Invitation to Tender

Destination Earth Initiative

Training Material and Activities in Scope of the Use of Machine Learning in DestinE

Volume II: Specification of Requirements

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Table of Contents

Acronyms

ADRA	AI, Data and Robotics Association
AI	Artificial Intelligence
AIFS	Artificial intelligence forecasting system
ANN	Artificial neural network
DA	Data Assimilation
DestinE	Destination Earth
DG CLIMA	Directorate-General for Climate Action
DG CNECT	European Commission's Directorate General for Communications Networks, Content and Technology
DG ENV	Directorate-General for Environment
DL	Deep Learning
ECMWF	European Centre for Medium-Range Weather Forecasts
ERA5	ECMWF global reanalysis data set
ESA	European Space Agency
EU	European Union
EUMETSAT	European Organisation for the Exploitation of Meteorological Satellites
FAQ	Frequently Asked Questions
GNN	Graph neural network
ITT	Invitation to tender
LAM	Limited area model
LMS	Learning Management System
ML	Machine Learning
MLOps	Machine learning operations
MLPP	Machine Learning Pilot Project [*a cooperation on ML between Member States*]
MOOC	Massive Open Online Course
NMHS	National Meteorological and Hydrological Services
SME	Small and medium-sized enterprise
WP	Work Package

1   Introduction

1.1   The Destination Earth Initiative

Destination Earth (DestinE) is an ambitious initiative of the European Commission to create "digital twins" (highly detailed computer simulations) of the Earth system by 2030, leading to greater understanding of climate change and extreme weather events, and to better understand anthropogenic interactions with the Earth system. DestinE supports the European Commission's Green Deal, the EU Digital Strategy, and the EU Data Strategy and aims to provide vital scientific input to European policy making, as well as driving innovation in weather/climate science, high-performance computing, data science and machine learning.

The European Centre for Medium-Range Weather Forecasts (ECMWF) is one of three European organisations charged with implementing DestinE, along with the European Space Agency (ESA) and the European Organisation for the Exploitation of Meteorological Satellites (EUMETSAT), under the leadership of the European Commission's Directorate General Communications Networks, Content and Technology (DG CNECT).

ECMWF is an independent intergovernmental organisation supported by 35 states. ECMWF is both a research institute and a 24/7 operational service, producing and disseminating numerical weather predictions to its Member and Co-operating States. This data is fully available to the national meteorological services in the Member States. The Centre also offers a catalogue of forecast data that can be purchased by businesses worldwide and other commercial customers. The supercomputer facility (and associated data archive) at ECMWF is one of the largest of its type in Europe and Member States can use 25% of its capacity for their own purposes. The organisation was established in 1975 and now employs around 450 staff from more than 35 countries.

In Destination Earth, ECMWF is entrusted to deliver two Digital twins on weather-induced Extremes and Climate Change Adaption, as well as the Digital Twin Engine, and Machine Learning/Artificial Intelligence (ML/AI) activities. ESA and EUMETSAT are responsible for delivering the other key components of DestinE: the Core Service Platform and the Data Lake.

DestinE is organised into phases. The first phase, which ran up to June 2024, covered the preparation, piloting and implementation of all main components of the DestinE system, including the first two Earth-system Digital Twins, Digital Twin Engine, Data Lake and Core Service Platform.

The second phase began in June 2024 and will last two years. It will focus on bringing the consolidation, continuous evolution of the key elements of the DestinE system and their transition towards operations. It exploits the latest breakthroughs in Machine Learning/Artificial Intelligence (ML/AI) that took place in the last couple of years further enhance the DestinE system through developments towards a ML earth-system model and the use of ML/AI methods to support uncertainty quantification and interactivity. ML activities in phase 2 of DestinE also include a training component to build ML capacity in Europe. More specifically, the activities undertaken by ECMWF and its partners in the second phase of DestinE will:

- Develop and deploy open-source workflows for ML Earth-system components towards a European foundation model.
- Foster development of ML demonstrators in high-impact domains, such as tropical cyclones, agriculture, city health, renewable energy, in a changing climate.
- Enhance the data handling and processing pipelines of the Digital Twin Engine to support the development, training, data-feed and execution of ML/AI models on the EuroHPC supercomputers within the Digital Twins framework.
- Develop a climate emulator to support exploring "what-if" scenarios
- Leverage LLMs to provide enhanced interactivity of the Digital Twins

- Prototype a forecast-in-a-box concept to provide enhanced Digital Twin interactivity
- Pioneer pilot use cases for supporting the AI-US collaboration for AI4Good.
- Provide training on generative AI
- Establish ethical guidelines, quality monitoring & management, and policy recommendations for generative AI and its associated data sources

More information about the DestinE initiative, the role of ECMWF, and links to further resources, can be found at ECMWF's Destination Earth micro site.

