Python Reimplementation of Fortran Subroutines: Bilinear Interpolation

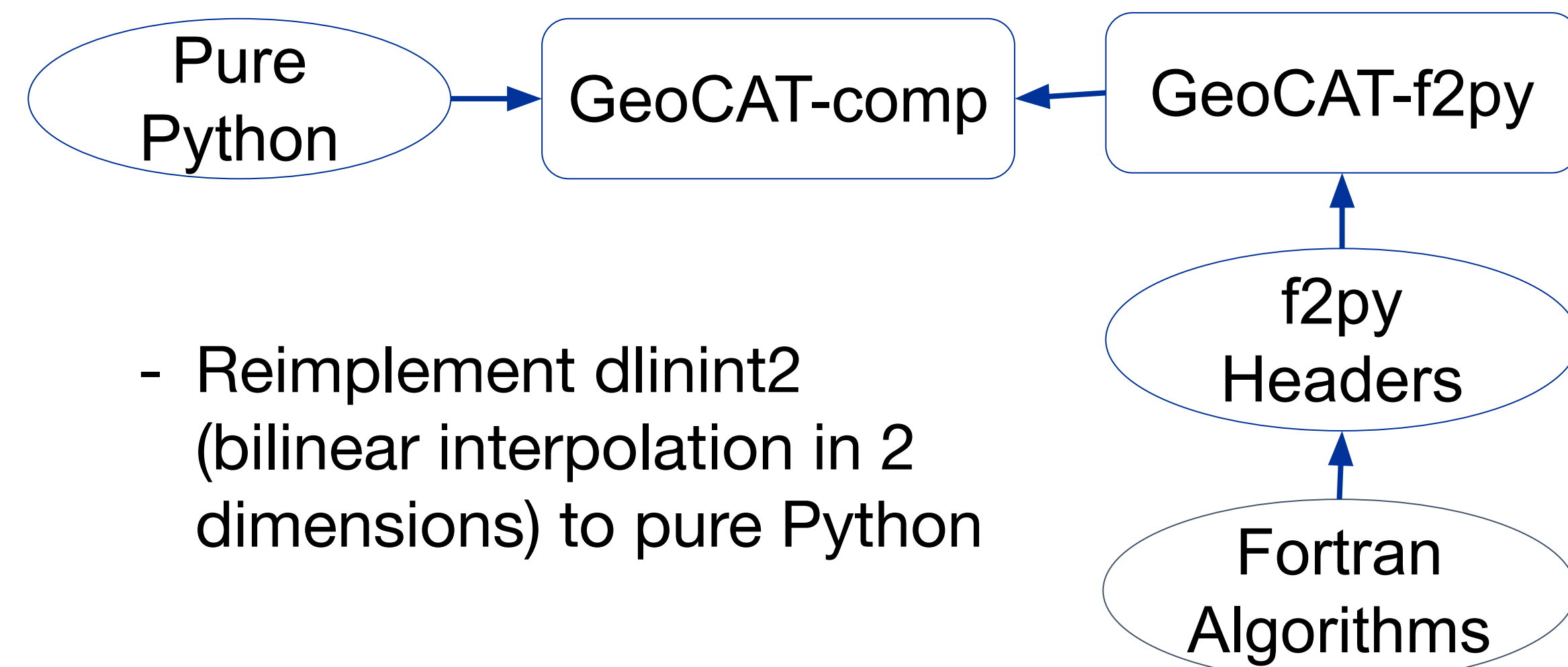**Alina Guha[1], Orhan Eroglu[2], Alea Kootz[2]**
[1]Grinnell College
[2]National Center for Atmospheric Research

