

Expanding GeoCAT's Visualization Capabilities

Aiding the transition from NCL to Python



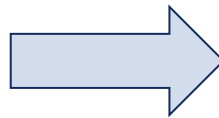
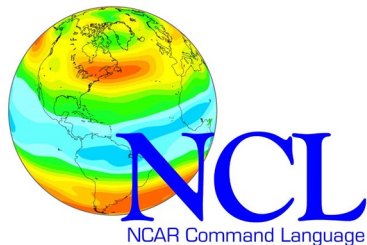
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University of Colorado Boulder, SIParCS*

July 27, 2022



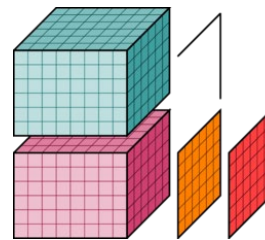
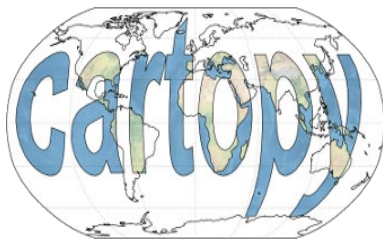
Background: NCL and Pivot to Python

- NCAR Command Language (NCL)
 - Programming language designed for visualization in Earth Sciences
 - Challenges with maintaining NCL
- “Pivot to Python” initiative, 2019
 - NCL put in “maintenance mode”



Why Python?

- Already popular in the scientific community
- Good documentation and support for beginners
- Free and open-source
- Packages make it easy to handle and visualize data



xarray

matplotlib
Version 3.2.2

GeoCAT Project



- **Geoscience Community Analysis Toolkit (GeoCAT)**
 - Project that aims to make transition easier for NCL users
- Three components of GeoCAT:
 - GeoCAT-Comp
 - GeoCAT-Viz
 - GeoCAT-Examples



