



Institute of
Atmospheric Pollution
Research
National Research Council of Italy

Project:
APEMAIA

Contract n.
2023-39-HH.0

Doc. N.: DEL_007_CNR-ITIAm_RF_EN-001

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Assessment of PM Exposure at intra-urban scale in preparation of MAIA mission (APEMAIA)

WP1104 – Dissemination and Reporting

DEL007 – Dissemination and Exploitation Results

Contract n. 2023-39-HH.0

CUP n. F83D23000210005

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PROJECT NAME	Assessment of PM Exposure at intra-urban scale in preparation of MAIA mission (APEMAIA)	CONTRACTOR	National Research Council – Institute of Atmospheric Pollution Research
PROJECT MANAGER	Maria Adamo (CNR-ITIAm)	DATE SUBMITTED	N/A
AUTHOR	M. Adamo, S. Fuina, M. De Lucia, M. Aquilino (CNR-ITIAm)	CONTRACTOR'S REFERENCE	Issue:01 Rev.:01 Date:25/09/26
PROJECT BEGIN DATE	26/09/2023	PROJECT END DATE	25/09/2026



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EXECUTIVE SUMMARY

This document is the current Dissemination and Exploitation Results (DER), reporting on all the dissemination and exploitation activities carried out and the results achieved by APEMAIA. It is released at the end of activities for WP1104 titled 'Dissemination and Reporting'. The release adheres to the planned schedule: (T0+24M).

**NAME OF ASI PROJECT
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No OF VOLUMES:



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1. AIM OF THE DOCUMENT

This final Dissemination and Exploitation Results (DER), formulated under WP1104 titled 'Dissemination and Reporting', reports on the dissemination and exploitation activities carried out over the full duration of APEMAIA and the results they produced. Specifically, WP1104 included the following tasks:

- Definition and implementation of a dissemination plan for the project results, including communication activities towards the scientific community and potential public and private stakeholders;
- Promotion of the visibility of the project through participation in workshops, conferences, and events;
- Collection, integration, and verification of all the contributions from the research WPs of nodes 2000, 3000, 4000 and 5000 in research reports and scientific publications;
- Sharing of the algorithms and processing chains developed within the project through open repositories (GitHub) and containerised environments (Docker), and consolidation of the APEMAIA WebGIS as the platform for public access to project products.

These activities were carried out throughout the project lifetime, up to and including the period T0+24M.

This final DER consolidates the strategy outlined in the preliminary version and reports the results achieved in terms of visibility, dissemination of scientific outcomes, sharing of software and data, and exploitation of project results, ensuring that project information reached a broad audience of relevant stakeholders.

1.1. Applicable and reference documents

This document incorporates, by dated or undated references, provisions from other documents. These references are cited at appropriate places in the text, and they are listed hereafter. For undated references, the latest edition of the publication referred applies.

In case of conflict between two or more applicable documents, the higher document will prevail.

1.2. Applicable documents

[AD 1] ASI Contract No. 2023-39-HH.0

1.3. Reference documents

[RD-1] ECSS CONFIGURATION AND INFORMATION MANAGEMENT, DOC ID. ECSS-M-ST-40C REV. 1



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1.4. Acronyms and abbreviations

Table 1-1 provides the acronym list.

Table 1-1: Acronyms and abbreviations

Acronym	Description
APEMAIA	Assessment of PM Exposure at intra-urban scale in preparation of MAIA mission
ARPA Puglia	Apulian Regional Agency for Environmental Protection
ASI	Agenzia Spaziale Italiana
CNR-ITIAm	Consiglio Nazionale delle Ricerche – Istituto di Tecnologie e Intelligenza Ambientale
CTM	Chemical Transport Model
EIRENE RI	Environmental Exposure Assessment Research Infrastructure
GEO	Group on Earth Observations
GPS	Global Positioning System
IGARSS	International Geoscience and Remote Sensing Symposium
NBS	Nature Based Solutions
US	User segment
WebGIS	Web Geographic Information System
WP	Work Package

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2. COMMUNICATION AND DISSEMINATION

The dissemination and communication activities carried out within APEMAIA supported the visibility, accessibility, and uptake of the project activities and results. While communication primarily addressed the visibility of the project and its outcomes towards a broad audience, dissemination focused on making the scientific and technical results available to relevant stakeholders and facilitating their understanding and potential reuse.

