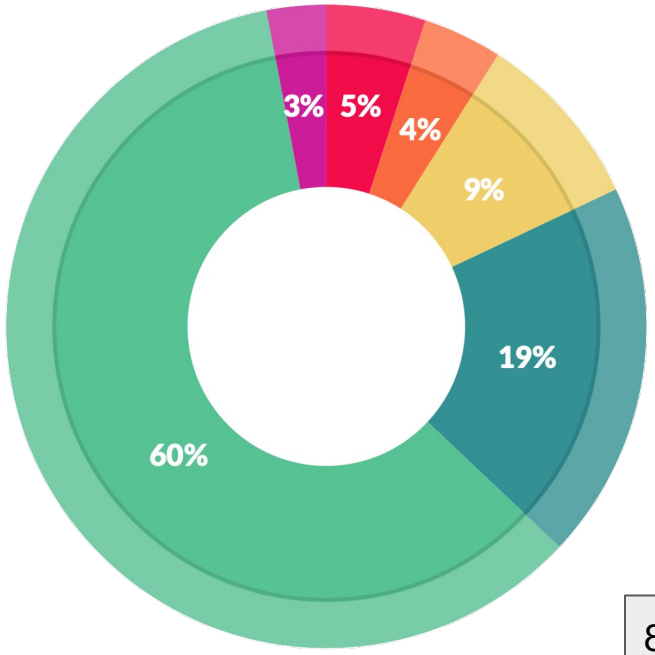
Introduction: Community-developed data exploration for earth system and beyond

Aparna Radhakrishnan

August 2024

The need for data exploration



Ref: How do data scientists spend their time?
Crowdflower Data Science Report (2016)

What data scientists spend the most time doing

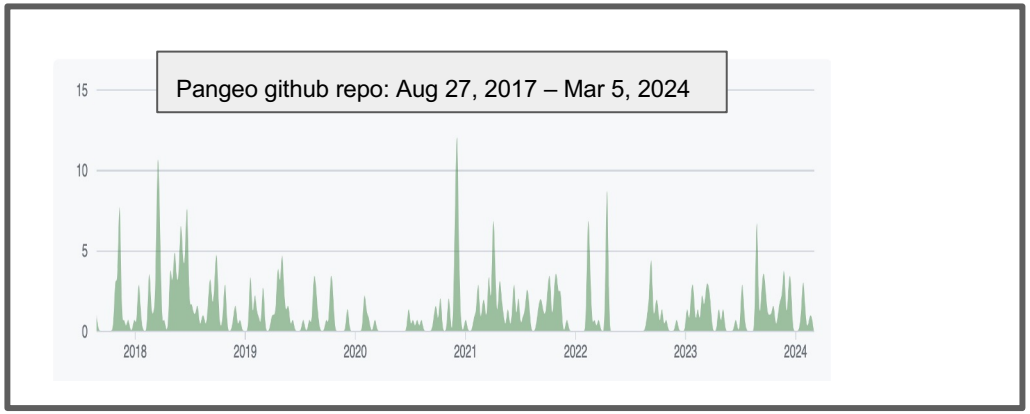
- *Building training sets: 3%*
- *Cleaning and organizing data: 60%*
- *Collecting data sets; 19%*
- *Mining data for patterns: 9%*
- *Refining algorithms: 4%*
- *Other: 5%*

80% of their time on preparing and managing data for analysis.

Acknowledging community collaborations

PANGEO

A community platform for Big Data geoscience

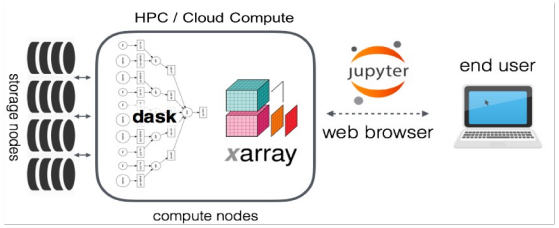


CMIP6 Hackathon (2019)

CMIP

select-OBS

How can search for data?
How can I load the data in my multi-model analysis?



