DESTINATION EARTH

Climate Digital Twin (DE340)

Towards the operationalization of use cases in the framework of the Climate Adaptation Digital Twin

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Summary: In order to deal with the high throughput of the high-resolution climate projections from the Climate Digital Twin, data streaming methods - designed to pass and process the data - have been developed. In the second phase of the project, the workflow that drives the data flow is being further developed as a fundamental piece to achieve operationality of the Climate Adaptation Digital Twin. Climate information can be obtained from the four use-cases corresponding to different impact sectors. In this poster, we show how the data streaming works, putting emphasis on the features that are essential for the energy sector

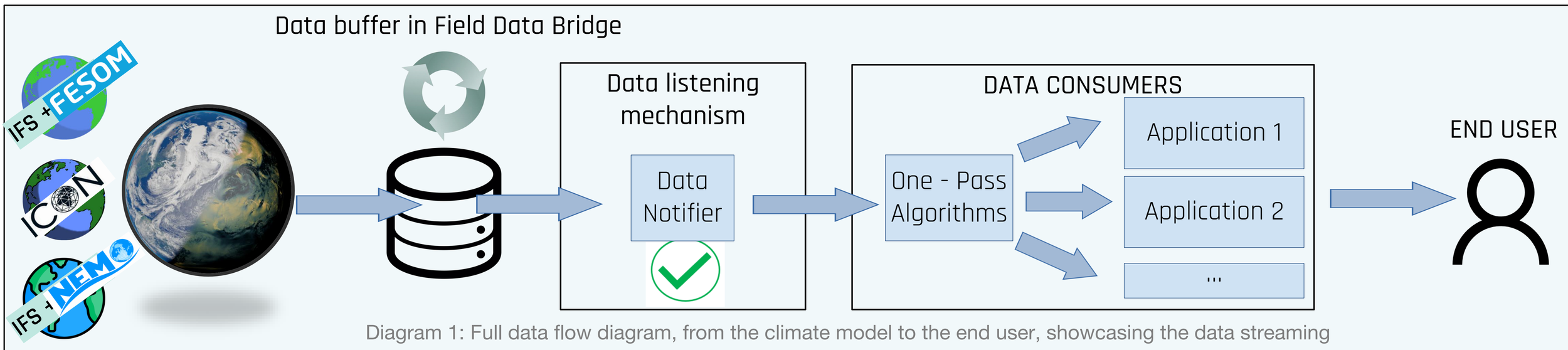

Diagram 1: Full data flow diagram, from the climate model to the end user, showcasing the data streaming

Data listening mechanism: Software that automatically notifies the downstream workflow that data is avalaible. (**1**)
One – pass algorithms: Mathematical algorithms that compute statistics required by the user on the streamed data (storage saving). (**2**)
Application: independent software packages that provide key indicators for desired impact sectors.

Key concept: **the Generic State Vector (GSV)**. The GSV is a standardized representation of the climate model output, that can be seamlessly used by data consumers downstream.
Challenges: manage the huge amount of data produced by the models in an efficient way ⟶ **data streaming**. (**1,2**)

