U.S.-Canada Center on Climate-Resilient Western Interconnected Grid

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WIRED GLOBAL CENTER VISION

The Western Interconnected Grid faces increasing climate-related impacts, including fires, changes in usage, floods, droughts, and other climate-related events. The U.S.-Canada Center on Climate-Resilient Western Interconnected Grid is a heavily multidisciplinary collaboration (see image below) involving policy experts, climate scientists, and computer scientists pioneering solutions to fortify the Western Interconnection.[1]

WIRED Global Center currently aims to establish a state-of-the-art Climate and Grid Cyberinfrastructure to seamlessly integrate data and computational services across member institutions.

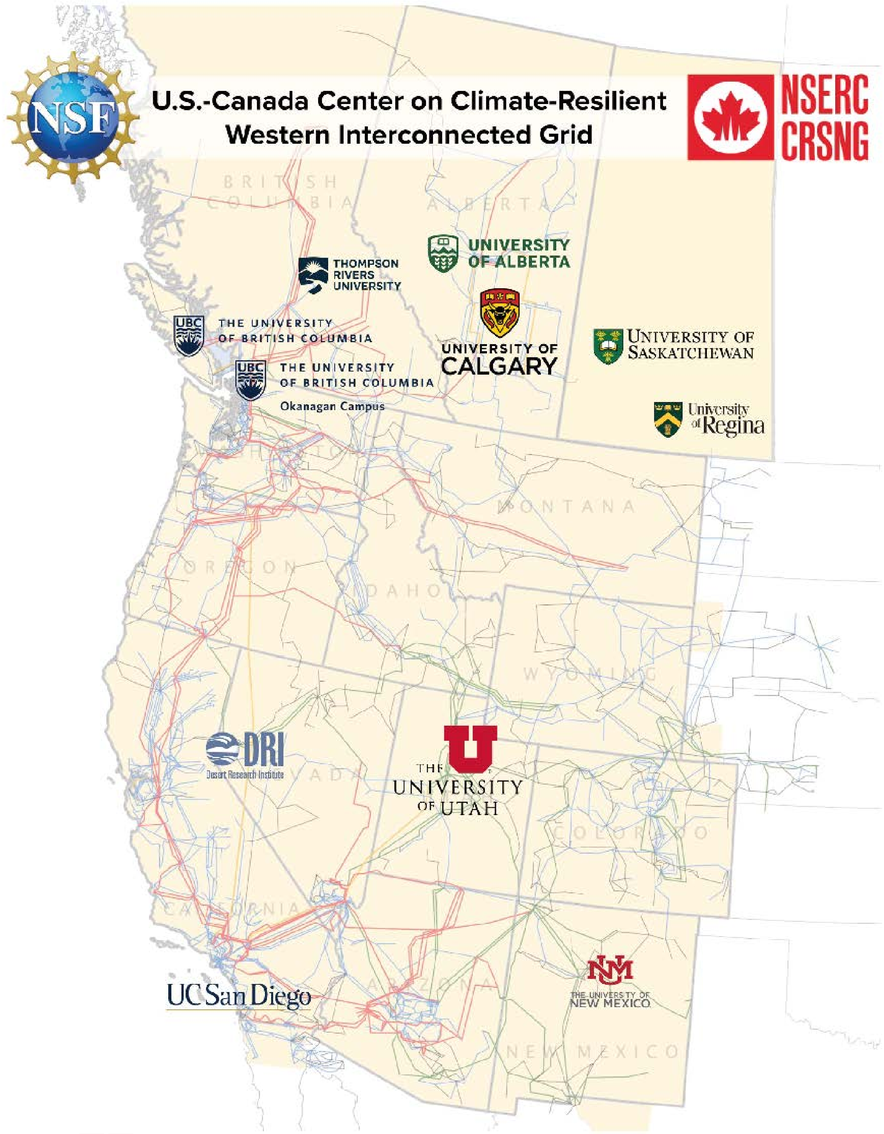

Figure 1: Predictions for ground level concentration of particulate matter 2.5 microns and smaller (PM2.5) in units of micrograms per meter cubed (µg/m3) on April 4th 2024.

