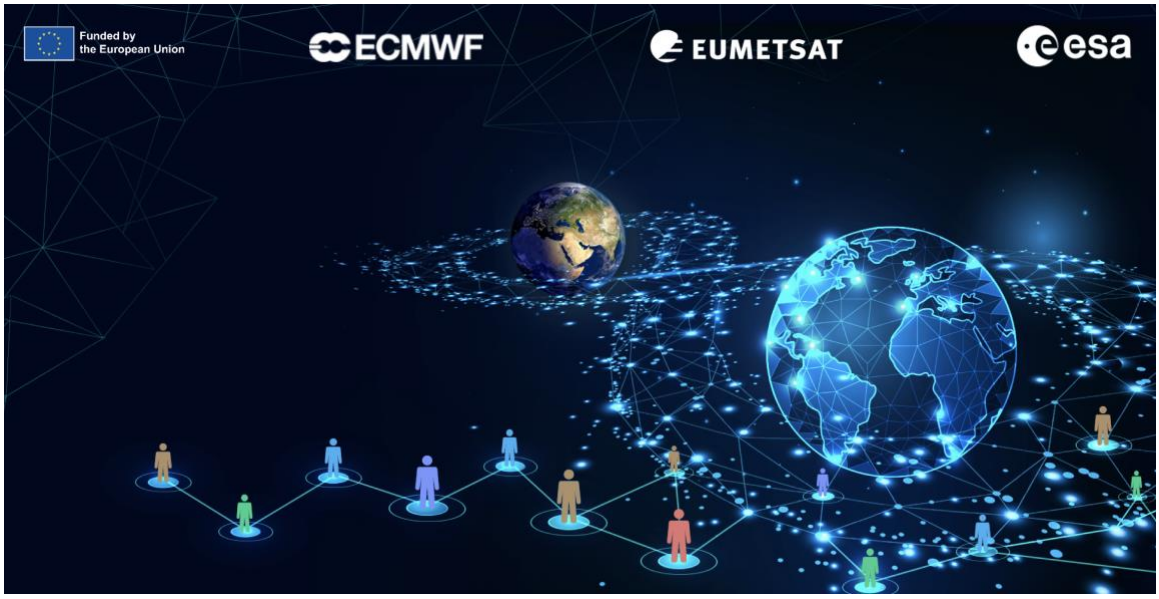

1st Destination Earth User eXchange

Meeting Report

Frascati, Italy - 15th February 2023

Executive Summary

The 1st Destination Earth User eXchange was held in at the European Space Agency's Centre for Earth Observations in Frascati, Italy on 15th February 2023. The meeting was co-organised by the European Space Agency (ESA), the European Organisation for the Exploitation of Meteorological Satellites (EUMETSAT) and the European Centre for Medium-Range Weather Forecasts (ECMWF).

This was the first of a series of regular events that aim at establishing a forum for exchange of DestinE stakeholders. The objective of this first event was to inform on recent progress as well as start building a community. The event was also an opportunity to identify further stakeholders or prospective partners, and their respective interests, understanding expectations and possible avenues for interaction and engagement.

The event was characterised by a wide and well-balanced participation. More than 100 people attended in person (onsite participation was capped due to room capacity), while 300+ attended virtually via Webex. Attendees included government institutions, academic institutions, national meteorological and hydrological services, as well as industry. The participants had a good geographical distribution, 30 countries were represented (23 EU Member States), Germany and Italy were the two countries with the highest participation.

This first user eXchange initiated the “open stakeholder dialogue”, one of the pillars of DestinE user engagement strategy. The wide and active participation during the event showed that there is clear interest in the activity, by scientific and technology contributors, end-users as well as by companies interested to provide solutions.
Representatives of ECMWF, ESA and EUMETSAT presented the state of the development of the main components of the DestinE system after about 1 year from the kick-off of the initiative. Although the initial services will be available to the users in 2024, the early engagement was appreciated by participants. Opportunities were presented to start engaging immediately to shape the future of DestinE.

Many panellists expressed high expectations from the Digital Twin paradigm and ambition to work with the system. DestinE was considered a digital decision tool, supporting the definition of pathways and strategies for climate resilience. There was a call to work closely with end-users throughout the development. Concerns articulated related to the perceived complexity of the system were also expressed, this highlighted the need to identify skill gaps and to provide technical support since the early stages of user adoption of the DestinE system. More information on technical and programmatic avenues for engagement is also needed.

Event description

The event consisted of 2 oral sessions and 3 panel discussions (Programme in Annex).

Framing session

The framing session was moderated onsite by Claudia Vitolo (ESA) and online by Ines Sanz Morere (ESA).

The session included interventions by representatives of the European Commission, a representative user and technology partner to highlight how DestinE should serve to support European Union policy ambitions. The session included information on how DestinE is positioned vis-à-vis Copernicus and the ESA Digital Twin Earth programme.

- Nicolaus Hanowski, Head of the Mission Management and Ground Segment Department at ESA in his opening statement highlighting the important alliance amongst ESA-EUMETSAT-ECMWF to achieve the goal of the project under the leadership of EC DG-CNECT. It was stressed that ESA Member States are fully on board with DestinE, which is also witnessed by the support received to develop the ESA DTE programme element which strongly relies on DestinE. "*The moment the users become visible; is the moment a project becomes possible*".

- Christiana Photiadou, Expert on Climate Change Impacts at the European Environment Agency, provided the perspective of a future user of the DestinE system. The EEA provides actionable knowledge on climate change hazards and supports EU initiatives. Support is based on evidence and knowledge. As such, the agency is interested in interacting with several DestinE data and tools for Climate Change Adaptation "*from climate data to actionable knowledge*". Adaptation support tools were described as methods for supporting countries in applying EEA policy's ideas and options. An example of how member states are applying the adaptation measures was provided. Challenges occur in the implementation phase, as tools are not available to implement the adaptation plan. The Climate-ADAPT knowledge hub was also described. DestinE could fit into this tool to help develop methods for regional implementation for member states. It was suggested to see DestinE as a digital decision tool, to determine pathways and strategies for climate resilience, including assessing risks and economic impact. Some obstacles were also identified: spanning the regional vs local context for decisions, complexities associated with compounding and cascading effects, cost and effectiveness of measures need to be considered, spatial and temporal resolution not consistent with many adaptation actions, information needs to be available and reliable.

- Chiara Marsigli, Scientific Collaborator at Deutscher Wetterdienst, talked about the potential benefits of Digital Twins for users in short-term forecast domains. The Global-to-Regional ICON (GLORI) Digital Twin project was presented. This is a project made possible by the tri-lateral cooperation amongst Germany, Italy, and Switzerland. Similar to the DestinE DT on Extremes, GLORI runs on heterogeneous GPU-CPU architecture at high resolution and provides short-range global storm-resolving km-scale (~3 km horizontal) predictions using hybrid variational ensemble data assimilation. GLORI offers on-demand high resolution (~500m-1km horizontal) predictions for selected regions (e.g., Alpine region), allows to perform on-demand predictions for energy applications (mineral dust), health applications (pollen), and can interface with hydrological models. From Digital Twins, improvements are expected in data assimilation, from the higher resolution and more rapid responses. She recognized many synergies between GLORI and DestinE that she was keen to explore.