In line with the end-user needs identified in DEL004, particular attention was devoted to reaching the main APEMAIA user groups: Space Agencies, scientists (US1), local and regional authorities and technicians (US2), and society (US3). The activities carried out throughout the project therefore aimed not only to communicate the progress of the project, but, more importantly, to present and valorise its results through channels and formats appropriate to the different target audiences.

The main results of the dissemination and communication activities include:

- Increased visibility of the APEMAIA project and its results, through the project website, social media, media coverage, and joint communication initiatives with ASI and NASA/JPL.
- Scientific dissemination of project results, through scientific publications, conference presentations, workshops, and other scientific events, supporting the exchange of knowledge within the Earth Observation and atmospheric science communities.
- Accessibility and reuse of project outputs, supported by the dissemination of algorithms and software through open platforms such as GitHub and Docker, and by the development of the APEMAIA WebGIS for the visualization and access to project products.
- Engagement with institutional and technical stakeholders, including local and regional authorities and environmental agencies, promoting awareness of the potential applications of APEMAIA products for air-quality assessment and environmental management.
- Knowledge transfer and capacity building, through training and other initiatives aimed at supporting the understanding and use of the methodologies and products developed within the project.
- Long-term accessibility and sustainability of the results, by making key outputs, tools, data products, and scientific contributions available beyond the project activities and supporting their potential uptake by the identified user communities.

Overall, the dissemination and communication activities contributed to extending the impact of APEMAIA beyond the consortium, facilitating the circulation of project results among the scientific, institutional, technical, and societal communities. The following sections summarize the main dissemination and communication channels adopted and, for each of them, report the activities carried out and the results achieved.

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2.1. Visual Identity

A consistent visual identity was established and maintained throughout the APEMAIA project, contributing to the recognisability and coherence of the project's communication and dissemination activities.

The APEMAIA logo (Fig. 2-1) represents the project's focus on Earth Observation and atmospheric monitoring, combining the concept of satellite observation of the Earth with the atmosphere as the main target of the monitoring activities. The logo was systematically included in the project deliverables, progress reports, presentations, posters, and other dissemination materials produced by the consortium. Its consistent use contributed to establishing a recognisable visual identity across the different communication and dissemination channels.

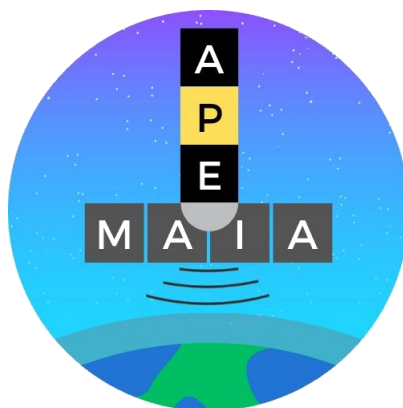


Figure 2-1: Logo of APEMAIA Project

In addition to the official ASI template used for APEMAIA Deliverables and Progress Reports, a dedicated PowerPoint presentation template was developed (Fig. 2-2) and adopted for both internal and external presentations. This ensured a consistent visual representation of the project and its results across scientific, technical, institutional, and dissemination events.