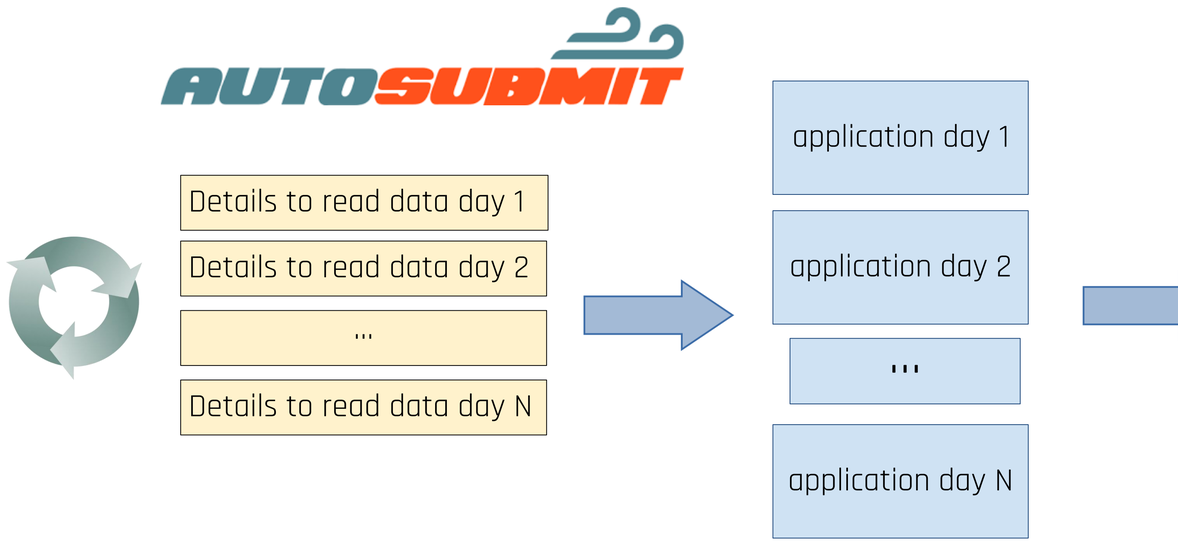

Diagram 2: Details on how is the from the streaming parameters are automatically passed to the application to compute the indicators

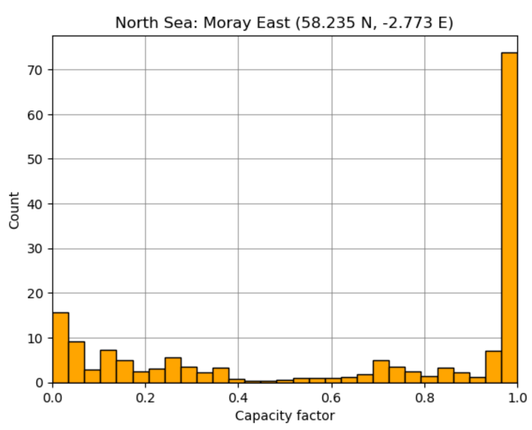

Figure 1: Wind speed (left) and capacity factor (right) distributions for a class S Vestas V164 wind turbine over one week and computed from 1-hourly wind components (100u, 100v). Data was obtained from the ClimateDT IFS-FESOM projection simulation.

Set of indicators (see Ghosh et al.)

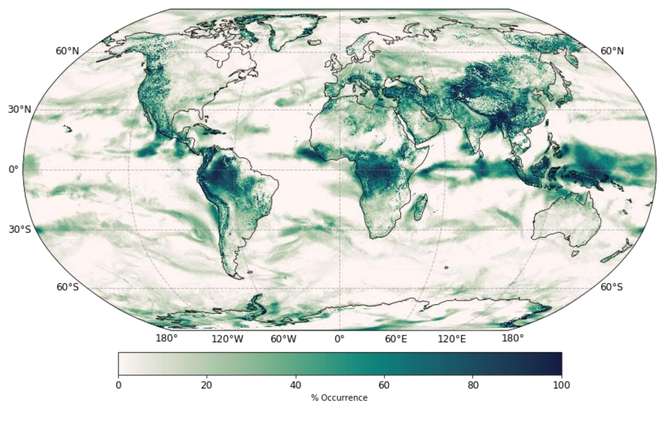

Figure 2 :Percentage occurrence of Low Wind Events (LWE) at 100m accumulated over one week irom 1-hourly wind components (100u, 100v). Data was obtained from the ClimateDT IFS-FESOM projection simulation. The threshold for LWE: Wind Speed below 3m/s.

The workflow allows for **flexible setup** of the different parts of it, that is, different combinations of models and applications. It uses a YAML structure supported by **Autosubmit** (REFFERENCE)

New paradigm in climate services:

1. Never before existed operational climate projections.
2. Operational user-relevant indicators (e.g. Fig 1,2)

Take home messages

- High spatio-temporal resolution **climate projections** are **operationally transformed into regional actionable climate information** tailored towards the needs of the different key users.
- First step towards the **operationalization of climate projections**, a significant development to inform near- to long-term adaptation in climate-dependent impact sectors.
- **Data streaming is the solution** to deal with vast amount of data that is produced from the high resolution simulations.

References

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[2]: Grayson, K., Lacima-Nadolnik, A., Roura Adserias, F., Sharifi, E., Thober, S., and Doblas-Reyes, F.: One-pass algorithms for streamed climate data, EGU General Assembly 2024, Vienna, Austria, 14–19 Apr 2024, EGU24-8062, https://doi.org/10.5194/egusphere-egu24-8062, 2024.

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