



DESTINATION EARTH

DIGITAL TWIN ENGINE WORKFLOWS AND DATAFLOWS FOR EXTREMES DT

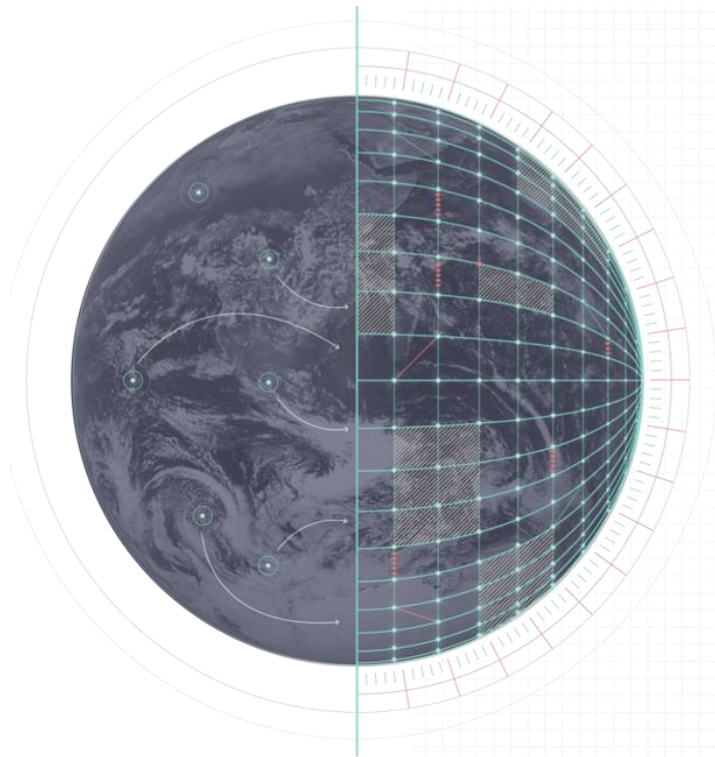
Tiago Quintino, M. Leuridan, J. Hawkes, S. Smart, E. Danovaro, D. Sarmany, P. Geier, M. Valentini, A. Bonnani, E. Betke, N. Manubens, S. Demir, M. Cakircali, P. Maciel, S. Najm, A. Warde, R. Aguridan, N. Wedi, B. Raoult, U. Modigliani, I. Sandu, F. Pappenberger