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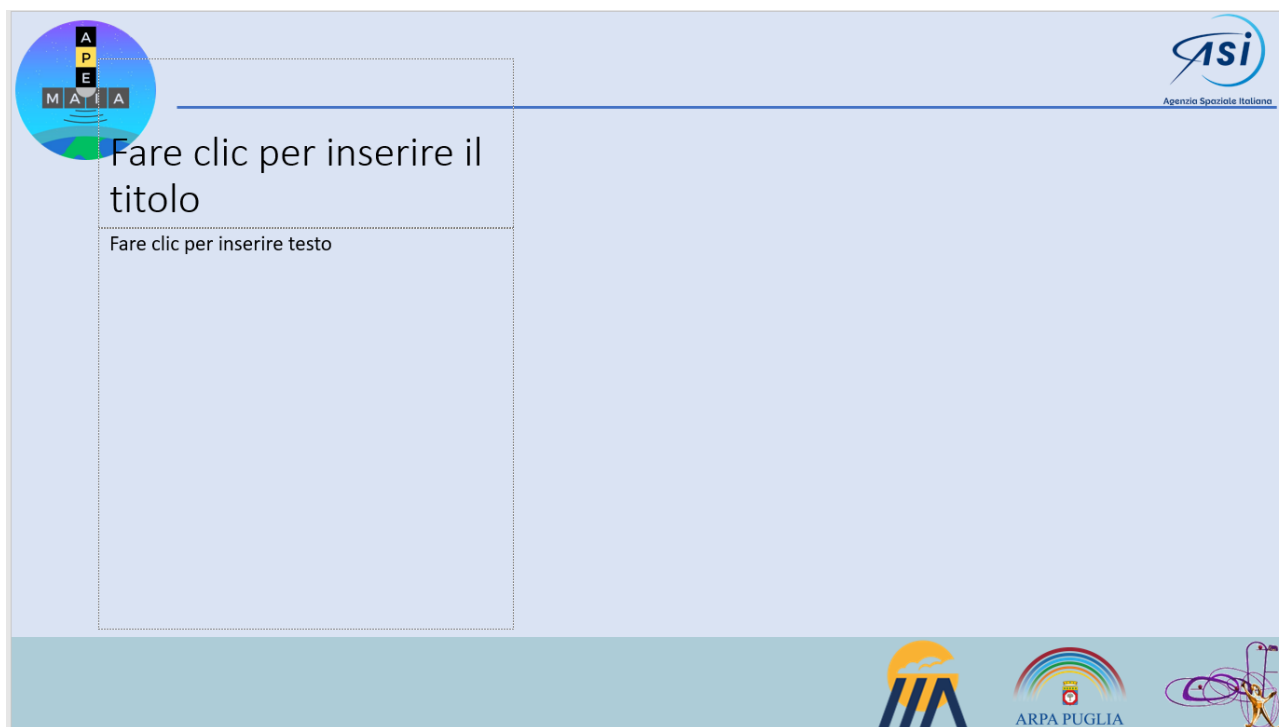


Figure 2-2: APEMAIA Presentation Template

2.2. APEMAIA Webpage and Social Media

The APEMAIA project webpage was established on the institutional website of CNR-IIA and served as a publicly accessible communication channel throughout the project. It provided general information on the project, its objectives, participating organisations and staff, as well as updates and relevant project materials.

A dedicated “Results” section was included to facilitate access to the main outputs produced during the project. This section provides links to project Deliverables, presentations, Open Access publications, the APEMAIA WebGIS portal (DEL_005), and other materials considered suitable for public sharing. The webpage therefore provided a central point of access to both general project information and the scientific and technical results generated by APEMAIA. Between 19 July 2024 and the reporting date, the APEMAIA project webpage recorded 219 page views, corresponding to 193 unique page views. These figures indicate that the project webpage has been actively accessed as a source of information on APEMAIA activities and results.

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The project webpage was complemented by the use of the CNR-IIA social media channels, which supported the dissemination of selected project activities, milestones, and results to a broader audience. Several project-related posts were published through the Institute's Facebook, X (formerly Twitter), LinkedIn, and YouTube channels, contributing to the visibility of APEMAIA beyond the scientific and technical communities directly involved in the project.

Together, the project webpage and social media channels contributed to increasing the visibility of APEMAIA and providing accessible information on its activities and results to different stakeholder groups.

2.3. Scientific Contributions

Scientific publications and contributions represented an important component of the dissemination of APEMAIA research results. Throughout the project, the scientific and technical outcomes were disseminated through peer-reviewed and scientific publications, contributions to international conferences and workshops, and institutional and technical publications. Particular attention was devoted to making the results accessible to the scientific community and to facilitating the exchange and potential reuse of the methodologies and findings developed within the project.

The scientific outputs covered several of the main research areas addressed by APEMAIA, including the use of Earth Observation data for intra-urban air-quality assessment, the estimation and spatialisation of particulate matter concentrations, the integration of satellite observations and modelling, and the application of artificial intelligence and deep-learning techniques to atmospheric monitoring.

The main scientific publications and contributions directly associated with APEMAIA include:

Peer-reviewed publications

- Fania A, Lorusso G, Cilli R, Amoroso N, Adamo M, Aquilino M, Bellantuono L, De Lucia M, Lacalamita A, La Rocca M, et al. High-Resolution NO₂, O₃, and PMs Estimation in Puglia: Leveraging AI and Explainability Techniques. *Atmosphere*. 2026; 17(2):209. <https://doi.org/10.3390/atmos17020209>
- Aquilino, M., De Lucia, M., Maggi, S., Fuina, S., Tarantino, C., Carbone, F., Pirrone, N., Bellotti, R., Monaco, A., Cilli, R., Fania, A., Pantaleo, E., Campanaro, V., Intini, F., Morabito, A., Nocioni, A., Schipa, I., Tanzarella, A., Adamo, M. (2024). Advancing Intra-Urban PM₁₀ Concentration Patterns in Bari City: Insights from the APEMAIA

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Project. IEEE International Geoscience and Remote Sensing Symposium (IGARSS 2024), pp. 1160–1163. DOI: 10.1109/IGARSS53475.2024.10641269.