BACKGROUND

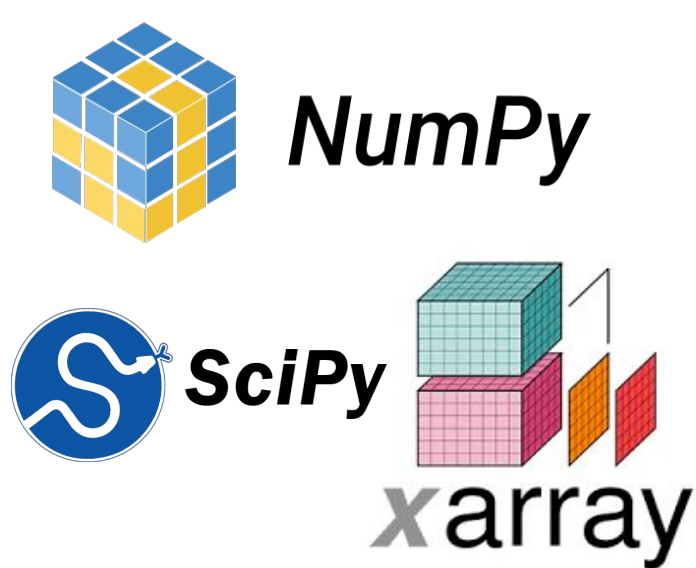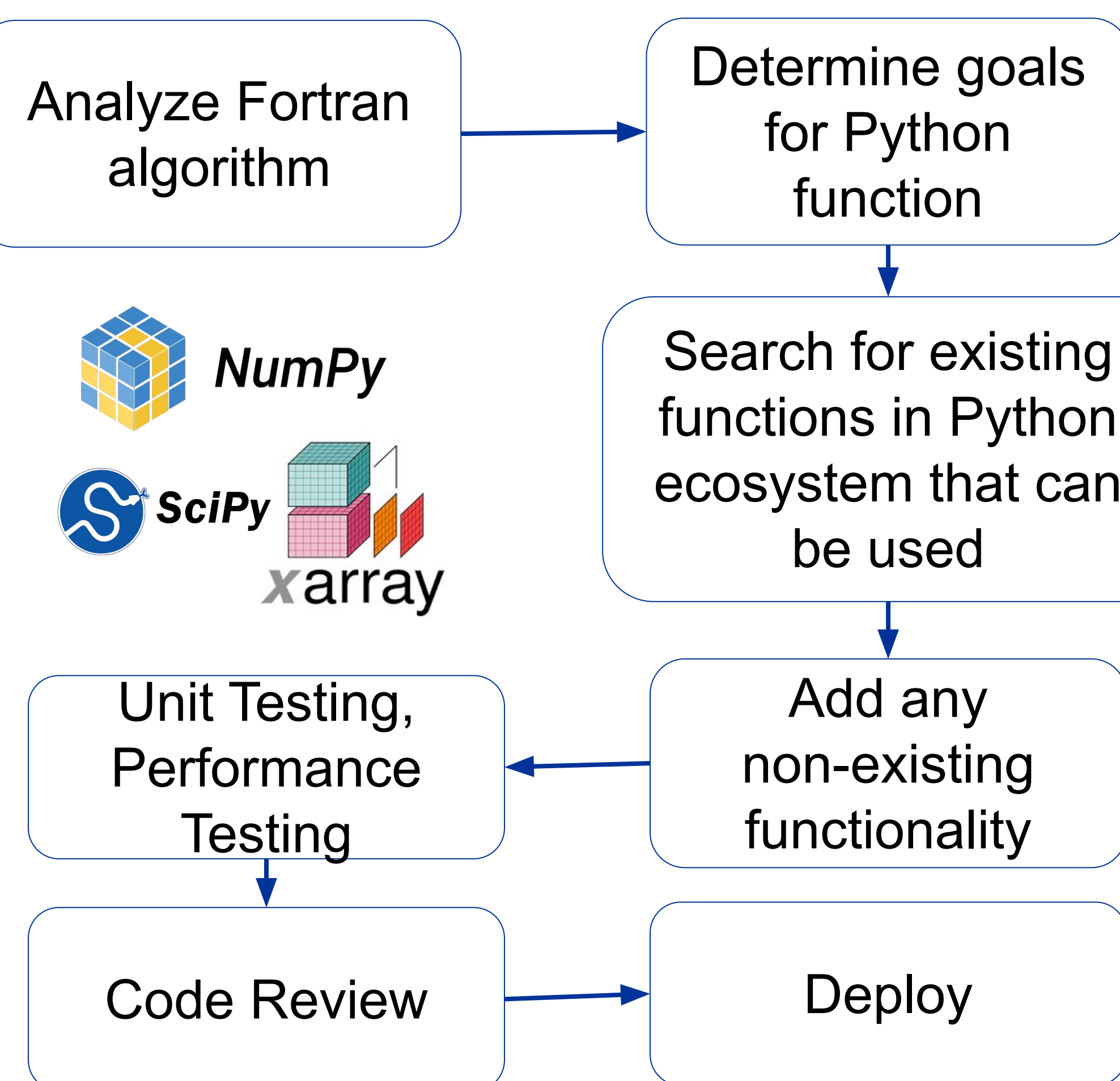- GeoCAT-comp and GeoCAT-f2py are two repositories in the GeoCAT software tools

Pure Python → GeoCAT-comp ← GeoCAT-f2py

GeoCAT-f2py ↑ f2py Headers ↑ Fortran Algorithms

- Reimplement dlinint2 (bilinear interpolation in 2 dimensions) to pure Python

```
SUBROUTINE
DLININT2(NXI,XI,NYI,YI,FI,ICYCX,NXO,XO,
NYO,YO,FO,XIW,FXIW,NXI2, XMSG,IOPT,IER)
```

