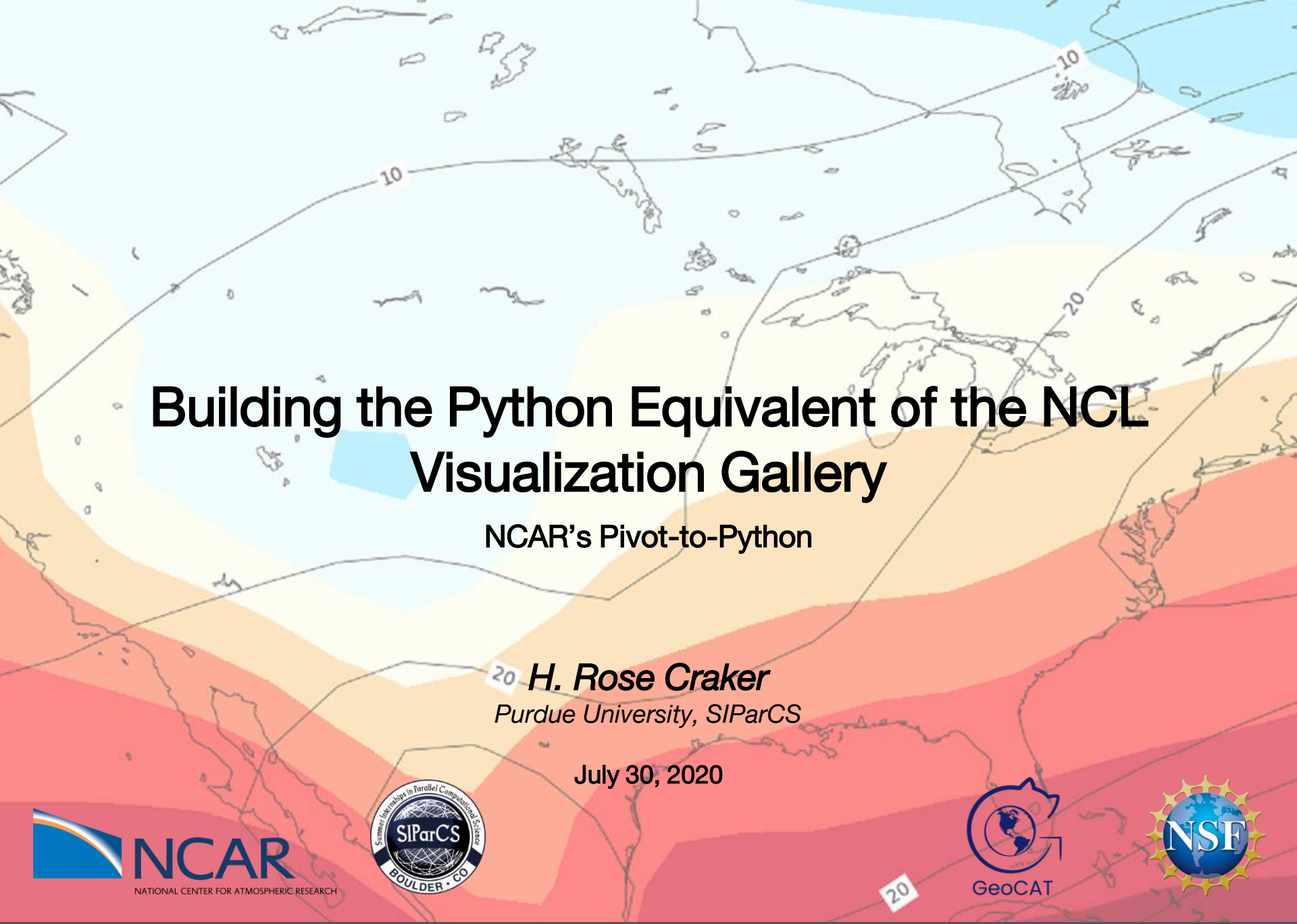

Building the Python Equivalent of the NCL Visualization Gallery

NCAR's Pivot-to-Python

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July 30, 2020

NCAR
NATIONAL CENTER FOR ATMOSPHERIC RESEARCH

SIParCS
Summer Internships in Parallel Computational Science
BOULDER · CO

GeoCAT

NSF

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History of NCL

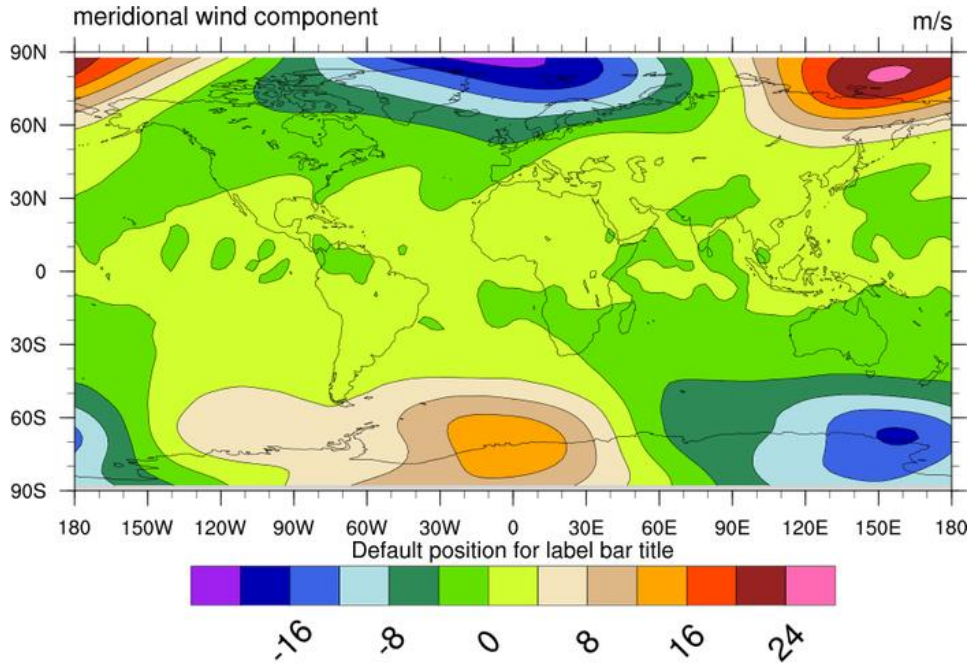
Created specifically for the Earth Sciences 1995 by NCAR

All-in-one tool for visualization of large, multidimensional data sets

Functions built in for niche computational routines

Made creating meteorology specific plots simple

Extensive library for cartography

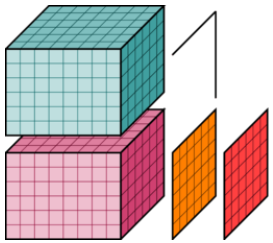


Motivation for Transitioning to Python

Maintaining NCL and its associated packages became difficult with reduced staff and a smaller budget

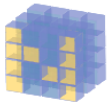
Python packages already exist for handling NetCDF data, visualization, cartography, and more