GeoCAT-Comp
Github

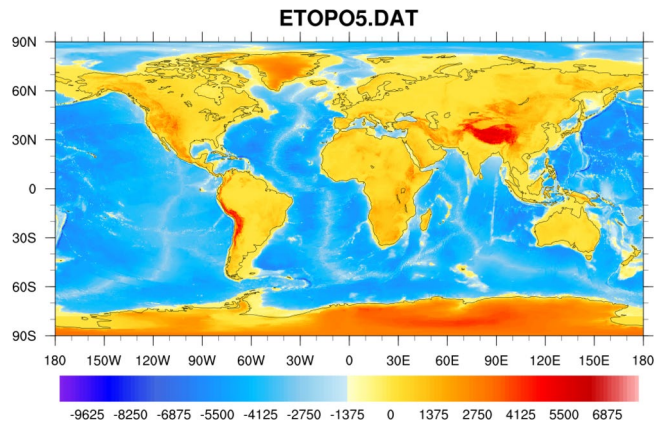


GeoCAT-Viz
documentation

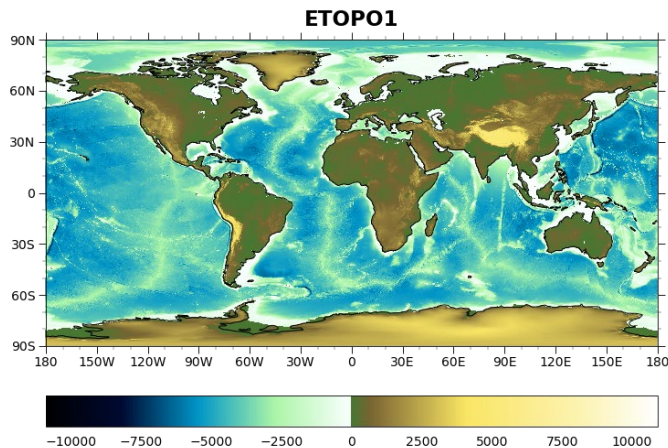


GeoCAT-Examples
Gallery

Recreating NCL topographic maps



NCL topo_1



Python topo_1

- Difficulties
 - Deprecated dataset

<u>Name</u>	<u>Last modified</u>	<u>Size</u>
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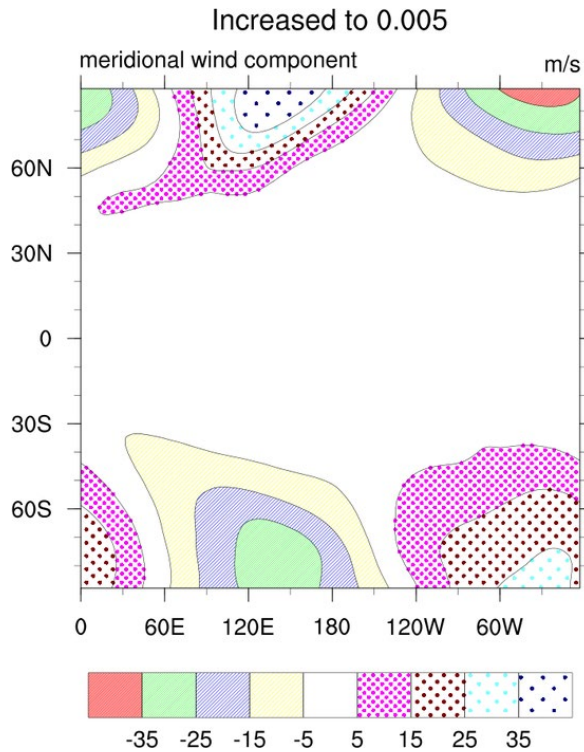
Parent Directory	-	-
ETOP05.DAT	2004-02-06 14:46	18M
ETOP05.DOS	2005-05-27 16:48	18M
ETOP05.txt	2005-06-03 15:06	5.3K
seltopo.exe	2004-02-06 14:46	42K

- Using a large dataset
 - Download time
 - Plotting time
- Solutions
 - Use ETOPO1 data
 - Use `ds.plot.imshow()`
- View this example in

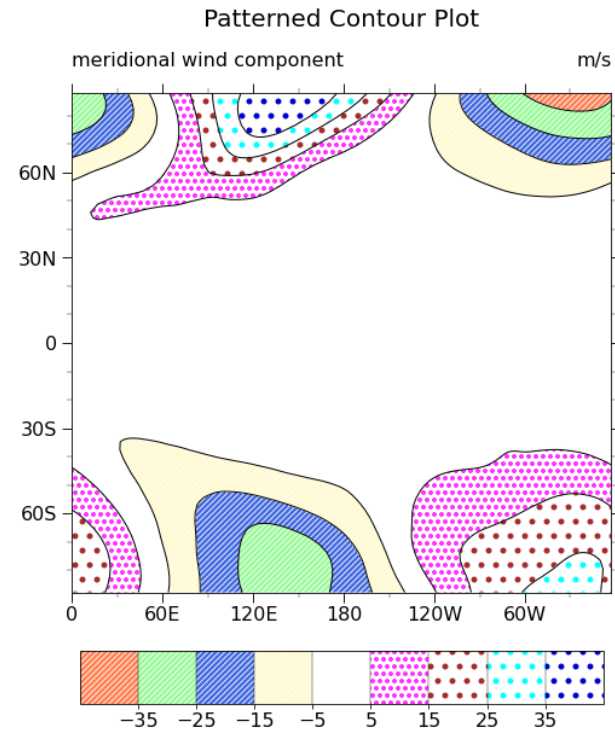
[GeoCAT-Examples Gallery](#)

