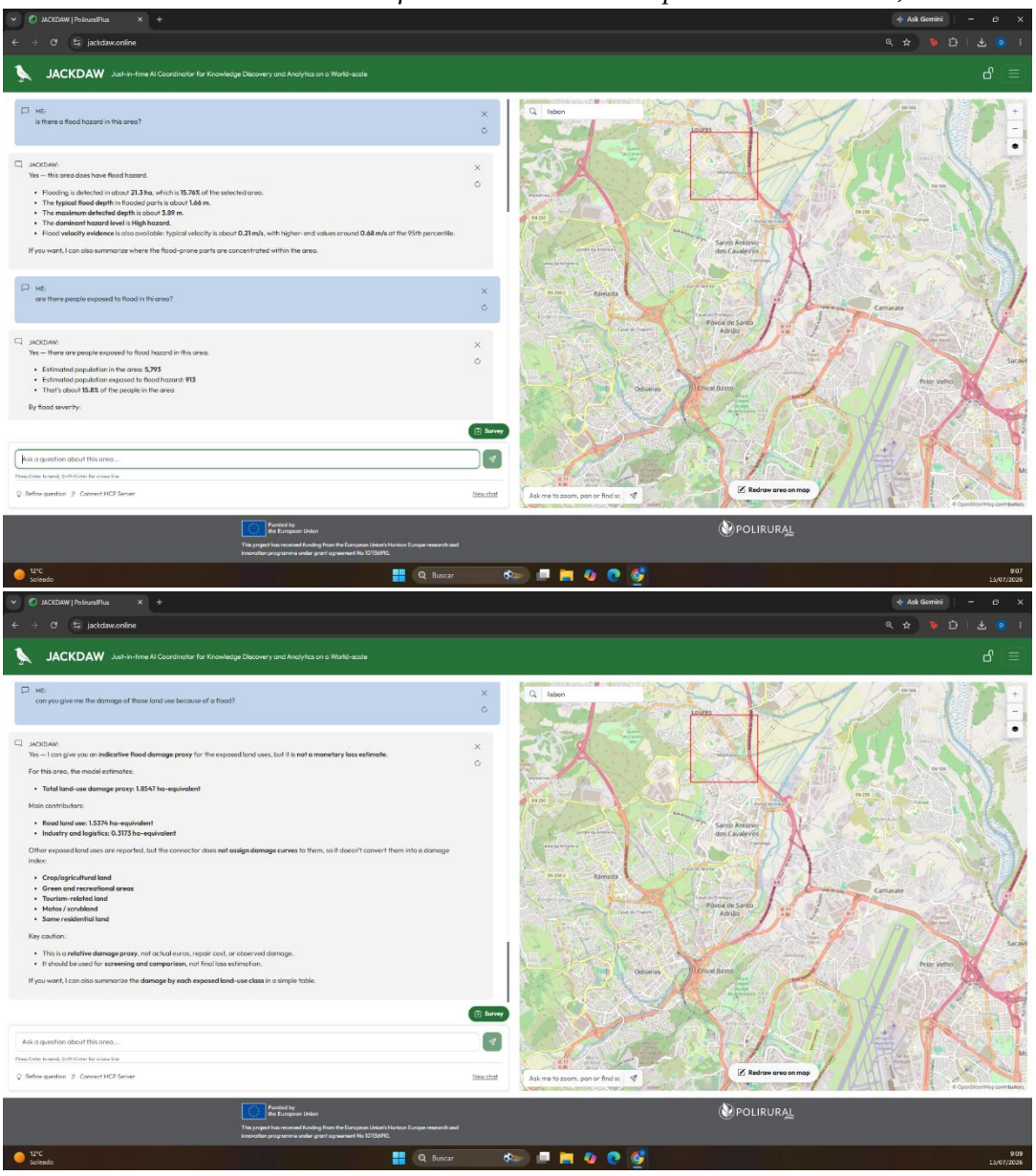


Figure B.1. Flood Hazard Connector results for the three FloodAI+ pilot cities: Valencia, Dresden and Lisbon.