Python is free, open source, and already popular in the scientific community



xarray

NumPy



matplotlib

Version 3.2.2

Purpose of the GeoCAT Example Gallery

Making the transition to Python easier

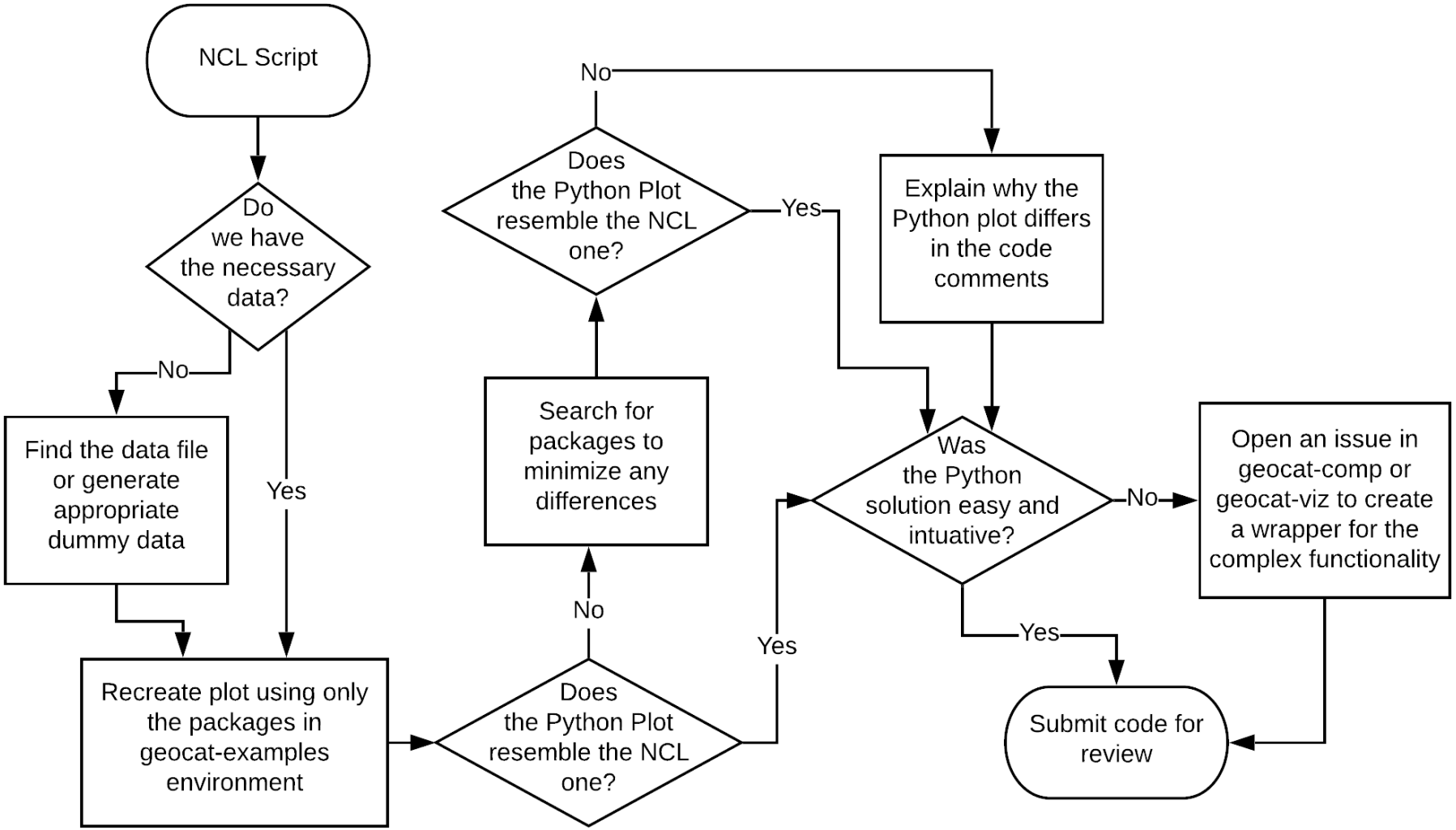
Providing scientists who are using NCL with example code for the same types of plots

