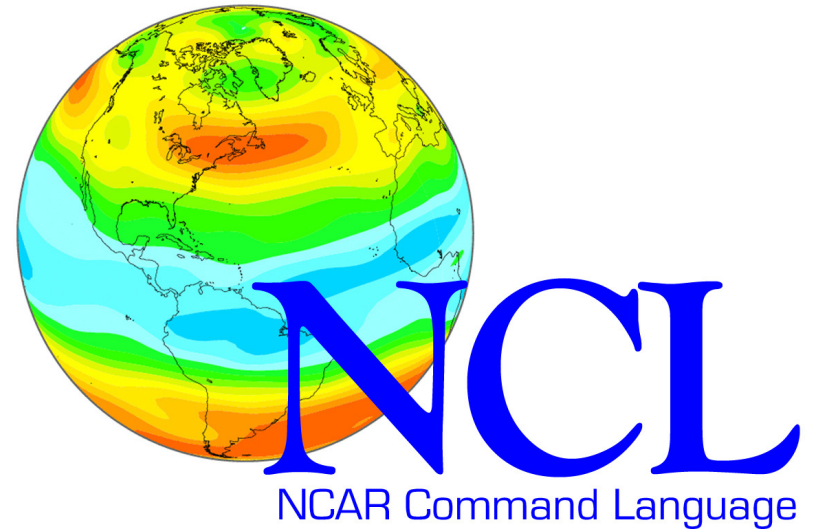


Introduction to NCL Graphics

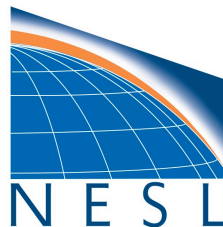
Graphics gallery

September 26, 2014

Mary Haley



*Sponsored by
the National
Science
Foundation*



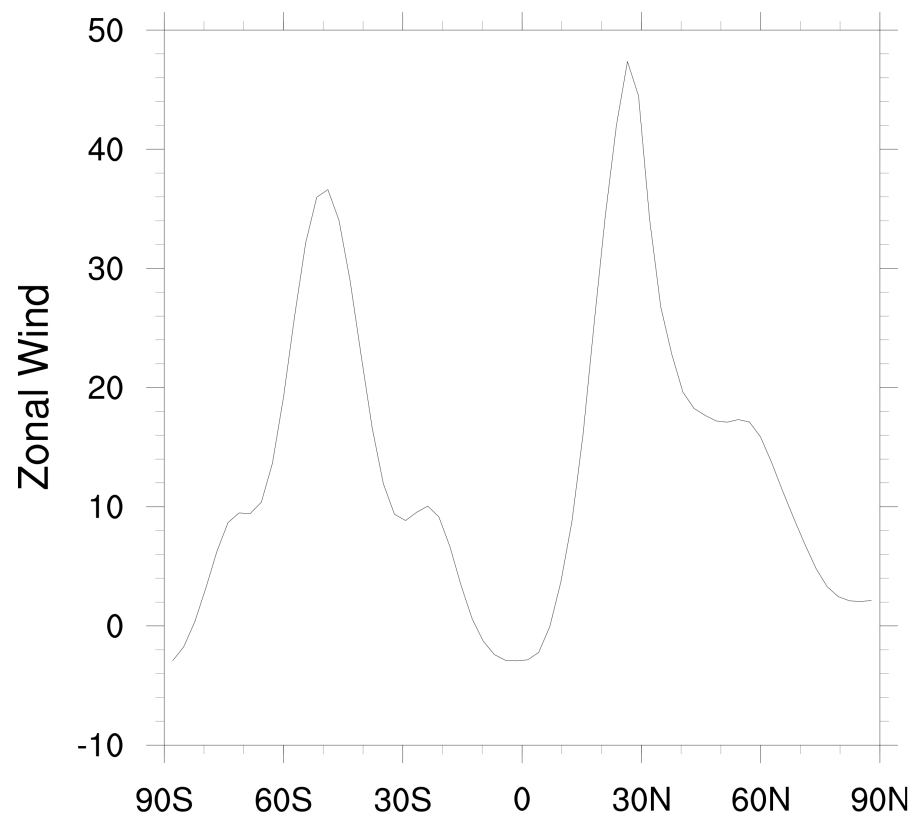
Types of graphics you can create with NCL

- Over 40 plotting templates
- XY
- Contour
- Vector
- Streamline
- Overlays
 - Contours over maps, vectors over contours, etc.
- Primitives
 - markers, polylines, polygons, text
- Specialized plots
 - bar charts, skew-T, wind roses, taylor diagrams