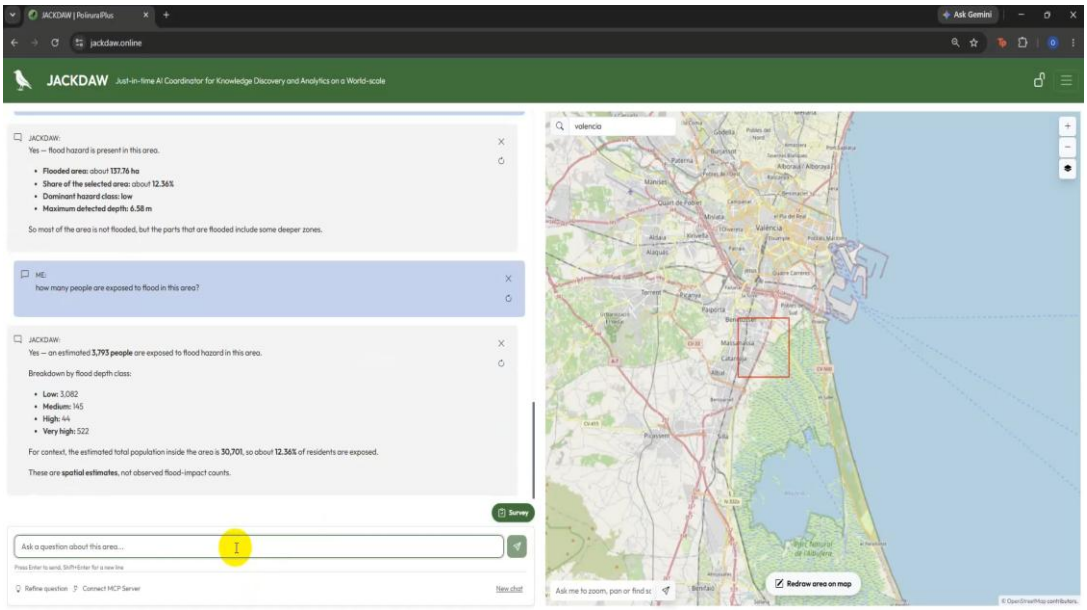