- Andreas Zucker, Policy Officer at DG-ENER, provided a comprehensive perspective on DestinE for policy benefits in the European energy market, which was characterised by huge variations in energy costs over the past years. The audience was urged to think about future gas demands and market conditions, especially in terms of prices and storage. He described the timeline of EU's initiative to phase out fossil fuels due to global political events (see also REPowerEU[1]). It was stressed that European decarbonisation requires electrification of economy, which must be secure and affordable, while decarbonising. The identification of suitable pathways to achieve this is currently under investigation. With regards to DestinE, it is expected the contribution to serve the need for data for investors who need information on the impact of their investments, and at government level, who need to understand how to make the correct policy proposals based on how effective the hydrogen transition is working.

- Gustav Kalbe, Acting Director of DG-CNECT, presented Destination Earth as a project of the European Commission that supports the green and digital transition. The overall motivation of DestinE is to create a highly accurate digital model of the Earth able to simulate numerous Earth phenomena and able to analyse scenarios. The need to merge heterogeneous data from many sources to simulate planet's past/present/future was strongly emphasised. DestinE is primarily aimed at supporting evidence-based policy making, less focused on expert science usage. DG-CNECT leads DestinE, which is funded under the Digital Europe Programme, with strong links to Horizon Europe, Copernicus and EuroHPC. The project is expected to be developed in three phases by 2030, with first two digital twins to become operational in 2024. The importance of high-performance computing (HPC) required for the high resolution near real-time decision making desired for

[1] https://commission.europa.eu/strategy-and-policy/priorities-2019-2024/european-green-deal/repowereu-affordable-secure-and-sustainable-energy-europe_en

DestinE was mentioned. Current HPC capacity is not sufficient for these demands, with x100 times available facilities required. The intervention closed by encouraging end-users to engage with the entrusted entities (ESA-EUMETSAT-ECMWF) to inform on existing capabilities and provide feedback on the evolution of the initiative, especially with regards to specific thematic fields.

The session ended with the audience enquiring about how the DGs of the European Commission internally coordinate on EO and Digital Twin related activities. Andreas Zucker replied that numerous Digital Twin related initiatives are ongoing (not limited to DestinE). A co-creation approach is in place to coordinate activities across various DGs.

Table 1 – Take-home messages for the Framing session

Take-home messages	**How should DestinE support European Union policy ambitions?** 1. Engagement with users means "having a mission". Community is invited to actively engage with DestinE. 2. DestinE is expected to match decision support needs at **local/regional level** for climate adaptation and extreme weather – **for different impact sectors**, including climate adaptation, energy, disaster management. 3. DT offer potential through Science and Technology developments, including better data assimilation and more rapid responses. 4. Co-design paradigm adds value. Users are encouraged and expected to be core to the development of DestinE, through interactions and exchange.

Information session

This session was moderated onsite by Claudia Vitolo (ESA) and online by Edward Malina (ESA).

The session included presentations from the three entrusted entities tasked to implement DestinE – ECMWF, ESA and EUMETSAT – to inform stakeholders of implementation progress and plans.

- Kathrin Hintze, Deputy Project Manager of DestinE at ESA, opened the session by presenting DestinE's general structure. DestinE is to be considered as one system, although the three components are autonomously implemented and operated. The components are coupled through data access interfaces. The project is in the early phase (1 year in), initial results will be visible this year but there is still a long road ahead.

- Thomas Geenen, Technology Partnership Lead for DestinE at ECMWF, introduced the Digital Twin Engine as the core component of the DestinE system tasked to generate information flows. It is characterized by an interactive and configurable access to data, models, and workflows much like a Game Engine but for Earth Systems. Workflows will accommodate different uses, from rapid research prototyping to full research experimentation and prototype operational production. Details on data access (using S3 bucket, Polytope, and notifications via Aviso) were provided, motivated by experience in operational Numerical Weather Predictions. Lastly, a timeline for an end-to-end data flow was presented, to support models to be demonstrated in Q2 2023. The development of more full-featured components is planned in Q3-Q4 2023.

- Kristian Pagh Nielsen, Meteorologist at the Danish Meteorological Service, presented the on-demand Digital Twin of weather-induced Extremes. The intervention opened with an anecdote on weather forecast history and experience on extreme forecasts, providing the perspective of national weather services. Physical models are important for managing extreme events, since they may not have happened before, so cannot be anticipated from statistical approaches. Moving to higher resolution offers promise, but also many challenges. Validation cases were presented. These focus on hydrology, air quality, renewable energy, and wildfires and are designed to test the system, based on collaborations with transmission system operators, therefore exploiting existing links.

- Jenni Kontkanen, Climate Strategist at CSC IT Center for Science in Finland, presented the Digital Twin on Climate Adaptation. The motivation for this work is driven by the need for new solutions to inform climate change adaptation efforts and to assess risks of failed mitigation actions. The Digital Twin on Climate Adaptation can be envisaged as a new type of climate information system that can be used to assess impacts of climate change and different adaptation strategies at local and regional levels over multiple decades. The plan for the next-generation Earth system models, as an accelerated development within DestinE, was presented. Observational operators will translate model information to observation space (remote sensing and in situ), which is key to comparability in a future climate, or in application contexts. Computationally expensive tasks will make effective use of LUMI, Leonardo, MN5. Five thematic use cases are developed in the context of the development of the Climate DT. First version of the Digital Twin for Climate adaptation will be developed by April 2024.