1.2 Machine learning activities at ECMWF

The Machine Learning activities in DestinE complement a range of ML activities that are taking place at ECMWF and in the National Meteorological and Hydrological Services in (NMHS) in its Member and Cooperating States (MS). In the last two years ECMWF has developed its own ML-based forecast model called AIFS (Artificial Intelligence Forecasting System), which is a purely data-driven forecast model based on graph neural networks (GNNs) and trained on the ERA5 global reanalysis produced by ECMWF in the framework of the Copernicus Climate Change Service. Although not yet fully operational, AIFS is now competitive with ECMWF's physics-based Integrated Forecasting System (IFS) in a number of metrics and output variables, while being computationally cheaper to generate forecasts. AIFS, which is undergoing continuous development and improvement, is now being implemented through ECMWF's Anemoi framework. Anemoi is an open-source, flexible and modular software infrastructure for ML models which is being used by ECMWF and a growing number of NMHS in ECMWF's Member and Cooperating States, who are also developing their own ML-based forecasting models.

ML also has promising applications in downscaling, preprocessing and post-processing, including uncertainty quantification and data assimilation, among many others, and these approaches are being explored and operationalised at ECMWF.

To foster greater collaboration and knowledge exchange between NMHS in ECMWF MS, the Machine Learning Pilot Project (MLPP) was recently launched, as part of the EUMETNET E-AI programme. The Pilot Project brings together NMHS from ECMWF MS to boost cooperation in ML for weather forecasting.

The rapid pace in ML development in weather forecasting is part of the wider AI revolution, fuelled by improvements in algorithms and training, computing power, the availability of large training data sets, and collaboration through open-source software. The European AI Act, which aims to ensure that *AI systems used in the EU are safe, transparent, traceable, non-discriminatory and environmentally friendly, entered into force in August 2024*. Its provisions are applicable in all EU Member States.

In recent years, ECMWF has run a number of training initiatives in ML:

- The Massive Online Open Course (MOOC) on ML for Weather and Climate which took place over 2022-2023
- The annual in-person training courses on ML (the last course was March 2024, next one is currently planned for October 2025)
- Webinars, such as the recent webinar on Anemoi
- Training through the ML pilot project (MLPP; so far this has included some presentations at the kick-off workshop, and a hackathon)
- An annual training event on data assimilation, which includes a strong component on ML.

Note that these training activities are not direct elements linked to DestinE.

1.3 Other relevant tenders/activities in DestinE

There are several relevant Invitations to Tender (ITTs)[1] being issued in DestinE in parallel with the present ITT, which Tenderers should be aware of:

- A Communication Services ITT (ref. DE_313_bis), which includes the organisation of a ML training event in autumn 2025.
- A website procurement (RFP ref. DE_310_bis), which includes a budget for creating an ML training landing page on the DestinE micro-site.
- An ITT (ref. DE_398) on the Development and Implementation of Ethical Machine Learning Strategies for Destination Earth, which will cover policy and ethical aspects of DestinE's future large-scale use of AI.
- An ITT (ref. DE_393) on the Development and Implementation of a ML-based Climate Emulator for Destination Earth.
- An ITT (ref. DE_394) on the Development and Implementation of a Climate and Weather Chatbot for Destination Earth.
- An ITT (ref. DE_374) on Destination Earth Impact Sector Pilot Services and Machine-Learning Demonstrators.

More details on the interaction of some of these tenders to the present work are given in Section 3.8.

1.4 Scope of this ITT

The purpose of this ITT is to invite Tenderers to submit proposals to design, develop and implement a package of courses and training materials in ML/AI for weather, climate, and Earth system modelling as part of DestinE, building to a large extent on the ML activities undertaken in the framework of the initiative at ECMWF and at its partner institutions.

The activities shall link to DestinE ML activities and help promote the Digital Twins and Digital Twin Engine where possible. Many of the ML activities in DestinE are currently ramping up as part of the second phase of the initiative. The Successful Tenderer will therefore be required to keep up to date with the progress of DestinE, and in particular of the ML activities including through periodic meetings with ECMWF.

The material should include a series of online courses, e-learning material, educational videos, podcasts and other innovative learning materials aimed to create an engaging learning experience, ensuring high-quality content. It shall also include inputs for in-person training events.

Details of the components of this training programme follow in Section 2.

1.5 Target audience

The training package is principally aimed at European scientists developing the DestinE system or feeding into its development through EU funded Horizon Europe projects; and at DestinE users and stakeholders, which comprise EU and ECMWF MS institutions focused on weather and climate science and prediction, including national meteorological services, climate centres, universities and research centres. Specialist staff at European Union organisations such as relevant DGs within the European Commission (CNECT, ENV, CLIMA, JRC, ECHO etc.) and European agencies such as the European Environment Agency as well as relevant UN agencies, are also within the target audience, as are technical stakeholders in SMEs, industry and business.

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[1] All procurements under DestinE are published at https://www.ecmwf.int/en/about/suppliers/destine-procurement

The primary target audience is generally assumed to be technical, typically with a scientific background in Earth sciences in its broadest sense. Participants are presumed to have at least a basic familiarity with programming and a background knowledge of statistics. For the more advanced courses, a more advanced level of ML knowledge may be assumed.

A secondary target group includes high-level information users and policy/decision makers from both public and private sectors, academia and industry. In this case, some basic knowledge of weather and climate science, statistics and informatics shall be assumed.

From here, this collection of developers, users and stakeholders will be referred to as the *target audience*.

2   Technical requirements

The central requirements of this ITT are to design, develop and deliver a package of online training materials on ML on weather, climate, and Earth system modelling, which links to and exemplifies the ML/AI activities carried out by ECMWF and its partners in DestinE and related projects and the Digital Twins.