Explaining the limitations of Python where needed

Showing the additional features Python provides that don't exist in NCL

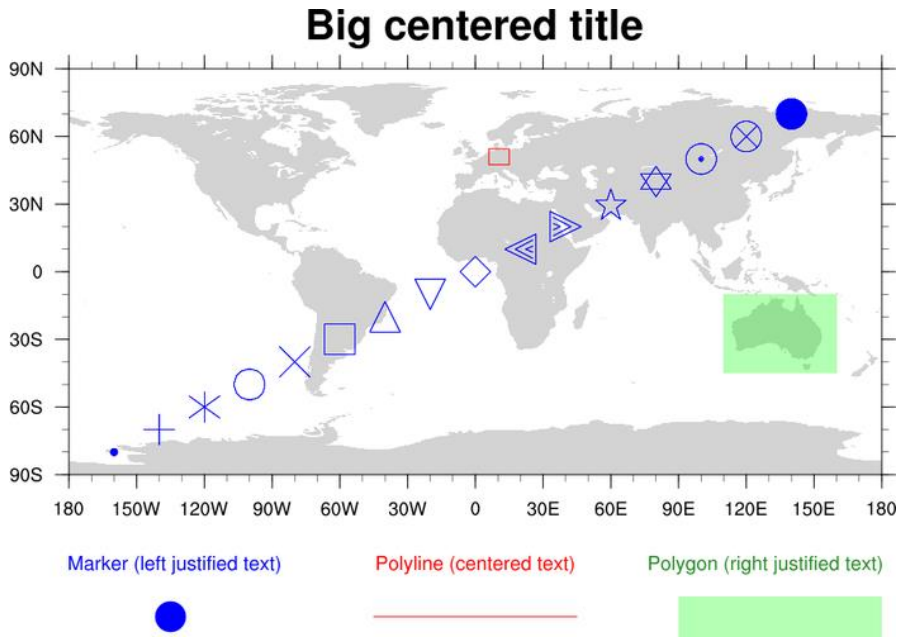
Providing resources for how to make accessible visualizations

Process

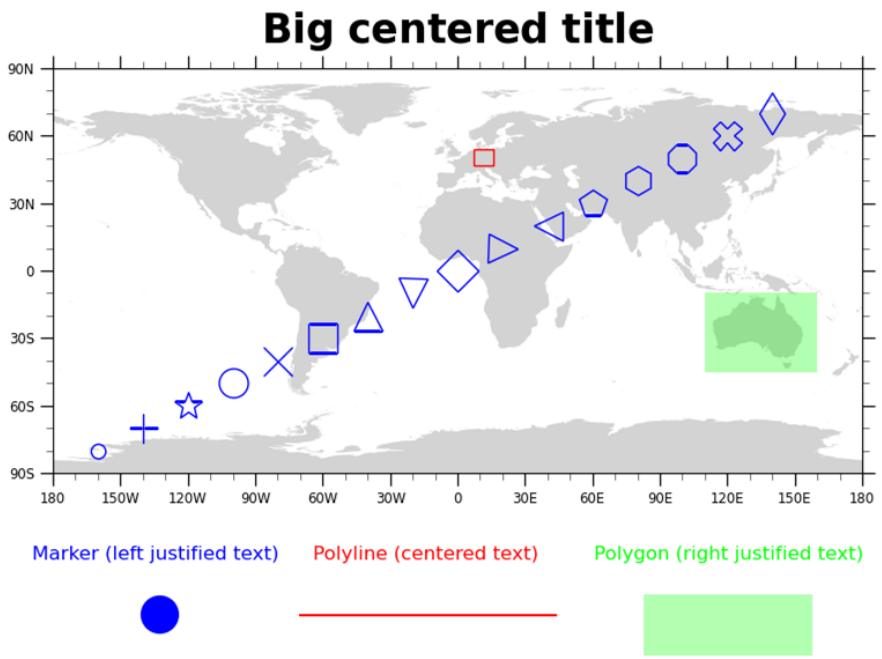

NCL Script
Do we have the necessary data?
No
Yes
Find the data file or generate appropriate dummy data
Recreate plot using only the packages in geocat-examples environment
Does the Python Plot resemble the NCL one?
No
Yes
Search for packages to minimize any differences
Does the Python Plot resemble the NCL one?
No
Yes
Explain why the Python plot differs in the code comments
Was the Python solution easy and intuative?
No
Yes
Open an issue in geocat-comp or geocat-viz to create a wrapper for the complex functionality
Submit code for review