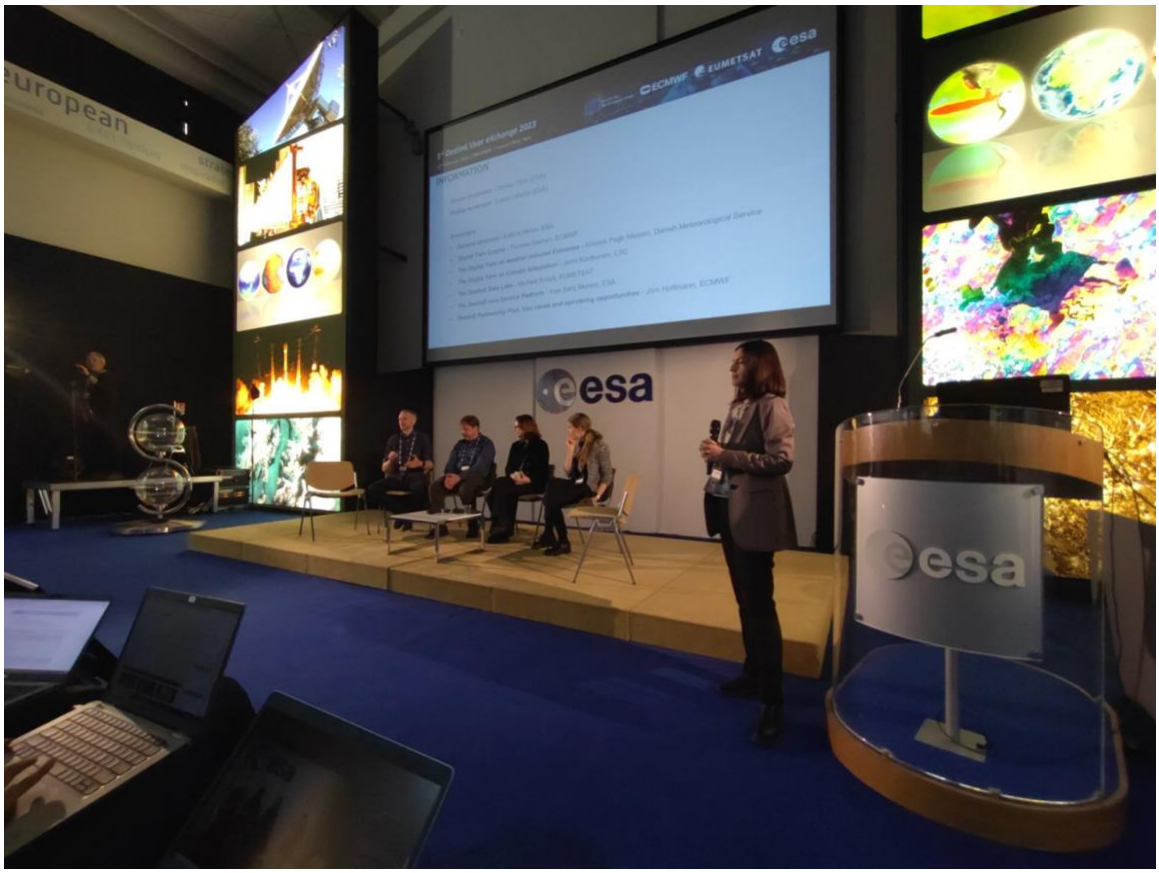

Figure 1 - Information session (part 1)

The audience enquired about key users for the Climate Digital Twin, to which Jenni Kontkanen replied mentioning national meteorological services with the possibility to expand to more users. The following discussion touched briefly on the existence of several interfaces and standards that could be potentially used within DestinE.

- Michael Schick, System manager for DestinE at EUMETSAT, presented the DestinE Data Lake (DEDL), which is built from geographically distributed physical elements, offering discovery, data access and big data processing near data. The key points of the component are to allow for fusion of DT data with data in fresh data pools originating from federated data spaces. The Data Lake is extendable thanks to reference architecture definitions and its content is a User-Driven Data Portfolio managed by a governance board.

- Ines Sanz Morere, Earth Information Data Process Engineer at ESA, presented the DestinE core Service Platform (DESP) as the single access point for users to the DestinE system, through which all services are available. Applications will be operating on DestinE data, free and open; enable complementary resources, including baseline, advanced and user-defined services. A procedure will be put in place to register services under DESP, which is gradually opening to users starting from Q4 2023.

- Jörn Hoffmann, Applications Partnership Lead for DestinE at ECMWF, presented the DestinE Partnership Plan as well as use cases and upcoming opportunities. The importance of engagement & co-design for DestinE was stressed. Within DestinE, impact sector models and user communities are brought closer to the complex Earth-system models. An open stakeholder dialogue (which includes own actions and participation to activities of others), together with targeted user partnerships are the pillars of DestinE stakeholder engagement strategy. Partnerships in a wide sense include procured use cases (several contracts already placed by ECMWF, more to come by ESA), technology contracts as well as in-kind contributions with external organizations for the co-evolution of the DestinE system.

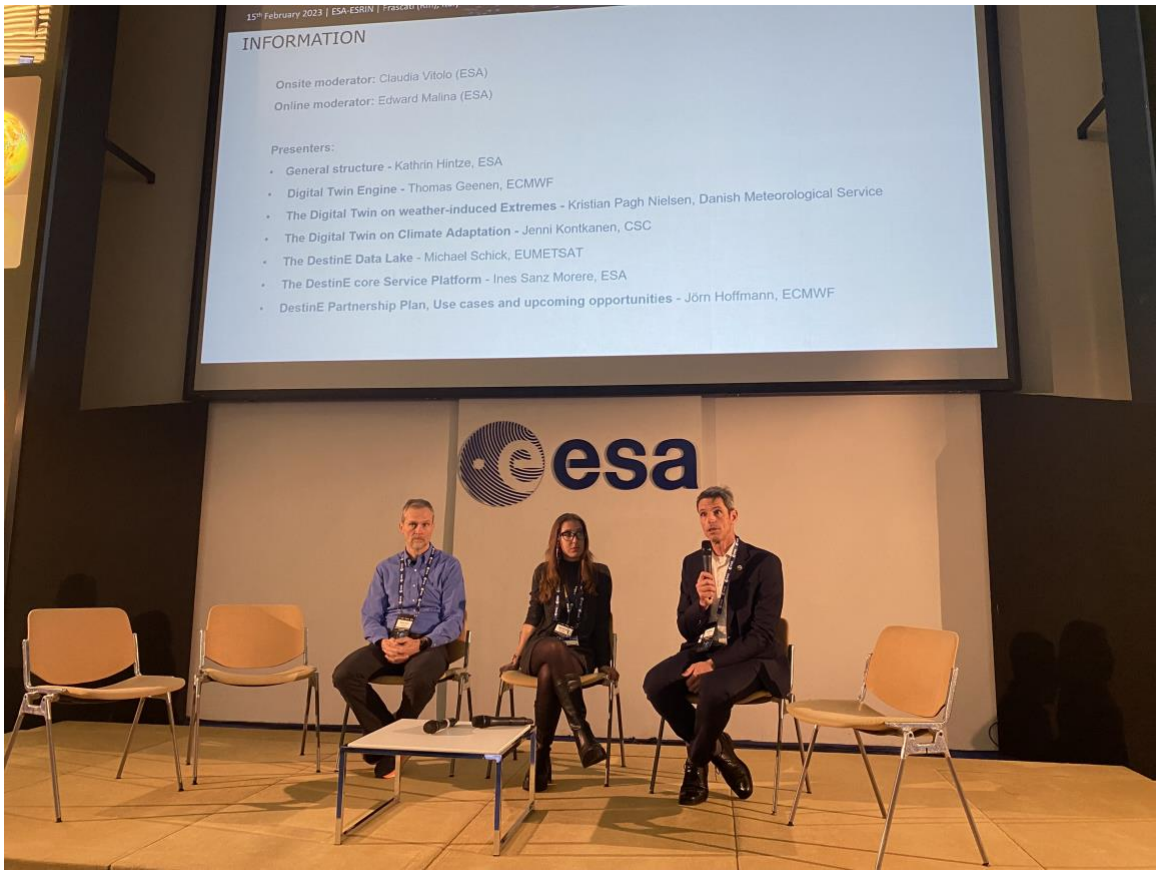

Figure 2 - Information session (part 2)

During the discussion with the audience, it was clarified that in situ data can be ingested and made available in the DestinE system but that requires ad hoc discussion. Relevant developments under Horizon Europe may (in)directly contribute to DestinE, also in terms of users/developers. It was noted that DestinE is also open to commercial applications, the services integrated on the platform may decide on their user offer. DestinE supported services (for which financial contribution is provided from the DestinE programme) have to offer a level of free services to DestinE users.