ECMWF and its partner organisations will provide some technical input to develop and quality assure lectures, webinars, etc. from their ML experts, but the Successful Tenderer is required to source the remainder of the technical content from external experts engaged through the contract. The Successful Tenderer shall appoint a dedicated scientific coordinator to select the experts, organise the content and contributions in agreement with ECMWF.

Tenderers should therefore demonstrate competences and experience in the design, development and implementation of training resources and events as well as quality assurance; and show the scientific capacity in machine learning. Accordingly, the tender is structured into the following activities:

WP0 Management and coordination

WP1 Scientific coordination and curriculum design (including identification of ML experts)

WP2 & WP3 Production of training materials and contribution to training events

2.1   WP0 Management and coordination

Work Package 0 covers all management, coordination and reporting activities for the contracted services. Requirements for this specific Work Package are expressed in Section 3.6.

2.2   WP1 Scientific coordination and curriculum design

Work Package 1 comprises the scientific coordination of all training material, the identification and appointment of experts who can deliver the scientific content, the design of the curriculums of each training course and scientific quality control.

2.2.1   Scientific coordinator

Proposals should include one or more named scientific coordinators (from here referred to in the singular) with proven expertise and experience in ML training and Earth systems science who will be responsible for designing and overseeing courses, selecting scientific experts, and assuring the quality of the scientific content of the training material. The scientific coordinator should be agreed with ECMWF during the negotiation. The scientific coordinator should meet with and report regularly to ECMWF, which will oversee and approve the course planning, expert selection, and content. This implies close interaction with ECMWF and some of its partner organisations in DestinE, including in-person meetings with the training manager and ML team during the kick-off phase and mid-way through the contract.

The scientific coordinator will also engage with stakeholders, ML networks and potential partner institutions to help publicise the training and to bring in experts. This may include the [ADRA network](#), the [AI for Good](#) initiative, the ML Pilot Project and others.

2.2.2 Selection and coordination of contributions by scientific experts

The scientific content of the training material will be overseen and organised by the scientific coordinator and will come from a mixture of sources. Some content will be provided by machine learning experts from ECMWF and their partner organisations in ML activities at no cost, while the remainder of the scientific content (e.g. lectures, Jupyter notebooks, webinars) should be created by external experts. Such experts may contribute as speakers, moderators, trainers, or by providing material.

The Tenderer shall therefore propose a budget for consultancy support by external experts for providing scientific content where necessary throughout the full length of the contract.

Please note that the EU Regulation 2021/694, as quoted in Section 3.2 of Volume I of the ITT, excludes the eligibility of experts joining the contract team as natural persons in capacity of (sub)contractors (cf. Article 18.3). The Successful Tenderer is therefore required to make the necessary arrangements to ensure eligibility. Experts shall be appointed with an indication of specific expertise and skills, and the selection of experts shall be approved by ECMWF prior to producing the content.

The scientific expertise of the experts shall cover expertise in machine learning, data science and statistics, programming in Python, especially in ML libraries such as Keras, PyTorch and scikit-learn, and topical expertise in meteorology, climate, and Earth system modelling.

Specialist expertise shall be sourced from ECMWF and public institutions or SMEs in EU and ECMWF MS, e.g. NMHS, universities, research centres, etc. The scientific coordinator shall select the experts and agree them periodically with ECMWF throughout the contract. The scientific coordinator shall oversee the management of the tasks of the selected experts and ensure that their inputs are provided in line with an implementation plan proposed by the Tenderer and agreed with ECMWF.

2.2.3 Curriculum design

The scientific coordinator shall design the course curriculums based around the themes outlined in this section, as well as putting forward additional themes, in consultation with experts and in agreement with ECMWF.

All training material should be constructed with an awareness of existing ECMWF training events and online material (in particular, the recent MOOC on ML in Weather and Climate) and complement them. It should consider the current coverage of ML topics, existing feedback, ML activities undertaken in DestinE, the ECMWF and its partner organisations, and the evolving state of the art in ML. The Tenderer shall also consider the needs and requirements of the target audience and other stakeholders. Training materials should aim to be comprehensive, thereby minimising the need for further ad hoc training courses on the same topic.

Under WP2 and WP3, a series of online training courses shall be created. The themes for training shall be:

1. **ML for Earth system modelling:** covering the theory and use of ML in Earth system modelling, and linking in particular to ML components developed under DestinE to model land, ocean or waves. This topic should complement and enhance existing MOOC content, linking to existing MOOC content where suitable.
2. **Implementing ML Forecasting**: focusing on data-driven forecasting models, it shall provide a deep dive into the theory and implementation of the deep learning models used in weather forecasting, especially those that form the basis of AIFS, and the earth system components developed in DestinE. It will use ECMWF's Anemoi framework in hands-on demos, to explain how to train, develop and run models like the AIFS.

3. **Explainable AI and ethics**: covering concepts and approaches of explainable AI and how these can be applied to Earth systems modelling in DestinE. Including ethical issues relating to data-driven models, linking to the EU AI Act and the wider context of the EU Digital Agenda.