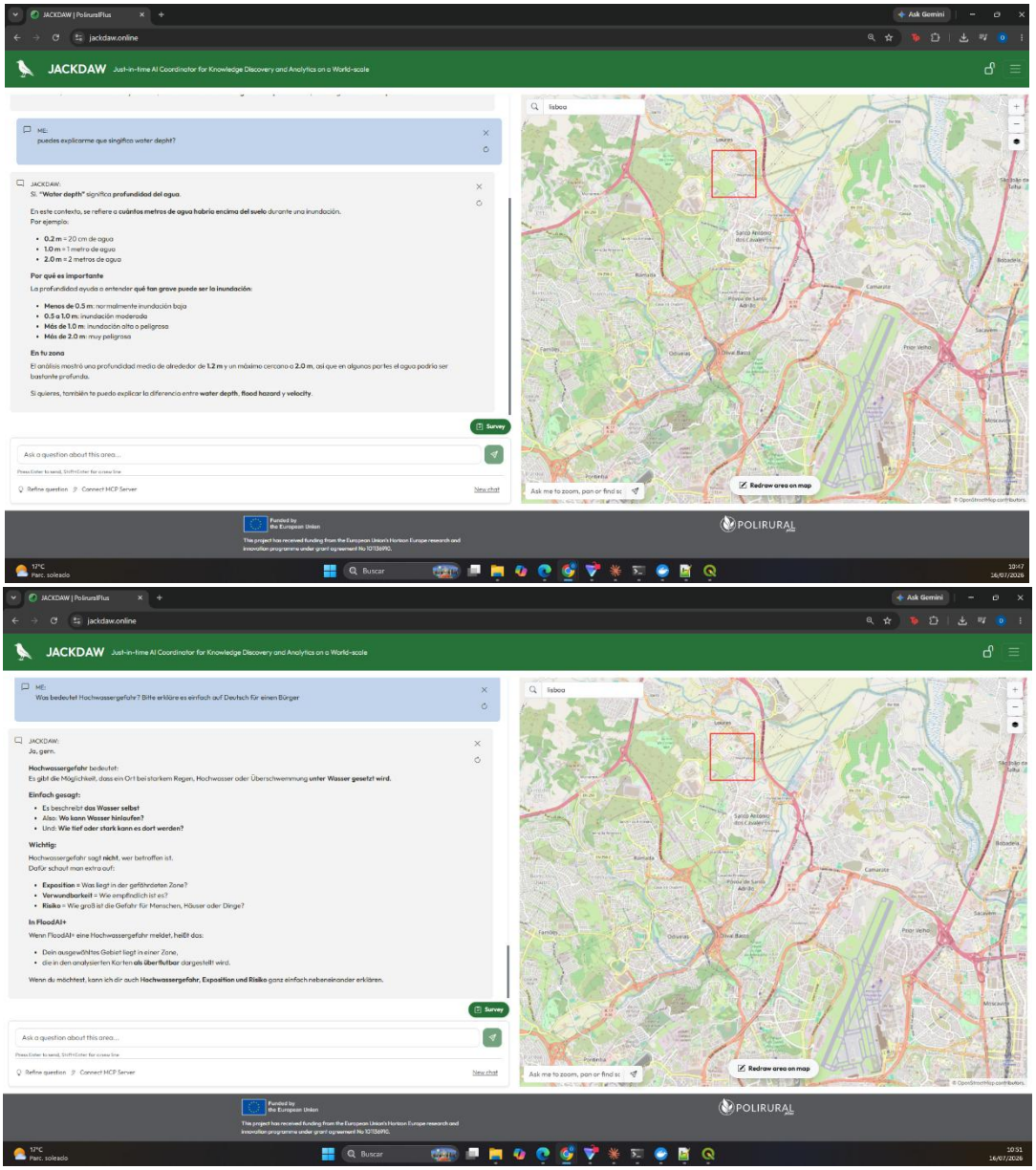