[2020-2021]

Informal Pangeo/ESGF Cloud Data working group

Columbia University

Centre for Environmental Data Analysis

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NOAA Model Diagnostics Task Force

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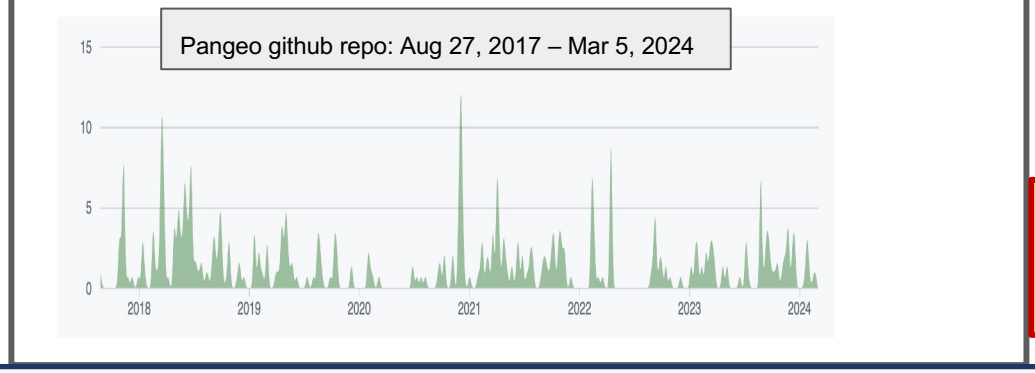

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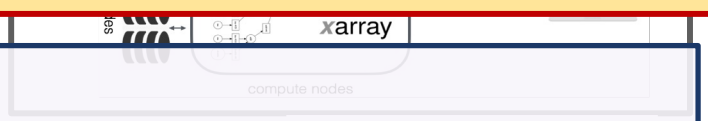
Intake-esm was introduced



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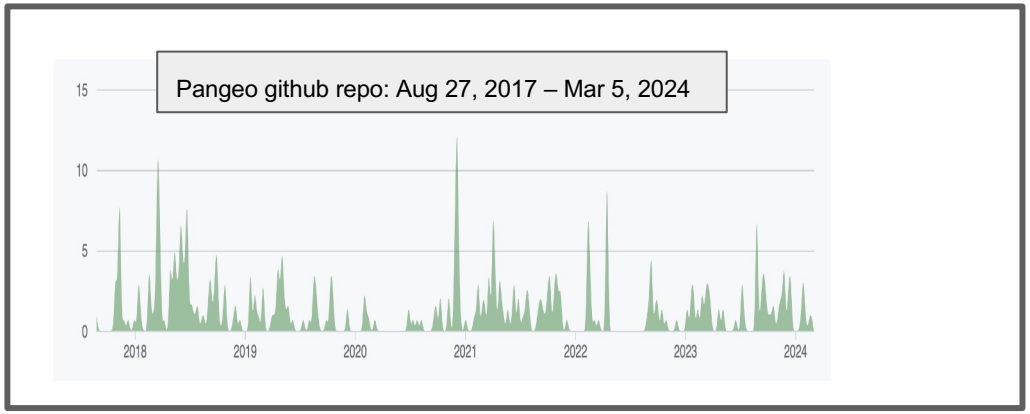

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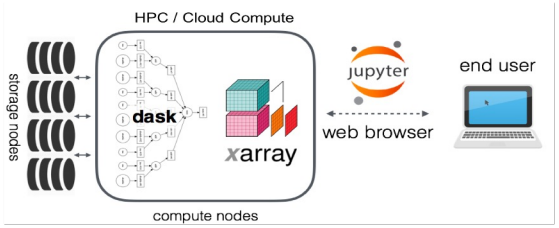

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Data catalogs? intake-esm?

Catalog Specification

- what we expect to find inside and how to open the “datasets”/objects?
- Provides metadata about the catalog
- Identifies how multiple files can be aggregated into a single “dataset”
- Extensible metadata
- Single JSON File

Catalog

- Tells us more about the data collection
  - Path to the files (objects), and associated metadata.
- User-defined granularity
- CSV File

Intake-esm: Opens possibilities to QUERY and ANALYZE

- Provides a pythonic way to “query” for information about data collections.
- Loads the results in an xarray dataset object

Data catalogs? intake-esm?


```
{
  "esmcat_version": "0.1.0",
  "id": "sample",
  "description": "This is a very basic sample ESM catalog.",
  "catalog_file": "sample_catalog.csv",
  "attributes": [
   {
     colum_name": "experiment_id",
     "vocabulary": "https://raw.githubusercontent.com/WCRP-CMIP/CMIP6_CVs/master/CMIP6_CV.json"
   } ,
   {
     "column_name": "variable_id",
     "vocabulary": ""
   },
   {
     "column_name": "path",
     "vocabulary": ""
   }
  ],
"assets": {
   "column_name": "path",
   "format": "netcdf"
 }
}
```


experiment_id,variable_id, path

cmdev-test,ts,tsfilename.1900.nc
cmdev-test,ts,tsfilename.1904.nc
cmdev-test,ts,tsfilename.1905.nc
cmdev-test,thetao,thetaofilename.1900.nc
cmdev-test,thetao,thetaoilename.1904.nc
cmdev-test,thetao,thetaofilename.1905.nc

```
col = intake.open_esm_datastore(path_to_catalog_specification
```