These themes are requirements based on the current understanding of training needs of the target audience and perceived gaps in the existing training material, but Tenderers may propose additional titles and topics. The training topics and course titles will be agreed with ECMWF.

The topical courses should be run in parallel, with start dates agreed with ECMWF and content gradually released and spread over the duration of 2025 and the first half of 2026. Tenders should include proposals for the approximate schedule of the training courses. Overall, at least 50 hours of high-quality training content are expected. See WP2 for more details.

Training should meet the needs of the target audience and avoid replicating existing material. The objective shall be that new training material draws upon existing material and integrates seamlessly with it to create a coherent ML training package – this implies some potential rearrangement of existing material which is addressed in WP2.

In addition to the online training material courses, the scientific coordinator will also collaborate with ECMWF provide scientific coordination to the in-person training event, to take place in Bonn (see Section 3.8).

The Successful Tenderer will also monitor training needs throughout the duration of the contract through various feedback channels (see WP3), and at the closure of the contract produce a forward-looking report outlining perceived future training needs in ML.

2.2.4   Quality control

The scientific coordinator will be responsible for the quality control of all scientific content produced under the contract.

2.2.5   Deliverables

- Initial curriculum outline by the sixth week from start of contract, to include proposed course titles and outlines, in agreement with ECMWF, and launch dates for each course.
- Detailed course plan including proposed content types to be used for each module, assigned experts, detailed description of topics covered, learning prerequisites and learning aims, details on logistics and budget. Initial version two months before launch of each course, with updated versions delivered on a monthly basis.
- Scientific coordination of the Bonn training event, in cooperation with ECMWF.

2.3   WP2 Production and management of training material

The Successful Tenderer will deliver a series of online training courses following the curriculums defined in WP1. This shall include the provision of scientific content, the creation of the learning materials, the hosting and management of the content via ECMWF's Learning Management System, and the organisation and running of the online courses and events (the latter is detailed in WP3).

2.3.1   Scientific content

The scientific content of the courses will follow the curriculums defined by the scientific coordinator (and in collaboration and agreement with ECMWF) in WP1. Scientific content shall include ML and scientific lectures and presentations, Jupyter notebooks, exercises, interviews, webinar presentations, interaction with students through online forums and emails, providing links and resources to the technical team responsible for creating and editing the learning materials, and other similar inputs.

Scientific input shall additionally be required for one or more in-person training events. The main event will be a multi-day training event planned indicatively for Autumn 2025 in Bonn. Logistics (venue, catering, etc.) will be covered in a separate tender but the scientific coordinator will contribute to coordinate the scientific content of the event, in cooperation with ECMWF, and ML trainers shall be primarily sourced from those helping to produce content in the present tender. See Section 3.8 for more details on the training event.

2.3.2 Format

Courses developed under this contract, and the learning material within, shall take inspiration from ECMWF's existing online courses (in particular the MOOC on ML in Weather and Climate), building upon them and suggesting innovations and improvements. Learning materials within each course may include (but are not limited to):

- E-Learning modules
- Educational videos and lectures (possibly interactive)
- Webinars with audience interaction and Q&A sessions
- Jupyter notebooks with examples
- Microlearning modules
- Interactive articles
- An educational podcast explaining ML concepts in the context of DestinE
- A library of links to other internal/external resources

Jupyter notebooks should feature examples and tutorials of applications of ML to specific problems (with a focus on DestinE), with required Python code and explainer text.

Webinars may include theoretical explainers on specific topics, presentations of specific DestinE ML examples, or generalised Q&A sessions. Webinars shall be moderated and the edited recordings made available on the ML training page.

Proposals for innovative content formats from Tenderers are welcome, including leveraging AI tools such as programming assistants or AI-based Moodle plugins, so long as they don't come at the expense of clarity. In general, content should aim to:

- Convey potentially complex concepts in a clear manner
- Keep learners interested and engaged, through a variety of channels
- Respect time and attention restrictions

Learning materials should follow the existing style guidelines to maintain a consistent visual identity for the courses (such as the visual ID of DestinE). Content should also be as accessible as possible, including subtitles for videos, and using colour schemes that are colourblind-friendly.

New content should be created with content management in mind, such that each content item should be tagged by type, topic, author, etc. All material developed for the online courses shall be freely available on the ECMWF website.

In total, the online courses will consist of at least 50 hours of high-quality training content, comprising a mixture of the formats outlined above. Tenderers shall include in their tenders a proposal for the formats of learning materials and other tools to be used in the online courses, including considerations for accessibility, feedback and communication between participants and instructors. Tenders should include estimates of the number and duration of each content type included in the courses, and the total number of hours of learning content. For context, the MOOC on ML and climate was mostly comprised of eLearning modules (about 25% of total learning time), webinars (25%) and Jupyter notebooks (30-40%), with the remainder being other learning materials, but Tenderers are invited to give their own proposals in this regard.

2.3.3   Hosting and content management

All online courses shall be hosted on, and run from, ECMWF's Moodle learning management system (LMS), which has courses on many topics relating to ECMWF's work, including ML. However, an additional landing page specifically for ML training will be created under the ECMWF DestinE micro-site, which will be used to publicise ML training materials created under DestinE, linking to courses hosted on the LMS, as well as announcing upcoming events. The construction of the micro-site training page will be produced under a separate tender (see Section 3.8 for details), but the Successful Tenderer will additionally provide periodic content for the micro-site – see the following section.

