Climate Digital Twin (DE340)

Wildfire risk and damages, now and in the future – A set of Destination Earth use cases

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INTRODUCTION

In many terrestrial ecosystems (from tropics to Arctic), wildfires are one of the main disturbances affecting also human life and societies. Globally wildfires are expected to increase with higher global warming levels. Wildfire weather has become more widespread, long-lasting, and intense in some regions (e.g. in Mediterranean). As Finland has high forest fraction and excellent forest and geospatial data, application tests will be conducted there. These applications are the FWI and WISE, used for fire danger estimations now and in the future and fire spread modelling. These are used to assess vulnerabilities and help in choosing the best adaptation options with climate and policy scenarios.

Key users:

- The Finnish forestry management project HIILIPOLKU
- North Karelian-Rescue Services
- Horizon Europe project PIISA

IMPLEMENTATION IN THE WORKFLOW

Hourly temperature, dewpoint temperature, wind v&u components and precipitation data are requested from the GSV and 24-h precipitation sum and average temperature from the One-pass layer for the applications over Europe. Climate data is read and processed using a Python wrapper, which is then used to run the wildfire application (FWI/WISE). Auxiliary data consists of fuel, land cover, topography, ground flash density climatology and population density projections data.

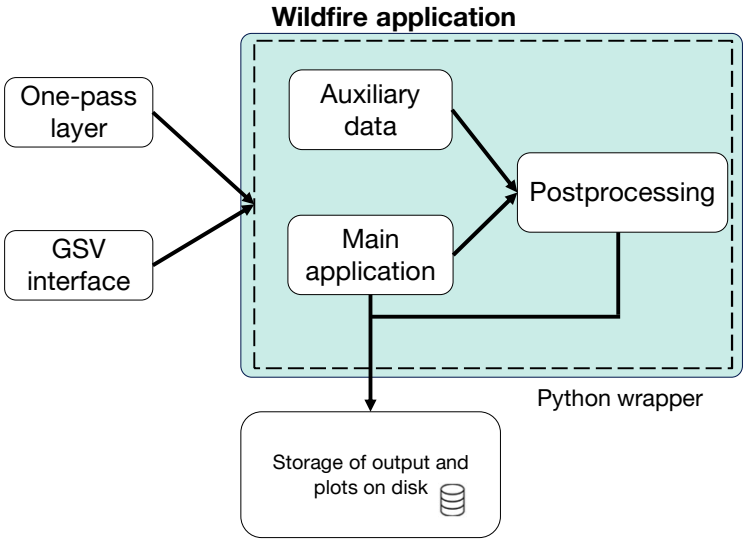

Figure 1: Architecture of the Wildfire applications and their implementation to the DestinE workflow.

Phase 2 development

Phase 2 will consist of continued development of both the FWI and WISE models. Main future steps involve integrating the FWI and WISE applications into a single application. The currently used inbuilt FWI calculations within the WISE model will be replaced with the newly developed version, which is globally applicable. Users will also be able to use their own fuel data as inputs for the WISE model. In addition to this, the next steps include optimizing code performance, developing additional indicators, and improving current indicators based on user engagement with key stakeholders, such as Karelian Rescue Services.

The WISE application will also be applied in the EU HORIZON PIISA project, where it will be used to estimate the efficiency of different vegetation control measures in a pilot study region in Portugal. Model results will help in recognizing key locations for e.g. creating fuel breaks, or changing vegetation types, to limit fire spread and damages to homeowners and communities.

How can the initiative help to improve the state of the art methods in this sector?

For this we can identify the user needs and requirements that the ClimateDT will be able to address:

Needs	Requirements
How will fire spread change in the future under different climate scenarios?	Model the fire spread in different boreal forest environments and compare results between different climate and forest policy scenarios
How can we limit the spread and damages from wildfires in high risk areas?	Simulate fire spread in risk areas using different vegetation control measures. Testing the effects of changing forest types and adding fuel breaks in key locations.
How will fire regimes change in the Boreal forest under different climate scenarios?	Simulate fire regimes in the boreal forest (Finland) and compare results obtained under different climate scenarios

RESULTS

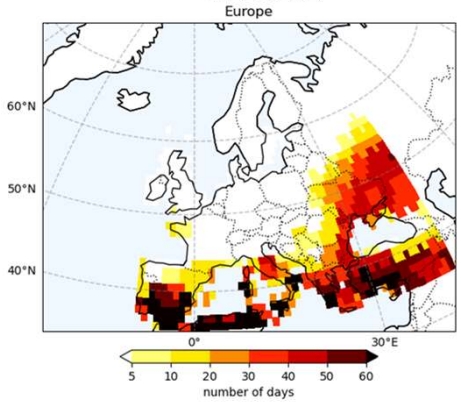

Figure 2: FWI: ClimateDT low-resolution simulation climatology of an annual number of days with FWI values exceeding Very High Danger (FWI 38 to <50) according to the European Forest Fire Information System (1991-2000). It is evident that a pronounced north-south gradient exists, indicating a higher likelihood of fire weather conditions in Southern Europe when compared to the northern regions.

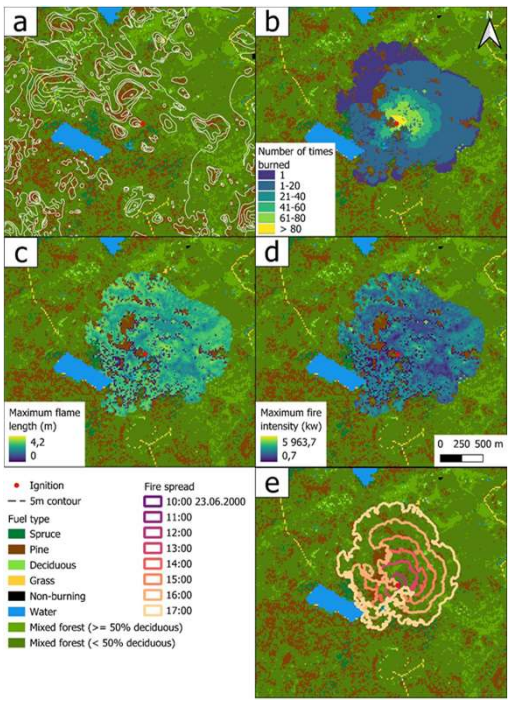

Figure 3: WISE: Example fire spread result from Kalajoki in Western Finland. The model was ran daily between 1.6 - 31.8.2000. Image a contains the fuel classification, b the number of times each cell was burned, c the maximum flame length, d maximum fire intensity and e an example fire spread case. Effects of different climate and forest policy scenarios can be tested with altering fuel class and climate data.

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