2021 Energy Climate Hackathon Data and Computing help-sheet
Version 1. see parallel google doc for the option to add more information

1. The JASMIN Supercomputer

JASMIN is the UK's data analysis facility for environmental science. It provides storage and compute facilities to enable data-intensive environmental science. Climate data can be incredibly large (TB-PB) so storing this locally is not a viable option, and processing can take multiple hours-days.

JASMIN is accessed through a terminal using a secure FTP. A number of online tutorials exist for how to login to a JASMIN account with extensive support and training materials on their website. A few are highlighted below:

- The **getting started with JASMIN** pages from help.jasmin.ac.uk provide a lot of useful examples and initial information if you are unfamiliar with this type of resource.

- There is a **youtube channel** of the JASMIN online training materials showing how to log in, extract variables from files in the CEDA data archive and do some introductory tasks.

- Python and R are available for data analysis on JASMIN (although R is not supported by the help desk), MATLAB is not available. A full list of the software available on JASMIN is available **here**

2. Climate datasets on JASMIN

- Huge amounts of climate data are available on JASMIN for use in the Hackathon, which can be searched for through the **CEDA archive** Please ask the climate specialists for more information about particular data products you may want to use. Access to some datasets may require access to a project group workspace. Please discuss this with hackathon project leads if necessary. Some examples of the available datasets are given below.

- Weather Station Observations: MiDAS, Central England Temperature
- Gridded Observations: HADISST, HADISST2
- Reanalysis Datasets: ERA-interim, ERA5 (both reanalysis from the European Centre for Medium Range Forecasting; ECMWF, not all fields are available on JASMIN). NOAA-20CR-v2 (A century-long reanalysis from NOAA).
- Climate projections: UKCP18 (the Met Office climate projections) CMIP5, CMIP6, PRIMAVERA.

3. Other available climate data

If data is required from alternative locations then please discuss with the project leaders. A lot of climate data can be accessed from the **Climate Data Store.** Including climate indices, climate projections, reanalysis data, seasonal forecasts and satellite observations. The search engine is the best way to discover content, where you can specify the product type you are interested in. A python API is available to download the required data. Th**e CDS toolbox** is also a good tool for data processing (see slides from presentation). Users need to be registered in the CDS to accept the terms and conditions, most of the CDS data is open source.

The **ESGF portal** is another portal where data (for example EURO-CORDEX climate projections) can be downloaded from.

If you are interested in processing large amounts of climate data one possible option is to use the **ESMValTool** which is a community diagnostics and performance metrics tool for the evaluation of Earth system models. It has **extensive documentation** including examples.

4. Online Climate Plotting Tools

These are useful for quick fact-checking or exploring climate data, particularly observed and/or reanalysis data. There is usually also an option to download the processed data for the plots you make.
NOAA Physical Sciences Lab: can be used for plotting maps, time series or comparing reanalyses.
KNMI Climate Explorer: This includes some more technical options than the previous example and also some climate model data.

5. Energy datasets from climate data

There are a number of demonstrator projects where you can explore climate and energy datasets:
- **The ECEM demonstrator**
- **The CLIM2power demonstrator**
- **Tealtool**

The Openmod community host a list of freely available datasets of energy variables (electricity demand, wind/solar/hydro-power) reconstructions based on climate reanalysis or climate change projections. This includes demand and renewable energy datasets from **Renewables.Ninja** , **C3S energy,** and the **University of Reading.**

If these tools are not appropriate there are also options to create your own bespoke dataset such as **merra2ools,** or **atlite.**

6. Energy system data

- A very comprehensive list is available from the **OpenMod community**
- **Open Power system data Network** provide open source information on power plant locations, national generation capacity, renewable power plants as well as time series of load, wind and solar PV and energy prices.
- **Global wind and solar PV observations**
- **UK Solar and PV observations**

For the UK specifically there are a number of open access data portals (some may require registration) but are all free to access.
- **Elexon data portal** networks, energy profiles, power data.
- **National Grid ESO data portal** Networks, Ancillary Services, Carbon intensities.
- **Western Power Distribution** Electric vehicles, networks, smart meters.
- **Our world in data** Networks, carbon intensities, energy risk
- **OpenLV project** Low voltage network, Electric vehicles, Metered Voltage and Power data.

7. Power system models

A number of open source power system modelling tools exist. An extensive list of open tools are available **here.** A couple of model developers are involved in the hackathon (there may also be others!). These models are:
- **Calliope**
- **Pyam** which has a short **youtube video** overview.

8. Open Source licenses.

- A **short summary** on how to apply the FAIR principles and open-source licenses correctly in your work