The courses and training materials produced under the present tender should leverage and complement existing ECMWF ML training material (in particular, the MOOC on ML) in order to create a complete and coherent ML training resource with entry points at different levels of expertise. The Successful Tenderer shall therefore be responsible for effectively managing the learning content produced under the present contract through the LMS, and shall implement improvements to the LMS in doing so, in order to integrate existing content and enhance the learning experience.

Whereas currently the LMS has courses organised into basic groupings, Tenderers are invited to propose technical solutions to improve the visual appeal and functionality of the LMS, enabling users to quickly find content based on attributes such as type, topic, technical level and others. Users should be able to engage with content either sequentially by following complete courses, or by searching for specific content based on topics and other attributes through an attractive and user-friendly interface.

The Successful Tenderer shall therefore further improve the Moodle LMS and the learning material it contains in the following three steps:

- Review and propose categories of learning material, including learning content currently packaged in the existing ML MOOC tiers, but also other standalone eLearning resources outside the MOOC.
- Further improve the LMS interface. In addition to the existing LMS functionality, it should include enhanced capability to search resources, such as by topic, content type, length, technical level, etc. It should also allow opening and display of learning resources from multiple formats, such as Jupyter notebooks beside video tutorials demonstrating the notebooks.
- Build the metadata template to apply to the learning assets to support the enhanced search. Apply this metadata to the existing and new ML learning material.

Note that the tasks above will require Moodle/PHP development expertise, but importantly also indexing and cataloguing expertise.

The Successful Tenderer shall also propose and maintain a repository structure and attractive web interface (such as through Jupyterbooks) for the Jupyter-based ML learning resources. The Successful Tenderer shall ensure the notebooks are accessible through the LMS, and also as standalone resources on GitHub.

2.3.4   Content for micro-site

Additional to the online courses, the Successful Tenderer will supply standalone content for the ML training page on the DestinE micro-site to the ECMWF communication team. The aim here shall be to provide short pieces of training/publicity content which can be used to engage visitors to the site and draw them into the training courses, including via links from social media.

Our initial ideas for this include a multiple-choice ML quiz challenge, as a gamified approach to draw some publicity and attention to the ML training page, entitled e.g. "Test your knowledge of Machine Learning". Other items may include the podcast mentioned earlier in WP2, micro-learning modules, and links to other resources. Tenderers are invited to propose their own content ideas in this respect. Note that the content for the micro-site is additional to the minimum 50 hours learning content in the online training courses.

2.3.5   Maintenance

The Successful Tenderer shall maintain all the ML learning material over the duration of the contract, ensuring to future-proof learning resources as much as possible, and to ensure that the maintenance of materials can be smoothly handed over to ECMWF at the end of the contract, keeping in mind relevant permissions, documentation, and other issues.

Where existing ECMWF learning material is integrated in courses and events under the present tender, the Successful Tenderer shall ensure that all learning resources are functional and Jupyter notebooks can be successfully run, including fixing or working around any dependency issues that may arise, regularly checking for broken links or obsolete references and reporting these to the ECMWF training coordinator.

2.3.6   Deliverables

- Initial report on technical proposals for online courses including proposed tools, audiovisual content, media formats to be used in online courses, and proposed modifications to LMS (for approval by ECMWF).
- Fully functional training materials that comprise the online courses, hosted on the LMS (or on the DestinE micro-site, for standalone content), plus source files (video recordings, sound files, PowerPoints, etc.) used to create the online courses.
- Improved LMS, integrating new ML training content in the present contract with existing ML content.
- Periodic content for the DestinE ML training micro-site.
- Scientific content for the Bonn training event.

2.4   WP3 Running and managing training events

The online training courses shall be launched as scheduled training events. The management of the live run, including administration of registrations, moderation, promotion, and all other relevant activities shall be undertaken by the preferred Tenderer.

2.4.1   Course setup

Each course should clearly state the prerequisite skills required to follow the course (e.g. in terms of knowledge of programming, statistics and ML, and topical knowledge), and the learning objectives of the course. The course (and/or modules therein) should conclude with a quiz which tests the knowledge of participants, and a short feedback survey. The results of quizzes and surveys should be recorded and accessible by course administrators.

Participants should be able to communicate with each other and with the course instructors, for example via a forum and/or a Comments section for each content piece or module.

2.4.2   Scheduling

As mentioned above, the topical courses should be run in parallel, with start dates agreed with ECMWF and content gradually released and spread over the duration of 2025 and the first half of 2026.

2.4.3   Promotion

All training content should be promoted through various channels, including ECMWF's events pages, the ML training page on the DestinE micro site (to be produced under another tender), social media, partner organisations, and other relevant channels. The Successful Tenderer shall create inputs needed for this promotion, including attractive graphics, flyers, images, animation and text for social media posts, etc, Based on agreed social media and visual guidelines by the ECMWF Destination Earth Communications Team.

All deliverables, including promotion materials, web content, articles, etc. shall be reviewed and approved by ECMWF prior to publication.

