

Tuesday, November 10, 2020 | **Class #11**

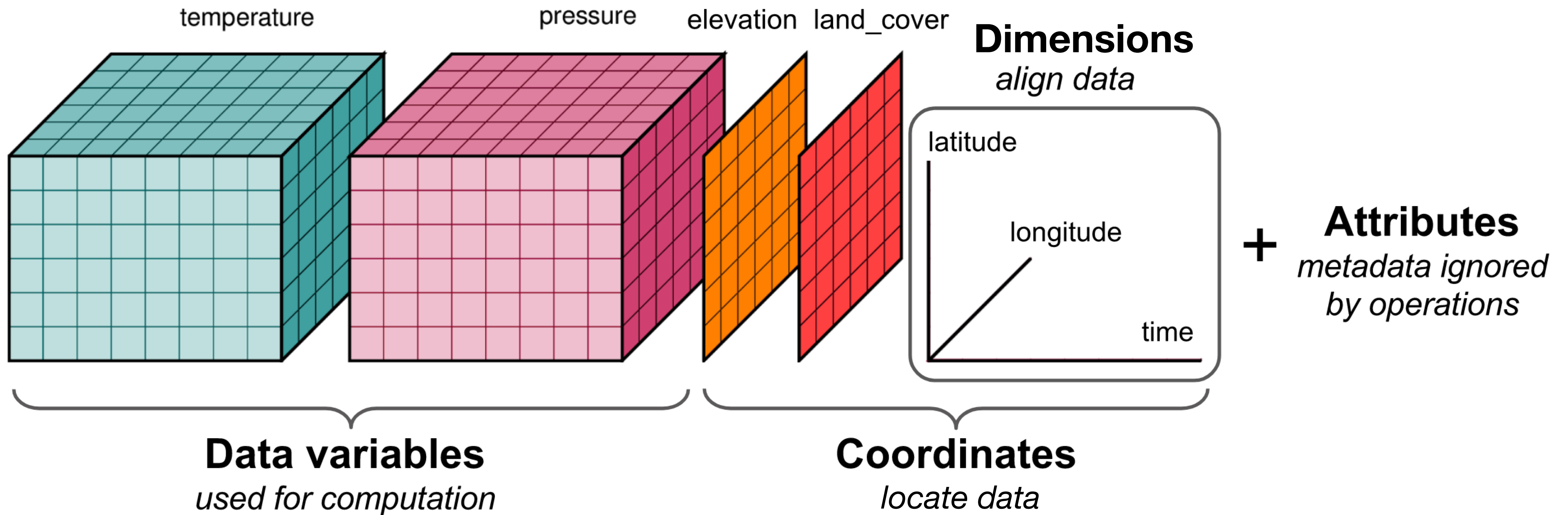
xarray, histograms, and what to do when things go wrong

OCEAN 215 | Autumn 2020

Ethan Campbell and **Katy Christensen**

xarray lets us deal with gridded data...