polyg_18.ncl versus NCL_polyg_18.py

NCL Made Example

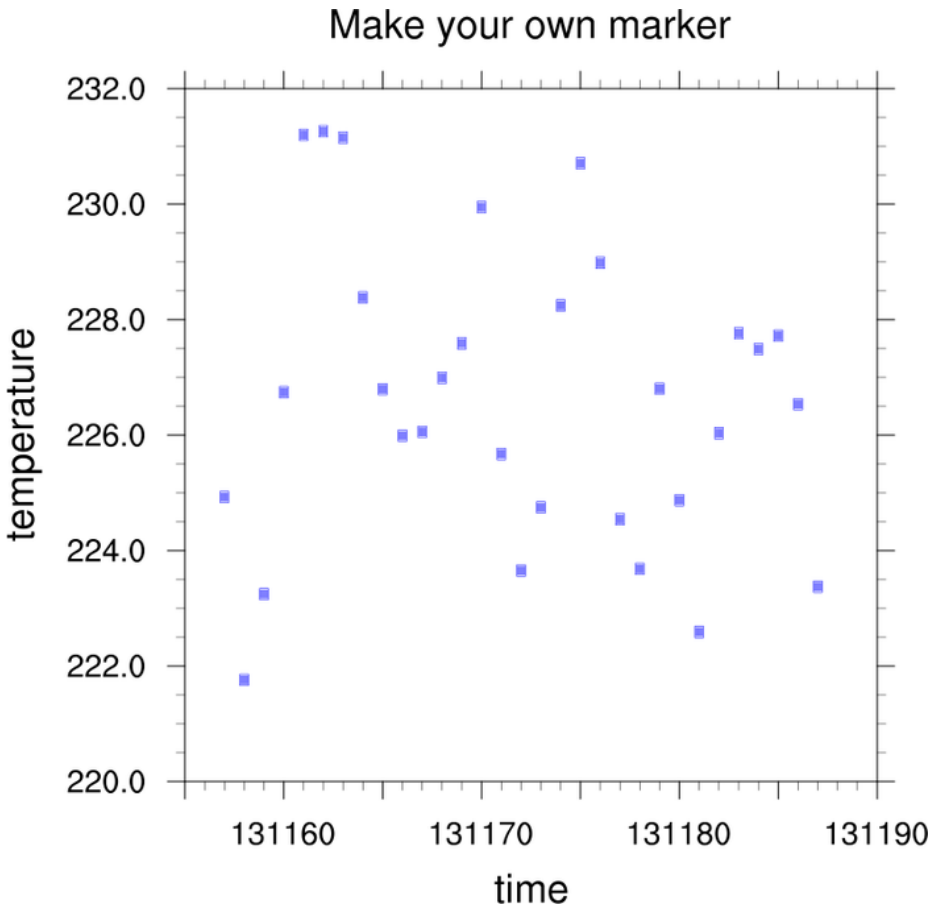


Python Made Example

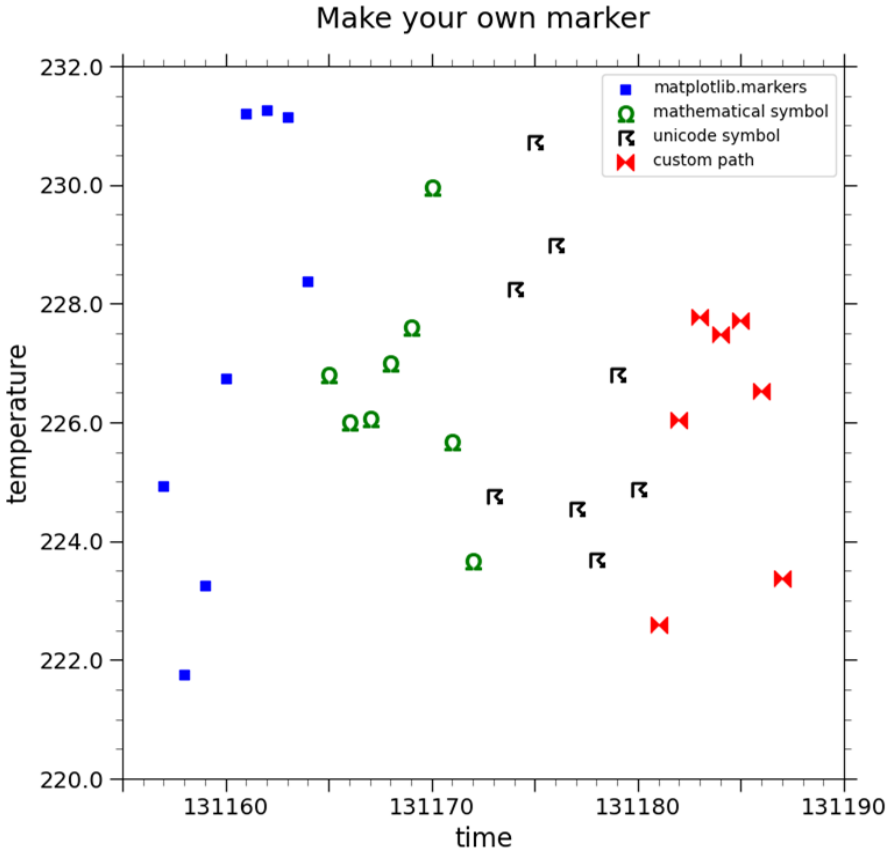


xy_4.ncl versus NCL_xy_4.py