Limitations of Python - coneff_11

Hatch mark density is not as customizable in Python



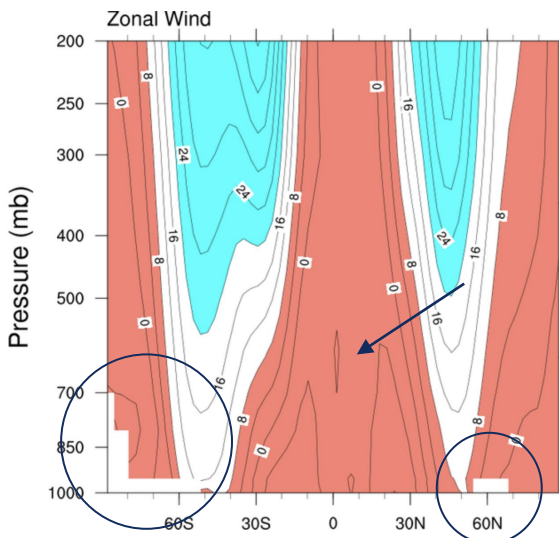
NCL Plot



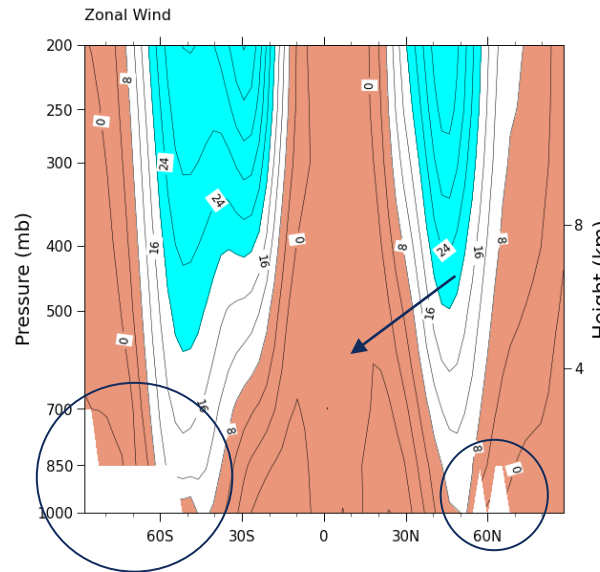
Python Plot

View this example in the GeoCAT-Examples Gallery [here](#)