Table 2– Take-home messages for the Information session

Take-home messages	**DestinE implementation progress and plans** 1. Development has started and will continue throughout the three phases of DestinE. 2. Users of DestinE going through the DestinE Service Platform will find an interactive and flexible environment. DestinE is to be co-designed amongst the users, stakeholders and the entrusted entities. 3. The DestinE Data Portfolio will respond to user needs. 4. DestinE Data is intended to be provided open and free (federated data policies are preserved) consistent with EU open data strategies. A specific data policy will be established in due time. 5. DestinE ecosystem is designed based on an inclusive and sustainable framework, facilitating the integration of external applications and DTs in an autonomous way. 6. DestinE is establishing many opportunities to interact, people are encouraged to submit ideas and suggestions.

Panel 1 – From Earth System Modelling to Impact

This session was moderated onsite by Jörn Hoffmann (ECMWF) and online by Thomas Geenen (ECMWF).

The objective of this panel was to contribute to a shared understanding on how use cases will (i) demonstrate the benefit of DestinE for users and (ii) serve to guide the development of DestinE towards meeting user needs. The panel also focused on early opportunities, i.e., DestinE phase 1, extending to phase 2.

The session opened with each panellist providing a brief introduction to their work an involvement in DestinE.

Panellists:

1. David Gustafsson, Hydrologist at SMHI working on the Digital Twin for on-demand Extremes, aims to use the DT to improve predictions of flooding in Europe and detailed numerous example events. An example of a current national workflow for flood forecasting was shared. This involved the use of a hydrological model and hydraulic model feeding an impact model to predict risk of flooding. His vision is to achieve an on-demand hyper resolution Numerical Weather Prediction that will feed into current downstream national workflows. Beyond that, the ambition is to embed hydro-models in the DT to get the feedback from the land to the atmosphere. Work is ongoing to demonstrate how this can be done in 9 different

countries and co-design actionable response workflows with societal users (mapping flood warning workflows), to ensuring uptake of DT solution into real-time decision making. Lastly, trying to improve on the flood warning quality by designing a roadmap for a global two-ways coupled model.

2. Sami Niemelä, Director of Meteorological and Marine Research Programme at FMI, presented the 5 use cases that have been proposed to demonstrate the fidelity of the information provided by the Earth System models within the Climate DT. The 5 cases (on Wildfires, HydroRiver, HydroMet, Energy and Urban) provide new tools for climate adaptation policy making. The vision on how the users are expected to interact with the DT was presented. The novelty lies in the data streams providing model outputs in a standardised way, one-pass algorithm to update summary statistics. The long-term vision (beyond Phase 1) is to achieve an interactive co-development with users. Use cases and development/setup of climates models will be updated based on user requirements and requests. The use case implementation is currently underway.

3. Marion Schrödter-Homscheidt, Scientist and Group Leader on Energy systems at DLR, presented the Energy system use case contracted by ECMWF. The current energy system is going through progressive electrification and de-fossilization. The shift to renewable energy is causing both energy generation and demand to be more and more driven by weather. Several grid operators are involved in this use case to address the European Resource Adequacy Assessment, 10-year planning process which attempts to respond to questions like: “What will happen if we change the system? What kind of additional power do we need? What generators do we need?”. It was stressed that beside the relevant role of spatio-temporal representation of weather patterns, it is important to ensure that compound and cascading events are properly assessed. Currently there are several obstacles to achieve reliable predictions and DestinE will contribute to overcome these challenges. Obstacles remains at the interface between climate and energy models, which is addressed in a co-design approach with users, in this use case. The use case makes use of REMIX (mixing energy production & demand models with approaches to plan this energy transition, including assessing load balancing and changes in the infrastructure) and ENDAT (connecting meteorological data to power generation models) tools. DestinE team was invited to provide tools and support to help users and end-users familiarise with what looks like a very complex system.

4. Filip Lefebre, Business Development Manager at VITO, presented a use case on urban heat mapping which aims at supporting EU adaptation policy. Cities are hot spots for climate change. Highest impacts occur at this type of location, especially in poor areas. Heat islands impact several sectors: energy, health, transport, tourism, biodiversity and economy. UrbClim was described as an urban climate model delivering data at 100m to be coupled to the Digital Twin on Climate

Adaptation. This will yield information on thermal comfort at street scale. European users and local administrations are both interested in this type of applications, to generate policies to develop more sustainable urban areas (with respect to regional investment funds) as well as what the future will be under different climate scenarios.

5. Femke Vossepoel, Associate Professor at TU Delft, provided an overview of possible DestinE applications for a safe and sustainable delta development under a changing climate. It was pointed out that multiple Digital Twins, connected together, will most likely be necessary and gave an example of scenarios users might need to investigate to monitor salt intrusion into the Rhine delta showing how far saline water penetrated the delta, especially under drought conditions. The eWaterCycle was also presented as a flexible and interactive tool that could work well within the DestinE system. A partnership is currently being explored to link eWaterCycle to DestinE. A plethora of other relevant projects was presented stressing that interaction with users can reveal what type of Digital Twins will be needed in the future.