Figure B.2. Examples of Flood Exposure Connector outputs combining flood-hazard information with available population, buildings, roads, infrastructure or land-use data.



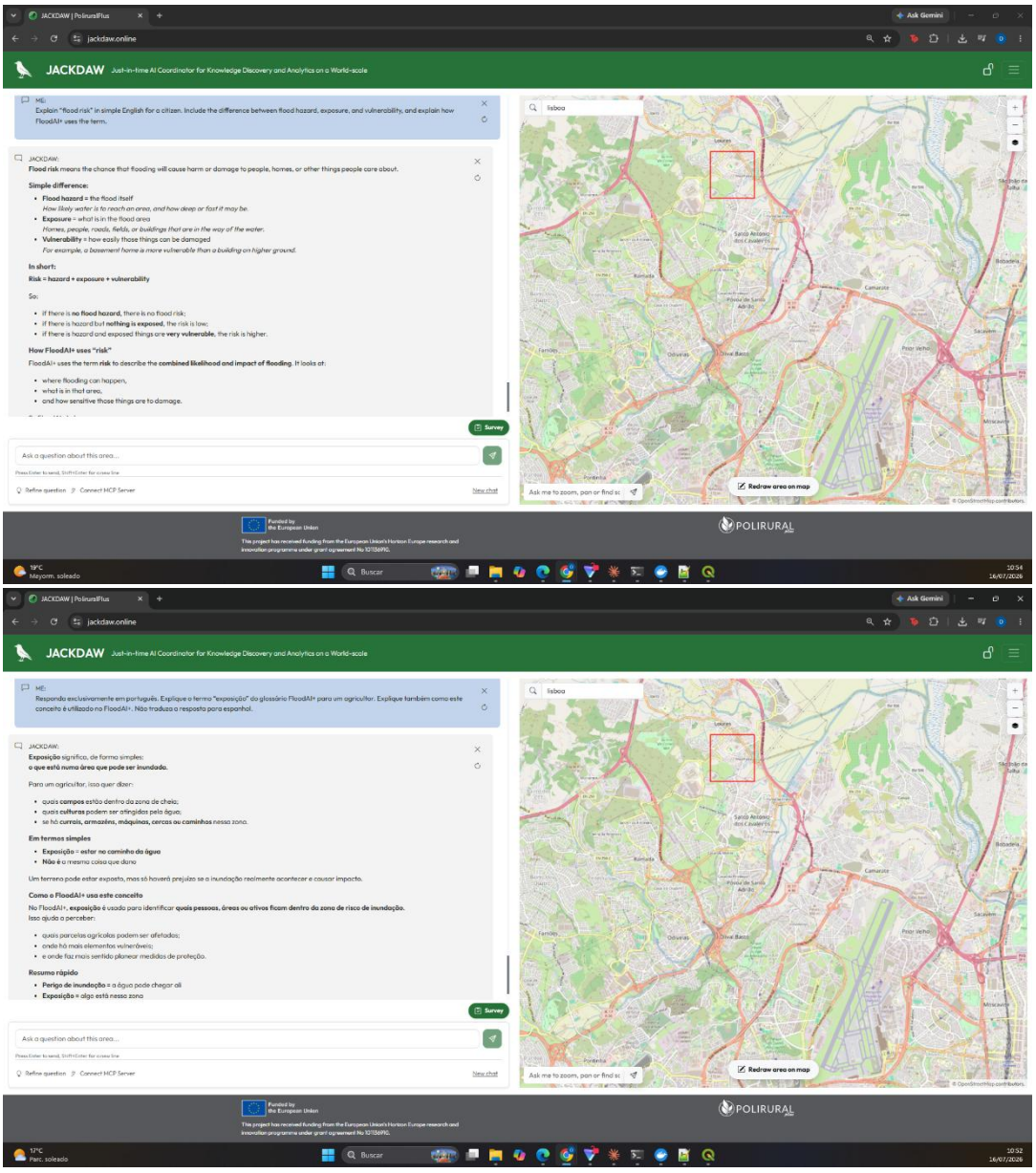
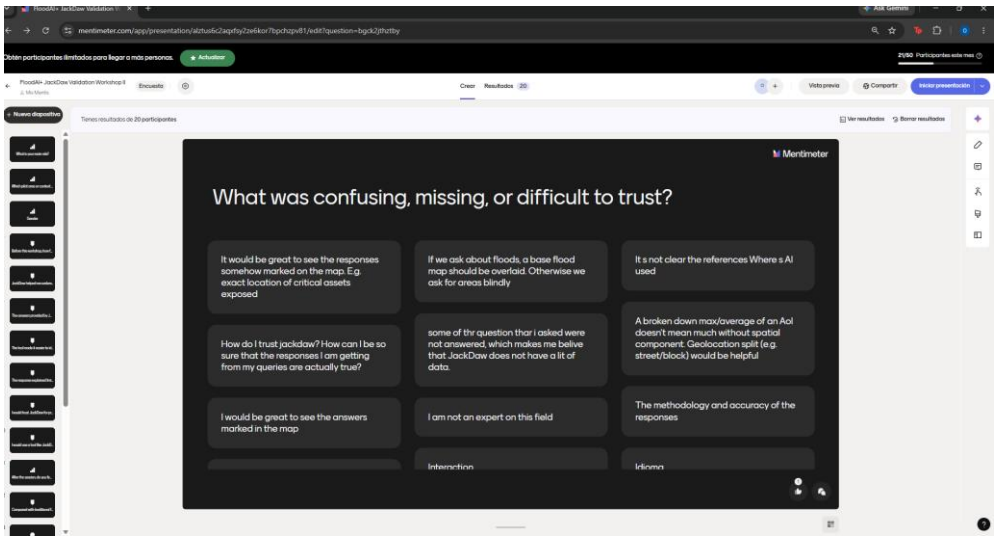