METHODS

Analyze Fortran algorithm → Determine goals for Python function

NumPy

SciPy

xarray

Unit Testing, Performance Testing ← Add any non-existing functionality ← Search for existing functions in Python ecosystem that can be used

Code Review → Deploy

RESULTS

Original Grid

Regrid (to coarse) - interp_multidim

Temperature (°C)
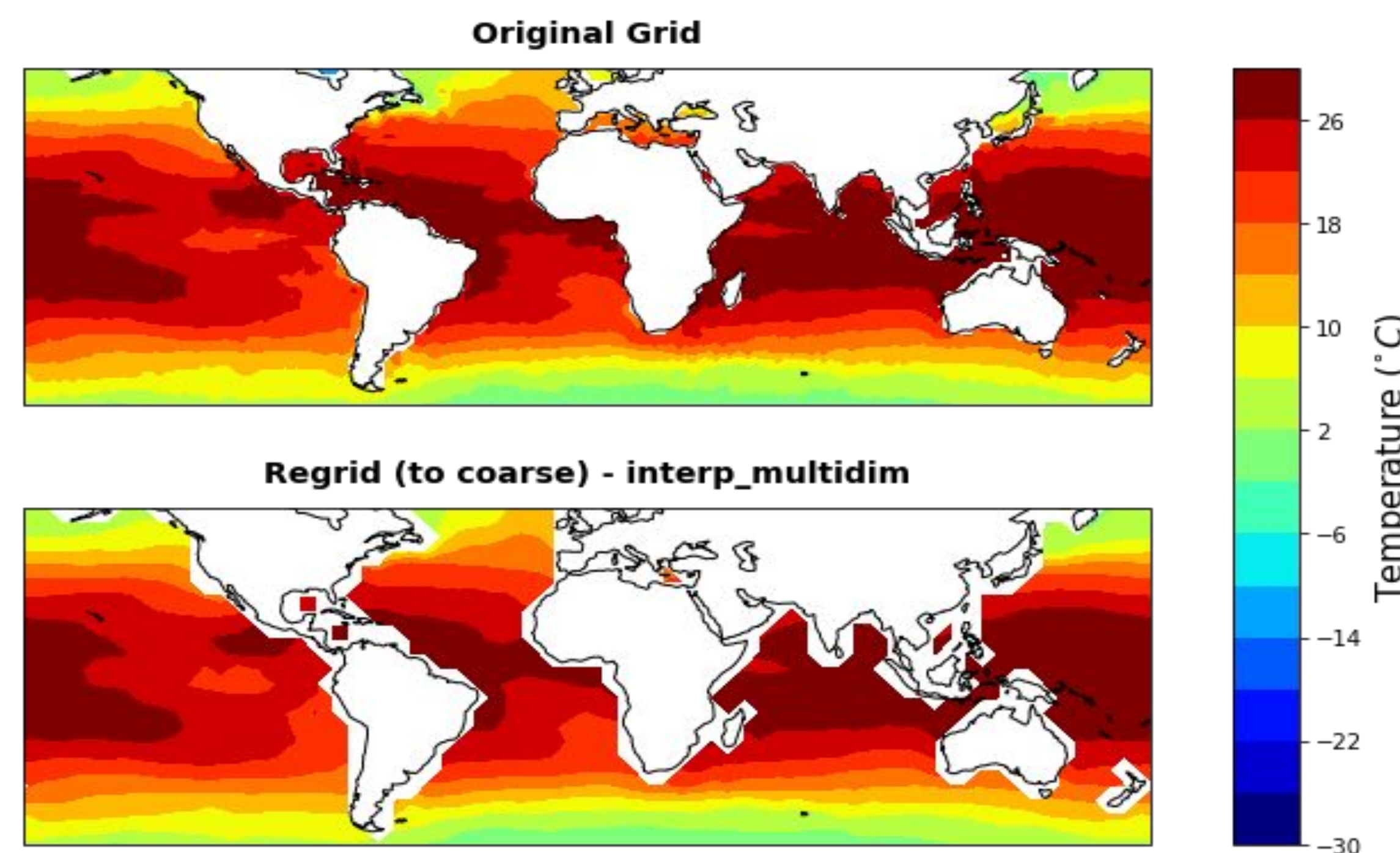
```python
def interp_multidim(data_in:
        typing.Union[xr.DataArray, np.ndarray],
            lat_out: np.ndarray,
            lon_out: np.ndarray,
            lat_in: np.ndarray = None,
            lon_in: np.ndarray = None,
            cyclic: bool = False,
            missing_val: np.number = None,
            method: str = "linear",
            fill_value:
        typing.Union[str, np.number] = np.nan)
```