... and gridded data is usually provided in a **netCDF file (.nc)**



4-D data is usually 3-D in space (x, y, z) + time

January

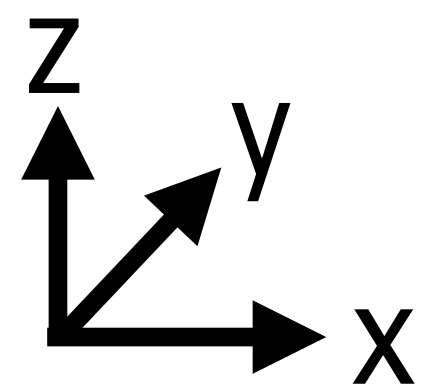
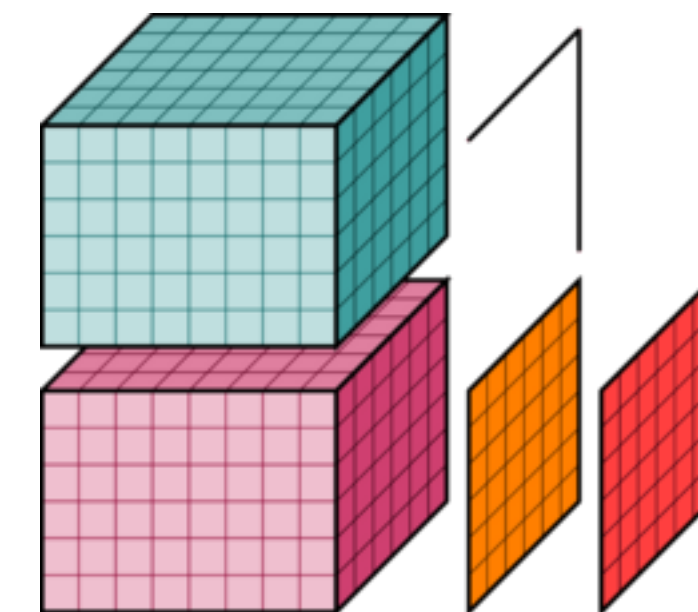