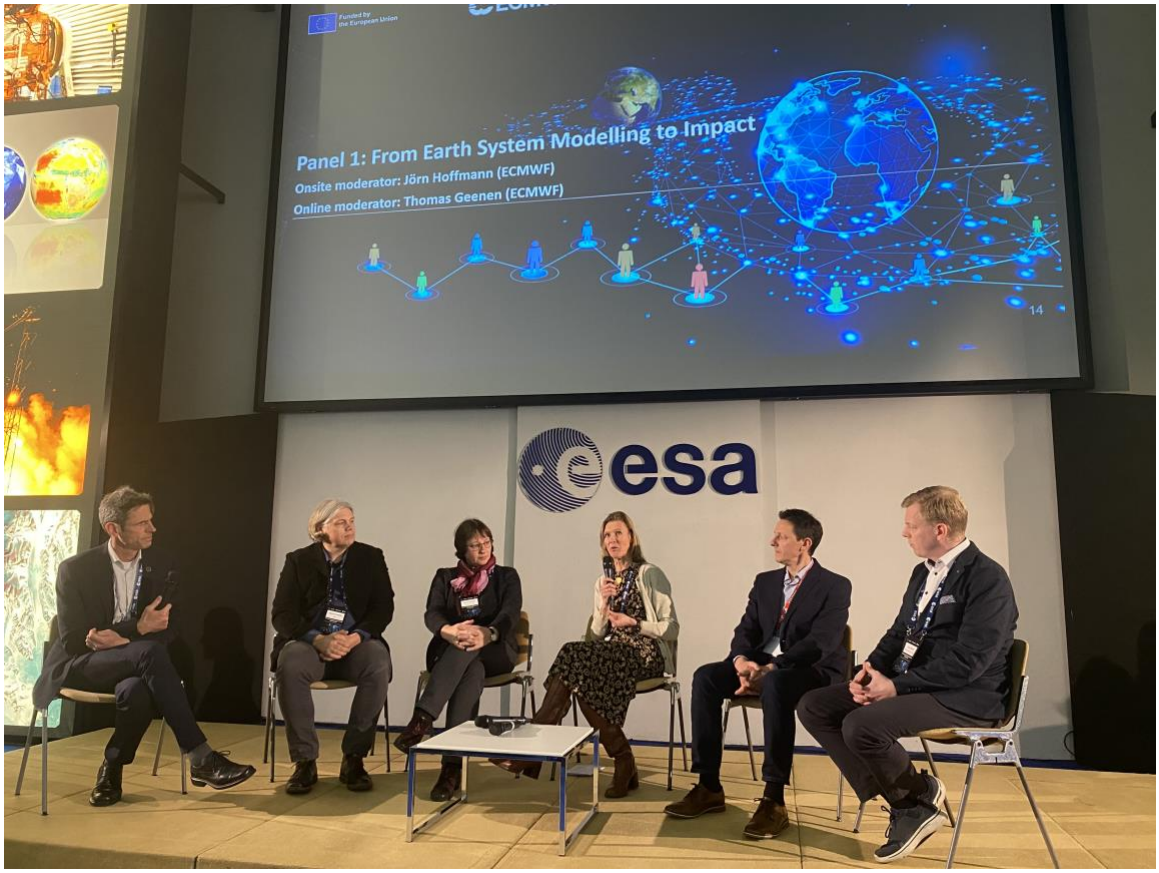

Figure 3 - Panel 1

Following the Panellists' presentations Dr. Hoffmann led a discussion among the Panellists focusing on their expectations from DestinE. They agreed on the promise the vision for

DestinE held, pointing to the increasing opportunity of users to interact with a coupled modelling framework as a key distinction to the capable models, which already exist. When asked about the challenges DestinE is faced with, there was a clear focus on engaging users. There was no question that users were in need of actionable data and information can deliver, but they stressed the expectation of users, including policy users, to receive answers, rather than further questions. Given the urgencies in many sectors to respond to global change issues the Panellists saw sufficient openness of users to engage and adapt new systems but expected DestinE to approach and listen to their needs. Issues of visualisation were not considered to be the most pressing, since other solution existed for this. But accessibility, relevance, and quality of information, including robust statistical uncertainty quantification, were considered essential. The role of use cases for DestinE was considered essential. They should serve to demonstrate the fidelity of data in a variety of concrete applications, help identify and understand key users and provide a means to listen to these and understand their needs. For specific domains they will also bring the value of improved climate models to the impact sector and ensure the co-design of the digital twins with users at different administrative levels.

Table 3 – Take-home messages for Panel 1

Take-home messages	**From Earth System Modelling to Impact** 1. Use cases will deliver tangible solutions already early on (Phase 1), e.g., how local and regional scale may interact. 2. DestinE should become a place of active user dialogue, a place where co-creation happens, thanks to a new interactive framework and the new way the information is delivered to users. 3. Demonstrators help to build a new narrative, but it is crucial to manage user expectations. 4. Use cases should work with policy-mandated users – they often are able to engage, sometimes a skill-gap needs to be bridged. 5. interoperability, flexibility and usability of outputs are essential to demonstrate added value. 6. Scaling up specific solutions will be a challenge – DestinE must be careful to define how to move beyond the current user involved. 7. Science to services: Need to discuss how the new components may concretely bring user dimension into play, knowing there is a variety of users, with different level of data literacy and external policy constraints.

Panel 2 – Interacting with DestinE

This session was moderated onsite by Danaële Puechmaille (EUMETSAT) and online by Michael Schick (EUMETSAT).

Objective: This panel discussed different ways to interact with the DestinE services and related time frame for their implementation. The focus was on technological capabilities, which are either under development or envisaged to be developed within Phase 1.

Panellists:

1. Miruna Stoicescu, Data Services Concepts and Evolution Engineer at EUMETSAT, opened the session providing an example of DestinE Usage Scenario. The envisaged scenario sees a user (with a question or clear workflow in mind) registering to DestinE on the core service platform (DESP). Once registered/logged in, the user has the possibility to explore data and service offering and can access a user-dedicated workspace. The user develops an algorithm or uses an existing one that makes use of a number of services (DT outputs and/or access federated data space, import user data, execute simulations, access built-in applications & functions, etc.). The results obtained can be shared with the wider community or used directly to take actions. It was stressed that not all the components to carry out such a workflow will be available in Phase 1.

2. Nils Wedi, DestinE Digital Technology Lead at ECMWF, provided an example of complex on-demand scenarios on the DestinE platform. The workflow may start from the Global Extreme DT, a continuous forecast initiated with latest observations, which provides extreme event notifications (based on user-defined criteria), triggering DT data streams. A notification will trigger an action (e.g., an on-demand DT for a targeted area-specific impact forecast). Information could be provided purely as a notification or as more complex impact forecasts and risk assessment. Visualisation could support a direct answer to a given question or support the process for deriving a decision. This can all feed into other application, such as hydrology DTs etc, with further processing at the end of all this including potentially translation of complex information through physical or ML/AI models that may be combined for policy and decision support.

3. Rochelle Schneider Dos Santos, DestinE AI Application Lead at ESA, presented a concrete AI/ML use case, demonstrating the interaction with the DestinE system, based on improving S5P NO_2 data, combined with WHO air pollution guidelines to predict the impact of NO_2 trends on EU health. Data are a combination of what's available in DestinE and users' own data/methods.