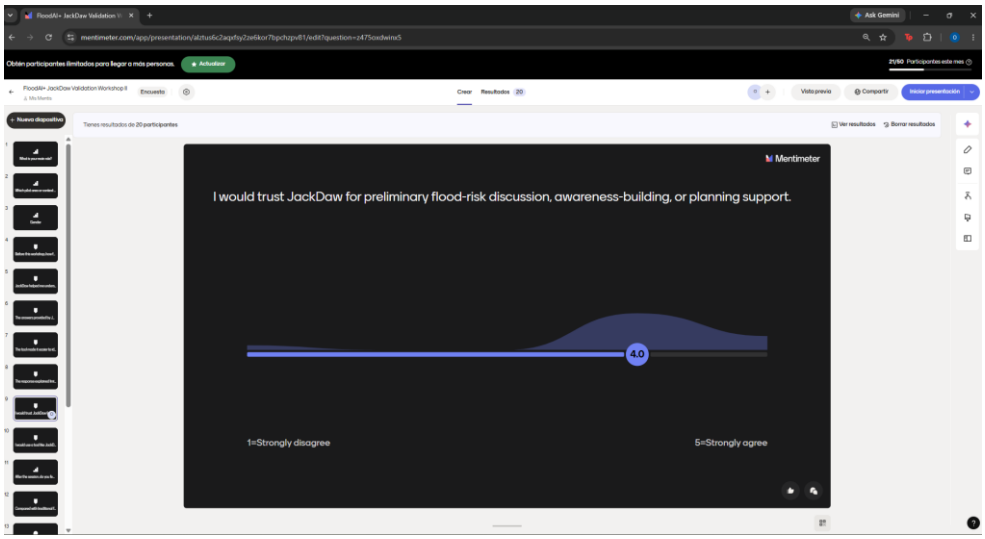
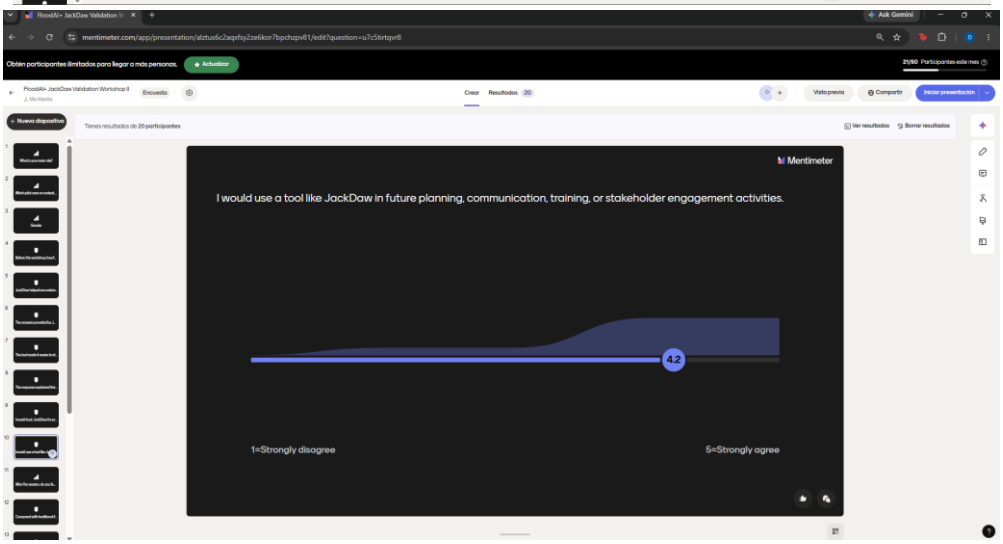
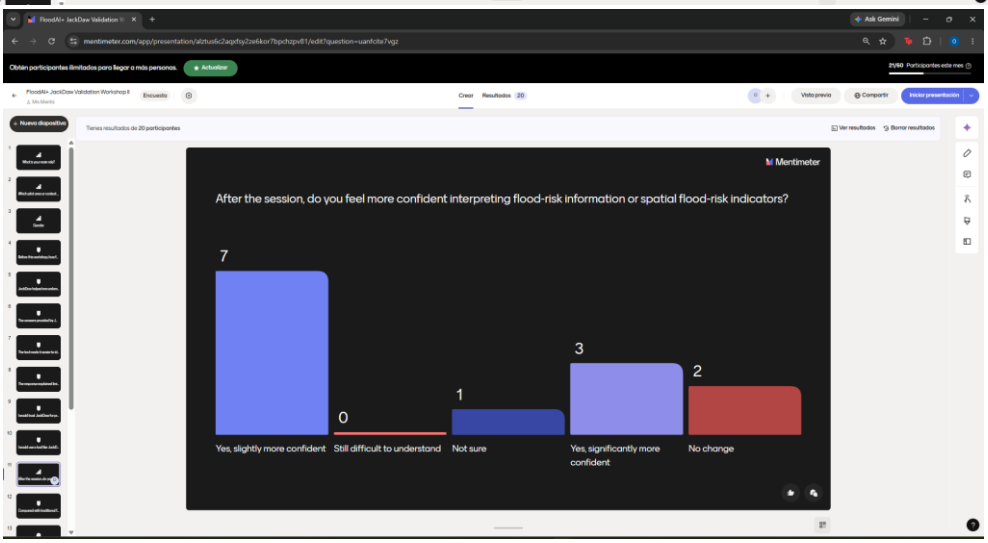