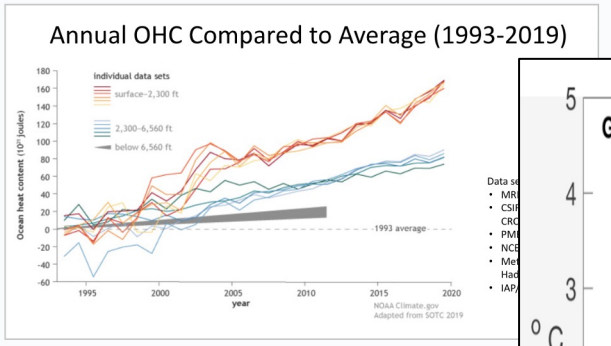
catalog with 2 dataset(s) from 6 asset(s):

```
exp_filter = [omdev-test]
variable_id_filter = "ts"
cat = col.search(experiment_id=exp_filter,
                 variable_id=variable_id_filter)
```

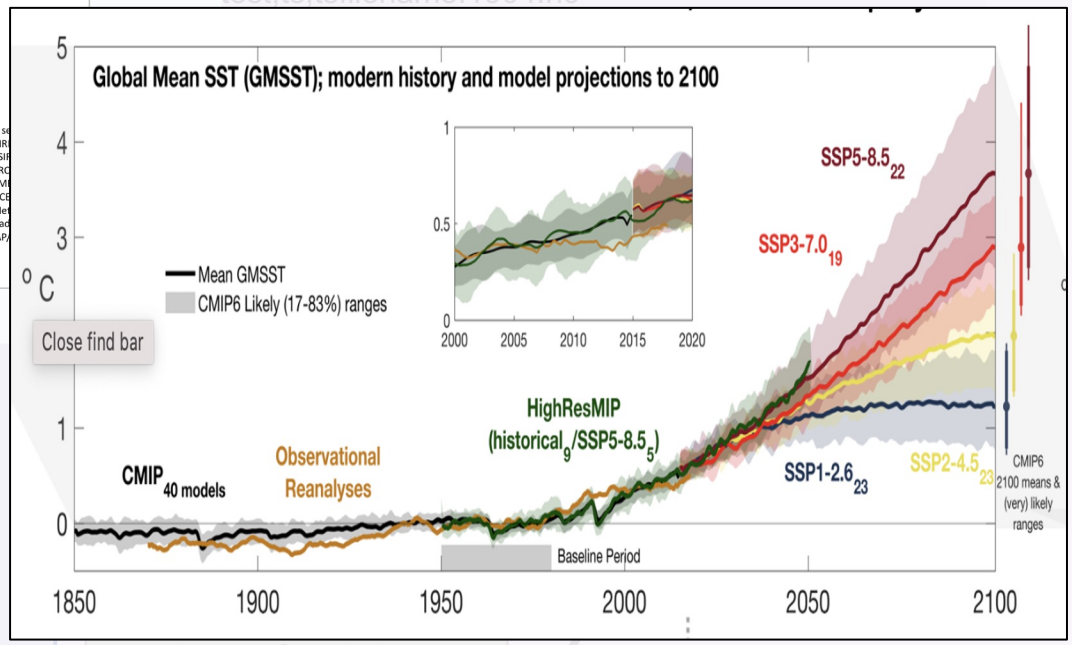
catalog with 1 dataset(s) from 3 asset(s):

Few lines of code later.. →

Data catalogs? intake-esm?



Cr. CIMES internship, Mackenzie Blanusa



Cr. IPCC and xMIP from Julius Busecke

A notebook example that “uses” the catalog

Example notebook [1] (Github reference)

Example notebook [2]

Example catalog specification (json), catalog (csv)

Please contribute notebook examples that use GFDL generated catalogs and intake-esm [Issue page]
(Homework) Binder link Once the link loads, go to notebooks and run the demo-search-explore cell by cell.
GitHub reference)

HOW TO BUILD A CATALOG? Please follow the GFDL Catalog builder video tutorial and docs.

More examples from the community:
MDTF example notebook (GitHub reference)
AWS S3 ASDI analysis collection
DKRZ documentation and references
Pangeo gallery
Student notebook