- Accepts input data array and output coordinate arrays to interpolate to
- Also accepts input and all coordinates as NumPy arrays
- Builds on xarray.interp, which is built on scipy.interp1d
- Involves wrapping of longitudes to handle cyclic data if cyclic parameter is set to true
- Supports extrapolation if fill-value is set to 'extrapolate'

CONCLUSIONS

New features: Nearest Neighbor Interpolation and Extrapolation

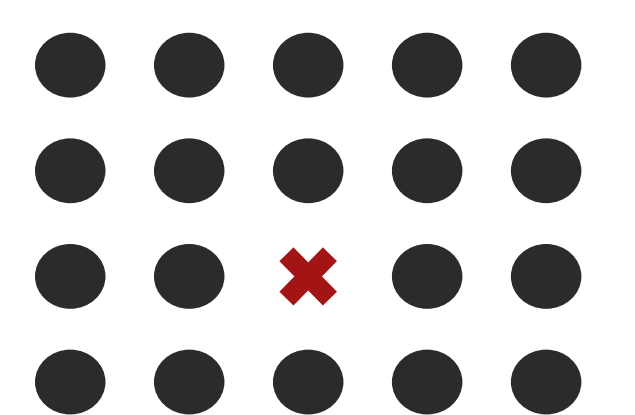Easily parallelizable and therefore more scalable
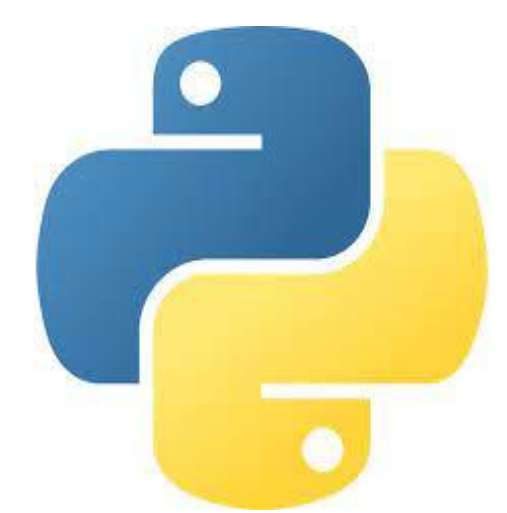
Native support for NumPy and Xarray
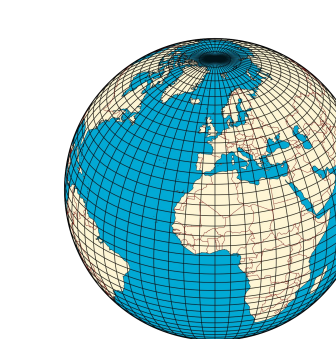
Easier to maintain and distribute

FUTURE WORK
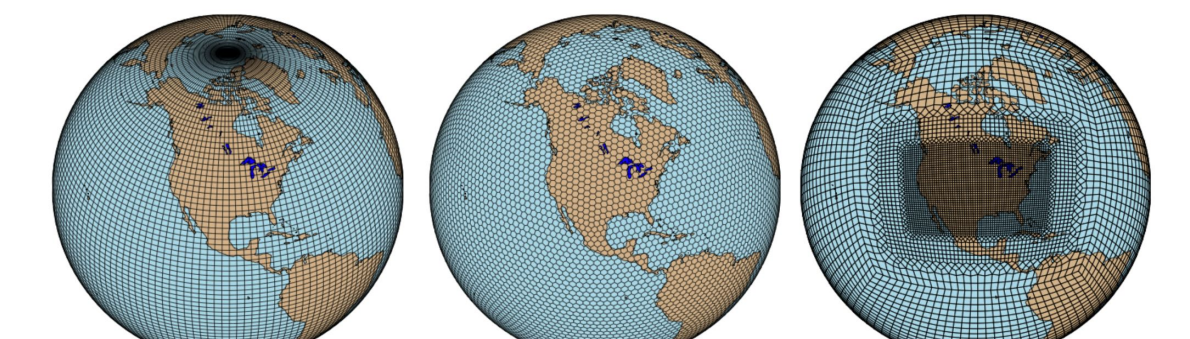
Working on next f2py functions

```
linint2pts
rcm2points
rcm2rgrid
rgrid2rcm
grid2triple
triple2grid
```

Handling missing data

Interpolation on a sphere

Working with unstructured data