Figure B.3. Validation of the Multilingual Flood-Risk Glossary in English, Spanish, Portuguese and German, including audience-adapted explanations.




Mentimeter
I would trust JackDaw for preliminary flood-risk discussion, awareness-building, or planning support.
4.0
1=Strongly disagree
5=Strongly agree


Mentimeter
I would use a tool like JackDaw in future planning, communication, training, or stakeholder engagement activities.
4.2
1=Strongly disagree
5=Strongly agree


Mentimeter
After the session, do you feel more confident interpreting flood-risk information or spatial flood-risk indicators?
7
0
1
3
2
Yes, slightly more confident
Still difficult to understand
Not sure
Yes, significantly more confident
No change

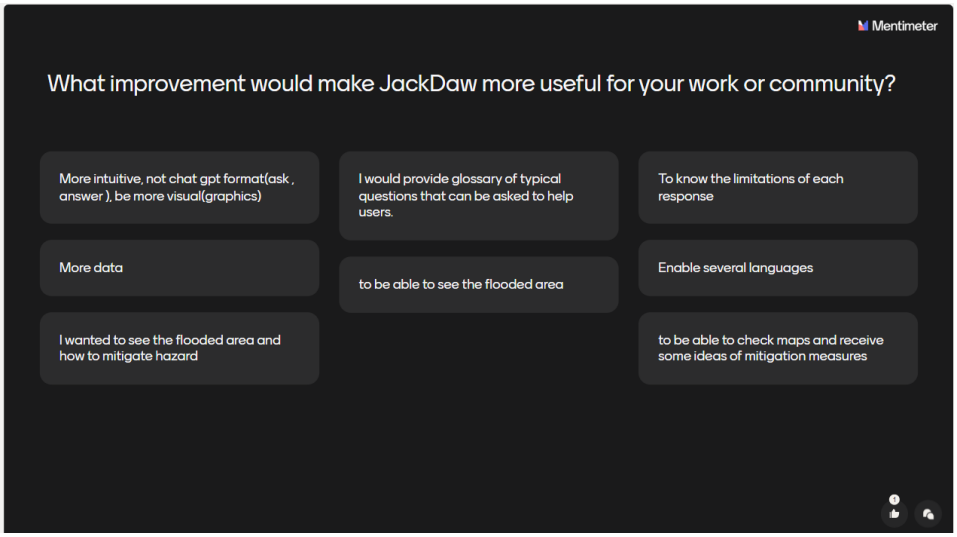
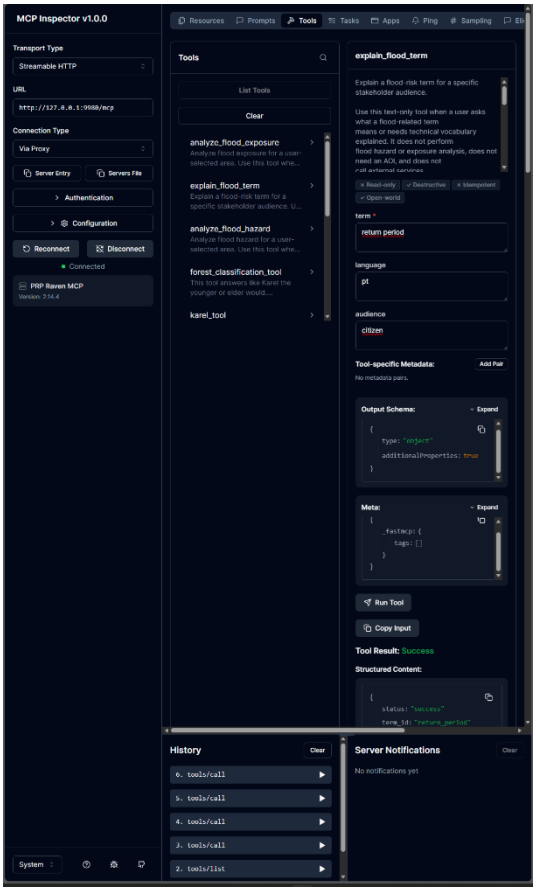
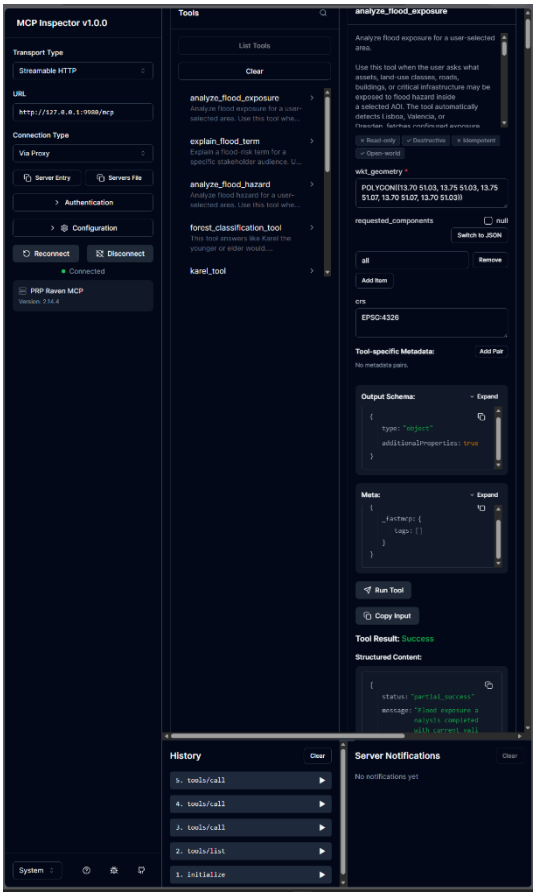