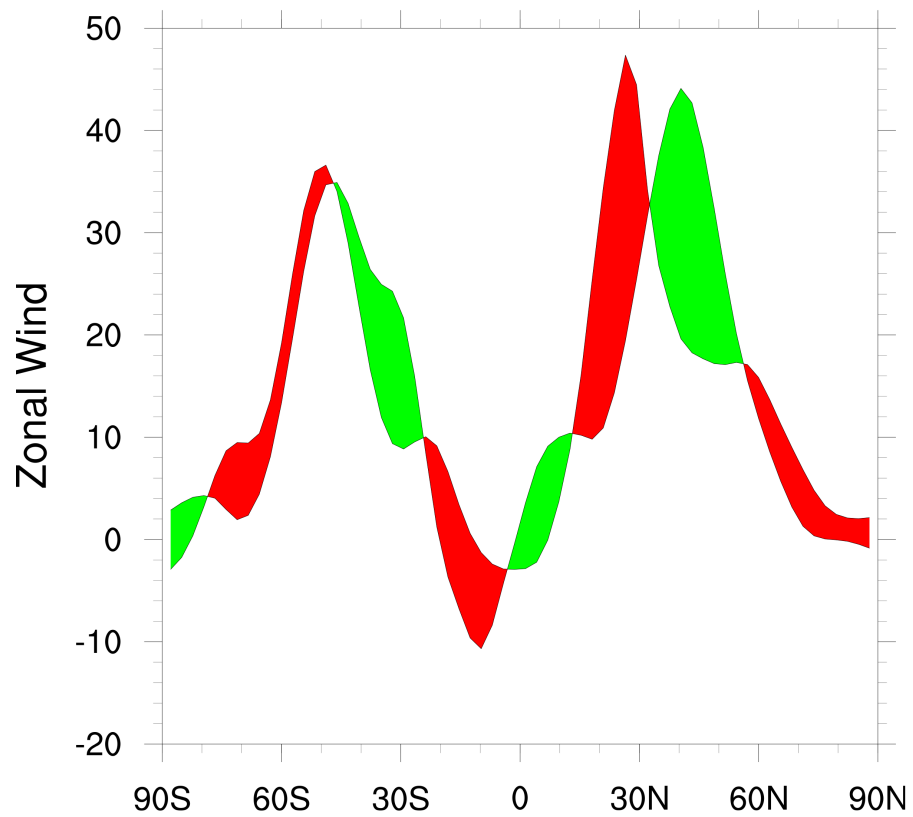
Types of graphics you can create with NCL

