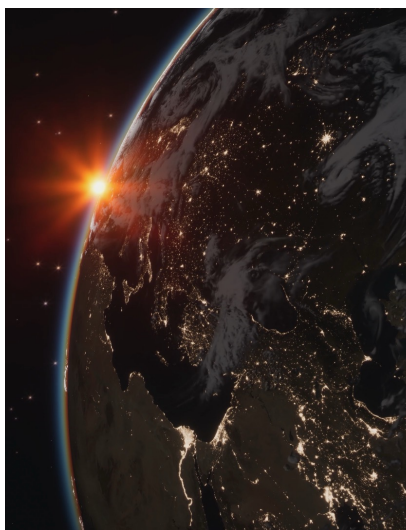


Immersive Interactive Visualisations

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Destination Earth

Destination Earth is a flagship initiative of the European Commission to develop a highly-accurate digital model of the Earth (a digital twin of the Earth) to model, monitor and simulate natural phenomena, hazards and the related human activities. These groundbreaking features assist users in designing accurate and actionable adaptation strategies and mitigation measures.

DestinE unlocks the potential of digital modelling of the Earth system at a level that represents a real breakthrough in terms of accuracy, local detail, access-to-information speed and interactivity.

By pushing the limits of computing and climate sciences, DestinE is an essential pillar of the European Commission's efforts towards the Green Deal and Digital Strategy.



Overview

Immersive and interactive visualisations are essential tools in modern data communication by transforming abstract simulations into intuitive, engaging experiences. Using advanced game engines, these visualisations place users inside the data, allowing them to experience weather and climate phenomena as if they were occurring around them. This approach not only enhances understanding but also increases emotional engagement, making the data more relatable and impactful.

This work creates immersive visualisations specifically designed for the high-resolution data of DestinE. Leveraging the digital twins developed by ECMWF and its European partners, these visualisations transform complex datasets into compelling, interactive experiences, making cutting-edge weather and climate science more accessible to the broader audience.



Current Status

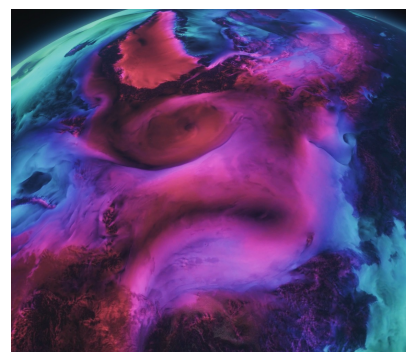
Initially, our work focused on creating photo-realistic videos that showcase the Earth from a satellite's perspective. Using Unreal Engine, we achieve high-quality visuals through its real-time, physics-based rendering capabilities. The interactive application delivers exceptional performance across Windows and Linux systems with dedicated GPUs, as well as on all recent Apple devices, including MacOS, iOS, and VisionOS.

We are now expanding into mixed reality by developing interactive apps with the game engine Unity and Apple's Reality Composer Pro, leveraging advanced support for mixed reality headsets. Superior integration with the Apple Vision Pro enhances user experience with improved hand tracking, foveated rendering, and dynamic reflections from the real environment.



Where are we heading?

Our long-term vision is to enable users to virtually "land" in specific locations and witness the impact of simulated weather and climate events — such as storms, floods, droughts, and wildfires — all around them. By immersing users in these simulations, we aim to provide a powerful and visceral understanding of the real-world consequences of climate change, fostering deeper engagement through interactive exploration. This approach not only helps inform decision-making but also inspires meaningful action by making complex data accessible and personally relevant.



Corner images: screenshots of a real-time flight around the Earth in interactive app created with Unreal Engine 5. These screenshots were taken on a Windows PC with Nvidia RTX 4090 GPU. The data for these visualisations comes from a 5km resolution forecast of the storm Ciarán. The forecast started on 31st October 2023. This simulation used the model configuration of the extremes digital twin created in Destination Earth.

Shown fields: top corners: total column liquid and ice water contents for the clouds; bottom corners: 2m temperature (color) and 10m wind speed (brightness).