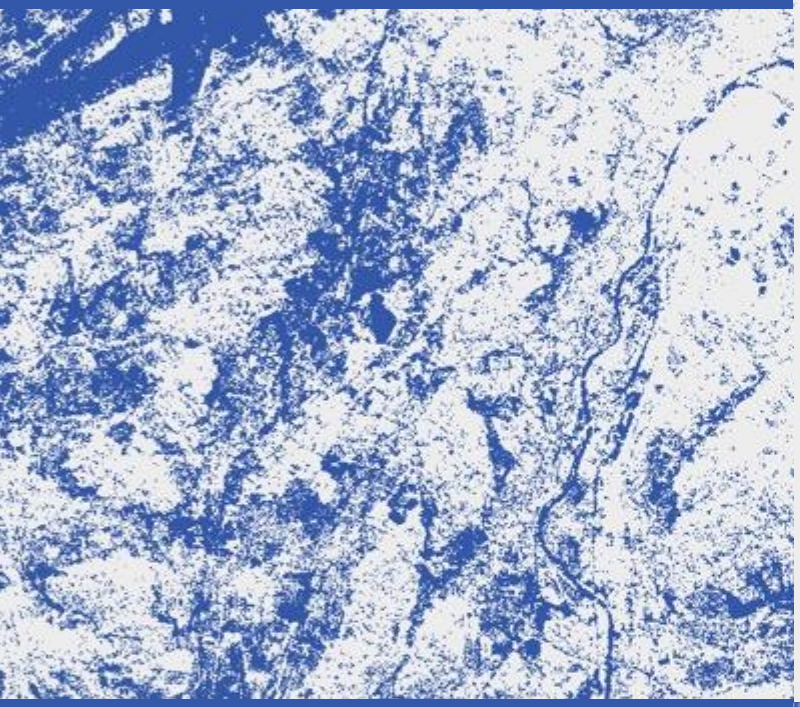
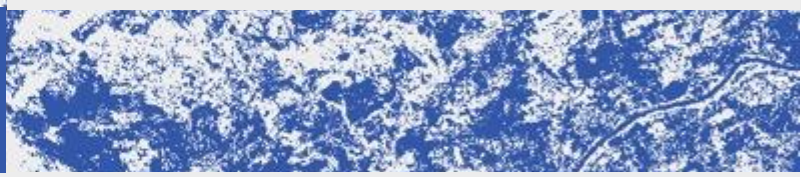


Earth Observation & Weather Data Federation with AI Embeddings



D5.2

Dissemination, Communication Report and Exploitation Mid-Term Report

Revision: v 1.0

D5.2 – Dissemination, Communication Report and Exploitation Mid-Term Report

Work package	WP 5
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Authors	Valentin Popescu (MARTEL)
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Abstract	This Embed2Scale mid-term report highlights the outreach, community building, and scientific dissemination, supporting project visibility and early exploitation.
Keywords	Communication, dissemination, social media, outreach, KPIs, exploitation, synergies

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Nature of the deliverable:	R	
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PU	Public, fully open, e.g. web (Deliverables flagged as public will be automatically published in CORDIS project's page)	**x**
SEN	Sensitive, limited under the conditions of the Grant Agreement	
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* *R: Document, report (excluding the periodic and final reports)*
DEM: Demonstrator, pilot, prototype, plan designs
DEC: Websites, patents filing, press & media actions, videos, etc.
DATA: Data sets, microdata, etc.
DMP: Data management plan
ETHICS: Deliverables related to ethics issues.
SECURITY: Deliverables related to security issues
OTHER: Software, technical diagram, algorithms, models, etc.

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EXECUTIVE SUMMARY

This mid-term report provides an overview of the dissemination, communication, and exploitation activities carried out within the Embed2Scale project during its first 18 months.

In the first reporting period, the project successfully established its communication foundations, including the launch of its website, social media channels, and introductory promotional materials. Embed2Scale's visual identity has been consistently applied across these channels, contributing to a clear and recognisable brand presence.

Online outreach has been a core focus, with the project website exceeding its annual KPI target for unique visitors and social media, particularly LinkedIn, emerging as an effective tool for engaging stakeholders. Two newsletters have been released, a comprehensive project video produced, and regular news articles published, ensuring continuous visibility of project milestones, scientific progress, and event participation.

The consortium partners actively participated in key scientific events (EGU General Assembly 2025, ESA-NASA Workshop, IGARSS 2024, EcoHackathon, SatSummit 2024, CVPR Earth Vision and ESA Living Planet Symposium), using these platforms to disseminate early results, engage with the scientific community, and raise awareness of its AI-powered EO data compression innovations. Scientific dissemination has been robust, with four peer-reviewed publications achieved by M18, contributing to the project's credibility and academic visibility.

Community building and stakeholder engagement (including the participation of the board at the general assembly meetings of the project) have been advanced through liaisons with complementary Horizon Europe projects such as ESiWACE3, NextGEMS, and CleanCloud. These collaborations supported benchmarking development, facilitated knowledge exchange, and enhanced the scientific relevance of Embed2Scale's AI-driven methodologies.

In parallel with communication and dissemination, the project has already delivered concrete exploitation outputs during the first 18 months and several partners initiated exploitation roadmaps, while the Earth2Vec community initiative and initial work on openEO and STAC standardisation ensure uptake beyond the consortium. These results demonstrate that exploitation activities are underway, providing an early foundation for sustainability and impact.

Embed2Scale's dissemination, communication, and exploitation activities are progressing effectively, with solid results achieved in visibility, stakeholder engagement, and scientific dissemination. The project enters its second phase with a strong foundation to build upon and clear next steps to amplify its impact across the EO and AI communities.

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ABBREVIATIONS

AI	Artificial Intelligence
API	Application Programming Interface
DLR	German Aerospace Center (Deutsches Zentrum für Luft- und Raumfahrt)
EO	Earth Observation
ESA	European Space Agency
EU	European Union
HPC	High-Performance Computing
KPI	Key Performance Indicator
R&I	Research and Innovation
SERI	Swiss State Secretariat for Education, Research and Innovation
UKRI	United Kingdom Research and Innovation
UX	User Experience
WP	Work Package

1 INTRODUCTION

1.1 PURPOSE OF THE DOCUMENT

This mid-term report (D5.2) serves as a comprehensive update on the dissemination, communication, and exploitation activities carried out within the Embed2Scale project from M01 to M18. Building upon the foundations laid in Deliverable D5.1 – Dissemination & Communication Strategy and Plan – this report evaluates the progress made towards enhancing the project's visibility, engaging key stakeholders, and creating early pathways for impact and uptake. It provides an evidence-based assessment of the strategy's implementation, outlines key achievements, and reflects on lessons learned during the first half of the project lifecycle.

Furthermore, this document identifies how dissemination and communication tools – both online and offline – have been deployed to promote project results and stimulate collaboration within the Earth Observation (EO), Artificial Intelligence (AI), and High-Performance Computing (HPC) communities. It also initiates the tracking of exploitation opportunities, reporting on early actions to identify, refine, and prepare project outputs for long-term sustainability and adoption beyond the project's duration. Finally, this deliverable supports internal coordination across partners and acts as a key input for project reviewers, the European Commission, and other stakeholders assessing the Embed2Scale project's impact and outreach performance.

1.2 STRUCTURE OF THE DOCUMENT

This report is structured to provide an overview of the communication and outreach efforts carried out during the first 18 months of the project. The document follows the flow of the project's communication and exploitation activities as laid out in D5.1 (Dissemination & Communication Strategy and Plan) and is organised into the following sections:

- Section 1 – Introduction: Provides the purpose, scope, and relationship to the initial strategy document (D5.1), establishing the foundation for the report.
- Section 2 – Progress on communication and dissemination strategy: Summarises the main communication objectives and the phased implementation approach, outlining key milestones and achievements to date.
- Section 3 – Online communication and dissemination Activities: Details web-based efforts, including website performance, social media presence, newsletter output, and video production and engagement metrics.
- Section 4 – Offline communication and dissemination activities: Highlights participation in scientific conferences and events, production of promotional materials, and contributions to academic dissemination through peer-reviewed publications.
- Section 5 – Exploitation progress and early strategies: Describes the identification of initial exploitable results, standardisation actions, open source engagement, and preliminary steps toward long-term sustainability.
- Section 6 – Synergies and collaborations: Outlines collaboration efforts with aligned Horizon Europe projects and related initiatives to maximise impact, interoperability, and knowledge exchange.
- Section 7 – KPIs and impact assessment: Provides a KPI-by-KPI analysis of progress made thus far.
- Section 8 – Conclusions and next Steps: Concludes the report by outlining the actions needed to reinforce communication impact and prepare for the final phase of the project.