- XY
- Contour
- Vector
- Streamline
- Overlays
- Primitives
- Specialized plots

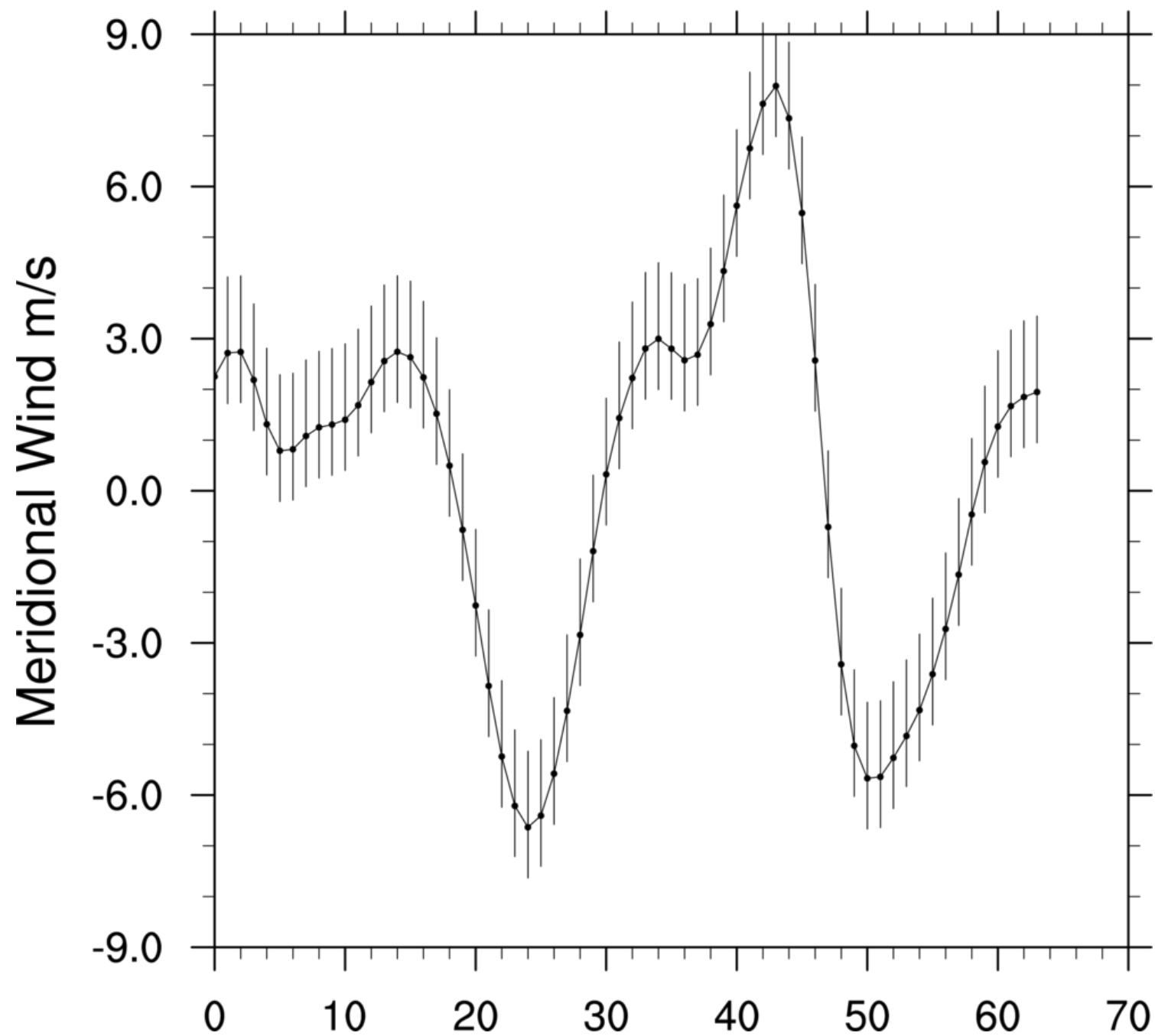
Basic XY plot



Filled XY plot