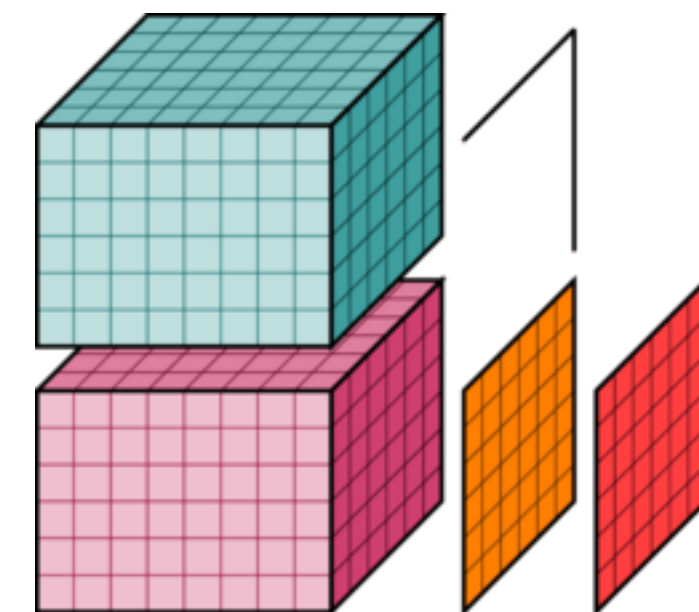
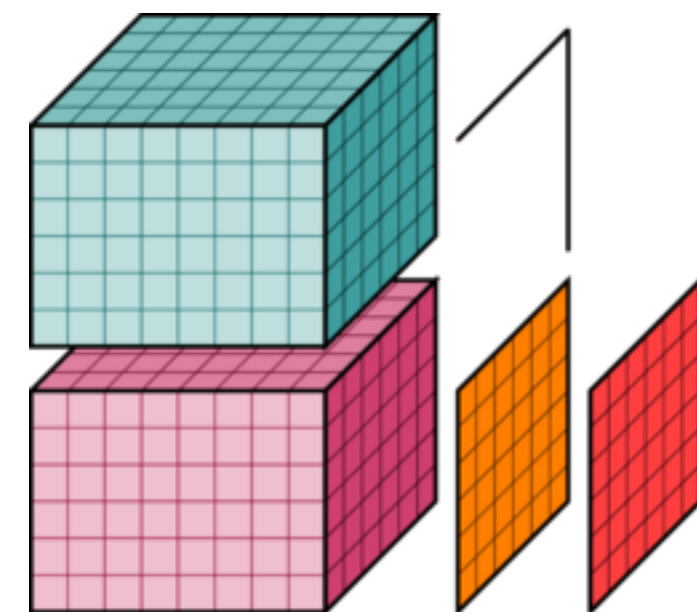
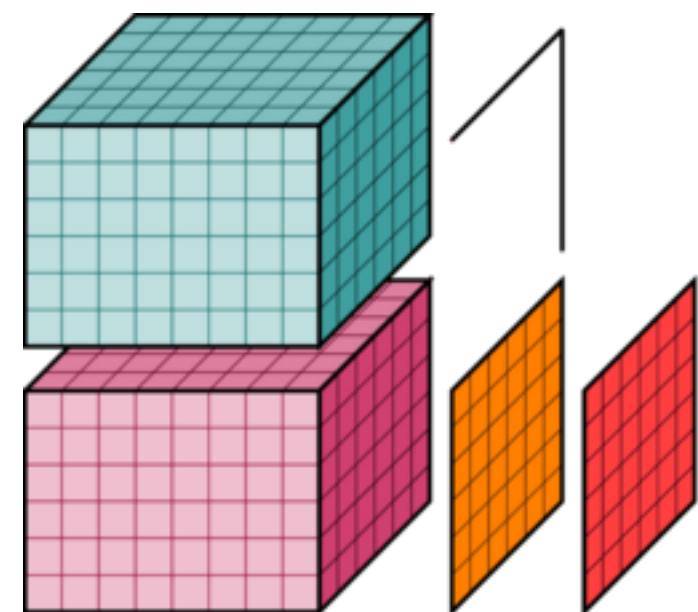
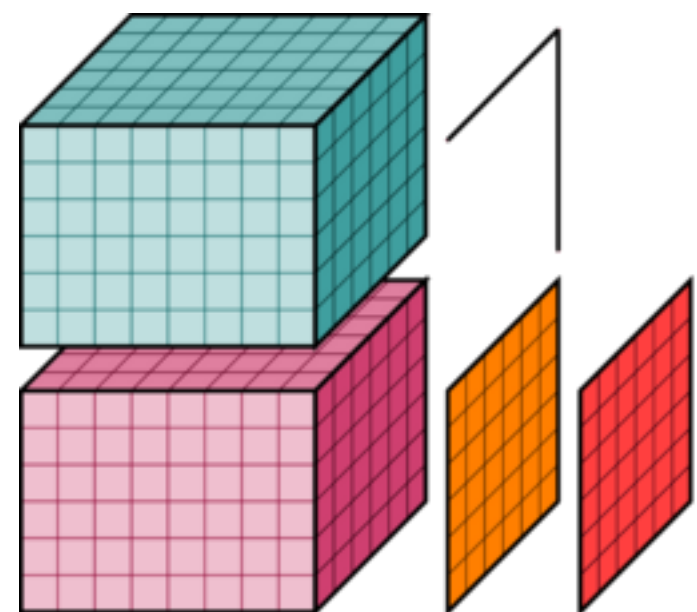
February