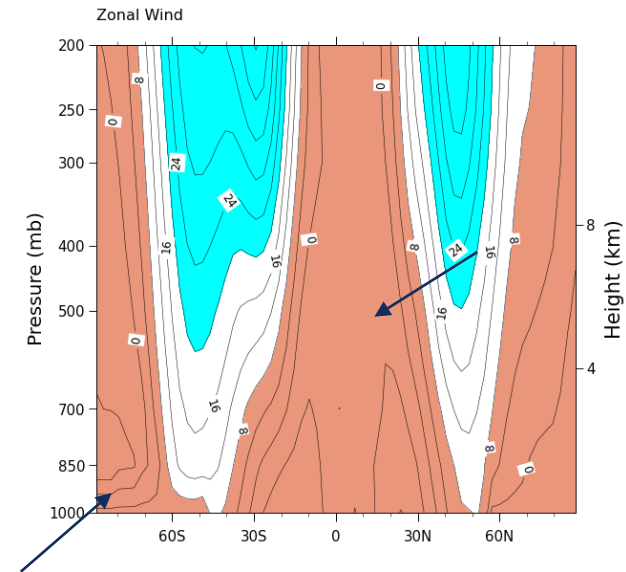
Issues with Python - coneff_8



NCL plot



Python plot before
handling missing
values

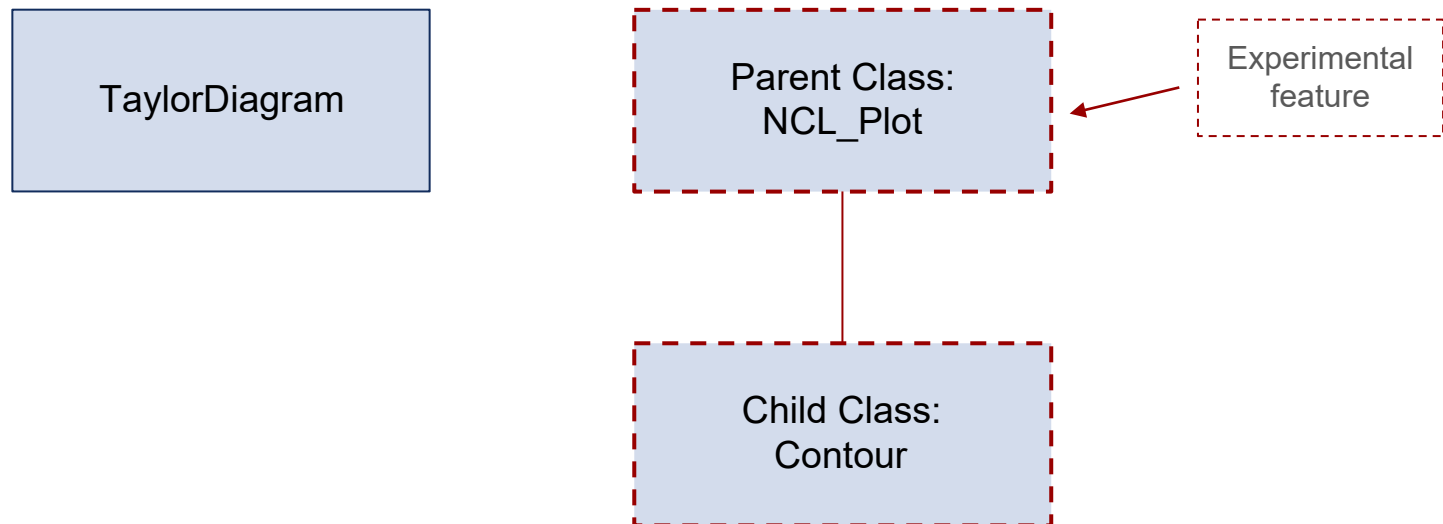


GeoCAT-Examples plot

View this example in GeoCAT-Examples Gallery [here](#)

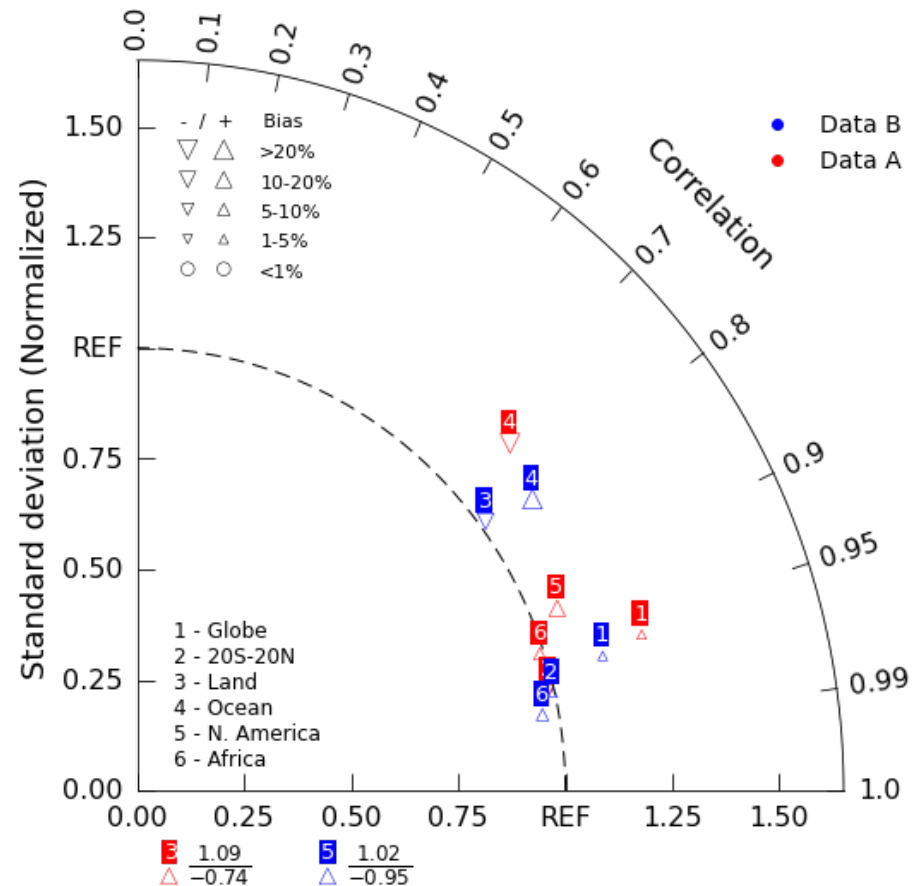
Using GeoCAT-Viz plotting classes

- Problem: Same set of geocat-viz utility functions used in many examples, adding many lines of code
- Solution: Wrap these functions into one plotting class to reduce code