Figure B.4. Selected Mentimeter results from the FloodAI+ workshops, covering perceived usefulness, willingness to continue testing, decision-support potential and preferred output formats.





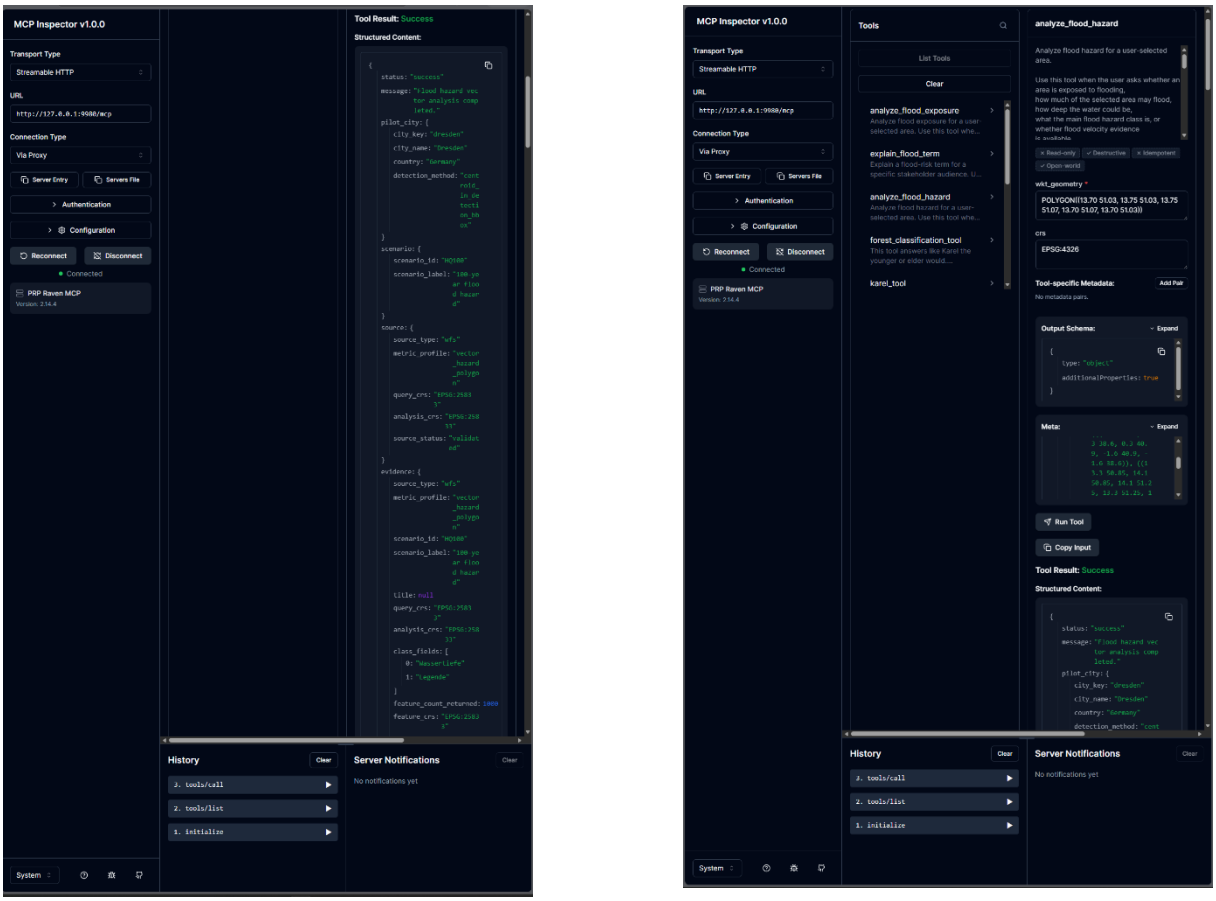


Figure B.5 Functional validation of the three FloodAI+ MCP tools using the MCP Inspector.

Additional supporting evidence

Additional evidence includes the first and second workshop materials and flyers, anonymised feedback summaries, the Part A public report, the Multilingual Flood-Risk Glossary and Stakeholder Style Profiles v1.0, and the feedback-to-improvement mapping. The Part B report, raw participant forms, attendance records, asynchronous responses and identifiable workshop screenshots are maintained as confidential supporting evidence.

Future Potential

25. Would you consider continuing to use technologies like the PoliRuralPlus ecosystem after the project? (yes, no, why/why not)

Yes. The modular architecture of JackDaw and MCP tools has strong potential for making complex geospatial information accessible through natural-language interaction. Continued use would depend on further platform maturity, stable technical support and reliable access to external data services

26. Which of the components you have used or assessed have the highest potential for further exploitation?

JackDaw’s MCP-based extensibility and the FloodAI+ toolchain have the highest potential for further exploitation. The existing Flood Hazard and Flood Exposure Connectors provide the foundation for developing a Flood Vulnerability Connector and an integrated Flood Risk Analysis tool. Combining hazard, exposure and vulnerability information could support the identification of risk hotspots, scenario comparison and prioritisation of mitigation and adaptation measures.

This approach could be extended to additional territories, datasets and administrative scales, supporting a more complete flood-risk management cycle aligned with internationally recognised frameworks. The multilingual glossary, stakeholder profiles and WFS/WCS integration approach could further support its use across different geographical and stakeholder contexts.

27. What improvements would make the ecosystem more useful?

The ecosystem would benefit from:

- greater platform stability and clearer version management;
- expanded technical documentation and testing examples;
- improved handling of unavailable services and large, high-resolution datasets;
- stronger map visualisation, potentially including WMS-based flood-area displays;
- clearer presentation of data sources, uncertainty and analytical limitations;
- more actionable outputs, including historical information, indicative damage assessment and adaptation options;
- easier configuration and publication of new datasets and MCP tools.

These improvements would increase reliability, usability and decision-support value for both technical and non-technical users.