Funded by the
European Union



Digital Twin



1PiB/day

EuroHPC

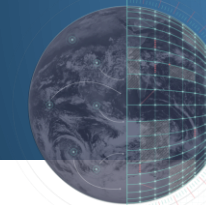
Users



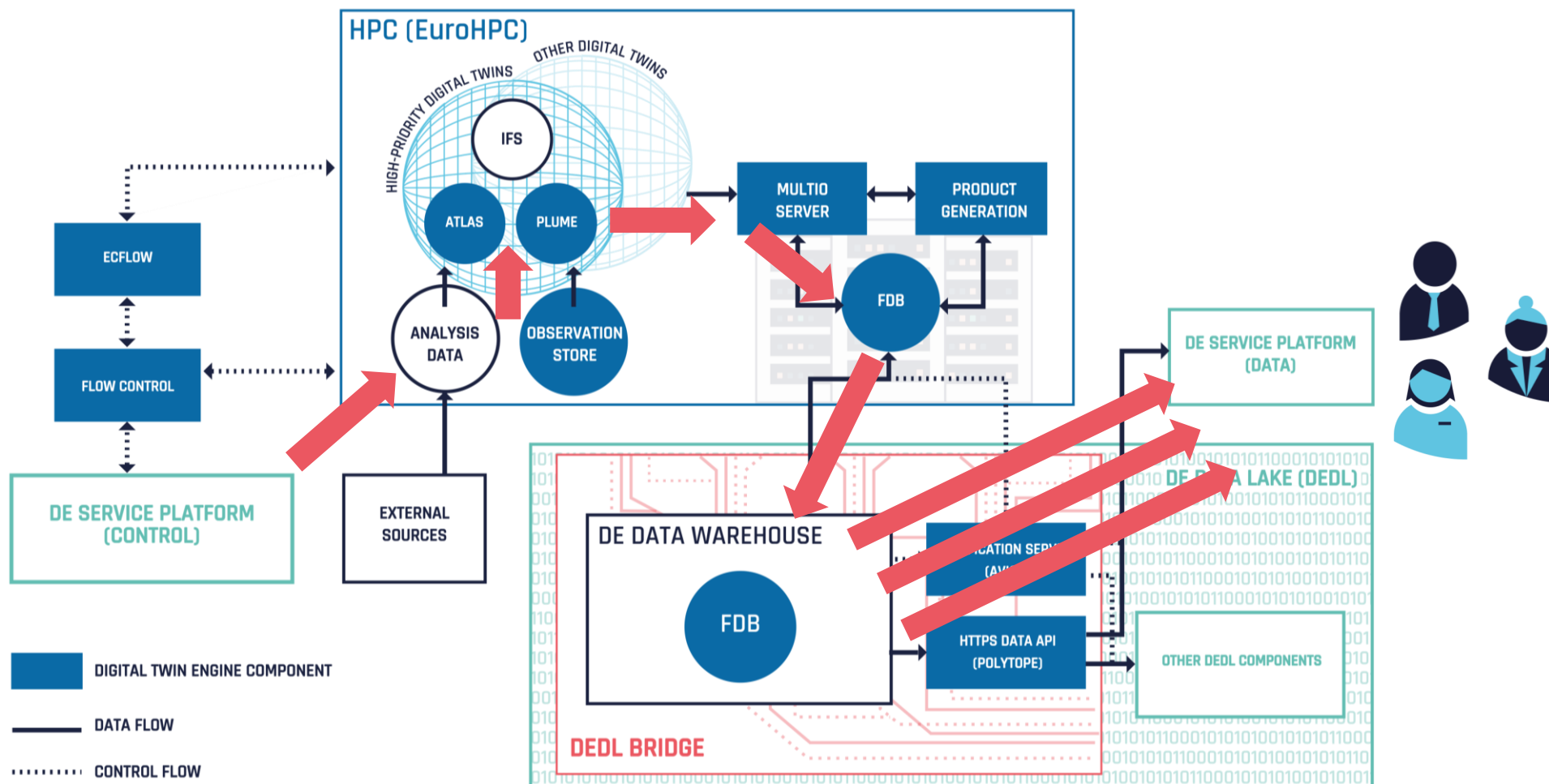
Decisions

DE Platform





DTE - Running DTs & Managing Big Data



Digital Twin Engine – What is it? Where can I find it?

Framework for Earth System Model Workflows

Think of a **Game Engine** but for Earth Systems...

- It's a Framework – not specific to a Digital Twin
- Collection of API's and Services
- Opt-in Components
- Build a custom system out of components


Documentation available @ <https://digital-twin-engine.readthedocs.io>

Docs » Destination Earth Digital Twin Engine

Destination Earth Digital Twin Engine


Warning

Work in progress!



The Digital Twin Engine (DTE) is a collection of components built to facilitate the implementation of Digital Twins. These components are developed by ECMWF as part of Destination Earth.

This software is developed with co-funding by the European Union under the Destination Earth initiative.