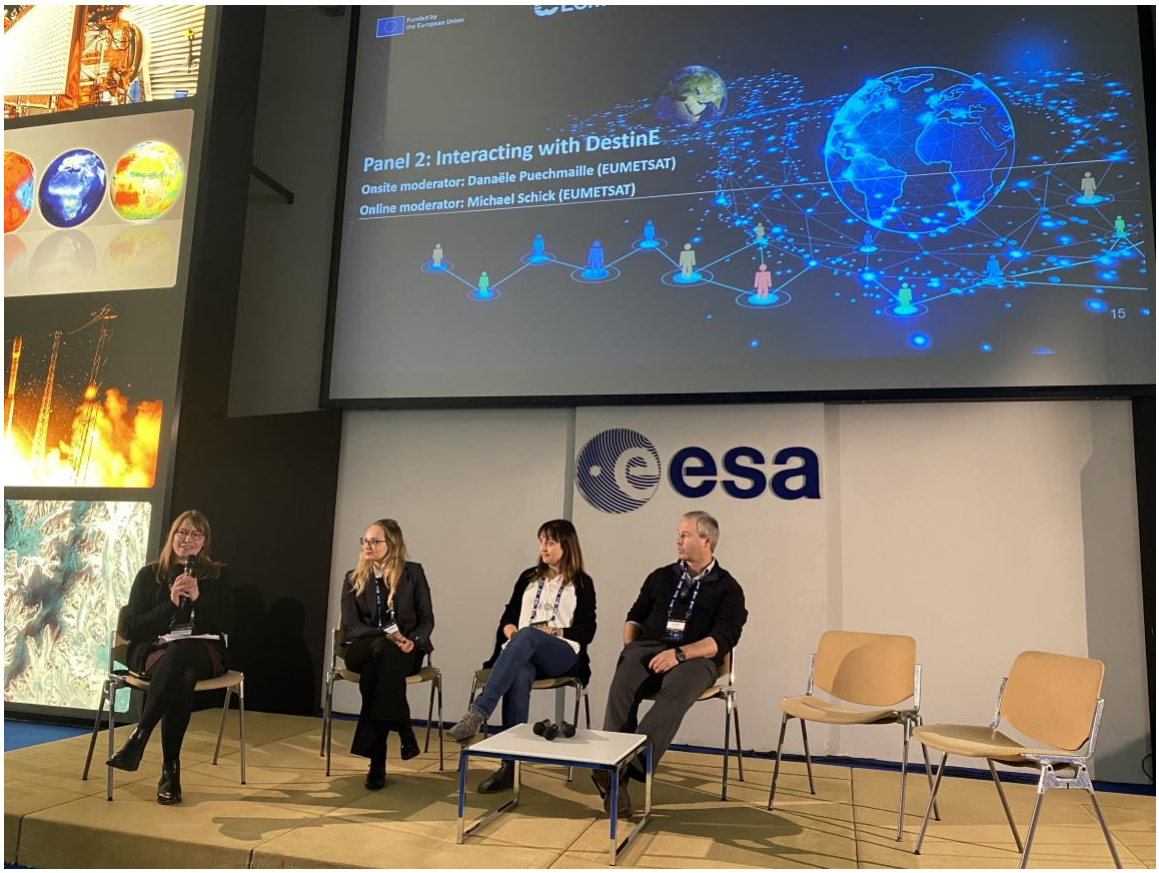

Figure 4 - Panel 2

Along the presentations of the three panellists, several questions were raised by the audience, online and in the room, about the Destination Earth System mechanisms and about technological capabilities.

The event attendees asked about the metadata tagging, cataloguing and interfaces foreseen to be used by DestinE Data Lake, to facilitate interoperability with others Digital Twins and similar initiatives. Panellists informed that the system is trying to satisfy widely accepted metadata standards but also experimenting with tools attempting to augment information about the traceability of data (how it was generated) but a satisfactory solution will only be available at later stages. However, the DestinE team is interacting with other organisations to break up silos.

The audience highlighted DestinE system seems complex, in particular the services offered by the DEDL, considered to be a system for software developers. The panellist clarified that support will be provided. Pre-built pipelines were mentioned as valuable for the uptake of DestinE, the panellists clarified they will be developed at later stage. The core platform will provide a Service Register housing applications meant to bridge the gap between the software developing skill needed to interact with the system and the (non-technical) user needs.

Clarification about the DestinE Data Portfolio was given: it will provide access to Digital Twins data while access to data from different data spaces will be developed gradually. A DestinE Data Governance Board will shortly be established and will meet periodically to

assesses all the requests for user-data sharing (also considering quality of data) and the potential addition of further datasets considered of interest for DestinE users. Access to datasets will be given via a Harmonized API and data policy document is being formulated to provide information about allowed metadata, timespan in which the data will be stored, etc. It was also stressed that DestinE data will be free and open, preserving federated data policies.
The on-demand Digital Twin was also subject of discussion. Users will be able to derive information while data is "in motion", but there will also be other ways to interact, e.g., attaching programmable elements to a running DT to derive indices. Re-running a DT with different settings is not envisaged for Phase 1 but could be considered later on.
Finally, it is important to note, that DESP will provide support via a Service Desk and a dedicated DestinE website will provide several types of educational material to facilitate user uptake.

Table 4 – Take-home messages for Panel 2

Take-home messages	**Interacting with DestinE** 1. Technologies can be complex to get used to, a DestinE help desk/documentation/example will provide some guidance. DestinE website is planned to include plenty of educational material, there will be a community manager that will collect info from users and enable interactions amongst users, also DESP will provide support via a Service Desk 2. Metadata standards are used to make DestinE data widely accessible and understandable (will be enhanced over time) 3. Interest in understanding whether DestinE data is AI ready, the goal is to make data more readily available for machines and people. 4. DestinE will provide services for a wide range of user groups, from non-expert to expert users, providing tools and services adapted to the needs of each user group. Pre-built pipelines for less technical users could be valuable to people that have no Scientific/technical background. There will be solutions for that, later in the project, available in the Service Register (in DESP)

Panel 3 – Community forum

This session was moderated onsite by Stefanie Lumnitz (ESA) and online by Sveinung Loekken (ESA).

Objective: This panel focuses on developing a better understanding of the communities targeted by DestinE in Phase 1, how to engage these communities and how to work together to co-evolve DestinE capabilities moving towards Phase 2.

Panellists:

1. Efstratios Stylianidis, Professor at the Aristotle University of Thessaloniki (AUTh), represented the team at AUTh contracted by ESA to develop a community building and engagement strategy. The intervention opened by introducing the devised plan to build a vibrant DestinE User Community. The team envisaged a rather comprehensive approach that encompasses the definition of target groups / community of practice, goals and governance structure; the development of content; the implementation of a co-design approach for ensuring continuous engagement and collating user requirements; and the systematic monitoring of performance to further enhance the engagement with the community. There are clear risks to mitigate, amongst which the fact that stakeholder might lose interest and stop engaging, as well as challenges to develop a self-sustained DestinE community.

2. Ines Alonso, Aerospace Engineer and Project Manager at Met Éireann, provided a concrete example of how the community is coordinating and preparing to DestinE introducing the Destination Earth National Group for Ireland. This is an intergovernmental/departmental group that represents Irish interests in DestinE, formed by a numerous and wide poll of stakeholders. The group is organised in committees and includes government departments and state agencies. The first plenary committee happened last year to discuss and understand Irelands resilience to climate emergencies, land management, other applications. Outlined considerations on user engagement (users and beneficiaries of the DestinE system "speak different languages" and the user engagement should reflect that), how to maximise the effectiveness and impact of DestinE (dedicated meetings on each impact sectors for focused discussions), need for a centralised knowledge management to facilitate trans-national collaboration.