1.3 RELATION TO D5.1 DISSEMINATION & COMMUNICATION STRATEGY AND PLAN

This mid-term report builds directly on the foundation established in Deliverable D5.1 – *Dissemination & Communication Strategy and Plan*. D5.1 outlined the overarching strategic framework, defining the project's communication objectives, key messages, target audiences, selected channels, and a phased roadmap for implementation. It served as the blueprint for all outreach, visibility, and stakeholder engagement activities during the first half of the Embed2Scale project.

Deliverable D5.2 now assesses how effectively that strategy has been put into action. It translates the planned activities into concrete outputs and outcomes, evaluating their reach, engagement levels, and alignment with project goals. Where appropriate, it highlights adaptations made in response to emerging opportunities, stakeholder feedback, or evolving project dynamics, while remaining within the strategic parameters set in D5.1.

This report also begins to bridge the gap between communication/dissemination and exploitation, as outlined in D5.1's long-term vision. It provides early insights into how awareness-raising efforts are supporting uptake potential and how the strategy is maturing towards sustainability and impact creation in the later project stages. By maintaining continuity with D5.1, this deliverable ensures consistency in narrative, metrics, and strategic intent while providing an honest assessment of execution to date.

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2 PROGRESS ON COMMUNICATION AND DISSEMINATION STRATEGY

2.1 SUMMARY OF COMMUNICATION OBJECTIVES

The communication objectives of the Embed2Scale project are designed to ensure that its progress and results are effectively shared with key stakeholders and the wider public, while also fostering community engagement and supporting future exploitation. These objectives were originally outlined in Deliverable D5.1 and remain the guiding pillars of all communication and dissemination activities. At their core, the objectives aim to maximise the visibility of the project's technological innovation in Earth Observation (EO) data processing using AI compressors, High-Performance Computing (HPC), and decentralised architectures. Communication activities are thus structured around five strategic priorities:

1. **Raise awareness:** Build recognition of Embed2Scale across target communities, including EO data providers and users, the AI and HPC research communities, and European policy stakeholders. This involves consistent branding, the development of an online presence, and tailored messaging across channels.
2. **Promote results and use cases:** Share project achievements, technical outputs, and use cases in an accessible and engaging manner. This includes showcasing intermediate results, success stories, and demonstrators to highlight real-world applications.
3. **Engage stakeholders:** Facilitate dialogue with key stakeholders such as industry actors, policy makers, standardisation bodies, and the scientific community. Engagement activities include workshops, webinars, event participation, and targeted outreach to foster collaboration and feedback.
4. **Support exploitation and sustainability:** Position Embed2Scale for long-term impact by promoting exploitable results and aligning communication with exploitation planning. This includes highlighting potential applications and market relevance.

These objectives are operationalised through a phased implementation strategy and monitored through KPIs, both of which are addressed in the subsequent sections.

2.2 IMPLEMENTATION PHASES AND ACHIEVEMENTS

The communication and dissemination activities of Embed2Scale have been structured around a phased implementation plan, as defined in Deliverable D5.1. This phased approach allows for targeted outreach aligned with the project's lifecycle, ensuring that each stage builds momentum toward awareness, engagement, and sustainable impact. The strategy is divided into three distinct but overlapping phases:

Phase 1 – Awareness creation and communication foundation (M01–M08)

This initial phase focused on laying the groundwork for all outreach activities. Key milestones included:

- The development and launch of the project's visual identity, including logo, color palette, and templates.
- The creation of the project web presence (www.embed2scale.eu).
- The establishment of the project's social media channels on LinkedIn, Bluesky, X, and YouTube.
- The publication and wide dissemination of the project's first press release.

- Initial promotional materials (flyers, banners) and participation in early events to announce the project.
- Production of an introductory video

Phase 2 – Community building and initial results dissemination (M09–M24)

Currently ongoing, this phase emphasises engagement with key stakeholders and dissemination of initial technical results. Achievements to date include:

- Regular activity and audience growth on social media channels, with curated content highlighting use cases, events, and EO innovation.
- Updates to the project website, including news sections and expanded information on the project's scope and progress.
- The setup of a subscription-based newsletter
- Participation in events
- Initiation of scientific publication planning and early contributions to peer-reviewed venues.
- Organisation of targeted webinars and stakeholder discussions in collaboration with Horizon Europe and related initiatives.

Phase 3 – Global outreach and sustainable impact (M25–M36)

This upcoming phase will focus on maximising the reach of project results, fostering uptake, and preparing for sustainability beyond the project's duration. Planned actions include:

- Extensive dissemination of open access results via the website, Zenodo, and scientific portals.
- Participation in high-visibility events
- Organisation of the webinars to summarise results and stimulate further exploitation.
- Strengthened collaborations with Copernicus, OGC, Destination Earth, and other related initiatives.

3 ONLINE COMMUNICATION AND DISSEMINATION ACTIVITIES

3.1 WEBSITE ANALYTICS AND UPDATES

The Embed2Scale website (www.embed2scale.eu) serves as the project's primary digital hub, offering up-to-date information on project activities, objectives, deliverables, publications, and events. Since its launch in January 2024, the website has been steadily growing in visibility and engagement, playing a key role in both awareness creation and stakeholder engagement.

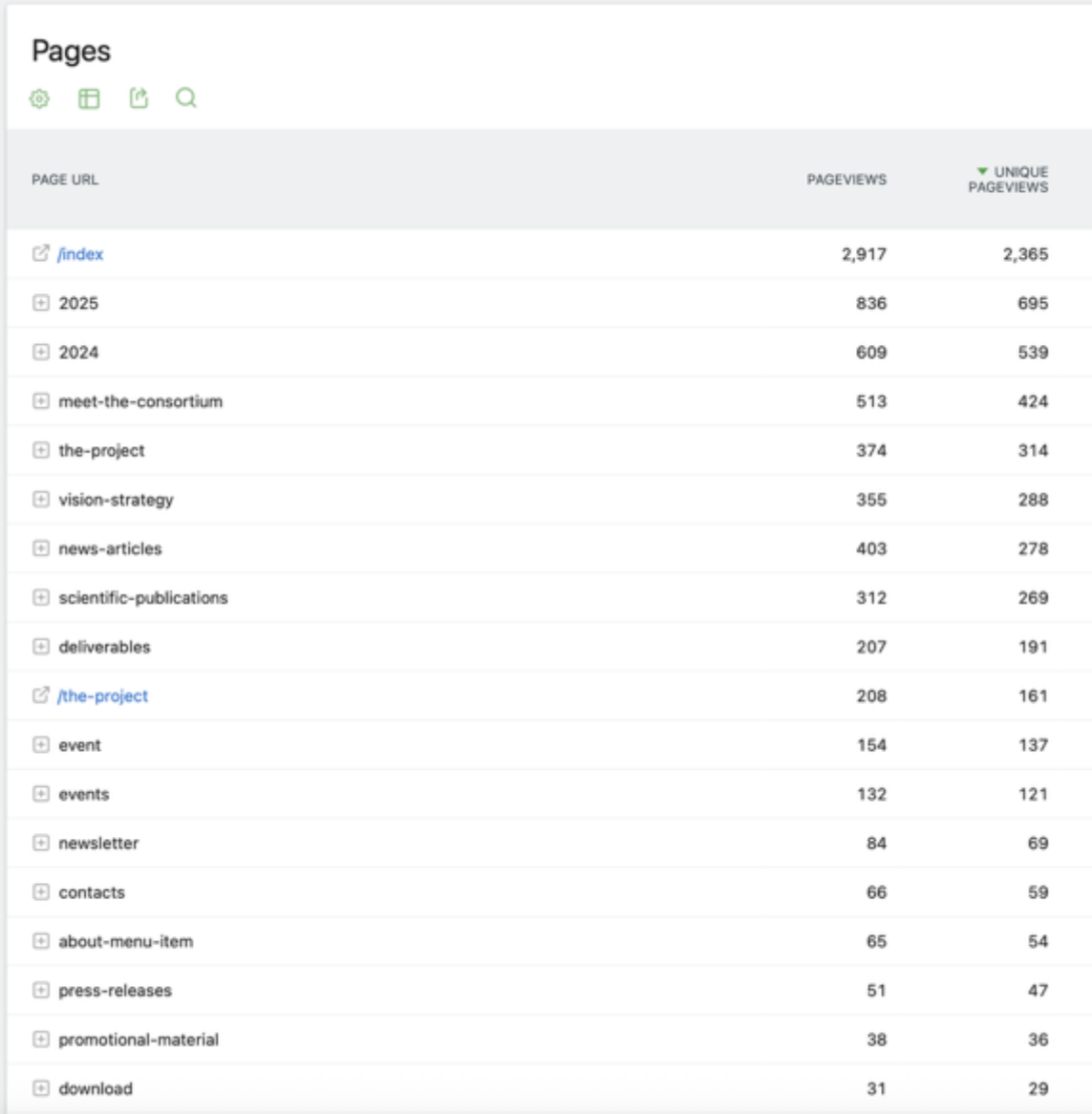
Performance and traffic overview
Between January 2024 and June 2025, the website recorded a total of 3,728 visits, of which approximately 2,960 were unique visitors. This translates to an average of ~170 unique visitors per month, projecting well over 2,000 unique visitors annually, surpassing the project's KPI target of >1,500 unique visitors per year. Monthly traffic grew consistently over time, with notable spikes in March (389 unique visitors), April (336), and May 2025 (269).