Conference contributions

- Adamo, M., Aquilino, M., De Lucia, M., Fuina, S., Maggi, S., Tarantino, C., Carbone, F., Pirrone, N., Bellotti, R., Monaco, A., Cilli, R., Fania, A., Pantaleo, E., Campanaro, V., Intini, F., Morabito, A., Nocioni, A., Schipa, I., Tanzarella, A. (2024). EO data and AI techniques for measuring PM concentration and exposure at intra-urban scale: the APEMAIA Project. EGU General Assembly 2024, EGU24-19691 (oral presentation)
- Pantaleo, E., Cilli, R., Amoroso, N., Fania, A., Aquilino, M., De Lucia, M., Maggi, S., Fuina, S., Tarantino, C., Carbone, F., Pirrone, N., Campanaro, V., Intini, F., Morabito, A., Nocioni, A., Schipa, I., Tanzarella, A., Adamo, M., Monaco, A., Bellotti, R. (2024). Spatiotemporal imputation and bias correction of Sentinel-3 SYN for intraurban air quality assessment using Generative Adversarial Networks/Deep Learning. URBIS24 – ESA Urban Earth Observation Workshop (oral presentation)
- Fania A., et al., High-Resolution Air Quality estimation in the Apulia region using AI and Explainability Techniques. ESA LIVING PLANET SYMPOSIUM, 23-27 JUNE 2025, Vienna, Austria (oral presentation)
- M. De Lucia, M. Aquilino, C. Tarantino, S. Fuina, M. Picchiani, S. Zoffoli, G. Rum, A. Morabito, V. Campanaro, F. Intini, A. Nocioni, A. Monaco, A. Fania, R. Cilli, E. Pantaleo, M. Adamo. "Enhancing PM estimation through multi-platform synergies: a preparatory study for the MAIA mission". Living Planet Symposium (ESA): From Observation to Climate Action and Sustainability for Earth), 23-27 Giugno 2025, Vienna. (poster)
- Marica De Lucia, Mariella Aquilino, Cristina Tarantino, Silvana Fuina, ..., Maria Adamo. "High-resolution PM prediction at intra-urban scale: the APEMAIA project in preparation for the MAIA mission" EAC 2025 - European Aerosol Conference 2025, Lecce, Italy, 2025 (poster)
- M. Aquilino, M. De Lucia, S. Maggi, S. Fuina, C. Tarantino, F. Carbone, N. Pirrone, R. Bellotti, A. Monaco, R. Cilli, A. Fania, E. Pantaleo, V. Campanaro, F. Intini, A. Morabito, A. Nocioni, I. Schipa, A. Tanzarella, L. Angiuli, R. Primerano, M. Adamo. "Through APEMAIA's Lens: Mapping Urban Air Quality to Protect Public Health from PM Particles". GEO Global Forum 2025. 5-9 Maggio, Roma. (e-poster)
- GEO Global Forum 2025, Roma, May 8, 2025. Talk title: Machine Learning approach and Satellite Data for mapping Daily Concentration of PM: Preliminary Results of APEMAIA Project

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- Xmaths Workshop 2023, at the Department of Mathematics, University of Bari "Aldo Moro", December 20-21, 2023. Title: "APEMAIA: predizione delle concentrazioni di PM₁₀ basate su remote sensing e machine learning" (Oral presentation)

Institutional and technical publication

- Adamo, M., Aquilino, M., Pirrone, N., Monaco, A., Bellotti, R., Morabito, A., Intini, F., Schipa, I., Tanzarella, A., Campanaro, V., et al. (2024). Dati di Osservazione della Terra e tecniche di AI per la misura della concentrazione di PM e esposizione a scala intra-urbana: il progetto APEMAIA. In SNPA Report 40/2024 – La qualità dell'aria in Italia, Section 10.8.

These publications and scientific contributions provided different opportunities to present and discuss APEMAIA results with the international Earth Observation and atmospheric science communities, as well as with institutional and technical stakeholders. In addition to disseminating specific scientific findings, they contributed to increasing awareness of the potential of satellite Earth Observation and artificial intelligence techniques for air-quality monitoring and exposure assessment at the intra-urban scale.