2.4.4 Evaluation and impact

The Successful Tenderer shall report on statistics of participants, including information such as country of origin, type of organisation and sector. Statistics shall also include course registrations and course completion, quiz results, quantitative and qualitative measures of satisfaction and others.

Tenderers shall therefore propose a feedback and monitoring system which effectively captures these aspects, include a mechanism for storage and organisation of feedback, analytics, reporting, and making feedback accessible to ECMWF on a periodic and/or continuous basis.

Feedback and monitoring tools may include an open survey where users can answer a series of simple questions, and short satisfaction surveys at the end of each training module. Feedback should be used to guide future deliverables, in consultation with the ECMWF training manager.

2.4.5 Bonn training event

The Successful Tenderer will work with ECMWF to organise and execute a training event in Bonn, as described in Section 3.8. The expected contribution to this event will be (a) the scientific coordination (as mentioned in WP1), and (b) planning and providing the scientific content of the event (as described in WP2), both in collaboration with ECMWF.

The logistics of the event will be covered by a separate tender.

2.4.6 Deliverables

- Following each course, a report including statistics on participation and satisfaction, describing the successes and challenges of the course and making recommendations for future courses.
- Report regarding the planning and execution of the scientific aspects of Bonn training event, in collaboration with ECMWF
- Final report summarising all work done, and including a roadmap for future training needs in ML.

3 General Requirements

3.1 Implementation schedule

ECMWF intends to award a single Agreement for the duration of **24 months**.

For the purposes of preparing responses, Tenderers should consider **1 March 2025** as the indicative start date for the contract. The actual contract start date, as well as necessary adjustments, will be agreed with the preferred Tenderer(s) during the negotiation phase.

The Tenderer is expected to provide a detailed schedule as part of the Tender. The proposed schedule shall address the main tasks, milestones and deliverables. Regular progress meetings will be held with ECMWF during the contract to assess contract status, risks and actions.

Courses should all be **concluded by mid-2026** by the very latest.

The launch of first training course would be expected for **May-June 2025.**

The training event in Bonn would be expected for **November 2025.**

To the extent possible, the Tenderer will produce selected preview and promotional outputs early in 2025, with the aim of publicising the upcoming courses and demonstrating tangible progress to ECMWF and DG CNECT. This could include, for example, one or more blog posts, social media releases, and/or webinars.

3.2 Meetings

3.2.1 Physical / face-to-face meetings

A kick-off (KO) meeting will be held no later than one month after contract signature.

One physical meeting should be budgeted for in Tenders submitted.

Tenderers should also foresee active participation in at least four relevant physical events over the duration of the contract in the DestinE context. This should include participation in events such as the DestinE User eXchange meetings, which should be assumed to take place in June 2025 (Vienna) and Q2/2026 (Brussels), and annual ECMWF DestinE meetings in Q3/25 in Bologna and Q2/2026 in Bonn. Contributions to further meetings may be proposed to support user engagement and outreach objectives. Such meetings should be chosen to maximize impact and relevance in the specific impact sector communities.

3.2.2 Regular meetings by web-conference

The Successful Tenderers are expected to organize and chair monthly progress meetings with ECMWF by videoconference, prepare corresponding summary minutes of these meetings and maintain a list of agreed actions and their status.

Successful Tenderers may also be requested by ECMWF to contribute to additional technical working groups on issues relating to the requirements and evolution of DestinE. These are expected to be held generally by web-conference.

3.3 Documents and reports

All project reports shall be produced in English. Unless otherwise specified in the specific contract, deliverables shall be made available to ECMWF in electronic format (Microsoft Word/PDF/Microsoft Excel or compatible), via the DestinE Deliverables Repository portal; the details will be agreed at the negotiation stage.

Please refer to Clause 2.3 and the Annex 5 of the Volume V Agreement for details on Reporting Obligations.

3.4 Graphical material and content for communication

All content shall be produced at least in English, unless specifically agreed by ECMWF. Additional languages may be used if justified. The Successful Tenderers shall ensure that all material (text, visuals, videos, etc.) is duly licensed for use by ECMWF and the European Commission.

Outreach activities will be organised by ECMWF during the period of the contract. In such instances, the Successful Tenderers will be approached by ECMWF for support on developing and delivering contents.

Successful Tenderers shall not establish their own brand for the selected projects but rely on and use DestinE and ECMWF pre-defined wording and branding. A communications package (including guidelines, logos and templates) will be provided by ECMWF at the start of the contract.

3.5 Data and IPR

It is a condition of EU funding for DestinE that the ownership of any deliverable (as defined in Volume V Agreement) developed with DestinE funding passes from the Successful Tenderers to the European Union via ECMWF. Ownership will pass from the date of the creation of the deliverable.

All pre-existing materials (e.g. software and products) used by the Successful Tenderer to produce the DestinE deliverables will remain the property of the Successful Tenderer. The Successful Tenderers will have

to provide a royalty-free, non-exclusive, worldwide, perpetual and irrevocable licence to those pre-existing materials to the European Union and ECMWF.

Developments or modifications to pre-existing materials that constitute results and are acquired or created specifically for DestinE purposes will be owned by the European Union.

Upon request, the Successful Tenderer may be granted a non-exclusive licence, at the discretion of ECMWF and subject to the approval by the European Commission, to use the deliverables which they have provided to DestinE.

