Development of a Climate Web Application on the EO Data Hub

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1 INTRODUCTION

As part of NCEO led **Earth Observation Data Hub** programme, several applications are being developed on the hub to provide inputs to requirements and to showcase capabilities. The brief for our work was to develop a **web application that combines climate projection and observation data** from trusted UK sources including the Met Office, EOCIS and NCEO.

The use case that we are focussing on is a tool to help **assess the risks to assets from climate change** with specific reference to chronic heat**.**

We are building upon the work undertaken by *OS Climate*, an open source programme focussing on climate aligned investing.

The solution is unique in providing single platform access to **climate model predictions**, **satellite observation data** and **derived indicators for heat**, with analysis workflows for asset data.

2 METHODS

Our approach has been to take the **OS Climate workflows** that assess the physical risk to assets, adapt them to the hub architecture and data sources and to provide additional capabilities by integrating useful insight from observations data.

The risk assessment process involves identifying

- **Hazards** such as those presented by chronic heat or inundation;
- Determining the **exposure of an asset** to the hazard based on its location;
- Calculating a score for the **vulnerability** according to the asset type.

Finally we will provide additional **insight** through the use of observations data (such as Land Surface Temperature) at high levels of spatial granularity.

To do this we use workflows running on the hub to create **hazard indicator datasets**. These derive simplified metrics from climate projections or other data sources that are useful for the risk assessment process.

For example when exploring the impact of **chronic heat** (i.e. long term increase in temperature) a hazard indicator might use UKCP 18 data to determine the number of days per year when average daily temperature exceeds a given threshold temperature under a specific warming scenario (e.g. RCP 8.5) for a specific target year (e.g. 2070).

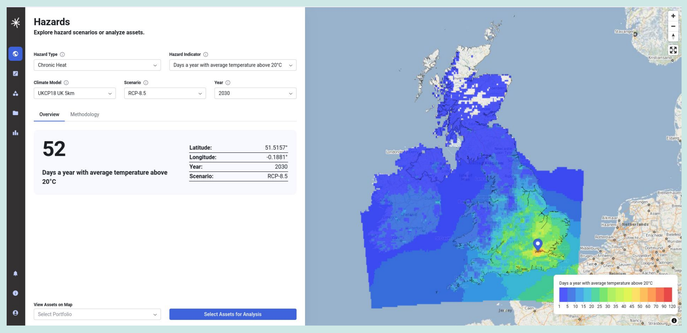
Vulnerability models (also implemented as hub workflows) use hazard indicator datasets for risk assessment. For example a vulnerability model for a thermal power station might evaluate the impact on power generation due to the reduced cooling efficiency from higher air and water temperatures.

3 RESULTS

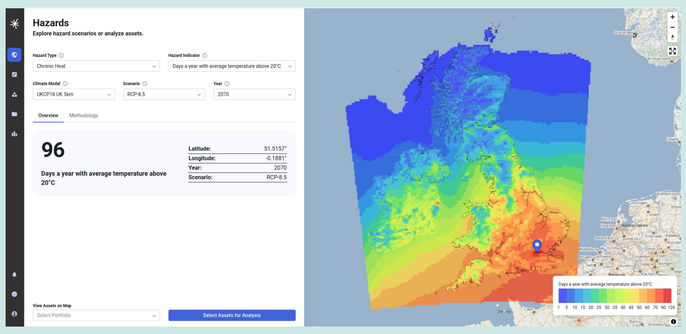
Climate / hazard indicators for chronic heat

Number of days per year where average daily temperature exceeds 20 degrees C, for RCP 8.5

2030



2070



Indicator datasets are created from UKCP18 projection data at 5 km resolution (without bias correction), using workflows executed on the hub. These calculate the indicator value, averaging across a 20 year window, and reproject the data onto Google Web Mercator projection for display in the web application and use by asset analysis workflows.

At the midpoint of EO Data Hub programme the Sparkgeo team have just released a **Minimum Viable Product** of our climate application.

The implementation makes use of a number of interoperable standards adopted by the hub platform:

- **OGC Best Practice for Earth Observation Application Package** which we use for workflows for producing hazard indicators and asset analysis
- **Spatio-Temporal Asset Catalogues (STAC)** for recording metadata about the indicator and observation datasets and presenting this in the user interface
- **Zarr** (xarray compatible), **Cloud Optimised Geotiffs** and **GeoJSON** for data storage
- **OGC Web Map Tile Service** for data visualisation

The functional capabilities of the MVP allow users to:

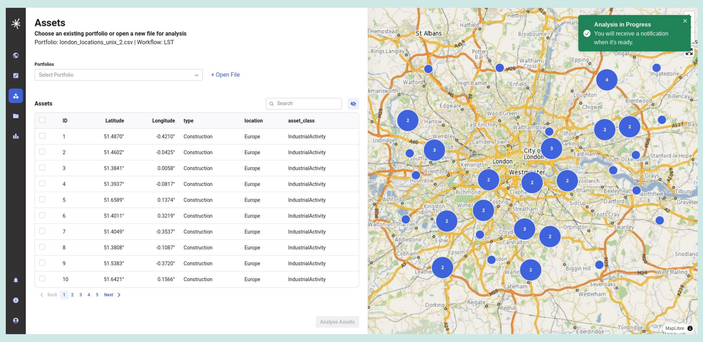
- View & interrogate **hazard indicator datasets** for Chronic Heat, derived from both NASA and UKCP 18 projections (the latter at up to 2.2km downscaled resolution)
- View & interrogate **land surface temperature** observations from the U of Leicester at up to 100m resolution
- **Upload asset portfolios** of user defined sites of interest or explore results from several sample asset portfolios
- Run **asset assessment** workflows, including *OS-Climate* vulnerability models and *land surface temperature* observation history at the asset site at 100m resolution in London
- View **metadata** to discover the provenance of data included in the solution

Land Surface Temperature, UK Heatwave, July 10th 2022

NCEO U of Leicester, Surface Temperature Group (EOCIS)

LST data gives insight into the urban heat island effect at a 100 metre resolution, providing insight into asset exposure.

Asset analysis



Workflows on the hub analyse asset data, calculating vulnerability scores from hazard indicators or creating observation reports for the asset location.

4 CONCLUSIONS & NEXT STEPS

The EO Data Hub is a unique platform that serves the national interest and for the **first time combines access** to the best UK Earth Observation Science for research, government and business use.

Further releases of the hub and climate application will be available between now and March 2025. The hub itself will expand to incorporate a wide variety of commercial and open datasets across EO and climate domains and provide data proximate processing environments for users and developers.

Functional capabilities of the climate application will also evolve. We are currently considering what additional workflows would deliver value to users across industry, government and academia.

If you are interested in exploring how assets may be impacted by climate change and how current observations can deliver insight we would welcome the opportunity to collaborate.

Please get in touch!

5 GET INVOLVED

To find out more about the EO Data Hub programme and to get in touch with the core hub team, visit the EO Data Hub website.

If you are interested in collaborating with Sparkgeo about the Climate Application please contact the author via LinkedIn.

REFERENCES

EO Data Hub - https://eodatahub.org.uk/

OS Climate - https://os-climate.org/

OGC Best Practice for EO Application Package - https://docs.ogc.org/bp/20-089r1.html

Land Surface Temperature : Perry, M. J. S, Remedios, J. J, Ghent, D, Veal, K. L, Göttsche, F, A new inverse method for the retrieval of Land Surface Temperature and Emissivity from the ASTER instrument, AGU Earth and Space Science, (in review 2024)