

Advancing The Understanding Of Hectoscale Forecasts For Renewable Energy Systems – *HectoRenew*

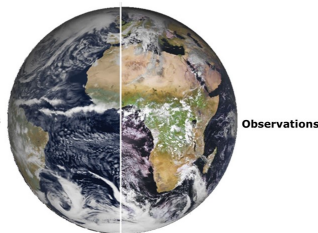
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Advancements

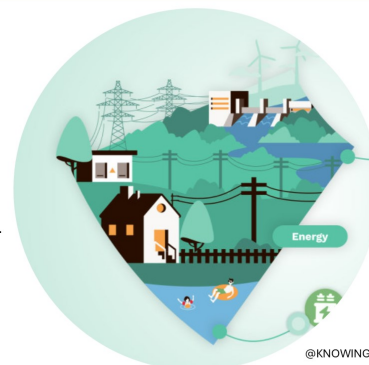
- Two high-priority digital twins support decision making and planning activities linked to extreme weather and climate change within the Destination Earth initiative.
- **Digital Twin (DT) for Weather-Induced Extremes** focuses on developing an extreme weather on-demand DT
- **DT Climate for Climate Application** produces multi-decadal projections (past, future) at km scale (approx. 5 km) to **understand climate change** and support adaptation strategies and policymakers across the impact sectors most affected [1]

Needs

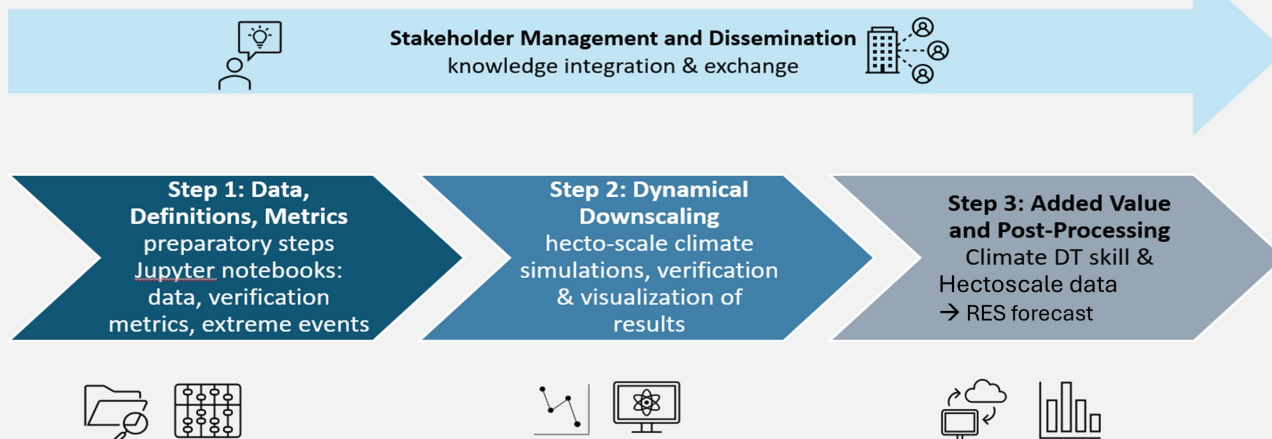
- Energy system is changing towards renewable energy sources dependent on meteorological conditions in the short- and longterm planning



<https://stories.ecmwf.int/explainer-digitaltwins/index.html>



Approach



Data used:

- High resolution observation data for validation of hecto-scale climate simulations
- DT Climate output used for initialization of simulations
- Performance curves of existing renewable energy infrastructure

Data produced:

- Hectometric data for specific events
- Post-processed power curves

Extreme event selection based on:

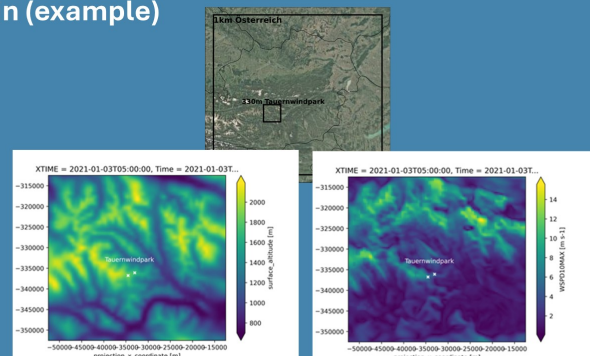
- Events negatively affecting the RE supply (e.g. Dunkelflaute)
- Events negatively affecting the infrastructure itself (e.g. storms, extreme precipitation)
- If possible in alignment with DT Extremes

Dynamical Downscaling:

2 Regional climate models:

- WRF [2] to be tested with and without Windfarm parameterization
- ICON [3]

Current test simulations: 800 m / 415m / 330m / 166m
Domain (example)



References

- (1) Hoffmann, J., Bauer, P., Sandu, I., Wedi, N., Geenen, T., Thieme, D.: Destination Earth – A digital twin in support of climate services, Climate Services, 30, 2023
(2) Skamarock, W. C., Klemp, J. B., Dudhia, J., Gill, D. O., Liu, Z., Berner, J., ... & Huang, X. Y. (2019). A description of the advanced research WRF version 4. NCAR tech. note ncar/tn-556+ str, 145.
(3) Pham, T. V., Steger, C., Rockel, B., Keuler, K., Kirchner, I., Mertens, M., ... & Früh, B. (2021). ICON in Climate Limited-area Mode (ICON release version 2.6. 1): a new regional climate model. Geoscientific Model Development, 14(2), 985-1005.

Project Details

Project Start: 01.2025
Project End: 12.2026

<https://projekte.ffg.at/projekt/5129507>

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