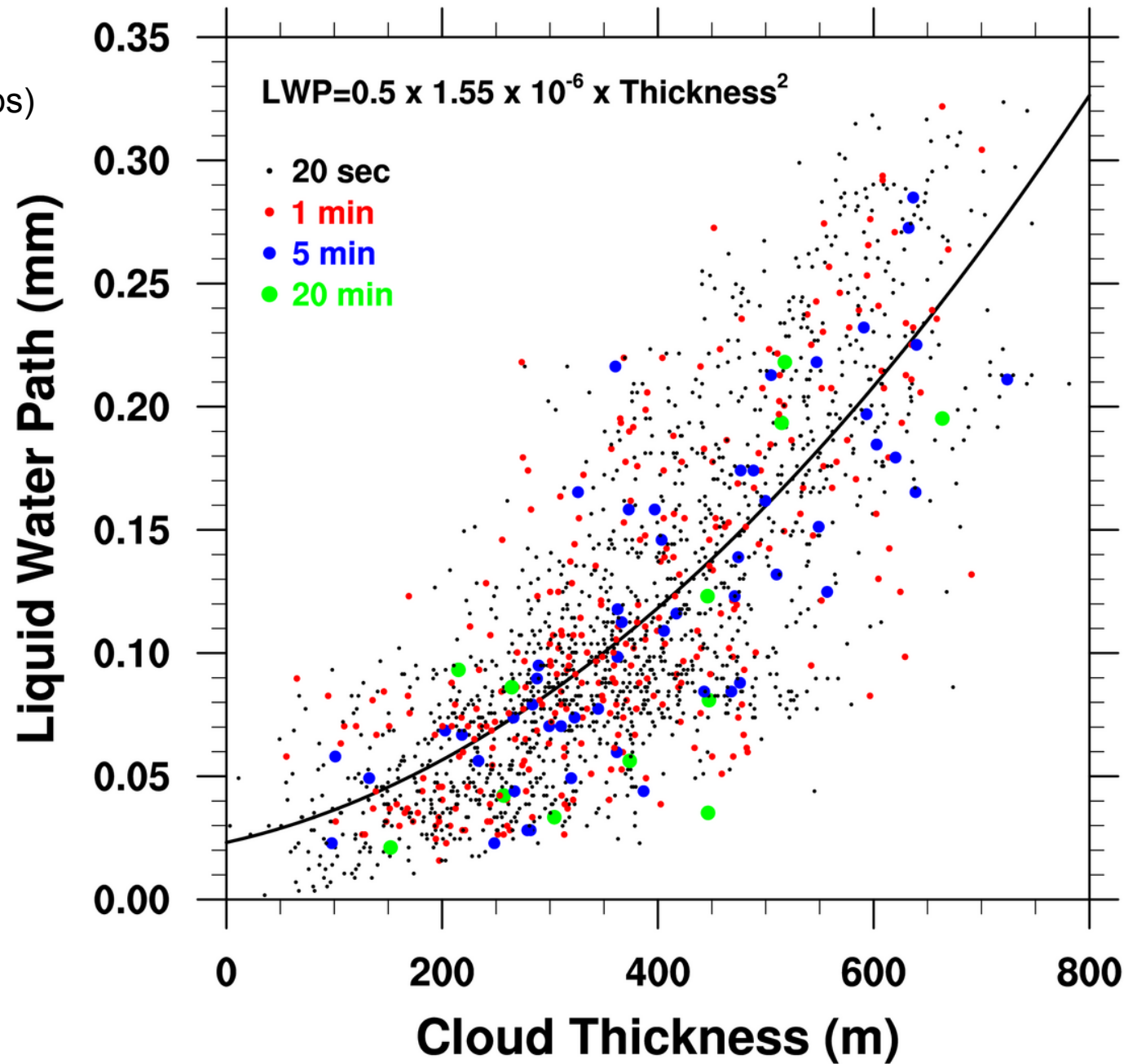


Example of error bars

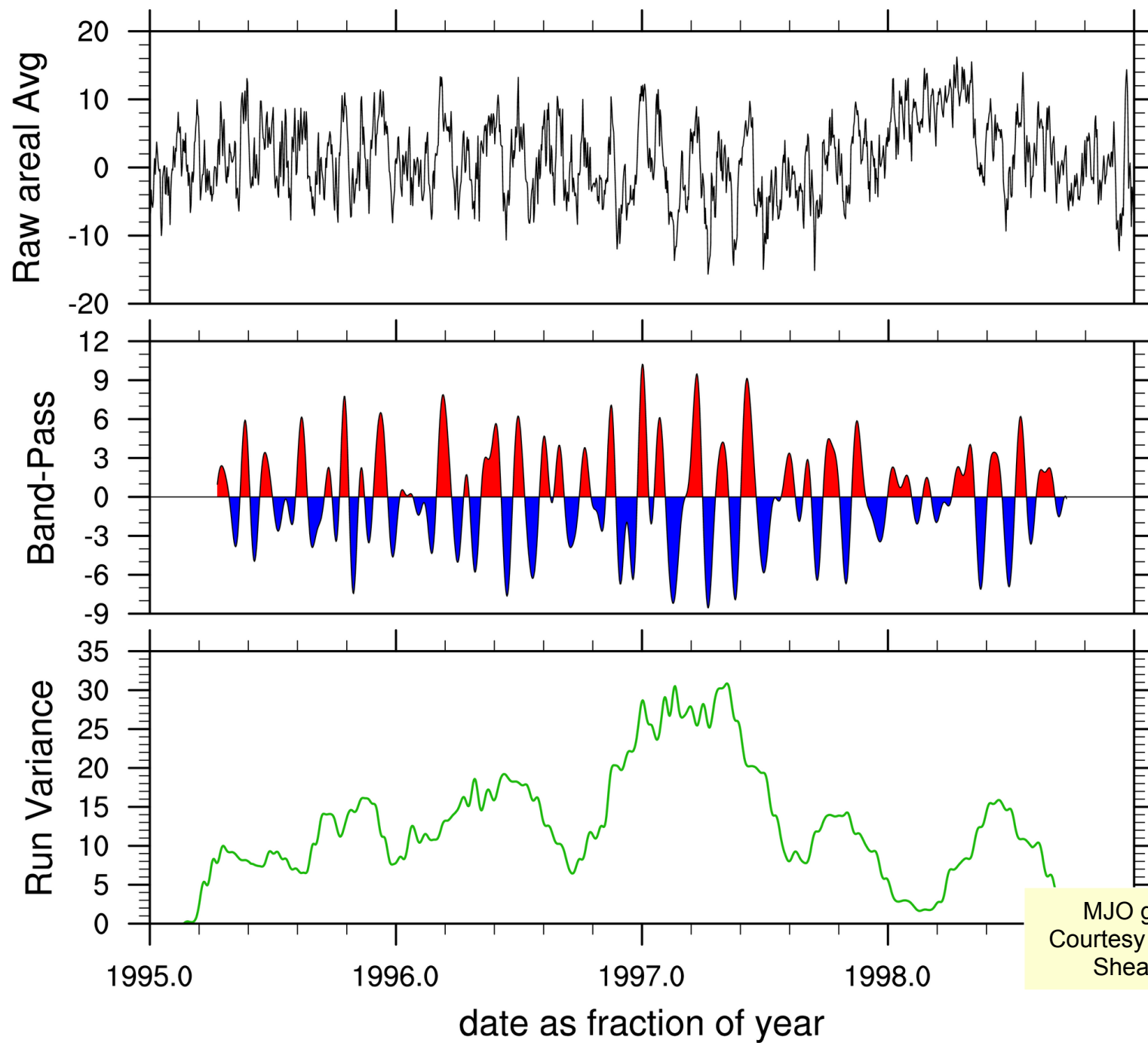


Scatter and line plot
Based on a
visualization
of Joel Norris (Scripps)
using dummy data