Documentation

- multio [docs, repo]
- aviso [docs, repo]
- polytope [docs, repo]
- pyfdb [docs, repo]
- atlas [docs, repo]
- pyflow [docs, repo]

Full docs coming soon:

- ecflow [docs, repo]
- fdb [docs, repo]

v: latest



Digital Twin Engine – Some Components

Some of the LEGO™ pieces ... (there is more)

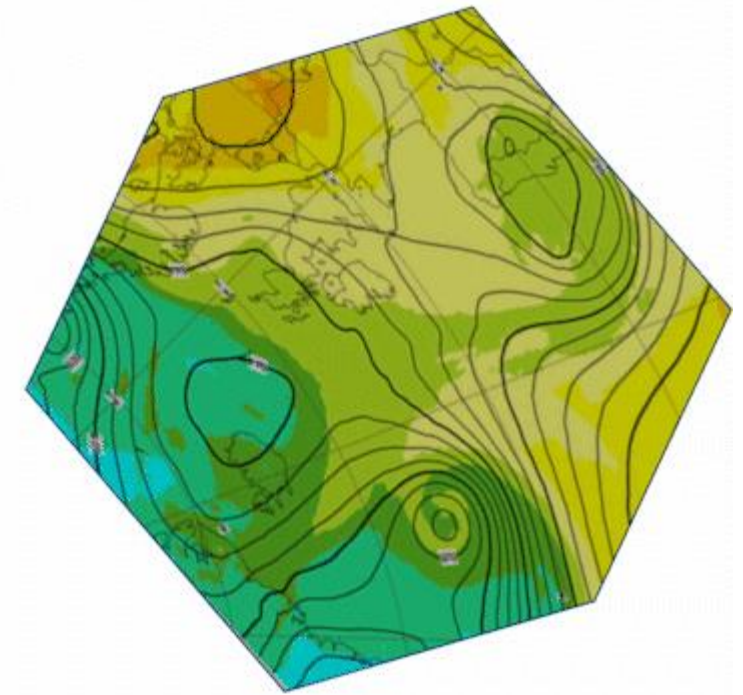
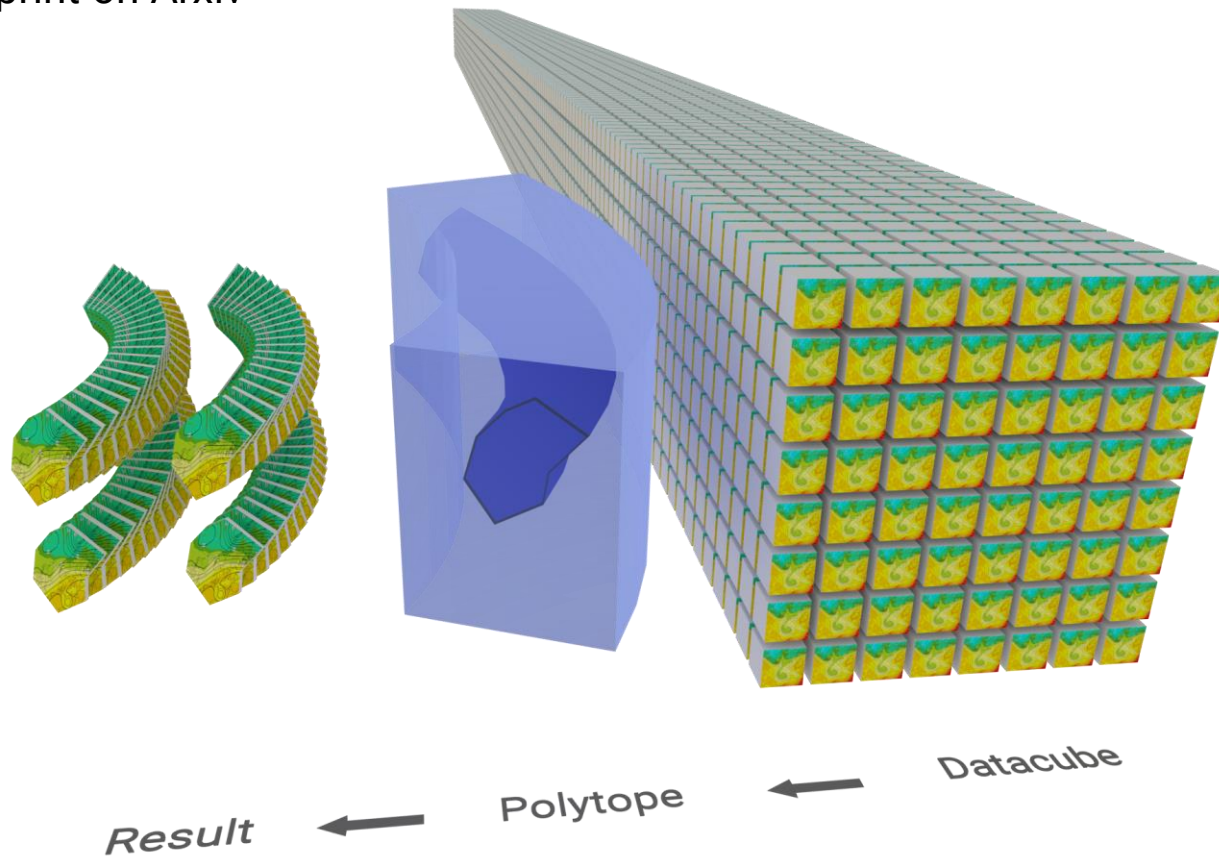
- **ecFlow** Workflow manager
- **Infero** Running ML inference models in operations
- **Plume** Model Plugin architecture
- **FDB** Key-Value Object Storage with Semantic Data access
- **MultIO**
 - Multiplexing IO-Server
 - On-The-Fly Post-Processing
- **Aviso** Data Notification system
- **Polytope** Data Cube API