Figure 1: Embed2Scale website traffic overview

User behaviour and engagement
Website users recorded 7,664 total pageviews (6,333 unique), with an average session duration of 2 minutes and 2 seconds. Each visit resulted in 2.4 actions on average, reflecting a moderate level of engagement. While the bounce rate stands at 59%, this is within the expected range for informational project websites with clearly defined content pathways.

The most visited pages include:

- Homepage (/index) – 2,906 views
- Project updates (2024/2025 project highlights) – 1,438 combined views
- Meet the Consortium – 511 views
- Vision & Strategy – 355 views
- Scientific Publications – 311 views
- Deliverables and news sections – 400+ combined views



Pages

PAGE URL	PAGEVIEWS	UNIQUE PAGEVIEWS
/index	2,917	2,365
2025	836	695
2024	609	539
meet-the-consortium	513	424
the-project	374	314
vision-strategy	355	288
news-articles	403	278
scientific-publications	312	269
deliverables	207	191
/the-project	208	161
event	154	137
events	132	121
newsletter	84	69
contacts	66	59
about-menu-item	65	54
press-releases	51	47
promotional-material	38	36
download	31	29

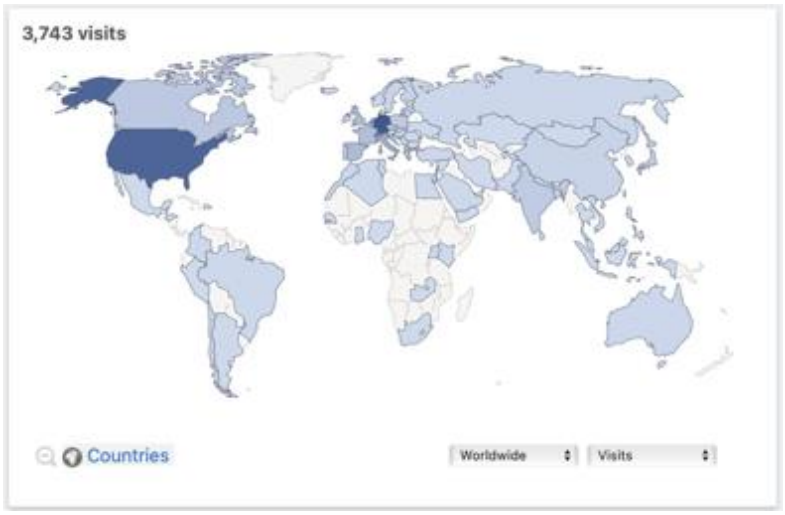
Figure 2: Embed2Scale website - most visited pages

These figures highlight the interest of visitors in both the project's background and its scientific/technical outputs.

Audience origin and acquisition channels

Visitors accessed the website from 84 distinct countries, with top locations including:

- Germany (673 visits)
- United States (598)
- Switzerland (417)
- Netherlands (306)
- Italy, Spain, and the UK also feature prominently



Country

COUNTRY	VISITS
Germany	675
United States	602
Switzerland	420
Netherlands	307
Italy	217
Spain	152
United Kingdom	142
Greece	135
France	133
Canada	83
Poland	70
India	69
Czechia	66
Japan	54
Austria	48
Ireland	44

Figure 3: Visits by country to the website

In terms of acquisition:

- 54% of visits were direct, indicating that Embed2Scale has established a recognisable brand presence.
- 26% of visits came from search engines, demonstrating successful indexing and relevance of the site's content.
- 13% of visits were referred from social media, reflecting active channel integration.

Additional referrals came from 37 external websites and 10 search engines, suggesting growing external recognition.

Content development and updates

Throughout the first 18 months, the website evolved from a landing page to a full-featured portal. Updates included:

- Dedicated sections for News & Events, Deliverables, and Publications
- Integration of press releases, partner highlights, and event recaps
- Launch of a newsletter subscription feature, already contributing to email-based engagement

Moving forward, the website will continue to be updated regularly with project outcomes, open-access resources, and final event information. It will also serve as a repository for public deliverables and scientific outputs, ensuring transparency, visibility, and long-term access beyond the project's lifecycle.

News and articles published on the website

This section of the Embed2Scale website has been a key component of the project's communication efforts, functioning as a dynamic space to share updates, scientific contributions, partner highlights, and event participation. It reflects the breadth of activity across the consortium and serves as an archive of progress, media engagement, and stakeholder relevance.

Between April 2024 and June 2025, a total of 28 articles were published, spanning news, partner features, event recaps, and scientific announcements. These articles significantly contributed to driving traffic to the website and improving stakeholder awareness of the project's scope and impact.

The articles can be categorised into four thematic clusters:

- **Event participation and conference visibility.** These updates ensured real-time coverage of Embed2Scale's presence at major scientific and policy forums:
  - "Embed2Scale to present Maritime Awareness Use Case at ESA's Living Planet Symposium 2025" (June 2025)
  - "Embed2Scale at SatSummit 2024" (Nov 2024)
  - "Research presented at EGU 2024 and 2025" (April 2024 – March 2025)
  - "Embed2Scale at ESA-NASA Workshop on Foundation Models" (Jan–May 2025)
  - "Embed2Scale at AI + Environment EcoHackathon" (May 2024)

- **Scientific results and research highlights.** A series of posts focused on breakthroughs in AI-based compression, foundation models, and EO analytics:
  - "Enhancing Biomass Mapping with Super-Resolution powered by Sentinel-1/2" (April 2025)
  - "Lossy Neural Compression for Geospatial Analytics to be Published in IEEE GRSM" (March 2025)
  - "Update: CVPR EarthVision Data Challenge" (April 2025)
  - "Multi-Spectral Remote Sensing Image Retrieval Using Geospatial Foundation Models" (April 2024)

- **Partner features.** A dedicated series highlighted the unique role and expertise of each consortium member:
  - IBM, DLR, SATCEN, Sinergise, Hisdesat, Forschungszentrum Jülich, University of Zurich, and Martel Innovate all received dedicated feature articles between June and September 2024.

- **General project updates and milestones.** Key milestones were communicated clearly and visually through the news stream:
  - "Introductory video now live" (October 2024)
  - "Embed2Scale Consortium Gathers in Oxford" (February 2025)
  - "Session proposal merges with broader EGU 2025 track" (March 2025)
  - "Earth2Vec Xchange Session Launch" (May 2025)

3.2 SOCIAL MEDIA ACTIVITIES

Social media engagement has played a central role in Embed2Scale's communication strategy, enabling the project to build an active community, disseminate content in real time, and reach diverse stakeholder groups. Throughout the first 18 months, Embed2Scale maintained a presence on LinkedIn, X (formerly Twitter), and Bluesky. Although Mastodon was initially foreseen, the consortium opted for Bluesky as an alternative decentralised platform.

Platform overview and KPI performance

The project's initial KPIs targeted a minimum of 250 followers on X and Mastodon, and at least 150 on LinkedIn. Actual performance to date has exceeded expectations:

- LinkedIn: 665 followers (well above the 150 target)
- X (Twitter): 49 followers (below target, but showing steady growth)
- Bluesky: 18 followers (pilot engagement channel)

Figure 4: Social media channel performance

While LinkedIn emerged as the most effective platform for professional engagement and visibility, Bluesky and X remain useful for live updates and interactions with the broader research communities.