3.6   Management and implementation plan (Work Package 0 – WP0)

The Tenderer shall provide a detailed implementation plan of proposed activities for the duration of the contract. Deliverables should be consistent with the technical requirements specified in Section 2.

The number of milestones is not prescribed, but they should be designed as markers of demonstrable progress in capabilities development and/or quality of capability delivery to keep progress monitoring manageable.

Adjustments to the proposed implementation plan can be proposed by the Successful Tenderer during the contract, but they must be agreed to by ECMWF.

As part of the general project management description, the Tenderer shall consider the following elements (this is not an exhaustive list):

- Semestrial, annual and final Reports and annual work Plans shall be provided in accordance with the Volume V Agreement Clause 2.3 and Annex 5.
- Monthly video-conferencing with ECMWF and a proposal for involvement of ECMWF in major project reviews shall be provided as part of the management plan. The contractor is responsible for the organisation of such meetings, including proposing specific topics of discussion, presenting, provision of minutes and maintaining a list of agreed actions.
- If relevant, a list of sub-contractors and details of their contribution, key technical personnel involved in the contract, legal names and addresses shall be provided. The Tenderer shall describe how the Volume V Agreement, in particular Clause 2.9, has been communicated to all their sub-contractors.
- The Tenderer shall describe in the Proposal the management of personal data and how this meets the requirements of Clause 2.8 and Annex 6 of Volume V Agreement.

The table below provides the template to be used by the Tenderer to describe the complete list of deliverables, milestones and schedules for WP0. All milestones and deliverables shall be numbered as indicated. All document deliverables shall be periodically updated and versioned as described in the table. Tenderers shall provide preliminary versions of the completed tables as part of their Tender.

Deliverables for WP0 shall include the following reports:

WP0 Contractual Obligations Template			
#	Nature	Title	Due
D0.y.z-YYYY	Report	Semestrial Implementation Report (January-June YYYY) YYYY being the Year n This includes a specific Financial Report	Annually on 15/07
D0.y.z-YYYY	Report	Annual Implementation Report YYYY YYYY being the Year n-1 This includes a specific Financial Report	Annually on 15/01
D0.y.z	Report	Final Implementation Report	60 days after end of contract
D0.y.z-YYYY	Report	Annual Work Plan YYYY	Annually on 31/08

D0.y.z-YYYY	Other	YYYY being the Year n+1	
		Copy of prime contractor's general financial statements and audit report YYYY, YYYY being the Year n-1	Annually (no-cost associated)

3.7 Key Performance Indicators (KPIs)

The Successful Tenderer shall report periodically on a number of Key Performance Indicators (KPIs) to assist the ECMWF training manager in evaluation and reporting activities.

At least the following KPIs shall be provided:

- Trainings
  - Number of events
  - Total hours of training
  - Efficiency and effectiveness (value for money), including flexibility in rescheduling
  - Quality assurance: complies with relevant standards, passes peer-review and ECMWF quality checks.
- Participants
  - Number of participants
  - Organisations of participants
  - Country of participants
  - User personas (e.g. academia, industry, policy)
- Evaluation
  - Quantitative statistics on user satisfaction
  - Qualitative information on user satisfaction
  - Information on user needs

The above KPIs shall be provided:

- Per training and overall
- On a quarterly basis
- In an easily digestible and reusable format, e.g. Excel spreadsheet.

The final choice of KPIs shall be discussed and agreed with ECMWF during the contract negotiation phase. Reports shall also be provided following each training event with a brief description of the training, any issues encountered, in addition to the KPIs.

3.8 Coordination with parallel activities

This section provides some context on parallel activities with which the successful Tenderer will be expected to coordinate.

3.8.1 Web platform

Currently, ECMWF's training material resides at https://www.ecmwf.int/en/learning, with e-Learning material hosted inside a Moodle platform at https://learning.ecmwf.int/. Tenderers should be aware of a parallel web development activity, in which a landing page at the Destination Earth micro-site (https://destine.ecmwf.int/) is being constructed for the ML training under DestinE. This page will feature links to the training material produced under the present tender (although the eLearning modules themselves will be hosted in the e-Learning site mentioned previously). The page will also feature news of upcoming training, events, possibly a training blog, and the material mentioned in Section 2.3.4. Tenderers will therefore have to coordinate with the page developers and the requirements of the ECMWF communication team to provide content and updates.

The Successful Tenderer will coordinate this activity where necessary, and with the help of ECMWF.

3.8.2 Training event

A machine learning training event is planned indicatively for autumn 2025, which will link to the current DestinE ML training package. This event, which is expected to be a multi-day event in Bonn, is expected to feature lectures and panel sessions on machine learning, with some presentations from students from the online courses. It will be a hybrid event for selected sessions and aim to train up to around fifty people in person.

The logistics of the event (venue, catering, etc) will be procured through a separate tender, but the scientific coordinator of the present tender will work with ECMWF to plan and execute the event and coordinate the scientific content, and experts involved in the online courses will lecture at the event and provide the educational material. The ECMWF training manager shall be the main point of contact.

3.9 Costs

All training courses and any associated events shall be free of charge for participants, but in case of on-site events, the cost of any travel and accommodation for participants shall **not be covered** by the Successful Tenderer.