The Consortium also shared relevant scientific outputs with the ASI Team, supporting knowledge exchange and coordination with the national MAIA-related activities. Overall, the scientific dissemination activities contributed to extending the visibility and impact of APEMAIA results beyond the project Consortium and to establishing a basis for their further scientific development and application.

2.4. Events and Conferences Participation

The dissemination of APEMAIA results to the scientific community was supported through participation in national and international scientific conferences, workshops, and other relevant scientific events. These activities provided opportunities to present the methodologies and results developed within the project, exchange knowledge with the scientific community, and receive feedback on the approaches and technologies applied to Earth Observation and atmospheric monitoring.

During the project, APEMAIA results were presented at several scientific events, including the IEEE International Geoscience and Remote Sensing Symposium (IGARSS 2024) in Athens, the EGU General Assembly 2024, the URBIS24 ESA Urban Earth Observation Workshop, and the European

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Aerosol Conference (EAC) in Lecce. These events provided opportunities to disseminate project results to specialised communities working in Earth Observation, atmospheric science, aerosol research, and air-quality monitoring.

APEMAIA also participated in the GEO Global Forum 2025, held in Rome from 5 to 9 May 2025. Two contributions were presented within the event. The participation in the GEO Global Forum provided an opportunity to present APEMAIA results within the international Earth Observation community and to highlight the potential of satellite data and Artificial Intelligence techniques for intra-urban air-quality assessment.

Further scientific dissemination activities included the presentation of APEMAIA research at the XMaths Workshop 2023, organised by the Department of Mathematics of the University of Bari, addressing the application of Machine Learning techniques to particulate matter retrieval from satellite observations. Project results were also presented and discussed in the framework of activities and meetings involving ASI and NASA/JPL related to the MAIA mission (e.g., MAIA Science Team Meeting, California Institute of Technology, 6-8 May 2024) supporting knowledge exchange with the scientific and institutional communities involved in the mission.

Moreover, during June to October 2024, Ph.D. student Marica De Lucia conducted research as a Visiting Student Researcher through the JPL Visiting Student Researcher Program (JVSRP) at NASA's Jet Propulsion Laboratory. She was assigned to Section 32 Sciences, specifically to the Earth Science 329 group, under the supervision of David Diner and Sina Hasheminassab, Ground Measurements Manager. De Lucia integrated herself into the MAIA group, attending weekly project update meetings and the final review meeting in October. During the research period, she also participated in several internal seminars, which provided networking opportunities with researchers working on the APEMAIA project. As part of this, he also presented the results of his work as part of a series of seminars involving the MAIA group and researchers from JPL's science section.

Overall, participation in these events contributed to increasing the visibility of APEMAIA, disseminating its scientific results, and fostering interaction with researchers, Earth Observation experts, atmospheric scientists, space agencies, and other stakeholders working on air-quality monitoring and particulate matter assessment.

3. Exploitation Plan

The exploitation of APEMAIA results was closely linked to the dissemination activities carried out throughout the project and focused on making the knowledge, datasets, methodologies, and products developed within the project accessible and reusable by the scientific community,

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institutional stakeholders, and potential end users. The exploitation activities supported the transfer of project results to further research, technological development, environmental monitoring, and applications addressing societal and policy needs.

The project partners represented the primary users and beneficiaries of the results and contributed to their further exploitation through research activities, scientific publications, technical contributions, and interaction with stakeholders. The availability and potential reuse of project outputs were also supported through data and software sharing, including the dissemination of datasets and processing tools through the WebGIS and GitHub/Docker environments described in the dedicated sections of this deliverable. These activities contributed to ensuring the accessibility and reproducibility of selected project outputs and to facilitating their use beyond the specific activities carried out within APEMAIA.

The main exploitation outcomes and opportunities identified based on the project results include:

- Integration of heterogeneous data sources for urban air-quality assessment. The PM products and methodologies developed within APEMAIA provide a basis for reconstructing air-quality conditions at intra-urban scale through the integration of Earth Observation data, ground-based air-quality measurements, and other contextual information. The results demonstrated the potential of combining complementary data sources to improve the spatial characterisation of particulate matter concentrations and exposure.
- Support to air-quality monitoring and modelling. The project results demonstrated the potential of satellite-based PM products to complement information provided by conventional air-quality monitoring stations and chemical transport models (CTMs). The high spatial detail achievable through the APEMAIA approach may also support the identification of local-scale patterns that are not adequately represented by conventional monitoring networks, while providing additional information that can be used to assess and improve the spatial representation of emissions and atmospheric processes in modelling frameworks.
- Contribution to exposure and health-related research. The spatially resolved PM products generated within APEMAIA provide a valuable basis for subsequent studies on population exposure and environmental health. In particular, the project results can support the integration of air-pollution information with population and health-related datasets within research infrastructures and initiatives addressing the exposome and the relationship between environmental exposures and health outcomes.
- Assessment of Nature-Based Solutions. The APEMAIA products provide a potential basis for investigating the relationship between urban green infrastructure and particulate matter concentrations and exposure. Their spatial detail can support future assessments of the effectiveness of Nature-Based Solutions (NBS) aimed at mitigating air pollution in urban environments.
- Further exploitation of Artificial Intelligence and Machine Learning approaches. The Machine Learning methodologies developed and tested within the project constitute a transferable component of the APEMAIA results. Their application can be extended to other datasets,

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geographical areas, and environmental-health research questions, including studies investigating the relationships between long-term exposure to particulate matter and health outcomes.

An important element supporting the exploitation of the project results was the implementation of the WebGIS, developed within WP1103. The platform provides an accessible environment for the consultation, visualisation, and dissemination of selected APEMAIA datasets and products, thereby facilitating their use by researchers, institutions, and other interested stakeholders. The availability of the project datasets through the WebGIS, together with the sharing of relevant software and processing resources through GitHub/Docker, contributes to the longer-term accessibility and potential reuse of the project outputs.

The exploitation activities therefore established a basis for the continuation and further application of APEMAIA results beyond the project period, particularly in the fields of Earth Observation-based air-quality monitoring, intra-urban exposure assessment, environmental health, and AI-supported atmospheric data analysis.

3.1. WebGIS

The APEMAIA WebGIS platform (<https://webgis-iti-am-bari.cloud.ba.infn.it/#/>) was developed to provide open access to the products generated within the project (PM concentration maps, exposure estimates, and ancillary datasets), allowing users to visualise and consult the results through a web-based mapping interface. The platform is linked from the project website and is intended to remain accessible for consultation beyond the end of the project. See Deliverable DEL_005 for further details.

3.2. Sharing of Algorithms via GitHub and Docker

To foster the reuse and reproducibility of the methodologies developed within APEMAIA, the algorithms and processing chains for PM retrieval and exposure assessment were shared through a public GitHub repository (<https://github.com/APEMAIAproject/src>), complemented by a Docker containerised environment enabling their execution independently of the local software configuration. See Deliverable SW010 documentation for further details.

4. Final Summary and Lessons Learned

This final section provides an overall assessment of the dissemination and exploitation activities carried out throughout the APEMAIA project. For each of the dissemination and exploitation channels identified in the initial Dissemination and Exploitation Plan (DEP), the activities

implemented and the main results achieved are summarised, highlighting their contribution to increasing the visibility, accessibility, and potential reuse of the project results.

The section also assesses the extent to which the objectives initially identified in the DEP were achieved and highlights the main lessons learned from the implementation of the dissemination and exploitation activities. These lessons provide useful insights for the planning and implementation of future projects addressing Earth Observation, air-quality monitoring, and the development and uptake of innovative environmental information products.

Channel	Planned (preliminary DEP)	Achieved
Visual identity	Logo design and use on all materials	Yes
Website	Project page on CNR-IIA website	Yes
WebGIS	Public access to project products	<i>The WebGIS platform was implemented and configured to be ready for public use and dissemination of the project products (see DEL_005 for further details). However, the platform was not populated with the final APEMAIA products during the project period. The project outputs were instead delivered to ASI through the project reporting and deliverable framework, ensuring their formal availability to the project funding agency.</i>
GitHub / Docker	Open sharing of algorithms and models	Yes (see SW010 documentation)
Scientific publications	At least one peer-reviewed paper per partner	<i>The objective was partially achieved. During the project, one Open Access journal publication and one peer-reviewed conference paper were produced, contributing to the dissemination of APEMAIA results within the scientific community. An additional scientific paper is currently being prepared for submission, providing a further opportunity for the dissemination and peer-reviewed publication of the project results.</i>



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Conferences and events	IGARSS, GEO Week, XMaths Workshop, ASI/JPL meetings	Yes
Other publications	Reports, popular articles, press material	Yes
Social media	Facebook, Twitter/X, LinkedIn, YouTube	Yes