Polytope Service & Feature Extraction

⚡ **Release!**

- Open-source on Github
- Pre-print on Arxiv



github.com/ecmwf/polytope

Polytope: Feature Extraction for Improved Access to Petabyte-Scale Datacubes

Author 1 and Author 2 (blurred)

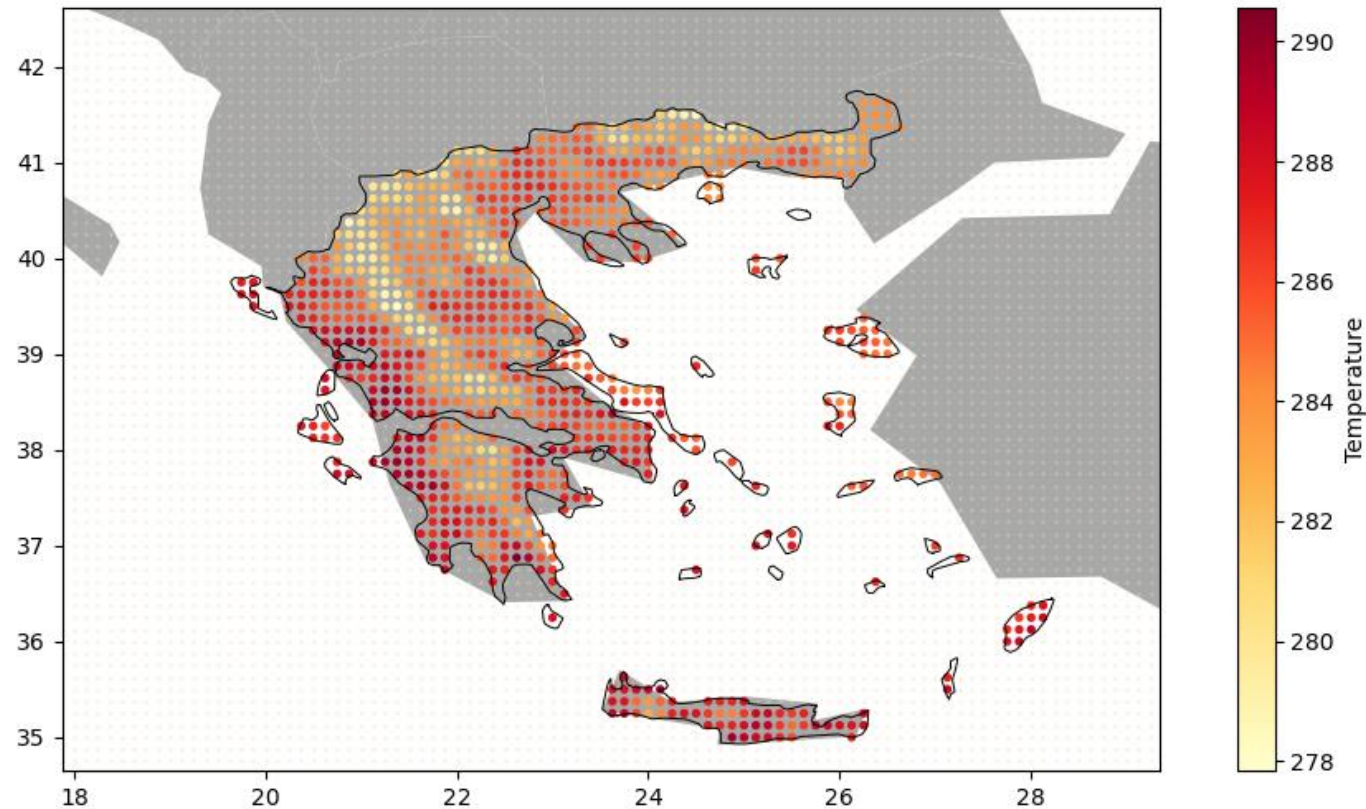
Department, Organization, Street, City, ZIP/Postal Code, Country (blurred)