3.10 Language

The language of all training activities and resources shall be English.

3.11 Quality assurance

Tenderers shall propose a quality assurance mechanism to ensure the trainings and resources meet the needs of the target audiences. The quality assurance mechanism shall ensure that training courses shall match or exceed benchmark standards and achieve value for money. It shall include a clearly defined evaluation approach for both the target audience and for ECMWF.

4 Tender Format and Content

General guidelines for the tender are described in Volume IIIB. Specific requirements to prepare the proposal for this particular tender are described in the next sub-sections.

4.1 Page limits

As a guideline, it is expected that individual sections of the Tenderer's response do not exceed the page limits listed below. These are advisory limits and should be followed wherever possible, to avoid excessive or wordy responses.

Section	*Page Limit*
Executive Summary	2
Track Record	2 (for general) and 2 (per entity)
Quality of resources to be Deployed	2 (excluding Table 1 in Volume IIIB and CVs with a maximum length of 2 pages each)
Technical Solution Proposed	4 + 3 per Work package + 3 for the Business Case (Table 2 in Volume IIIB, the section on references, publications, patents and any pre-existing IPR is excluded from the page limit and has no page limit)

Management and Implementation	6 (excluding Table 4 and Table 5 in Volume IIIB) + 2 per each Work package description (Table 3 in Volume IIIB)
Pricing Table	No limitation

Table 1: Page limits

4.2 Specific additional instructions for the Tenderer's response

The following is a guide to the minimum content expected to be included in each section, additional to the content described in the general guidelines of Volume IIIB. This is not an exhaustive description and additional information may be necessary depending on the Tenderer's response.

4.2.1 Executive summary

The Tenderer shall provide an executive summary of the proposal, describing the objectives, team and service level.

4.2.2 Track Record

The Tenderer shall demonstrate for itself and for any proposed subcontractors that they have experience with relevant projects in the public or private sector at national or international level. ECMWF may ask for evidence of performance in the form of certificates issued or countersigned by the competent authority.

4.2.3 Quality of Resources to be Deployed

The Tenderer shall propose a team that meets at least the following requirements:

- A senior team member with more than 5 years of experience in managing activities related to this ITT (referred to as Service Manager). This person will be the point of contact on technical matters.
- A team member with experience of managing projects and contracts of this type and size (referred to as Contract Manager). This person will be the main point of contact for administrative matters.
- Team members with demonstrated experience in performing activities related to the various aspects of this ITT.

These team members shall be involved in the activities of this ITT at a minimum level of 10% of their total working time.

4.2.4 Technical Solution Proposed

The Tenderer is expected to provide a short background to the proposed technical solution to demonstrate understanding of the solution proposed, as well as an exhaustive and detailed description of the proposed technical solution and its organisation into work packages.

As part of this section of the Tenderer's response, the Tenderer shall respond to the following **Business Case**. This response should not exceed the page limit indicated in Table 1 above. The outline should be accompanied by a breakdown of associated costs for the various activities (i.e. steps, processes) proposed to fulfil the requirements of the Business Case. Tenderers are free to choose any format for providing this breakdown of costs, however as a minimum it should include the resource type, unit price/rate and volume/quantity (e.g. days/hours/units etc.).

Business Case description:

We would like you to outline the steps required, processes you would use and likely costs to organise and execute an online training course on machine learning (ML) for weather forecasting. The scientific coordinator will work with ECMWF to devise the curriculum of the training course and to identify ML experts to give the training, which will be a mixture of ECMWF staff, experts from the DestinE network, and externally-contracted experts where necessary. The course should include learning materials in a mixture of

formats, for example eLearning modules, videos, audio, Jupyter notebook examples and audio, among others. The total quantity of learning materials should be around 20 hours (note that the 20 hours are for this representative business case only; the tender overall will be in the range of 50 hours), and the course shall be hosted on ECMWF's Moodle platform. You are free to propose the course schedule.

Please outline your approach and the associated costs to planning and executing the course, including timings. This should include:

- Scientific coordination and liaising with ECMWF, including curriculum design and coordination of ML experts
- Delivery and quality control of scientific content
- Design and delivery of learning materials (lectures, eLearning modules, etc.)
- Management of the course (promotion, registrations, interactions with students)
- Management of the Learning Management System and other web activities
- Monitoring and evaluation of student satisfaction, participation, and other relevant KPIs

4.2.5 Management and Implementation

See section 3.6.

4.2.6 Diversity and inclusion

If multiple Tenderers present equally qualified Tenders (discrepancy lower than 1%), ECMWF will take into consideration the diversity and gender balance of each Tenderer's organisation as a tiebreaker when making the final decision. We recognise that diversity and a collaborative environment are essential for advancing scientific discovery and innovation, and we are dedicated to creating a culture that encourages and supports the contributions of individuals from all backgrounds. As part of this commitment, we encourage Tenders from Tenderers who share our values and demonstrate a commitment to diversity and inclusion in their own organisations. We believe that working with suppliers who support our efforts to create a more inclusive and diverse community is key to achieving our goals and driving progress forward in all our areas of activities. Therefore, the Centre encourages all potential Tenderers to take these values into consideration when submitting proposals.