International Cyberinfrastructure

The cyberinfrastructure we develop will enable data acquisition, storage, management, and visualization. Critical components of the infrastructure include Edge Compute and Entry Points, hosted on various hardware from drones to laptops, which allow streamlined access to various data sources. Central nodes, anchored by the University of Utah and the University of British Columbia, harness existing resources while ensuring data security and authorized access.[1]

CEDMAV's role is to lead the design and implementation of this cyberinfrastructure to enable collaborative research.

The first step to developing the cyberinfrastructure is to determine the data of interest and to define how they can be accessible. We are using CEDMAV's OpenVisus to convert data of interest to the IDX format.[2] Additionally, we establish cloud storage accessible across member institutions to have climate, energy, and other data available for use by the scientists.

Methods and Materials

To create the overall cyberinfrastructure we will:

1. Take a census of our collaboration's resources. This ensures we create cyberinfrastructure that is equitable among all collaborators.
2. Through meetings with our domain scientist collaborators, determine scientific use cases of interest to motivate data selection.
3. Using OpenVisus, we convert data identified with collaborators to IDX format and provide Pythonic tools to access this data.
4. Design a data schema to define how the various data relate to each other.
5. Develop an online portal to provide access these data and the Pythonic tools associated with them.

Current Progress

We have been having discussions with our domain scientist collaborators to understand what their specific research problems of interest are and what data they specifically would like to access to answer these questions. With this information, we have begun using OpenVisus to convert datasets of interest and datasets by our collaborators.

Figure 1 shows one such dataset produced and visualized by The Weather Forecast Research Team at the University of British Columbia.[3] This data on PM2.5 particulate matter is currently available from UBC by downloading a netCDF file for the day one is interested in obtaining.

Figure 2 shows the prototype for a dashboard we created to enable viewing and exploring the PM2.5 data over the past three years without having to download netCDF files and process them manually.

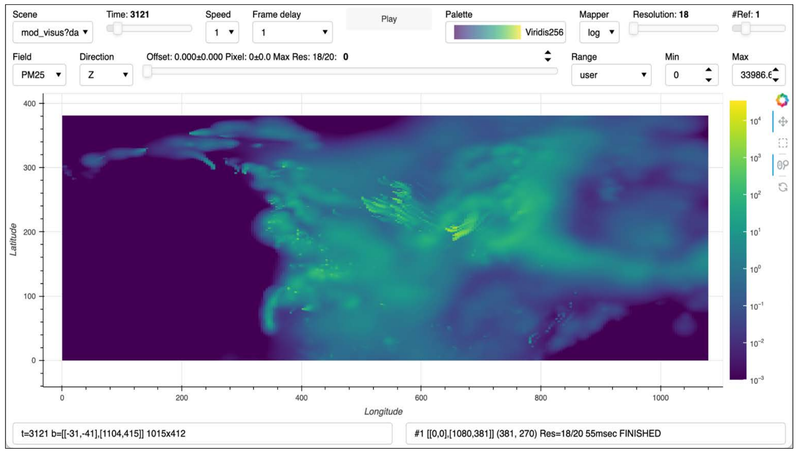

Figure 2: Prototype of an OpenVisus dashboard enabling viewing, analyzing, and downloading the IDX version of PM2.5 data either from a web portal or from a Jupyter Notebook.

Discussion

The primary challenge is in gathering and converting the data of interest for the center. Some data sources are private access whereas some are not, additionally, different temporal and spatial resolutions of various climate data exist and are of potential use.

We are currently in an iterative exploration phase: we convert data and create Jupyter Notebooks to access the data, we share this with our collaborators to get their reactions and input, we convert more data and/or begin implementing features that researchers request.

As we acquire proprietary data we will introduce a proper infrastructure to ensure access only to authorized users and enable secure collaboration between the industry and the greater research community.

Additionally, we will choose various scientific use cases to pursue to motivate the design of our system so we may continue to grow it from there.

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References:
1. https://resilience.utah.edu/
2. https://github.com/sci-visus/OpenVisus/tree/master
3. https://firesmoke.ca/