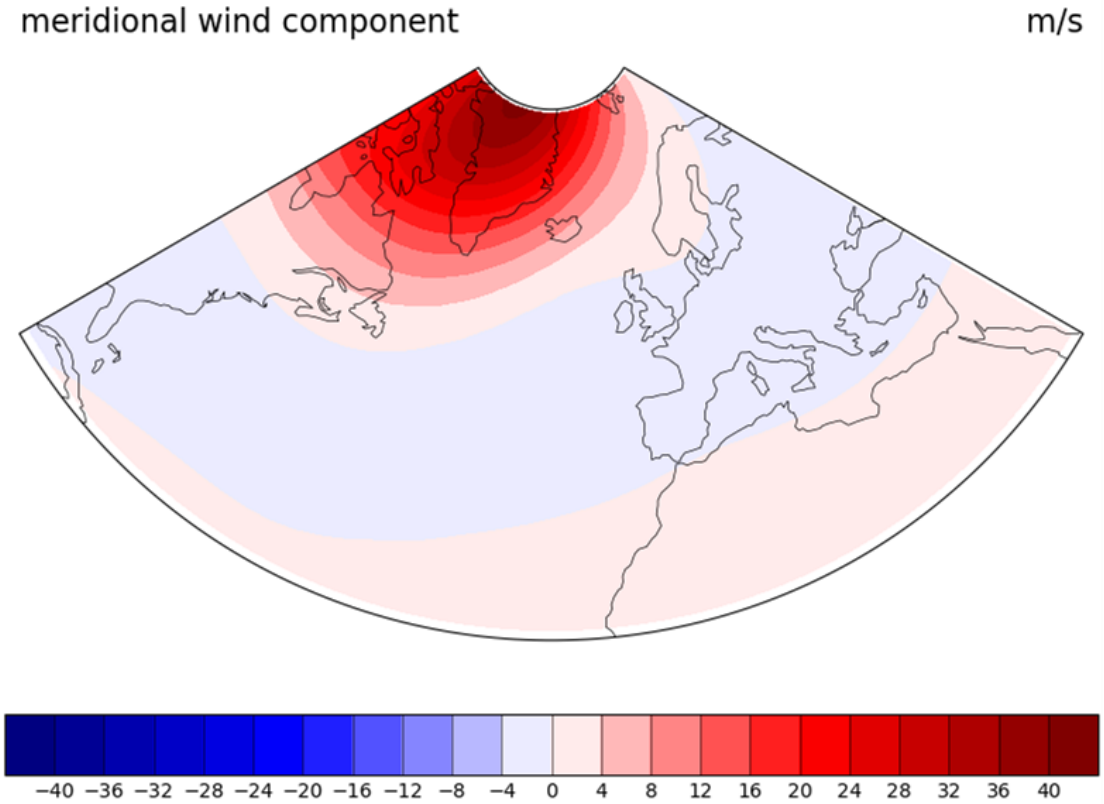
NCL Made Example



Python Made Example



More Complex Examples In Python



Making the map boundaries conform to the curves of the projection

NCL: 1 line