March 15, 2023

Abstract

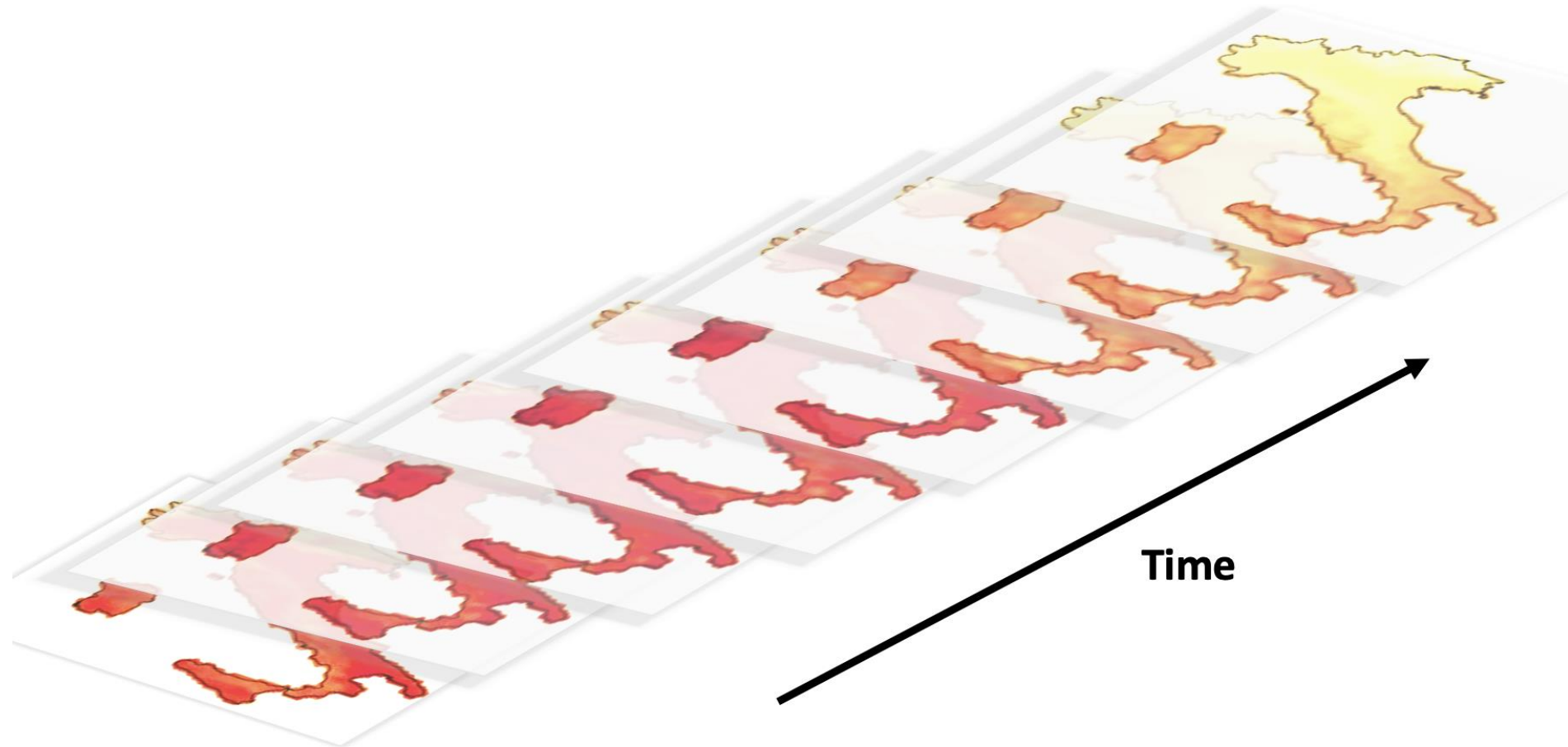
Summary text (blurred)