Activity and engagement

According to Hootsuite analytics (Jan 2024 – June 2025):

- 105 posts were published across platforms
- These generated 54,084 post impressions, indicating high visibility
- The posts received 1,318 reactions/likes and were shared 131 times
- Video content had 2,405 views across posts
- The average engagement rate was an impressive 11.97%, well above industry benchmarks for research and innovation projects

Figure 5: Engagement rates and video views on social media

This demonstrates not only consistent publishing activity, but also high-quality content that resonated with the audience. Engagement included reactions, shares, post comments, and click-throughs to external links (especially the project website and publication pages).

Content themes and strategy

The editorial strategy was designed around:

- Project updates and milestones (e.g., launch, workshops, scientific results)
- Partner features (highlighting roles, publications, and events attended)
- Event visibility (e.g., posting from events)
- Explainer content (video interviews with the project partners)
- Calls to action (newsletter subscription, website visits, feedback surveys)

Next steps

In the second half of the project, Embed2Scale will:

- Continue leveraging LinkedIn as the core platform for professional engagement
- Expand the use of short videos and visuals, given their performance in engagement metrics
- Consider boosted posts and collaborative content with EU-funded projects in the same cluster

3.3 NEWSLETTER

The Embed2Scale newsletter is one of the tools used to maintain regular contact with stakeholders, inform the broader community of project progress, and drive traffic to the website and social media channels. Aligned with the project's overall communication strategy, the newsletter is intended to be concise, visually engaging, and informative, featuring news, highlights from partners, upcoming events, and recent results.

Implementation and KPI tracking

The project's communication plan set a Key Performance Indicator (KPI) of 8 newsletters over the project duration. As of Month 18, Embed2Scale has successfully delivered two editions, with further issues scheduled bi-annually moving forward to meet the target.

Newsletter #1 – December 2024

- Sent: 17 December 2024
- Open rate: 10%
- Click-through rate: 10%
- Content: Project launch highlights, partner spotlight, website launch, and announcement of first publications.

Newsletter #2 – April 2025

- Sent: 8 April 2025
- Open rate: 15%
- Click-through rate: 15%
- Content: Recap of EGU 2024 participation, new deliverables published, scientific publication previews, and updated event calendar.

All newsletters are published on the project website, are compliant with GDPR and include clear unsubscribe options, with audience consent captured during subscription.

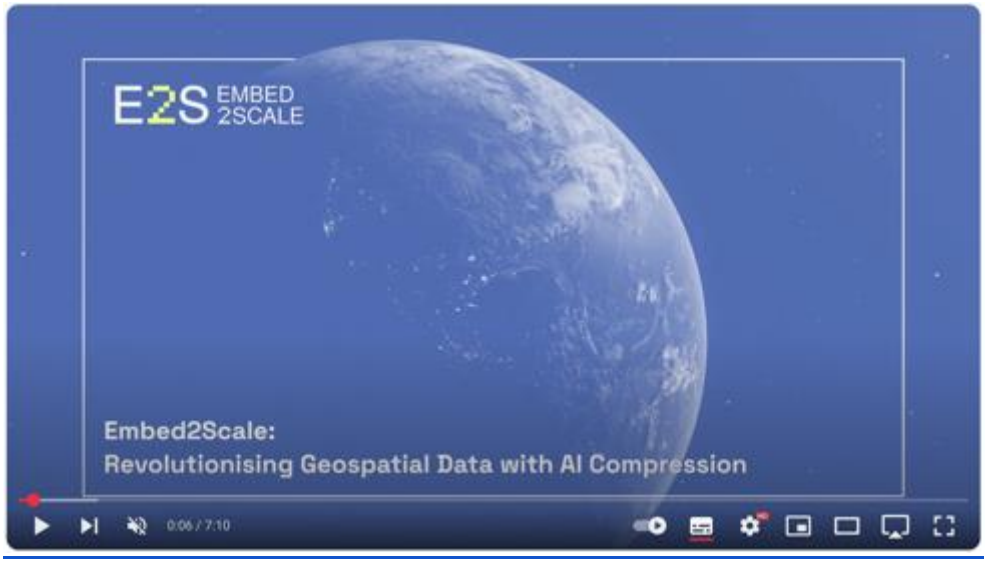
3.4 VIDEO PRODUCTION AND ENGAGEMENT

Video content has been an integral part of Embed2Scale's communication strategy, offering an engaging, accessible, and visually compelling way to introduce the project and highlight its innovative contributions to the field of Earth Observation (EO). As of Month 18, the project has produced and shared a comprehensive **introductory video** alongside several **highlight clips** tailored for social media engagement.

Overview of video content

The main **introductory video**, hosted on YouTube and promoted across LinkedIn and X, provides a high-level overview of the project's mission, technological innovations, and relevance to various sectors. It communicates complex topics such as AI-powered data compression, federated learning, and scalable Earth Observation processing in a concise and visually clear format.

Full video: https://www.youtube.com/watch?v=Vahgl08DFZc



The video showcases how Embed2Scale enables faster, more sustainable insights into domains such as:

- Climate monitoring
- Agriculture
- Maritime awareness
- Biodiversity and environmental analytics

Social media integration and teasers

To maximise reach and engagement, the video was broken down into a series of **highlight snippets**, each featuring a key partner or thematic insight. These clips were strategically distributed on LinkedIn, where the platform's algorithm favours native video content and expert commentary. The following teaser clips were published:

- **Philip Stier** (University of Oxford): On the project's role in shaping the future of EO through AI-driven atmospheric data processing
- **Matej Batič** (Sinergise): On democratising access to EO data and making geospatial intelligence more actionable
- **Thomas Brunschwiler** (IBM Research): On the technical backbone of Embed2Scale and its data compression innovations

Each snippet was shared with contextual copy, a direct link to the full video, and hashtags to increase discoverability. These efforts contributed to sustained visibility and enriched stakeholder engagement across professional networks.

Impact and reach

According to Hootsuite and Youtube analytics:

- Total **video views**: **2,405**, across platforms
- On Youtube, the full video has 293 views
- The **average post engagement rate** for video-related content was consistently above **12%**, outperforming static posts
- The videos received **numerous reactions, shares, and comments**, reinforcing their role in driving community interaction

All video assets are available on the Embed2Scale website and YouTube channel, ensuring long-term accessibility and reusability.

4 OFFLINE COMMUNICATION AND DISSEMINATION ACTIVITIES

4.1 EVENTS AND CONFERENCES ATTENDED

Active participation in scientific conferences and innovation-focused events has played a key role in raising awareness about Embed2Scale and its novel approach to geospatial data compression. These activities not only supported the project's dissemination objectives but also facilitated engagement with diverse stakeholder groups, ranging from academic researchers to EO industry leaders and policy stakeholders. Below is a summary of the most relevant events attended by consortium members during the reporting period.

EGU General Assembly 2025

- Date & location: 27 April – 2 May 2025, Vienna & online
- Partners involved: IBM, DLR, FZJ
- Target audience: Research communities in geoscience, climate, and remote sensing
- Contribution: The Embed2Scale consortium had a strong presence at the EGU General Assembly 2025, one of Europe's premier geoscientific conferences. Four scientific contributions were accepted for presentation, showcasing the project's leadership in applying foundation models and embedding-based compression to satellite data. These presentations underscored the project's alignment with the EO research community's drive toward more efficient, scalable, and AI-integrated data infrastructures.
- The accepted contributions included:
    - **A Practical Guide to Hyperspectral Foundation Models** by Conrad M. Albrecht et al. – providing insight into how hyperspectral EO data can benefit from foundation model approaches.
    - **Earth Observation Embeddings at the Test: A Novel Benchmark to Evaluate (Neural) Compression for Satellite Imagery** by Rikard Vinge et al. – introducing a benchmarking methodology to assess neural embedding performance.
    - **Neural Embedding Compression for Earth Observation Data – an Ablation Study** by Amelie Koch et al. – analysing different configurations and trade-offs in embedding-based EO data compression.
    - **Scalable Efficient Compression in Large-Scale Earth Observation** by Erik Scheurer et al. – discussing large-scale deployment of efficient compression architectures within federated EO infrastructures.