Python: 5 lines and a lot of debugging and math for one case

Supporting Packages from GeoCAT

Python has its limitations

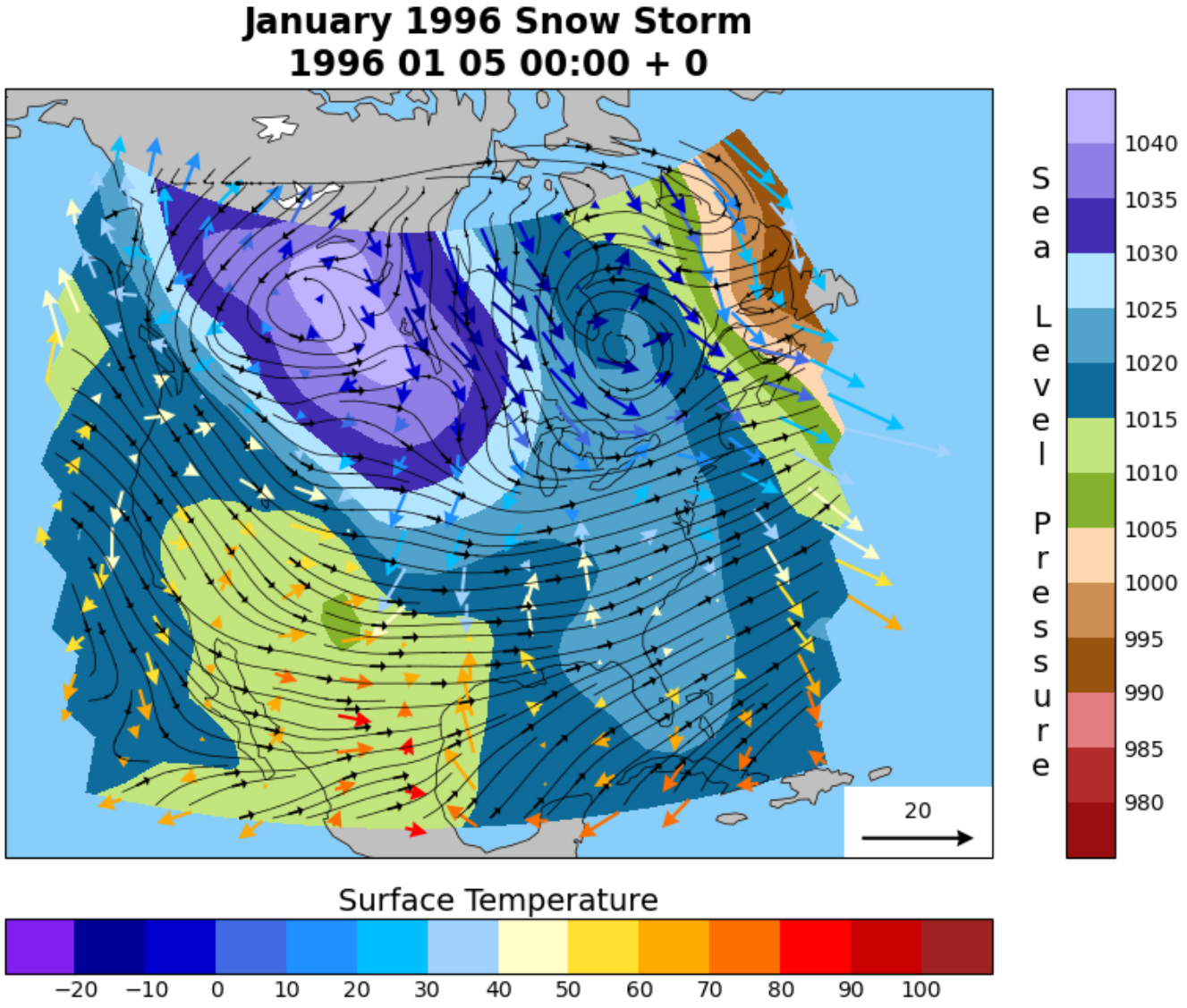
Geocat-comp wraps some of NCL's computational routines