Example: Shape Extractions

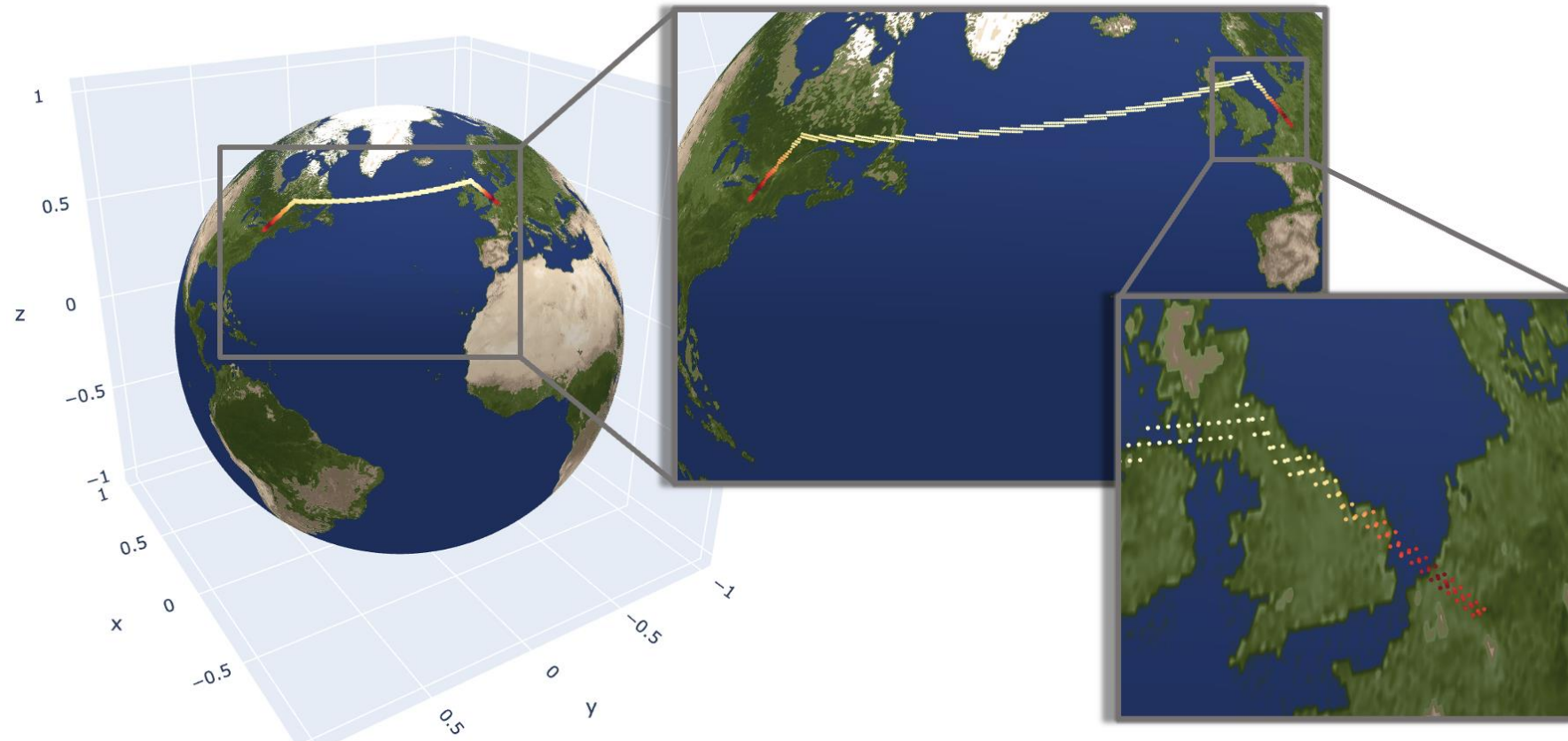


The coloured points are directly extracted from the field.
The **full field was not read** from the IO system, **ONLY** these points.

