Climatology Calculation Support in the GeoCAT Ecosystem

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NCL to GeoCAT

Two main groups of functionality in the NCAR Command Language (NCL) need to be added to the GeoCAT Python ecosystem.

Visualization
- Example gallery (GeoCAT-examples)
- Wrapper functions for plotting (GeoCAT-viz)

Computation (GeoCAT-comp)
- Handling data from different atmospheric models
- Interpolating/transforming data
- Climatology calculations (means, anomalies)

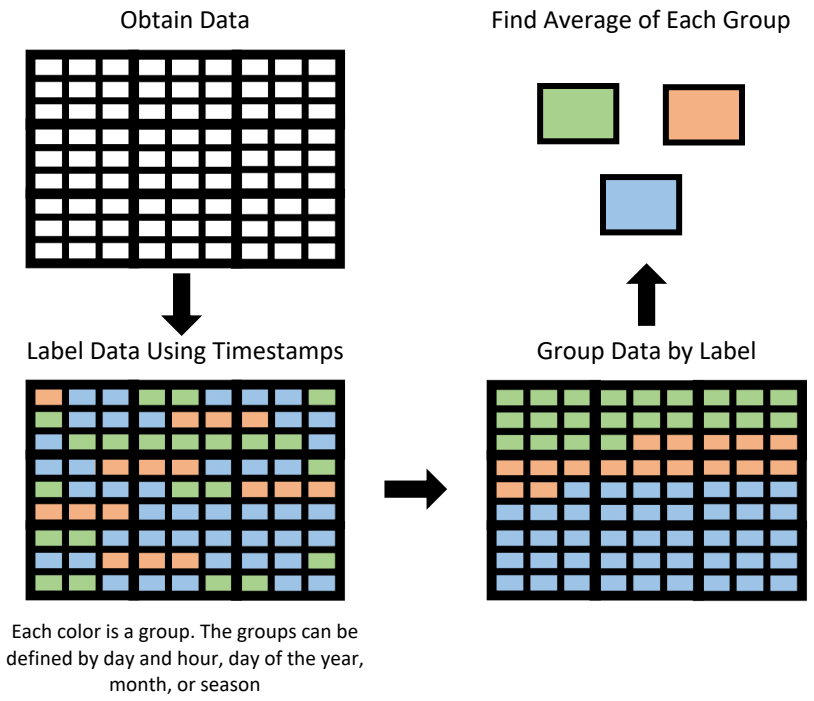
This project focuses on adding computational support for doing climatological calculations, specifically climate averages.

Climatological Calculations

What is a Climatological Average?
- Climatological averages are long term averages aggregated over multiple years
- Data must be grouped by a time period before the average is taken (i.e. by month)
  - Grouping must disregard years
  - All data in any January (regardless of year) is a part of one group

Grouping by datetimes
- Grouping sequential datetimes can be easily done by slicing an xarray.Dataset
- It is harder to group data that isn't sequential
  - Months aren't all the same length
  - Leap years add variability
  - Non-standard calendars add complexity
- xarray.DateTimeAccessors and the groupby() function make this easier

Processing Data



Fundamental Packages

NumPy

xarray

Challenges

- Supporting non-standard calendars for different weather model outputs
  - Data where there are never leap years
  - Data recorded in the Julian calendar
  - Data where months are all 30 days (including February)
- Doing a weighted averages when going from monthly averages to seasonal averages

`climatology_average()`

Calculates long term hourly, daily, monthly, or seasonal averages across all years in the data

Inputs:
- `dset`: The data as an xarray.DataArray or xarray.Dataset
- `freq`: A string representing the frequency of the calculated climatological averages
  - 'hour', 'day', 'month', 'season'
- `time_dim`: The name of the time dimension
  - Optional, will be inferred if not given

Output:
- Climatological averages for each period

Future Work

- Address user feedback now that geocat-comp 2021.7.1 is released
- Add functionality to change how time bounds are handled
- Implement NCL climate anomaly functions along with other computational routines
- Create any new tools that users need

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GeoCAT Website
geocat.ucar.edu

GeoCAT-comp Repository