Geocat-viz adds utility functions to make Python generated plots resemble NCL generated plots aesthetically

These packages are also following a continuous release model

Over time more functions will be added

Poor Quality Visualizations



More than Rebuilding

Opportunity to expand on what NCL has provided

A teaching tool for Python and best practices for data visualizations

Comparing and contrasting different color maps

Figure 1:
Rainbow Color Projection

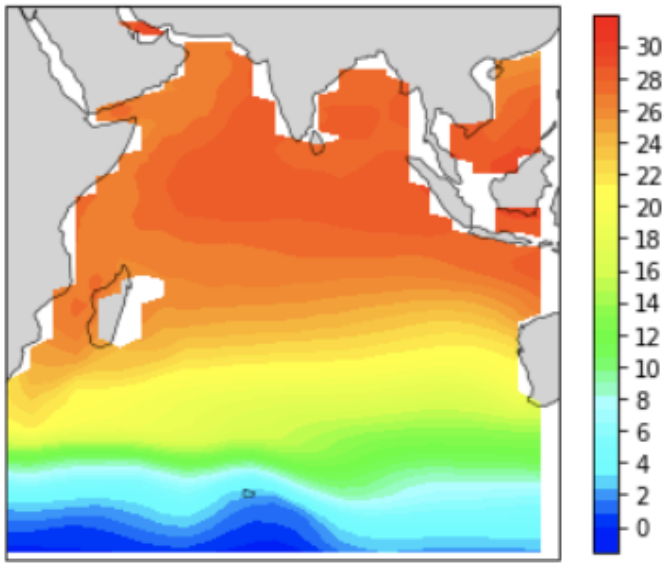
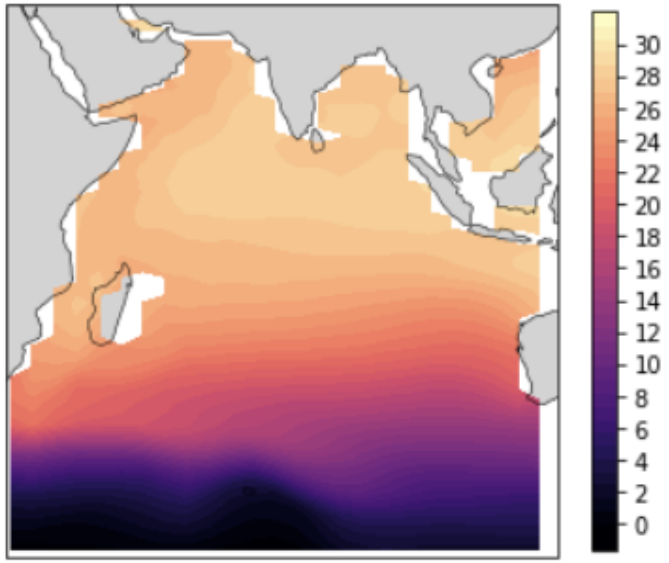


Figure 4:
Magma Color Projection



Future Work for the Gallery and GeoCAT

Create the remainder of the examples in Python

Add examples discussing best practices for data visualization

Add pages to gallery with tutorials for specific plot elements with relevant examples linked

Continue to add NCL's core functionalities and computational routines to **geocat-viz** and **geocat-comp**

GeoCAT Examples Gallery

geocat-examples GitHub

GeoCAT

Special thanks to my mentors this summer:
Julia Kent, John Clyne, Orhan Eroglu, Kevin Paul, and Michaela Sizemore