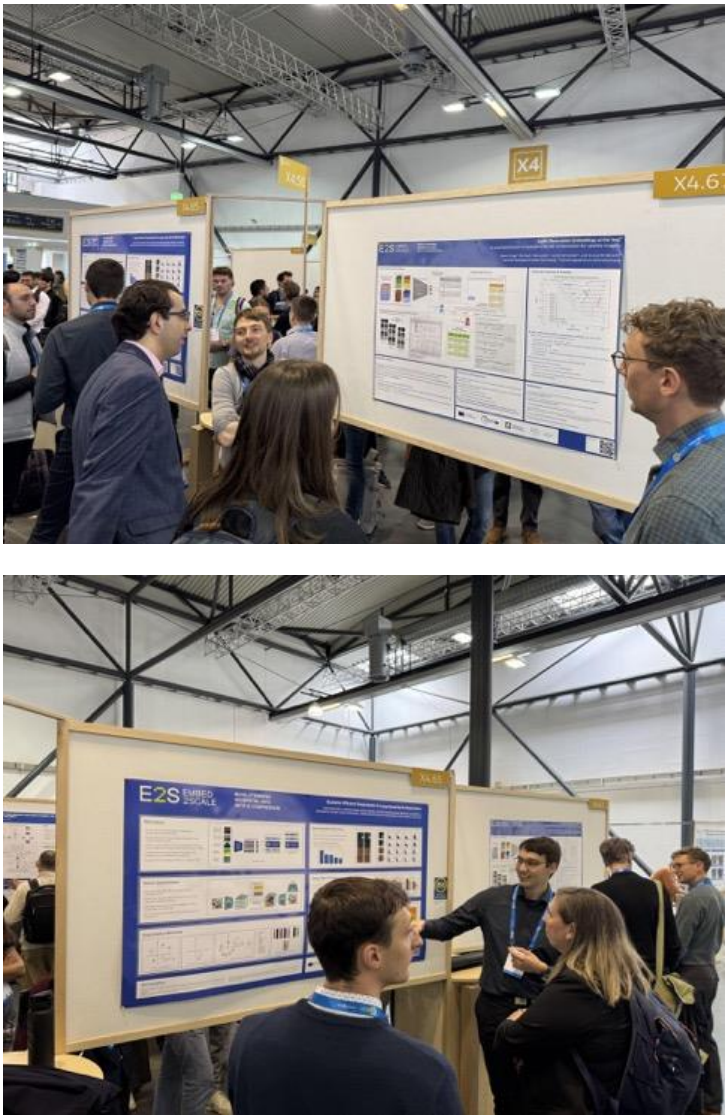


Figure 6: Embed2Scale poster session at EGU General Assembly 2025

EcoHackathon – AI + Environment

- Date & location: May 2024, ETH AI Center, Zurich & remote
- Partner involved: IBM (Carlos Gomes, Thomas Brunschwiler)
- Target audience: Research communities, innovators, and biodiversity monitoring stakeholders
- Activity: Embed2Scale was represented at the AI + Environment EcoHackathon, which focused on data-driven innovations for biodiversity and environmental monitoring. Participation allowed for direct interaction with grassroots innovators and highlighted the relevance of AI compression techniques for conservation use cases.

IGARSS 2024 – IEEE Geoscience and Remote Sensing Symposium

- Date & location: 7–12 July 2024, Athens, Greece
- Partners involved: IBM, DLR, FZJ
- Target audience: EO community, climate monitoring experts, ESA, EU-funded projects, industry, investors

- Activity: Embed2Scale was showcased through multiple contributions:
  - Session co-chairing: Gabriele Cavallaro (FZJ) co-chaired a session on scalable ML on HPC infrastructure
- Papers presented:
  - Neural Embedding Compression for EO Data by IBM
  - Task-Specific Pretraining with Noisy Labels for RS Image Segmentation by DLR
  - Multi-Label Guided Soft Contrastive Learning by DLR

SatSummit 2024

1. Date & location: 18–19 November 2024, Lisbon, Portugal
2. Partner involved: IBM
3. Target audience: Executive-level stakeholders in the EO sector
4. Activity: Embed2Scale was featured as part of a high-level session on the future of Earth Observation, focusing on the project's embedding-driven approach to data compression and its potential to accelerate applications in agriculture, maritime surveillance, and climate action.

Figure 7: Embed2Scale partners at SatSummit 2024

ESA–NASA International Workshop on AI Foundation Models for Earth Observation

- Date & location: 5–7 May 2025, ESA-ESRIN, Frascati, Italy
- Partners involved: DLR, IBM
- Target audience: Scientific and institutional EO stakeholders, including ESA and NASA research communities
- Contribution: Embed2Scale had strong visibility at this high-level international workshop. Two dedicated sessions were delivered:
  - "Embed2Scale: Transforming Earth Observation through AI-Driven Data Compression and Collaboration", presented by Nassim Ait Ali Braham (DLR), which outlined the project's mission, methodology, and early results.

- "Earth2Vec Xchange: Embeddings for Earth Observation – Kick-Off Meeting", led by Isabelle Wittmann and Thomas Brunschwiler (IBM Research) together with Conrad Albrecht (DLR), marked the launch of a new initiative to build a community around embedding models in Earth Observation.

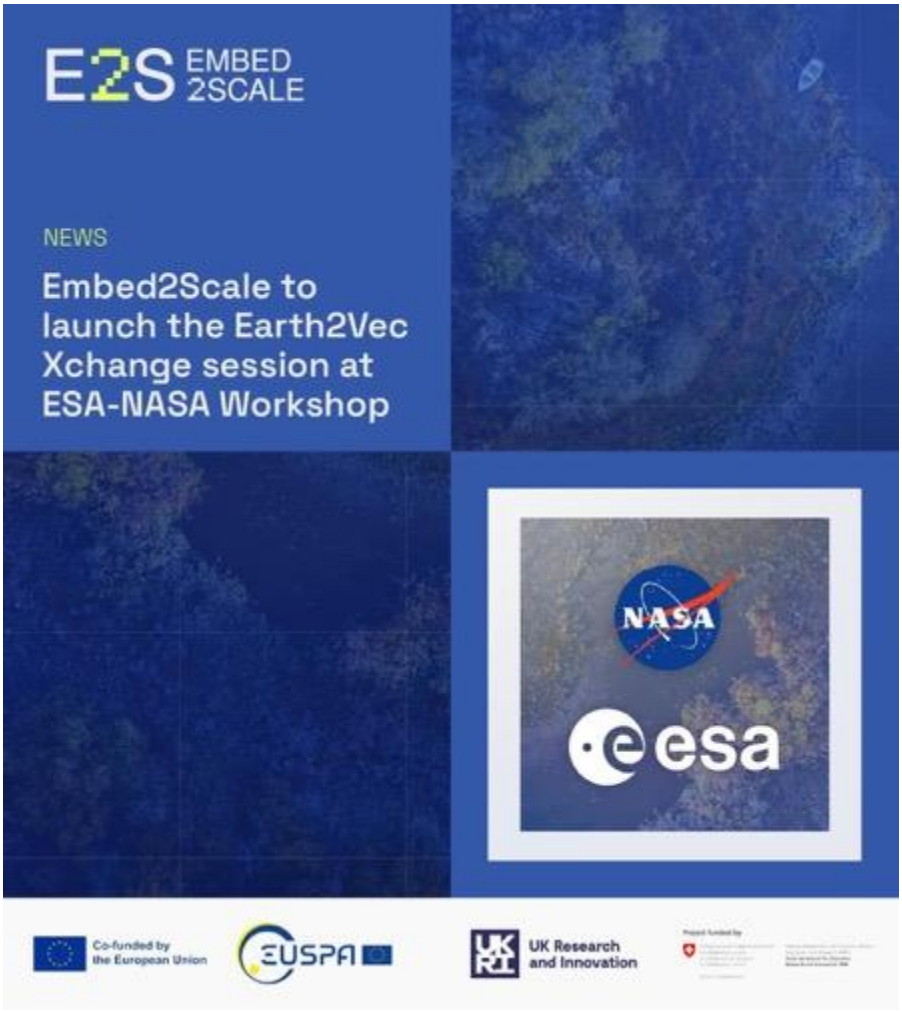


Figure 8: Social media announcement on ESA–NASA International Workshop

4.2 SCIENTIFIC DISSEMINATION

A core component of Embed2Scale's dissemination strategy is the contribution to high-impact scientific discourse through peer-reviewed publications. As outlined in the original communication strategy (D5.1), publishing in reputable journals, conferences, and workshops not only maximises the project's academic visibility but also reinforces its credibility in the domains of Earth Observation (EO), Artificial Intelligence, and data compression.

By the mid-term point, the project has made significant strides toward the KPI target of over 10 peer-reviewed publications. Notable outcomes include original research articles, reviews, and workshop papers, many of which have been presented at internationally recognized conferences and symposia.