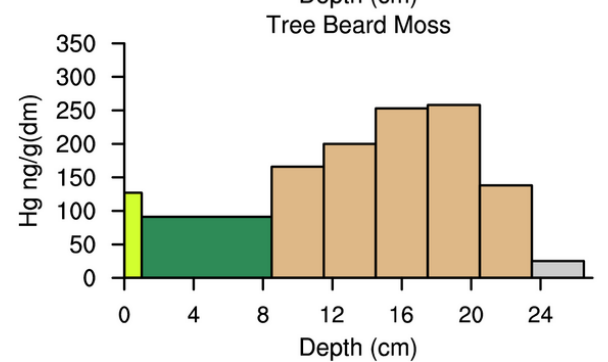
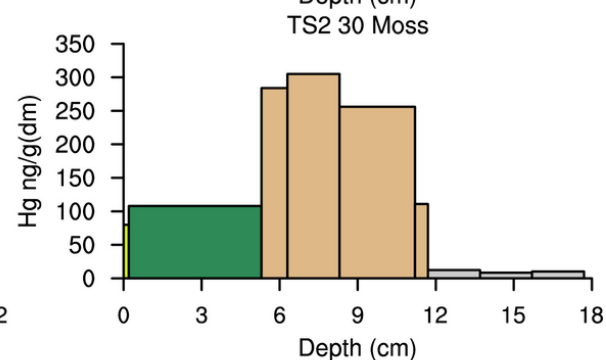
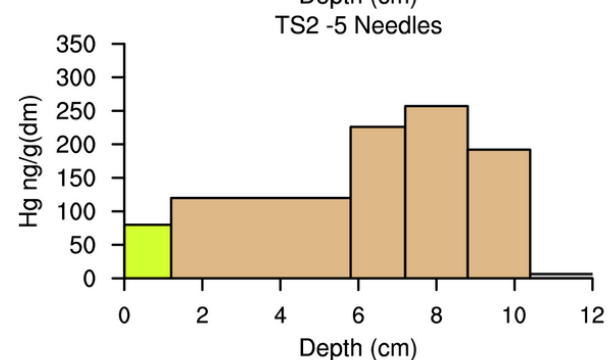
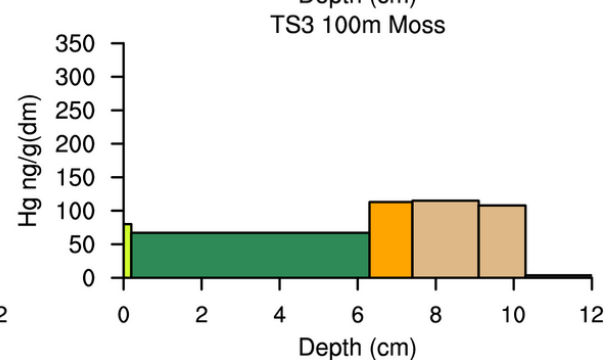
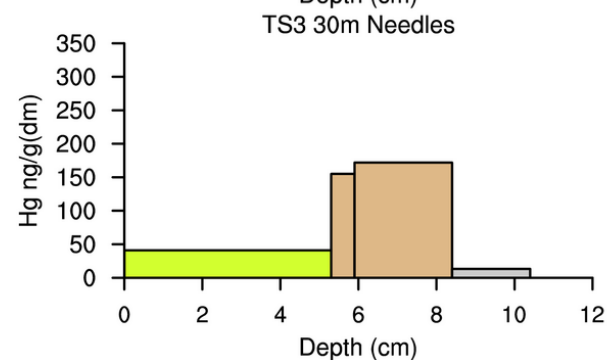
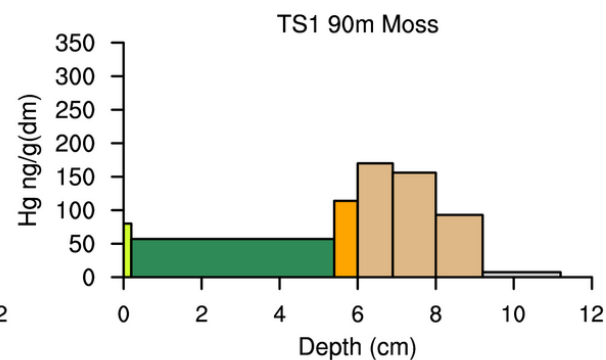
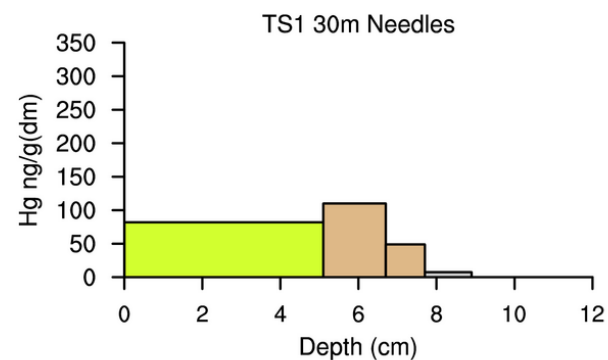
2000 Mar 19 1040-1725Z