March

April

May

...



.....→ time

Demo: Southern Ocean current velocities from a climate model

File (~400 MB):

bsose_monthly_velocities.nc

Data source:

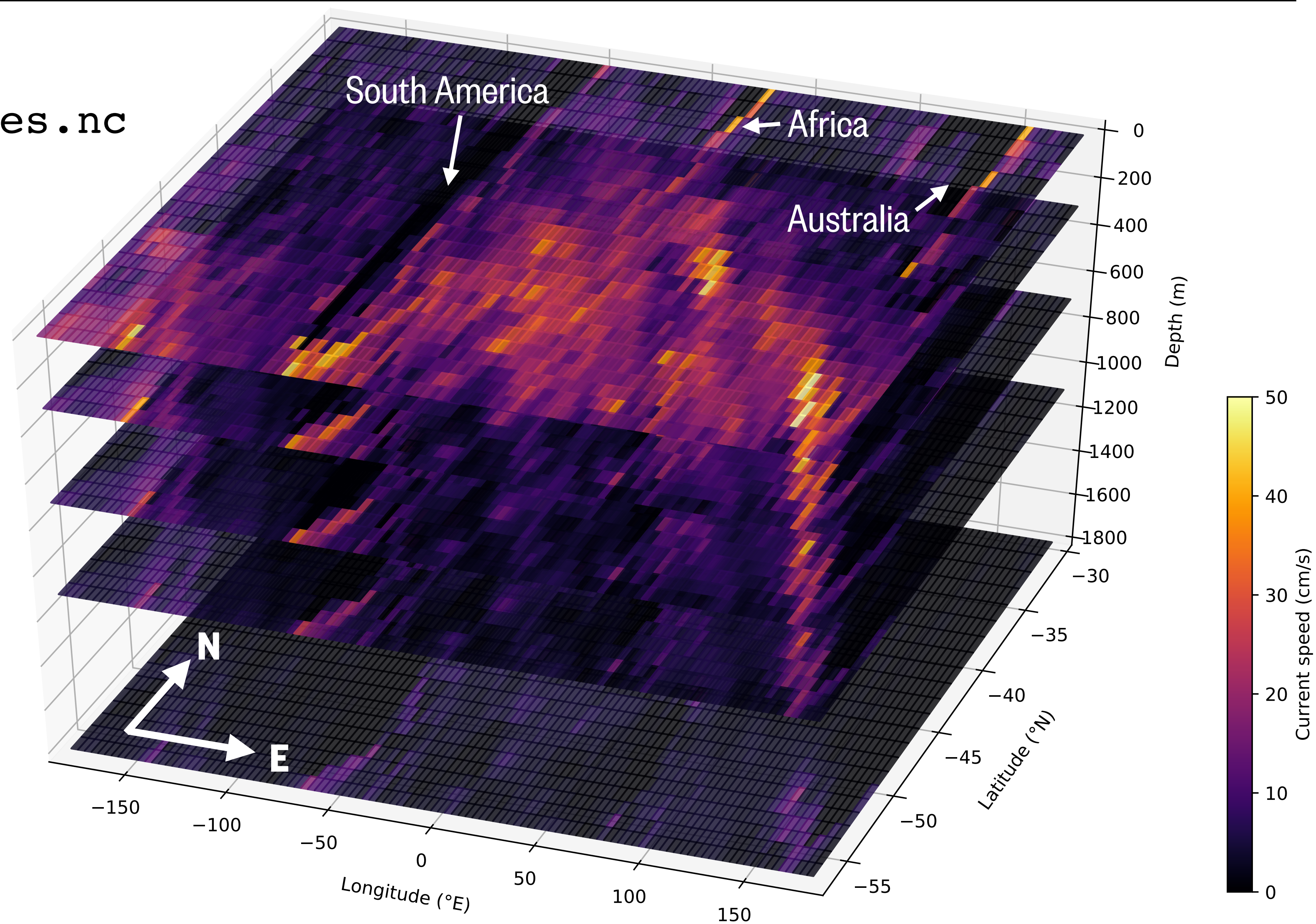
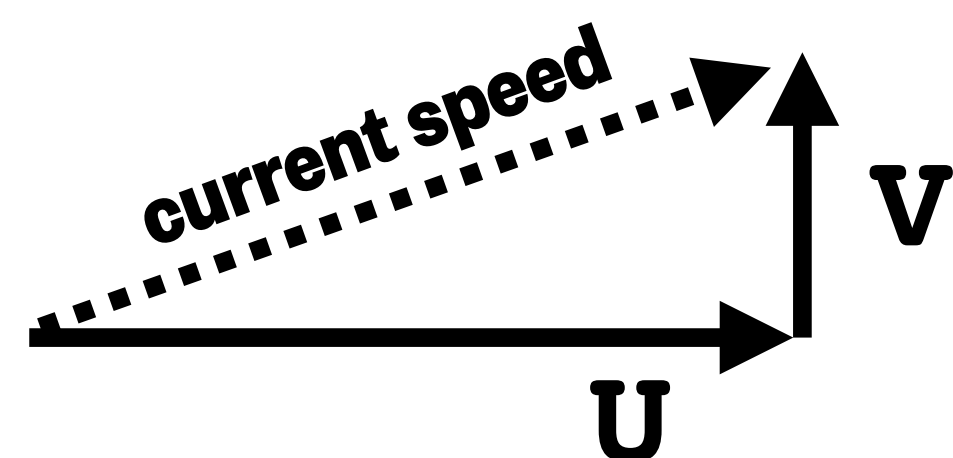
B-SOSE (Southern Ocean State Estimate) model output

Data resolution:

Time: monthly for 2012
Horizontal: $1/3^\circ$ lat-lon grid
Vertical: 13 depth levels

Variables:

U: eastward velocity
V: northward velocity











Getting information about a Dataset

display (<Dataset variable>)



xarray.Dataset

► Dimensions: (depth: 13, lat: 294, lon: 1080, time: 12)

▼ Coordinates:

time	(time)	datetime64[ns]	2012-01-30T20:00:00 ... 2012-12-30T1...	 
lat	(lat)	float32	-77.96525 -77.89555 ... -29.789328	 
lon	(lon)	float32	-179.66667 -179.33333 ... 180.0	 
depth	(depth)	float32	2.1 26.25 65.0 ... 3000.0 4600.0	 

▼ Data variables:

U	(time, depth, lat, lon)	float32	0.0 0.0 0.0 0.0 ... 0.0 0.0 0.0 0.0	 
V	(time, depth, lat, lon)	float32	0.0 0.0 0.0 0.0 ... 0.0 0.0 0.0 0.0	 

► Attributes: (0)

Selecting data from `xarray` objects using `.sel()` (selection by coordinate value)

Use `method='nearest'` when you don't know the exact coordinate values...

```
<DataArray or Dataset> .sel (<coordinate name>=<a single coordinate value> , ... ,  
                             method= 'nearest' )
```









Example:

```
1 data['U'].sel(time=datetime(2012,1,30), lat=-53, lon=-13, depth=2, method='nearest')
```

`xarray.DataArray` 'U'