Key publications to date

1. **Multi-Spectral Remote Sensing Image Retrieval Using Geospatial Foundation Models**
   - Authors: Benedikt Blumenstiel, Viktoria Moor, Romeo Kienzler, Thomas Brunschwiler (IBM Research Europe)
   - Published: arXiv, May 2024 https://doi.org/10.48550/arXiv.2403.02059
   - Summary: This paper introduces a retrieval system based on geospatial foundation models such as Prithvi, achieving state-of-the-art accuracy on BigEarthNet datasets. It evaluates multi-spectral retrieval pipelines that generalise across different modalities without re-training, showcasing real-world potential in operational EO workflows.

2. **Neural Embedding Compression for Efficient Multi-Task Earth Observation Modelling**
   - Authors: Carlos Gomes, Thomas Brunschwiler (IBM Research – Europe)
   - Published: arXiv, April 2024 https://doi.org/10.48550/arXiv.2403.17886
   - Summary: Proposes Neural Embedding Compression (NEC), which significantly reduces EO data volumes while preserving task-specific accuracy. It introduces a method that reduces bandwidth by up to 99% with minimal accuracy loss in scene classification tasks, representing a scalable solution for model deployment across distributed EO infrastructures.

3. **Lossy Neural Compression for Geospatial Analytics: A Review**
   - Authors: Carlos Gomes, Thomas Brunschwiler, Gabriele Cavallaro, and others from from Embed2Scale consortium: IBM, DLR, FZJ, University of Oxford, and University of Zurich
   - Published: IEEE Geoscience and Remote Sensing Magazine, 2025 https://doi.org/10.48550/arXiv.2503.01505
   - Summary: A comprehensive review of neural compression methods for EO and Earth System Modelling (ESM), highlighting the challenges of managing high-volume data streams and proposing a taxonomy of neural compression techniques. This article helps bridge the fields of AI and EO through a structured overview of emerging trends and applications.

4. **GSR4B: Biomass Map Super-Resolution with Sentinel-1/2 Guidance**
   - Authors: Kaan Karaman, Yuchang Jiang, Vivien Sainte Fare Garnot, Maria João Santos, Jan Dirk Wegner (University of Zurich)
   - Published: GSW 2025 Proceedings https://arxiv.org/html/2504.01722v2#S0.SSx7.SSS0.Px2
   - Summary: This work addresses the upscaling of low-resolution biomass maps to high-resolution (10 m) using Sentinel-1/2 imagery, introducing a Guided Super-Resolution (GSR) framework. It outperforms baseline regression approaches and offers a scalable solution for carbon and biodiversity monitoring

5. **A Multimodal, Multiseasonal Dataset for Pretraining**
   - Authors: Benedikt Blumenstiel, Nassim Ait Ali Braham, Conrad M Albrecht, Stefano Maurogiovanni, Paolo Fraccaro
   - Published: arXiv, Feb 2025 https://doi.org/10.48550/arXiv.2503.00168
   - Summary: This technical report presents SSL4EO-S12 v1.1, a multimodal, multitemporal Earth Observation dataset designed for pretraining large-scale foundation models.

Conference posters

1. **Towards Efficient Neural Compression for Earth Observation Data**
    - Marszalek, M. L., Vinge, R., Koch, A., Wittmann, I., & Albrecht, C. M. (2025). Towards Efficient Neural Compression for Earth Observation Data. 2025 ESA LPS, Vienna, Austria. Zenodo. https://doi.org/10.5281/zenodo.15837746

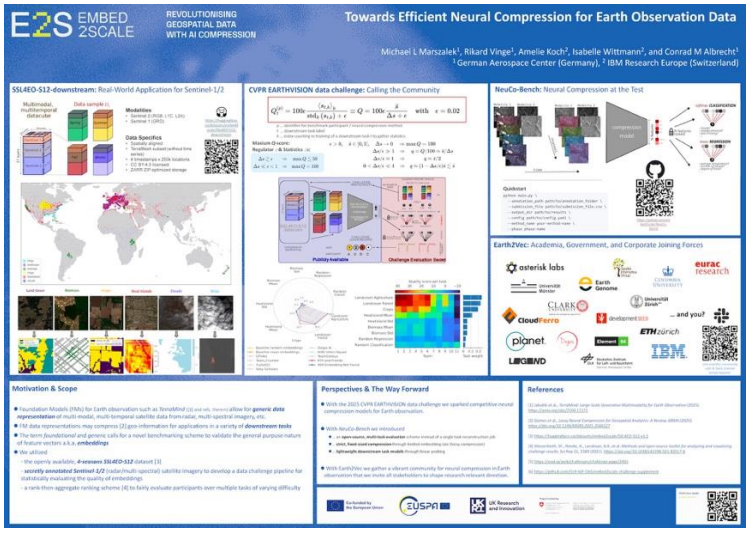


Figure 9: Poster "Towards Efficient Neural Compression for Earth Observation Data"

2. **A novel benchmark to evaluate (neural) compression for satellite imagery**
    - Vinge, R., Marszalek, M. L., Schneider, J., & Albrecht, C. M. (2025). Earth Observation Embeddings at the Test: **A novel benchmark to evaluate (neural) compression for satellite imagery.** EGU General Assembly 2025, Vienna, Austria. Zenodo. https://doi.org/10.5194/egusphere-egu25-16756

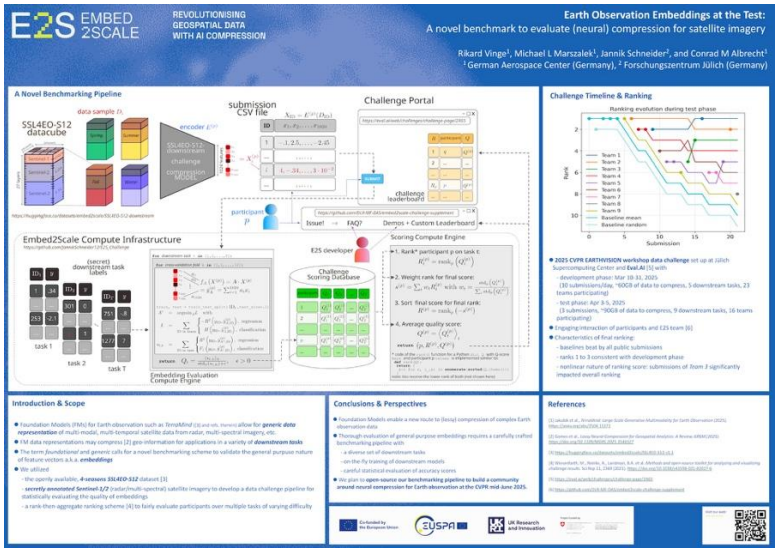


Figure 10: Poster "A novel benchmark to evaluate (neural) compression for satellite imagery"

Conference presentations:

1. Koch, A., Wittmann, I., Gomez, C., Vinge, R., Marszalek, M., Albrecht, C., and Brunschwiler, T.: Neural Embedding Compression for Earth Observation Data – an Ablation Study, EGU General Assembly 2025, Vienna, Austria, 27 Apr–2 May 2025, EGU25-17172, https://doi.org/10.5194/egusphere-egu25-17172, 2025.
2. Gomes, C. and Brunschwiler, T.: Earth Observation Applications through Neural Embedding Compression from Foundation Models, EGU General Assembly 2024, Vienna, Austria, 14–19 Apr 2024, EGU24-19460, https://doi.org/10.5194/egusphere-egu24-19460, 2024.
3. Brunschwiler, T., Blumenstiel, B., Moor, V., and Kienzler, R.: Geospatial Foundation Models for Efficient Retrieval of Remote Sensing Images, EGU General Assembly 2024, Vienna, Austria, 14–19 Apr 2024, EGU24-18300, https://doi.org/10.5194/egusphere-egu24-18300, 2024.
4. Vinge, R., Marszalek, M. L., Schneider, J., and Albrecht, C. M.: Earth Observation embeddings at the test: A novel benchmark to evaluate (neural) compression for satellite imagery, EGU General Assembly 2025, Vienna, Austria, 27 Apr–2 May 2025, EGU25-16756, https://doi.org/10.5194/egusphere-egu25-16756, 2025.
5. Scheurer, E., Wang, J., Sedona, R., Maurogiovanni, S., Blumenstiel, B., Jakubik, J., Fraccaro, P., Brunschwiler, T., Kesselheim, S., and Cavallaro, G.: Scalable Efficient Compression in Large-Scale Earth Observation, EGU General Assembly 2025, Vienna, Austria, 27 Apr–2 May 2025, EGU25-19016, https://doi.org/10.5194/egusphere-egu25-19016, 2025.
6. Reichelt, T., Tyree, J., Kloewer, M., Dueben, P., Lawrence, B., Hammerling, D., Baker, A., Faghih-Naini, S., and Stier, P.: ClimateBenchPress: A Benchmark for Compression of Climate Data, EGU General Assembly 2025, Vienna, Austria, 27 Apr–2 May 2025, EGU25-15912, https://doi.org/10.5194/egusphere-egu25-15912, 2025.
7. Michele Lazzarini, Miguel Angel Belenguer-Plomer, Conrad M Albrecht, Rikard Vinge, Michael Marszalek, Sergio Albani, Spaceborne SAR compression with AI for data-efficient vessel detection, ESA Living Planet Symposium 2025, https://lps25.esa.int/programme/programme-session/?id=1D2BE63E-1359-4C00-A069-098C46B11DC9&presentationId=D788A9FD-EE71-4982-96D5-BA3FD5C366A9
8. Spectral Super-Resolution for Greenhouse Gas Detection, Ruben Gonzalez, Benedikt Blumenstiel, Ranjini Bangalore, Nassim Ait Ali Braham, Johannes Jakubik, Paolo Fraccaro, Conrad M Albrecht, Thomas Brunschwiler, ESA Living Planet Symposium 2025, https://lps25.esa.int/programme/programme-session/?id=954D4F1E-F4FF-49E7-9C0A-2BBA9300BC44&presentationId=7B83669C-B46E-41D8-AF96-F1A30CD2242B
9. Leveraging Neural Compression for Earth Observation, Isabelle Wittmann, Johannes Jakubik, Carlos Gomes, Benedikt Blumenstiel, Thomas Brunschwiler, Conrad M Albrecht, ESA Living Planet Symposium 2025, https://lps25.esa.int/programme/programme-session/?id=3B6EF15D-E53F-4BAA-8C8C-F6F7C253C8F0&presentationId=427577B0-BEA3-4BBA-A2BC-8CC374338FC6
10. Self-Supervised Learning for Earth Observation (SSL4EO) Put to the Test - a perspective through the lens of two Horizon Europe projects (invited presentation), Conrad M Albrecht, ESA Living Planet Symposium 2025, https://lps25.esa.int/programme/programme-session/?id=3B6EF15D-E53F-4BAA-8C8C-F6F7C253C8F0&presentationId=427577B0-BEA3-4BBA-A2BC-8CC374338FC6
11. Guided Super-Resolution for Biomass Upsampling, Kaan Karaman, Yuchang Jiang, Damien Robert, Vivien Sainte Fare Garnot, Maria João Santos, Jan Dirk Wegner, ESA Living Planet Symposium 2025, https://lps25.esa.int/programme/programme-session/?id=929C8B43-C533-4949-B175-61AF38DA0A97
12. Presentation of the E2S data challenge at the CVPR EARTHVISION workshop in Nashville, TN, USA (invited presentation), Isabelle Wittmann, Conrad M Albrecht, 2025 CVPR EARTHVISION workshop, https://www.grss-ieee.org/events/earthvision-2025/?tab=challenge

13. Leveraging Neural Compression for Earth Observation Data, Isabelle Wittman, ESA-NASA Workshop: AI Foundation Models for Earth Observation, https://airdrive.eventsair.com/eventsairwesteuprod/production-nikal-public/837ec0486e4d491aa0c8f3015c87609b
14. "Embed2Scale: Transforming Earth Observation through AI-Driven Data Compression and Collaboration, Thomas Brunschwiler, Conrad Albrecht, ESA-NASA Workshop: AI Foundation Models for Earth Observation", https://airdrive.eventsair.com/eventsairwesteuprod/production-nikal-public/837ec0486e4d491aa0c8f3015c87609b
15. Towards Efficient Neural Compression for Earth Observation Data. Michael L Marszalek, Rikard Vinge, Amelie Koch, Isabelle Wittmann, Conrad M Albrecht ESA, at Living Planet Symposium 2025, https://lps25.esa.int/programme/programme-session/?id=ED4266A9-53C0-4768-A18A-7AA5C2CF00D9&presentationId=52FE19DC-73EA-43BA-AE53-8AF37EE548A3

Besides the reach to different stkeholders, the number of downloads of deliverable, report, scientific papers from the E2S website demonstrate the relevance of the work carried out by the project partners.

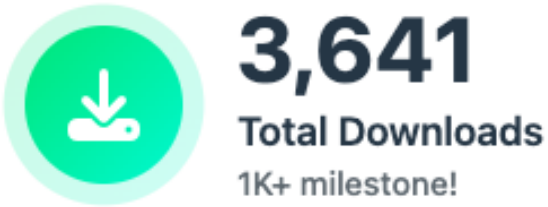


Figure 11: Number of downloads for the project's assets

4.3 PROMOTIONAL AND PRINT MATERIALS PRODUCED

To strengthen the visibility and recognisability of the Embed2Scale project across diverse stakeholder groups, a cohesive set of promotional and print materials has been developed. These materials are aligned with the project's visual identity and communication strategy, and are used consistently at events, online, and in partner communications.

Project introductory roll-up banner
The Embed2Scale roll-up banner serves as a mobile and eye-catching visual asset for use at physical events such as conferences, workshops, and public exhibitions. The banner features:

- The project's full title and Horizon Europe funding acknowledgment
- The central message: "Transforming geospatial data employment with AI"
- Key domains: Earth Observation, Weather Data, AI Embeddings, and Federation
- A call to action: "Follow our advancements"
- A clean, bold design with the project's logo and branding elements

The roll-up has already been deployed at multiple venues, including EGU 2024 and the ESA-NASA Workshop, and is available in print-ready PDF format with scalable vector graphics.

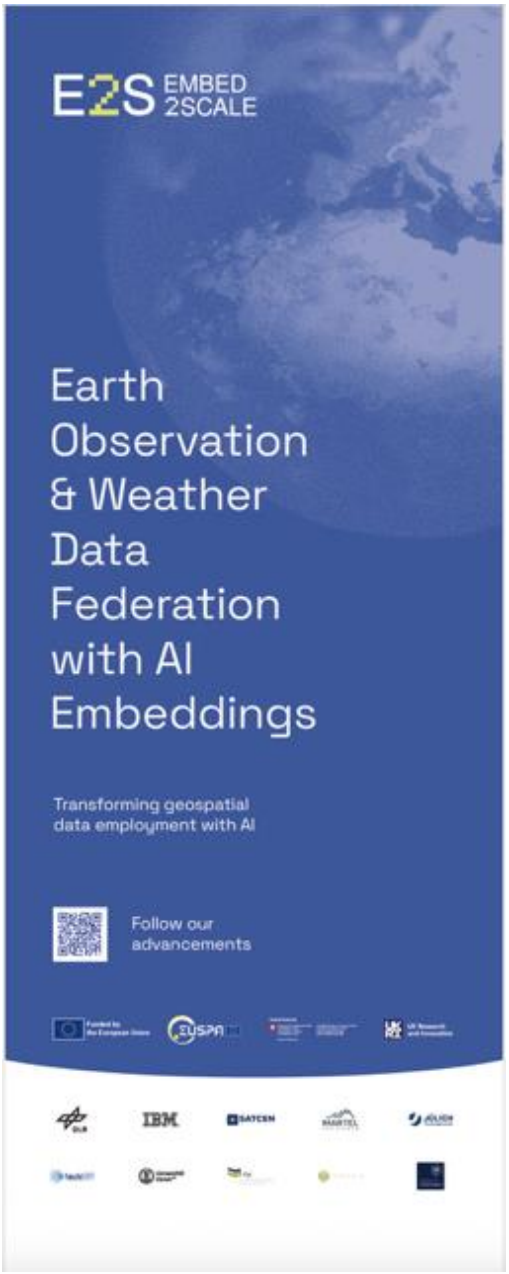


Figure 12: Embed2Scale promotional rollup

Project introductory leaflet

A double-sided project leaflet has been created to offer stakeholders a quick yet comprehensive overview of Embed2Scale. It is used as a takeaway at events and for digital distribution via the website and newsletter. The leaflet includes:

- A concise introduction to the project's vision and goals
- A summary of the core technologies (AI compression, decentralised processing, EO federation)
- Visuals of the use cases and thematic application areas
- Partner logos and contact information
- Links to social media and website via QR codes

The leaflet has been printed and disseminated during the project's first year and is available in high-resolution for additional print runs.

Figure 13: Embed2Scale Project introductory leaflet

Project logo

The Embed2Scale logo is a central element of the project's branding. Designed for versatility and scalability, it is available in:

- Full and compact formats
- Light and dark background variants (positive/negative)
- Both PNG and SVG file types, ensuring optimal usability in print and digital formats

The logo has been applied consistently across all visual assets: website, videos, presentations, social media, posters, and printed documents.
All promotional materials are stored in a shared cloud repository accessible to all partners.