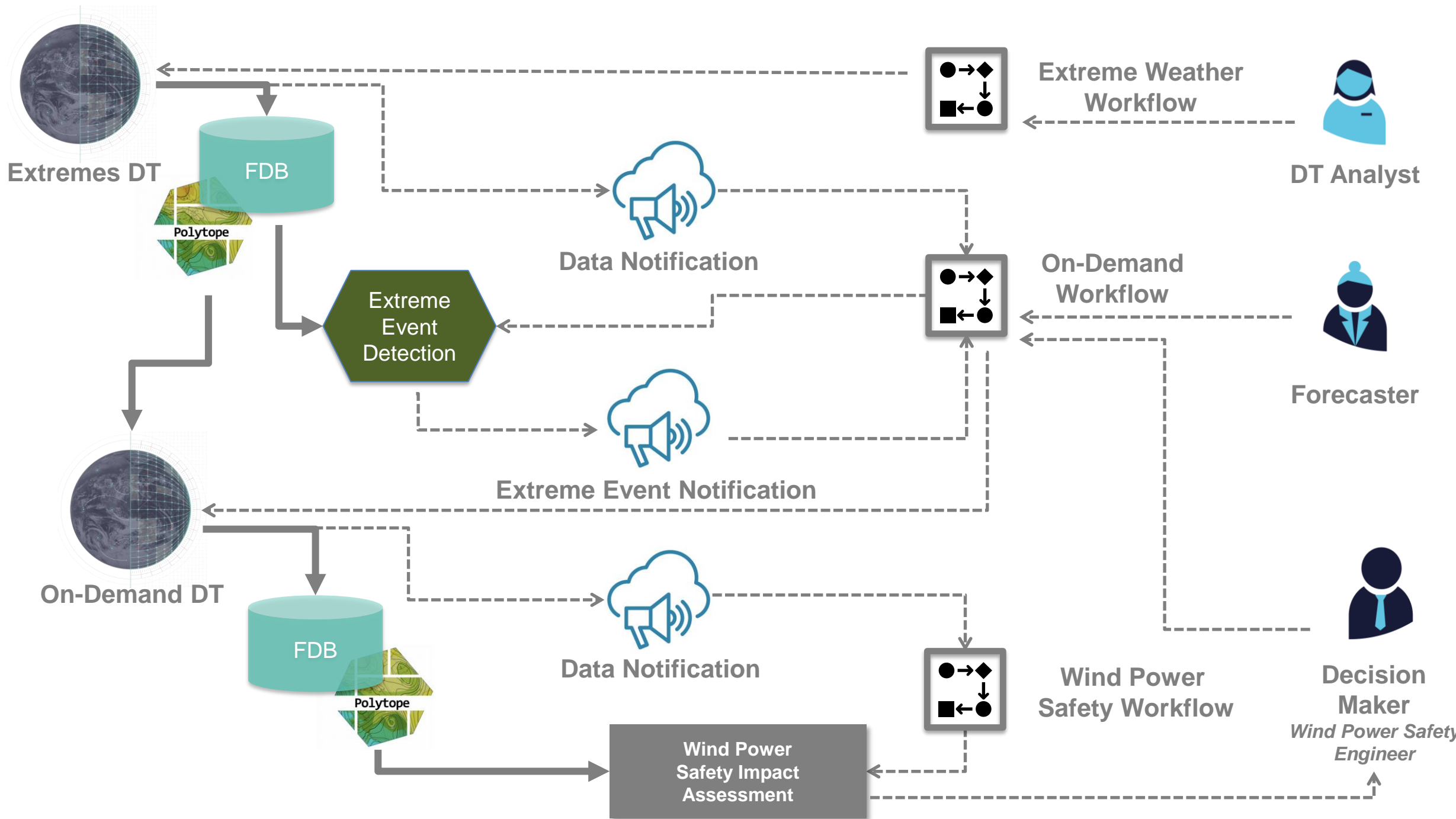
Example: Country Time Series



Example: Flight Path



99.99% I/O reduction vs 4D (x, y, z, t) bounding-box



Messages To Take Home

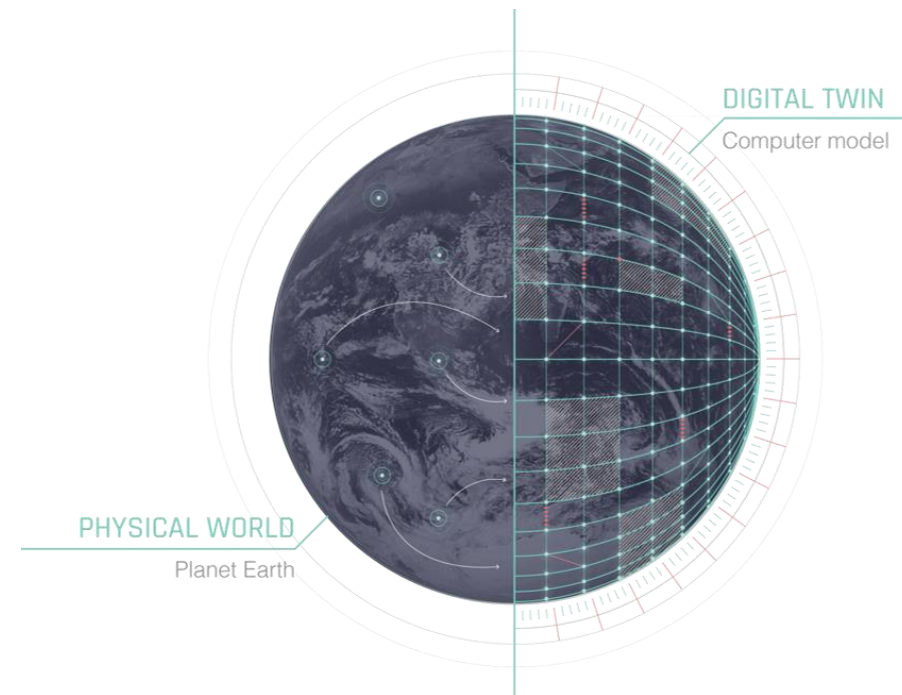
*Destination Earth will deliver massive data sets daily ~ 1PiB
A challenge for delivering useful information to users*

*ECMWF is developing the **Digital Twin Engine** to support
Digital Twin development and Interoperability*

***Digital Twin Engine** also helps users and decision makers
to access the data in a useful manner and
allow them to interact with the Digital Twins' workflows*

PROGRAM INFORMATION

www.ecmwf.int/destine



Digital Twin Engine are “LEGO” pieces ...

... what will you build?