Anomalies: Daily OLR: Areal Averaged & Filtered: 20-100 days: nw=201



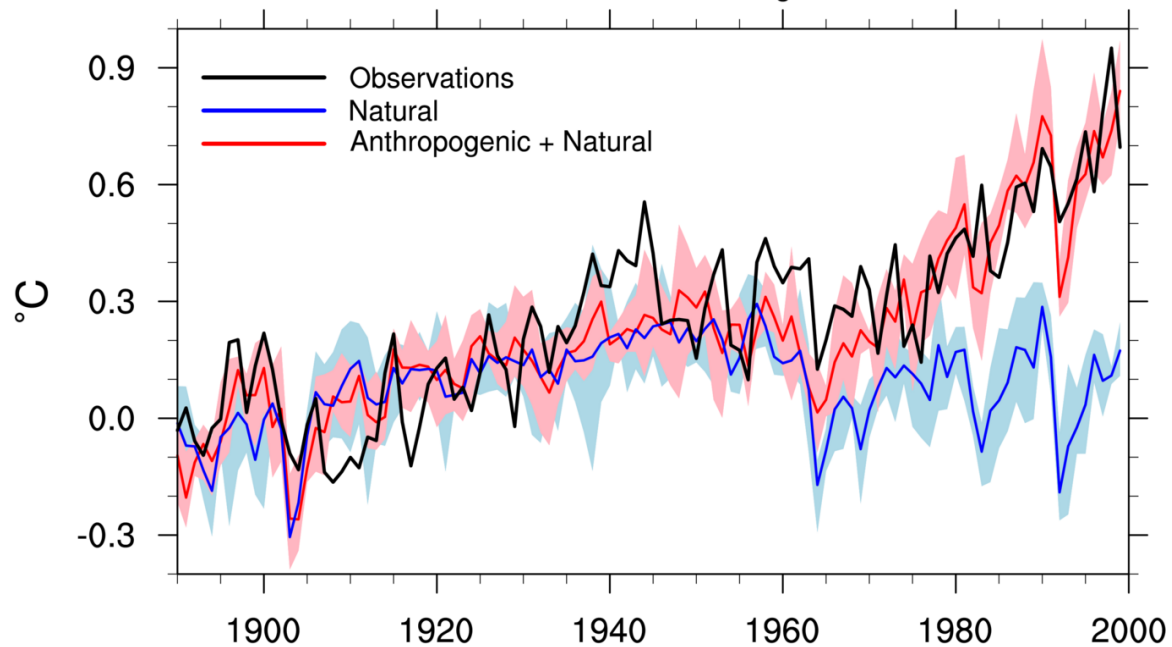
MJO graphic
Courtesy of Dennis
Shea/CGD



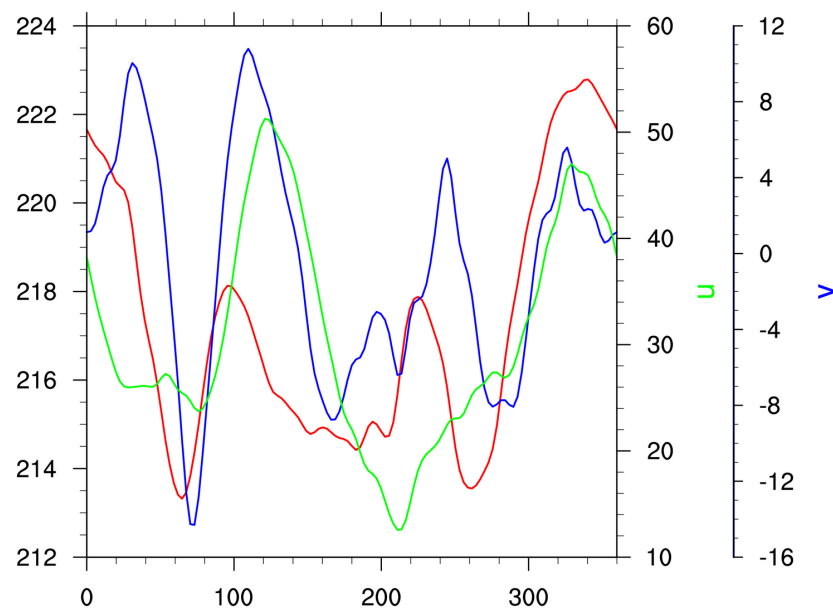
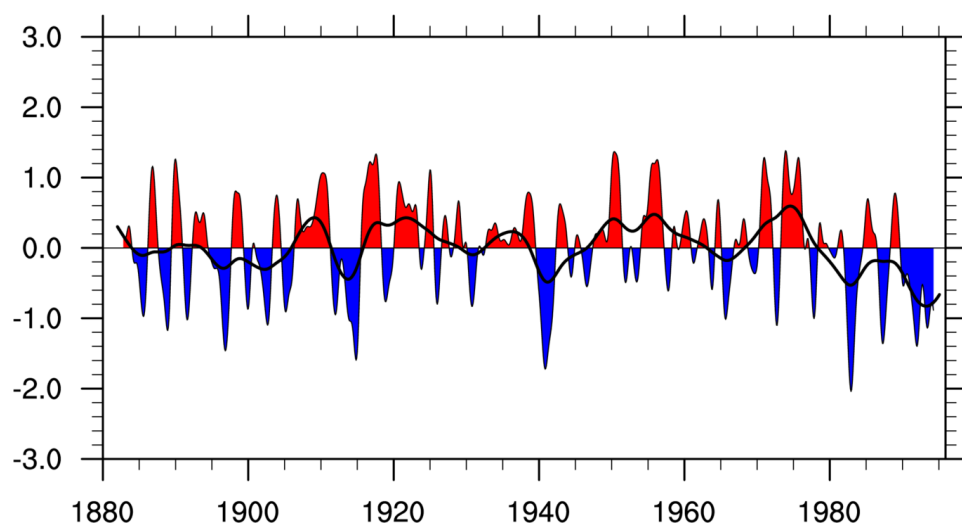
Parallel Climate Model Ensembles