3. Peter Salamon, Scientific Officer European Commission Joint Research Center, shared his experience in supporting decision and policy makers involved in the Copernicus Emergency Management Service (CEMS). CEMS was described as a very user-driven service with very clearly defined users, e.g., authorised emergency services in EU, European emergency response systems and UN agencies. These correspond to multiple scales of engagement. Engagement of these users comes in four key pillars, developed over a number of years, including regular feedback collection, regular meetings, webinars/trainings/workshops, and outreach through (social) media.

4. Anne Fouilloux, Research Engineer at Simula Building, encouraged DestinE to foster adoption of Open Science practices. The UNESCO definition of open science was mentioned to draw a parallel to DestinE. Following the principle of Open Science would make the initiative more accessible, inclusive and equitable for all

(including users that have not yet been taken into consideration). The benefits of open science for open innovation include the possibility to encourage a wide range of collaborations to break silos, to generate products that will tend to be more interoperable and create greater impact. In this context, a bottom-up approach is important to encourage buy-in from DestinE Community members. Users should be given centre stage, because “Community is about people”. The key to bridge the gap between science and policy making could lay in the “sharing while doing” approach. What do we need to support DestinE end-users? A platform to share and collaborate, a Code of Conduct to create a positive atmosphere that encourages contributions, to be as inclusive as possible.

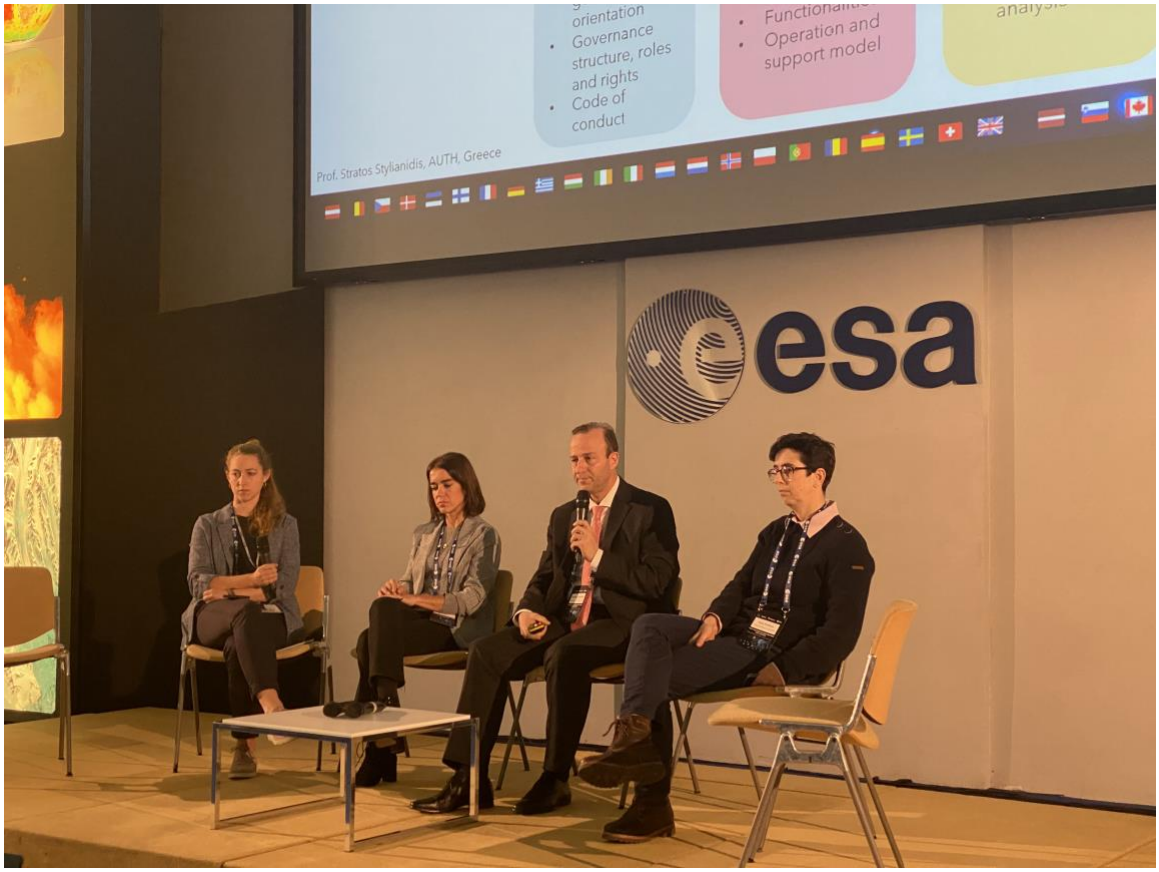

Figure 5 – Panel 3

Following short introductions and seed presentations by each panellist, Stefanie Lumnitz opened the panel discussion showing the results of the community questionnaire which was sent out to the attendees prior to the event. 60 answers were received. SL invited the panel to revisit and elaborate further on the question: Who are the potential DestinE users? The panellists agreed that there is a large community of practice supporting in DestinE Phase One targeted end-users, such as policy and decision makers. This community of practice includes other identified potential users (developers, scientists, industry) that need to be included from the beginning. It was highlighted, that DestinE could play a significant role in the challenge to bridging global to local data, applications

and communities. CEMS was highlighted by the plenum as one existing community to involve in co-development and exploration of the integration of existing services into the wider DestinE ecosystem.

SL led the discussion towards the question on: how the audience as community representatives would like to get involved into DestinE? The results of the questionnaire indicated that the most popular answer (>60%) is "to review and co-develop DestinE services", also popular was "to be a user of the services". The panellists and plenum accentuated that different groups use different tools and methods to collaborate and communicate, which needs to be reflected in the service portfolio. However, transparency and openness are highlighted as common key elements to successful collaboration. The panel and plenum concluded that enabling collaboration through services that allow users to openly contribute (with what they have, being that data, algorithms, etc.) to DestinE will encourage the establishment of strong links with the community.

Next, the discussion led into the question on how contributions by the community could be encouraged, to build a self-sustained community growing beyond funded activities. Although defined users in initial phases of DestinE are European, the project has global implications and international partners could be included in future. The panellists suggested to take into account diversity, inclusivity and equity in use case selection. A DestinE 3E representative outlined that international cooperation is possible and already in place for one of the use cases, i.e. one of the regions involved are the Philippines (EU NGO cooperating with regional users in the Philippines on climate adaptation measures). The panellists concluded that incentives have to be built in future to nurture an interest from the community to build DestinE. The value of DestinE to exchange ideas and crossing existing global and local community boundaries were mentioned as such incentive.

SL closed the panel by revealing more answers to the questionnaire: Most people would like to see DestinE events organised every 6 months. Regular email newsletter seemed to be the preferred means for disseminating information. ESA's contractor leading the development of the user engagement strategy confirmed that the expectations of the community are in line with what is planned in terms of communication and future events.

Table 5 – Take-home messages for Panel 3

Take-home messages	**Community forum** 1. Co-design processes are at the core of the community building strategy. For long-term sustainability of the community, it is very important to understand common interests shared by group of people (Communities of Practice). 2. National DestinE coordination groups are beginning to organize in several European countries, discussing about user needs and priorities.