Using TaylorDiagram

- Finished product
- Simplifies the complex task of creating a Taylor Diagram



taylor_8

Using Contour

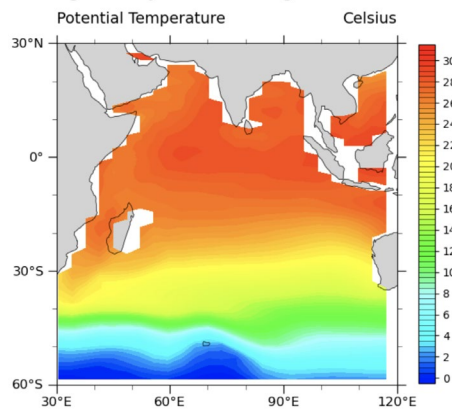
Pros

- One function call can create a finished plot
 - Example: `ce_3_1`

Cons

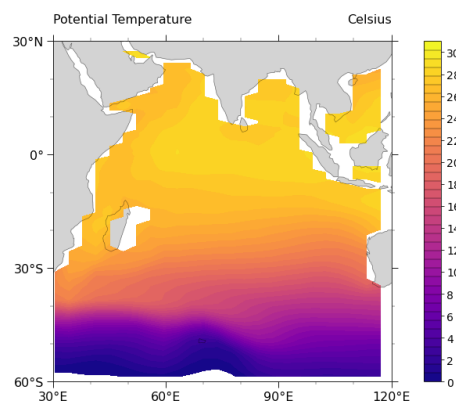
- Not as customizable
- Lots of inputs

30-degree major and 10-degree minor ticks



Original GeoCAT-
Example: 14
function calls

30-degree major and 10-degree minor ticks



ce_3_1 with Contour:
1 function call, 11
inputs

Improving colormap usage

NCL Default colormap

Matplotlib "plasma" colormap

Original



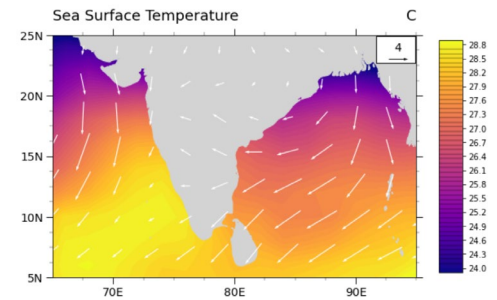
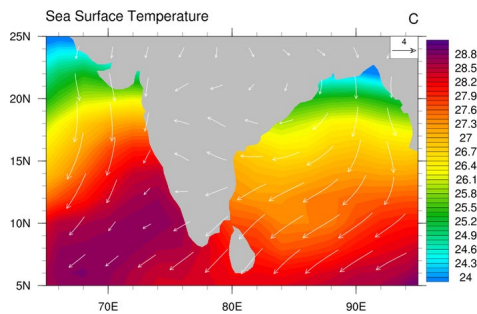
Greyscale



Red/Green
colorblindness
(deuteranopia)
view



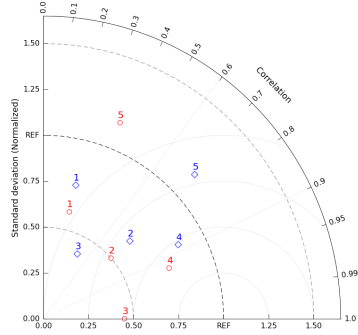
Vector_1
Example



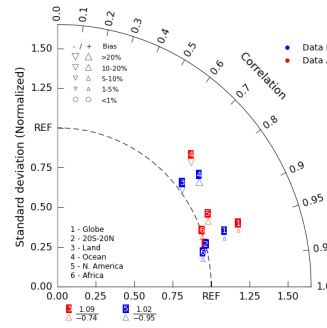
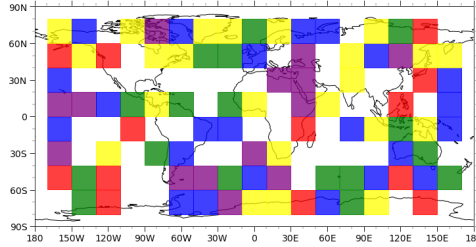
Learn more about colormaps [here](#)