Global Temperature Anomalies

from 1890-1919 average



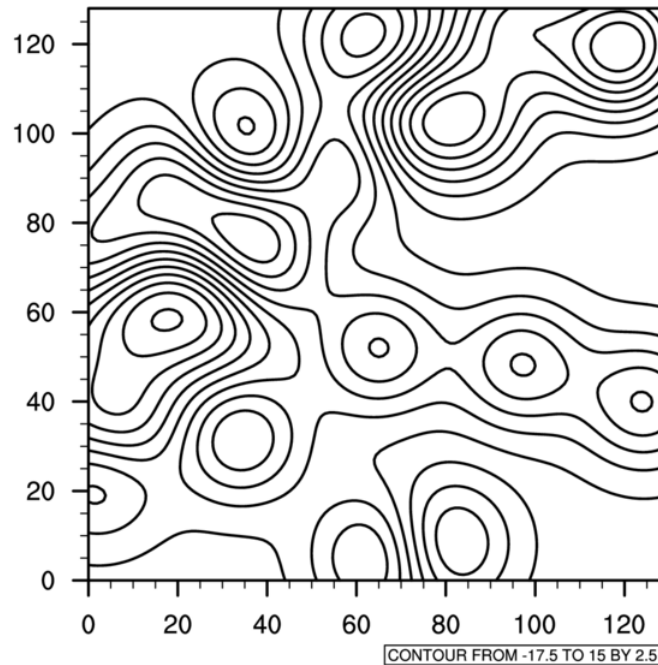
Darwin Southern Oscillation Index



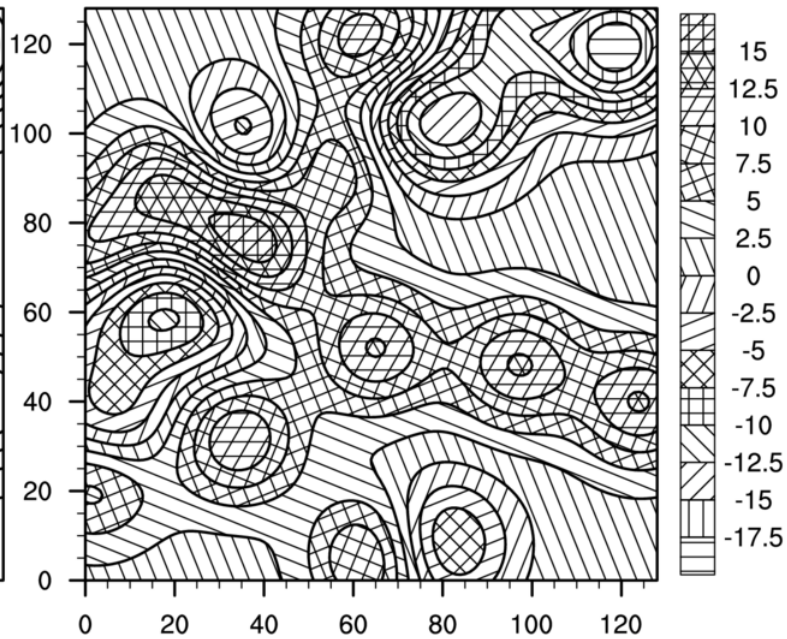
Types of graphics you can create with NCL

- XY
- **Contour**
- Vector
- Streamline
- Overlays
- Primitives
- Specialized plots