	3. Sectoral engagements would allow more focused discussion and engagement. 4. DestinE could learn and benefit from the experience and established channels for engagement of the Copernicus Services, which include regular user feedback collection, Annual User Meetings, webinars/trainings/workshops, and social media outreach. **5.** Open Science & Innovation principles fit very well the objectives of DestinE initiative. There are great benefits in adopting these principles that benefit people through sharing knowledge, data and tools.

Closing session

Claudia Vitolo started the closing session by sharing some stats on registrations. 400+ total registered, 100+ onsite from 30 countries, amongst which Germany and Italy had the highest participation. Claudia also summarised the content of the different sessions in few take-home messages (see Tables 1 to 5 above). She then invited Michael Schick, Jörn Hoffmann and Tobias Wiesenthal to provide some closing remarks.

Michael Schick provided a word cloud (see Figure 6) summarising the events discussion to give another angle on the previous summary. Key points in word clouds include DestinE, decision making, user engagement and many others.

Jörn Hoffmann highlighted that the objectives of meeting (inform, start building a community, and understand better who the users might be) had been achieved. The impressive number of attendees is a testimony to that. The team now has the important task to digest inputs received during the event.

Tobias Wiesenthal reiterated the EC goals of DestinE, a flag ship missions to support the green initiative. Thanks to this event, the direction towards this goal has been cleared up, with user needs partially identified. Identified ‘Interaction’ to be a keyword during the event, identifying the best course of action for development.

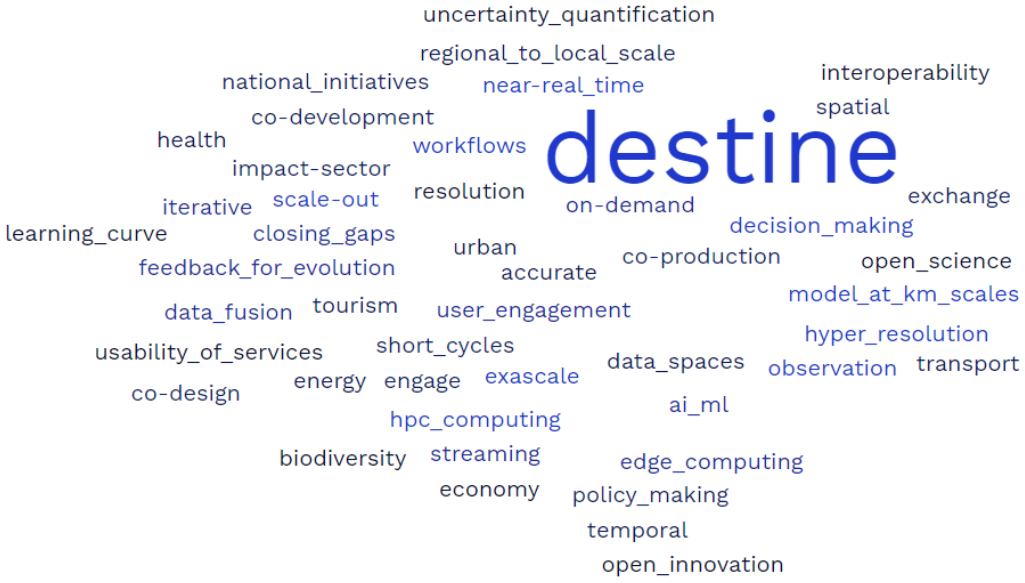

Figure 6 – Word cloud

Appendix A: Programme

*= *Remote Presentation*

09:00	***Arrival and registration***
9:30	**Start of event**
9:35	***Framing DestinE*** Short interventions by representatives of the Commission, a representative user and technology partner to highlight how DestinE should serve to support European Union policy ambitions. Includes how DestinE is positioned vis-à-vis Copernicus and ESA Digital Twin Earth. • Opening statement (Nicolaus Hanowski, ESA) • DestinE and Climate Change Adaptation (Christiana Photiadou, European Environment Agency)* • Potential benefits of Digital Twins for users in short-term forecast domains (Chiara Marsigli, Deutscher Wetterdienst)* • Perspectives for policy benefits of DestinE (Andreas Zucker, DG ENER)* • Destination Earth in support of the green and digital transition (Gustav Kalbe, DG CNECT)* • Q & A
10:25	***Information*** The three entities tasked to implement DestinE – ECMWF, ESA and EUMETSAT – inform stakeholders of implementation progress and plans. • General structure (Kathrin Hintze, ESA) • Digital Twin Engine (Thomas Geenen, ECMWF) • The Digital Twin on weather-induced Extremes (Kristian Pagh Nielsen, Danish Meteorological Service) • The Digital Twin on Climate Adaptation (Jenni Kontkanen, CSC) • Q & A
11:10 Coffee break	
11:40	***Information (continued)*** • The DestinE Data Lake (Michael Schick, EUMETSAT) • The DestinE core Service Platform (Ines Sanz Morere, ESA) • DestinE Partnership Plan, Use cases and upcoming opportunities (Jörn Hoffmann, ECMWF) • Q & A

12:15	***Panel 1: From Earth System Modelling to Impact*** Objective: This panel will contribute to a shared understanding on how use cases will (i) demonstrate the benefit of DestinE for users and (ii) serve to guide the development of DestinE towards meeting user needs. The panel will focus on early opportunities, i.e., DestinE phase 1, extending to phase 2***.*** Panellists: 1. David Gustafsson (SMHI) 2. Sami Niemelä (FMI) 3. Marion Schrödter-Homscheidt (DLR) 4. Filip Lefebre (VITO) 5. Femke Vossepoel (TU Delft) 6. Q & A
13:15	Lunch break
14:00	Visit to Φ-Experience - for people who booked it
14:45	***Panel 2: Interacting with DestinE*** Objective: This panel will discuss different ways to interact with the DestinE services and related time frame for their implementation. The focus is on technological capabilities, which are either under development or envisaged to be developed within Phase 1. extending to phase 2. Panellists: 1. Miruna Stoicescu (EUMETSAT) 2. Rochelle Schneider Dos Santos (ESA) 3. Nils Wedi (ECMWF) 4. Q & A
15:45	Coffee break

16:15	***Panel 3: Community forum*** Objective: This panel focuses on developing a better understanding of the communities targeted by DestinE in Phase 1, how to engage these communities and how to work together to co-evolve DestinE capabilities moving towards Phase 2. Panellists: 1. Efstratios Stylianidis (Aristotle University of Thessaloniki) *Towards building a vibrant DestinE User Community* 2. Ines Alonso (Met Éireann) *Destination Earth National Group - Irelands' coordination mechanism on DestinE* 3. Peter Salamon (European Commission, Joint Research Center) *Supporting decision and policy makers - experiences from the Copernicus Emergency Management Service* 4. Anne Fouilloux (Simula) *Building on communities to foster adoption of Open Science practices in the DestinE initiative* 5. Q & A
17:15	Closure