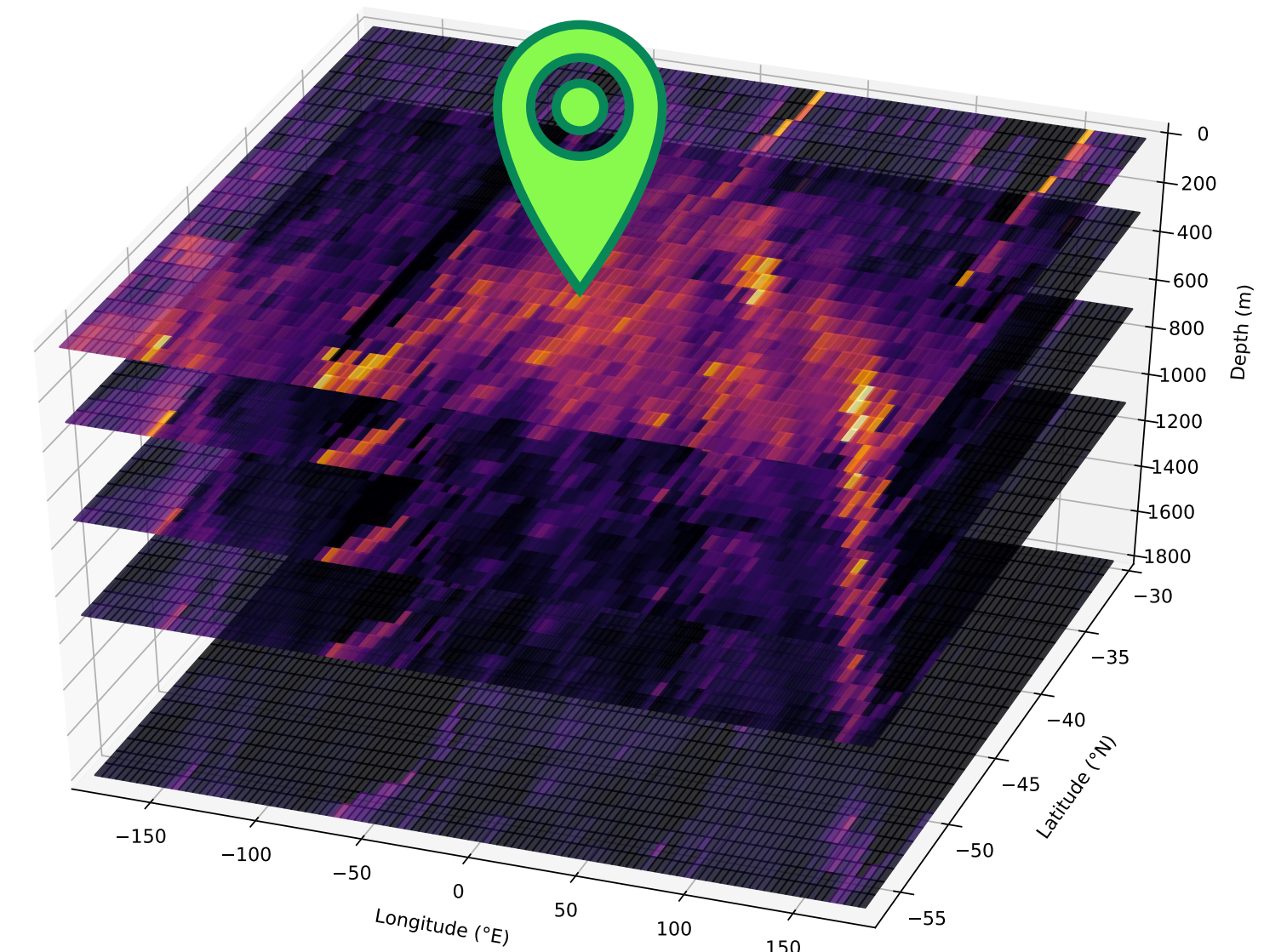
0.12865335

Coordinates:

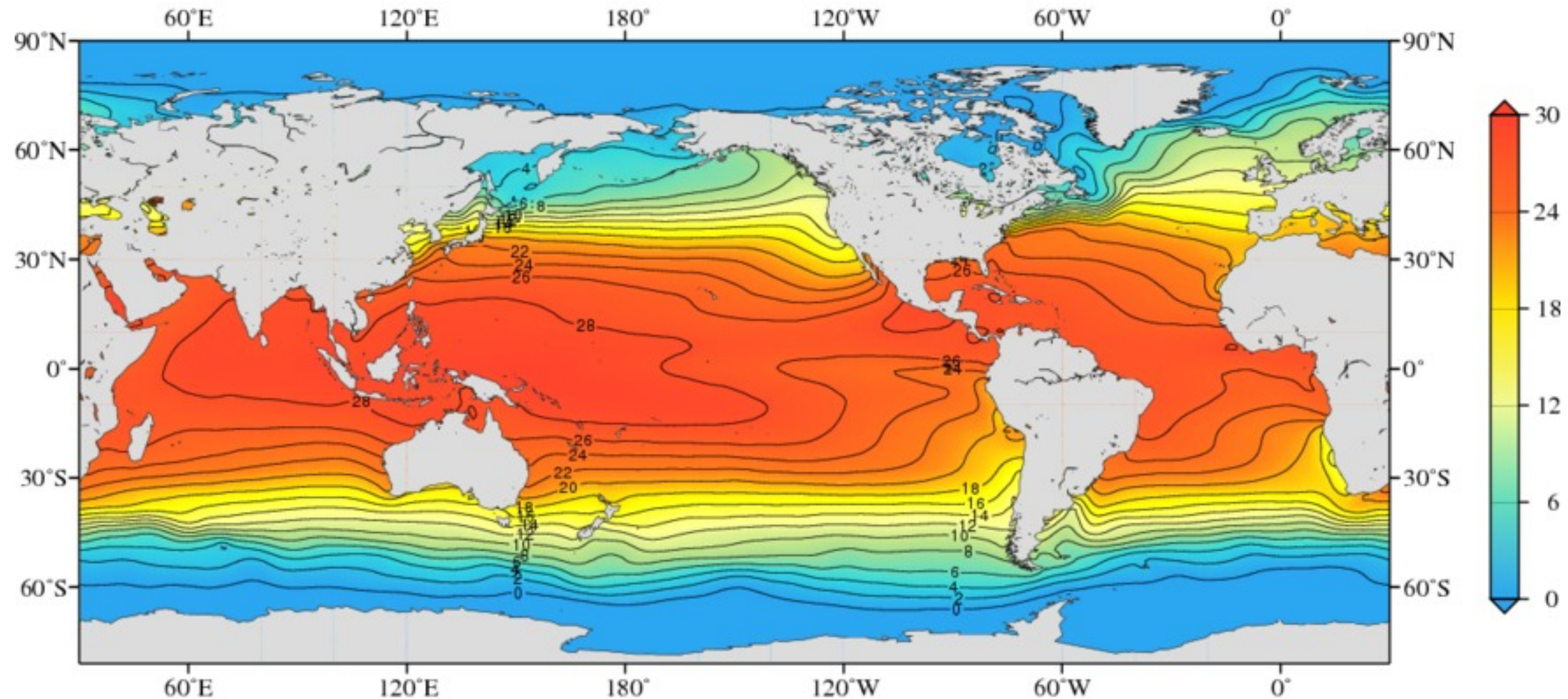
time	()	datetime64[ns]	2012-01-30T20:00:00	 
lat	()	float32	-52.90755	 
lon	()	float32	-13.0	 
depth	()	float32	2.1	 

Attributes:

units :	meters/second
long_name :	Zonal Component of Velocity (m/s)
standard_name :	UVEL
mate :	VVEL



xarray activity: World Ocean Atlas ocean temperatures



Google Doc with activities (also accessible from Canvas Modules or Google Drive folder):

<https://tinyurl.com/OCEAN215-Class11>

Interpreting error messages

What to do when things go wrong:

```
1 import numpy as np
2
3 array1 = np.array([1,2,3,4,5,6])
4 print(arral)
```

```
-----
NameError                                Traceback (most recent call last)
<ipython-input-2-c46f69a08ac5> in <module>()
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----> 4 print(arral)
```

NameError: name 'arral' is not defined

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1 import numpy as np
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3 string1 = 'This is a string'
4 print(string1
5 print(array1)
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```

```
File "<ipython-input-11-0802b516da26>", line 5
```

```
print(array1)
  ^
```

SyntaxError: invalid syntax

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1 list1 = [1,2,3,4,5,6]
2 sub_list = list1-1
3 print(sub_list)
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```

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<ipython-input-12-732eed5f4882> in <module>()
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Error messages tell you what line your error is on! **mostly*
Error messages also tell you what when wrong in the code.

My code isn't working :-)