5 EXPLOITATION OF PROGRESS RESULTS

To maximize the impact of Embed2Scale, the exploitation plan is structured around three core objectives:

- First, it establishes a comprehensive inventory of all exploitable assets generated by the project, including software tools, datasets, models, methodologies, and know-how.
- Second, it identifies key stakeholder groups such as industry partners, public institutions, and the research community, that stand to benefit from these assets, ensuring targeted and relevant dissemination.
- Third, it outlines the go-to-market strategies both at the individual partner level and for the consortium as a whole, taking into account varied commercialization pathways, licensing models, and collaboration opportunities to drive sustainable uptake and long-term value creation.

While Deliverable D5.3 provides the long-term strategy and plan, several concrete exploitation activities and results were already achieved in the first 18 months under Task 5.3.

3. Identified exploitable results

The consortium produced a preliminary set of exploitable assets, including:

- **SSL4EO-S12 Dataset** – a large-scale, openly available satellite dataset, already used by partners and external researchers for benchmarking self-supervised learning approaches.
- **NeuCo-Bench** – a benchmarking tool for neural compression methods, applied during events such as **EGU 2025**.
- **ClimateBenchPress** – a benchmark suite for compressor performance on climate datasets (jointly with ESiWACE3, initiated M14 and presented at EGU 2025).
- **TerraTorch-Embeddings** – an open-source library integrating geospatial embeddings into PyTorch.
- **Vessel Detector** – an EO-based maritime use case demonstrator

Each asset was mapped against exploitation routes, potential users, and TRL progression.

4. Partner-specific exploitation roadmaps:

Several consortium partners already initiated exploitation pathways:

- **IBM** linked its embedding-based compression prototypes to the Earth Information Services (EIS) framework.
- **DLR** applied EO embeddings for spectral workflow optimisation in maritime/security use cases.
- **FZJ** adopted SSL4EO-S12 as part of their benchmarking suite for HPC–ML integration.
- **SATCEN/HISDESAT** prepared uptake scenarios for operational maritime surveillance, based on vessel detection demonstrators.

5. Community-oriented exploitation:

The Earth2Vec initiative was officially launched in May 2025 during the ESA–NASA workshop in Frascati. This initiative provides a community hub to share embeddings, datasets, and workflows, ensuring uptake beyond the consortium.

6. Standardisation and interoperability efforts:

Activities were initiated during the reporting period to align project outputs with international standards and open frameworks, notably:

- **openEO API** integration work.
- **STAC-compliant catalogues** for dataset discoverability.

- Ensuring **FAIR data principles** in published assets.

These activities show that exploitation is not only a future plan but has already delivered tangible results and community impact in M01–M18. They provide a strong basis for further development in the second project phase and complement the broader strategy described in D5.3.

6 SYNERGIES AND COLLABORATIONS

Building strategic connections with complementary Horizon Europe projects and scientific initiatives has the potential to enhance the impact and relevance of Embed2Scale. These synergies have supported knowledge exchange, resource efficiency, scientific alignment, and opportunities for joint dissemination. Below are key collaborations that have contributed to the advancement of Embed2Scale's objectives during the reporting period.

ESiWACE3 (Grant Agreement No 101093054)

Connection: Embed2Scale researchers Tim Reichelt and Philip Stier are actively collaborating with ESiWACE3 partners—including Juniper Tyree, Sara Faghih-Naini, and Peter Dueben—on the development of ClimateBenchPress, a benchmarking suite for assessing compressor performance on climate datasets.

Relevance to Embed2Scale:

- This collaboration ensures that benchmarking practices in Embed2Scale are aligned with the broader needs of the climate modelling community.
- The shared development of ClimateBenchPress creates a common evaluation framework that benefits both projects and the community at large.
- Notably, storage infrastructure (Amazon S3) provided through ESiWACE3 was used during the initial stages of development, reducing the resource burden on Embed2Scale.

The first results of this joint work were presented at the EGU General Assembly 2025, raising visibility and encouraging community engagement with the benchmarking tools under development.

NextGEMS (Grant Agreement No 101003470)

Connection: Philip Stier, an active member of Embed2Scale, is also involved in the NextGEMS project. Collaborations with researchers in his group, including Lilli Freischem and Philipp Weiss, are focused on comparing kilometre-scale climate model outputs with geostationary satellite observations.

Relevance to Embed2Scale:

- This work leverages foundation model embeddings—developed in Embed2Scale—to evaluate and constrain high-resolution climate simulations.
- The collaborative research directly informs the Embed2Infer use case by exploring how embedding-based representations can facilitate more accurate and efficient model-observation comparisons.
- The methods developed in NextGEMS are also transferable to other use cases within Embed2Scale, strengthening the scientific underpinnings of the project's AI-driven approach.

CleanCloud (Grant Agreement No 101137639)

Connection: Embed2Scale's Philip Stier is also a participant in CleanCloud, which seeks to advance understanding of aerosol-cloud interactions (ACI). Group member Sadhitro De, funded by CleanCloud, contributes to research closely related to Embed2Scale's data-driven model validation efforts.

Relevance to Embed2Scale:

- Regular intra-group exchanges ensure fluid knowledge transfer between CleanCloud and Embed2Scale, particularly in the application of AI embeddings for process understanding.
- The Embed2Infer and Embed2Find use cases are directly supported through CleanCloud-related research, where AI-based embeddings are explored as tools to constrain climate model parameters and interpret satellite-derived observations.

These synergies illustrate how Embed2Scale benefits from and contributes to a broader European ecosystem of AI and climate science innovation. Moving forward, such collaborations will continue to support sustainability goals, facilitate the reuse of tools and datasets, and provide robust validation contexts for the project's outputs. Further structured collaboration, especially around benchmarking standards, evaluation pipelines, and cross-project dissemination, will be explored in the final reporting period.

7 KPIS AND IMPACT ASSESSMENT

At M18, Embed2Scale shows solid progress towards its dissemination and communication objectives. While several KPIs have been met or exceeded, others highlight areas for intensified action in the second half of the project.

Table 1: KPIs and impact assessment

Measure	Target KPI	Achieved at M18
Project website	N. of unique visitors to the website (average per year) > 1500	1,973 unique visitors (average per year)
Social networks	N. of followers Twitter, Mastodon >250, LinkedIn >150	732 followers
Press Releases / publication in press	N. of press releases issued to specialised and general media channels at key project milestones 3.	1
Publications	N. of peer reviewed publications in journals, conferences and workshops	4
Newsletters	N. of newsletters (published every quarter)	2
Videos	N. of videos published	4
Workshops, events, webinars (online included)	Number >2 (per year), Average number of participants per workshop >60	in planning*
Participation in events and presentations (online included)	Number of external events partners attended to promote the project, including scientific conferences, and number of demos and or presentations >8	20

* During the first 18 months, Embed2Scale focused heavily on building its scientific and technical foundations (e.g., dataset releases, benchmarking tools, early use case demonstrators) and ensuring strong visibility through major international conferences such as EGU, IGARSS, SatSummit, and the ESA–NASA Workshop. These high-profile venues provided a broader outreach platform than initially foreseen, but required significant preparation and coordination, which delayed the launch of project-branded webinars and workshops. **Recovery Plan (M19–M36):** To address the shortfall and ensure KPI compliance, a structured webinar series will be designed, involving all consortium partners. This series will cover technical advances, use case demonstrations and cross-project synergies.

8 CONCLUSIONS AND NEXT STEPS

During the first 18 months of the project, Embed2Scale has successfully established a solid foundation for communication, dissemination, and exploitation activities. Through the coordinated efforts under WP5, the project has significantly increased its visibility, built early community engagement, and contributed to scientific discourse via publications and event participation.

The project's website, social media presence, newsletters, video content, and event contributions have all met or exceeded initial targets. Strategic collaborations with projects such as ESiWACE3, NextGEMS, and CleanCloud have further strengthened Embed2Scale's position within the European research landscape, supporting shared innovation and resource efficiency.

Next Steps:

- Increase the pace and frequency of online content creation, including news updates, technical blogs, and targeted posts to maintain community engagement and expand reach.
- Organise and participate in additional scientific and industry events to promote project outputs and use cases.
- Further strengthen collaborations with related EU projects and initiatives to ensure long-term relevance and impact.
- Conduct KPI tracking and impact assessment to ensure objectives are met and the dissemination strategy remains effective.

Funded by the European Union