New additions to GeoCAT-Examples

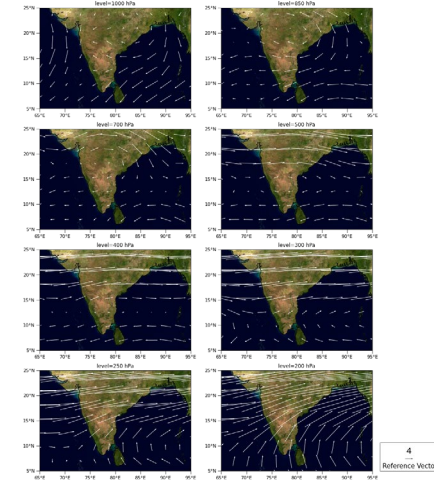
Example



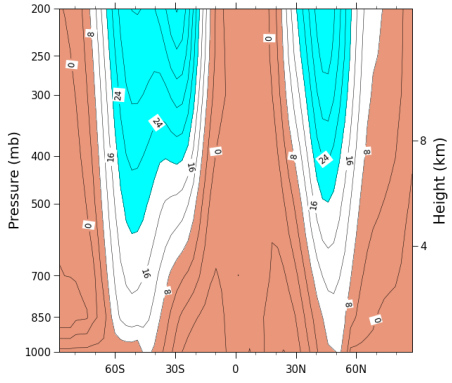
Dummy markers over a map



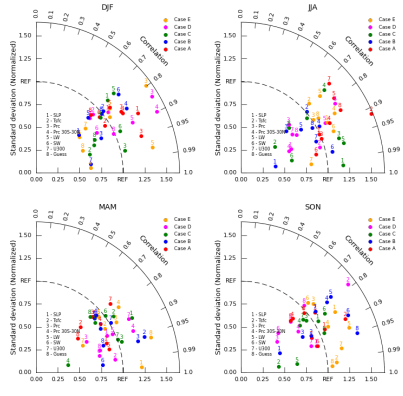
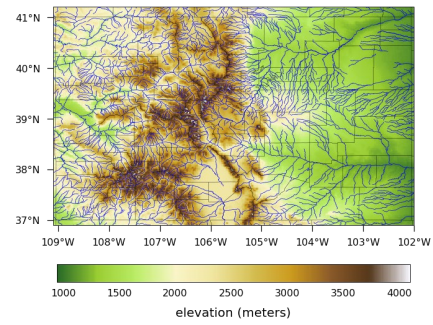
Zonal Wind (m/s)



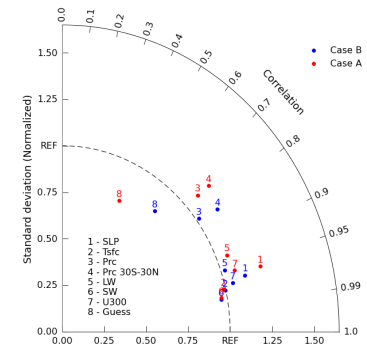
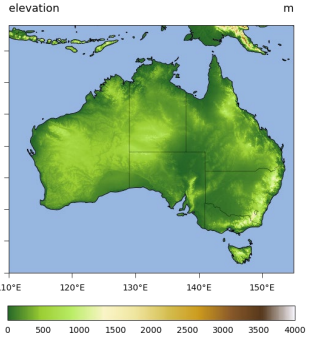
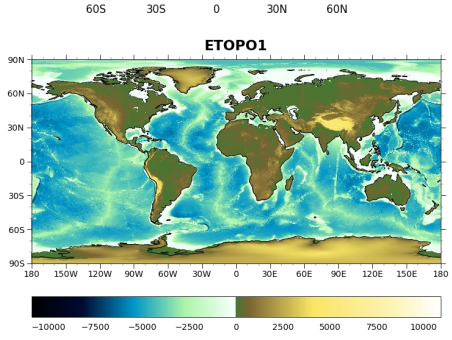
Zonal Wind



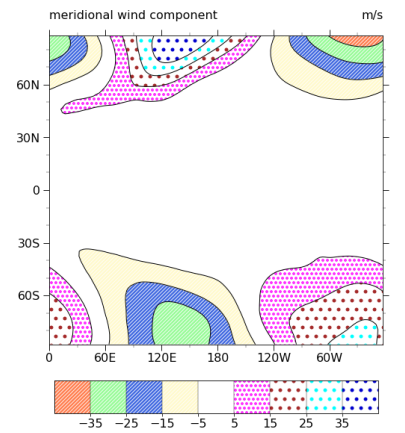
Rivers of Colorado



ETOPO1



Patterned Contour Plot



Questions?

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Thank you...

Mentors: Anissa Zacharias and Michaela Sizemore
GeoCAT team
SIParCS Program