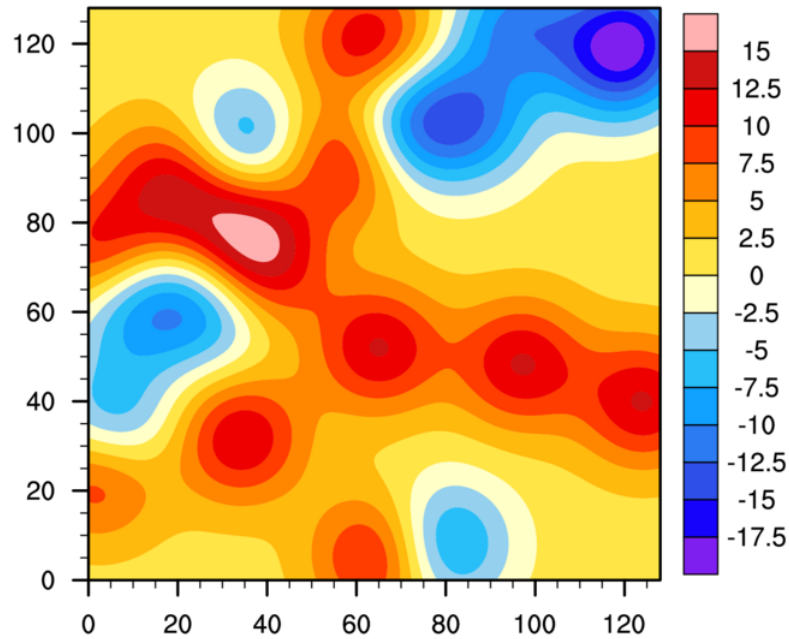
Line contours



Pattern-filled contours

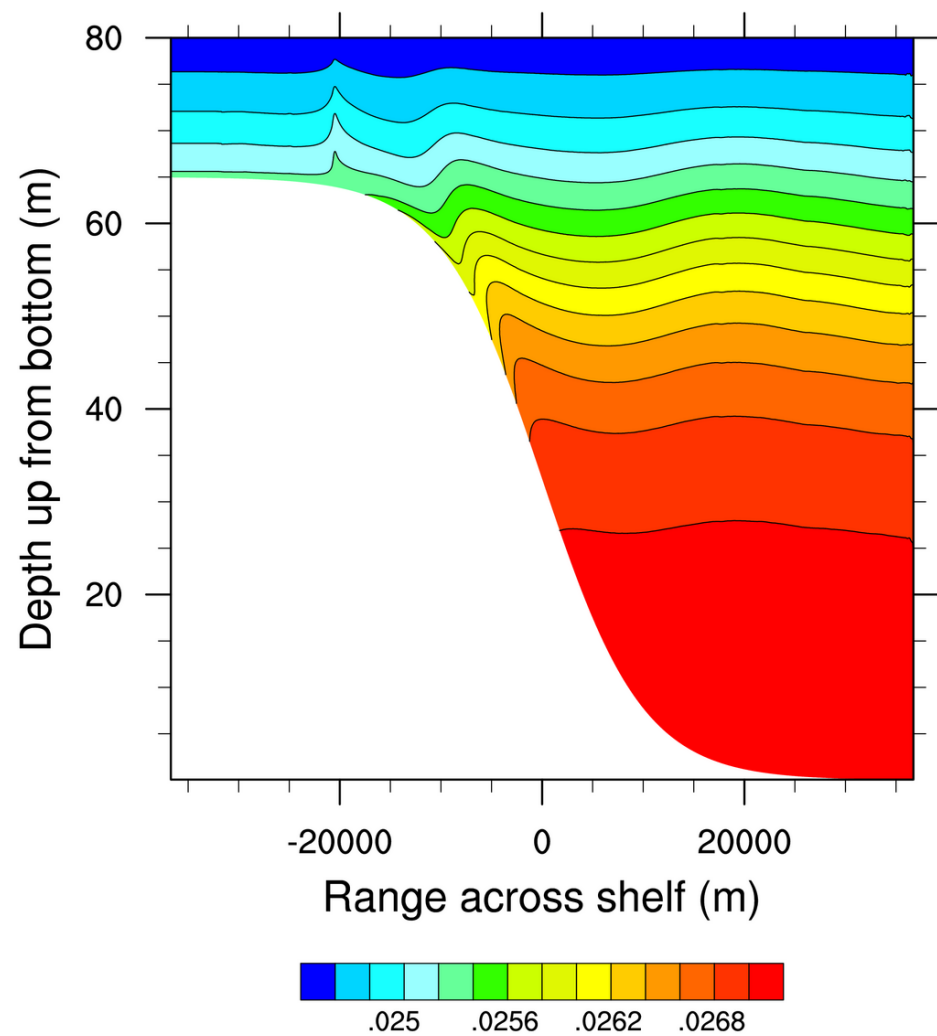
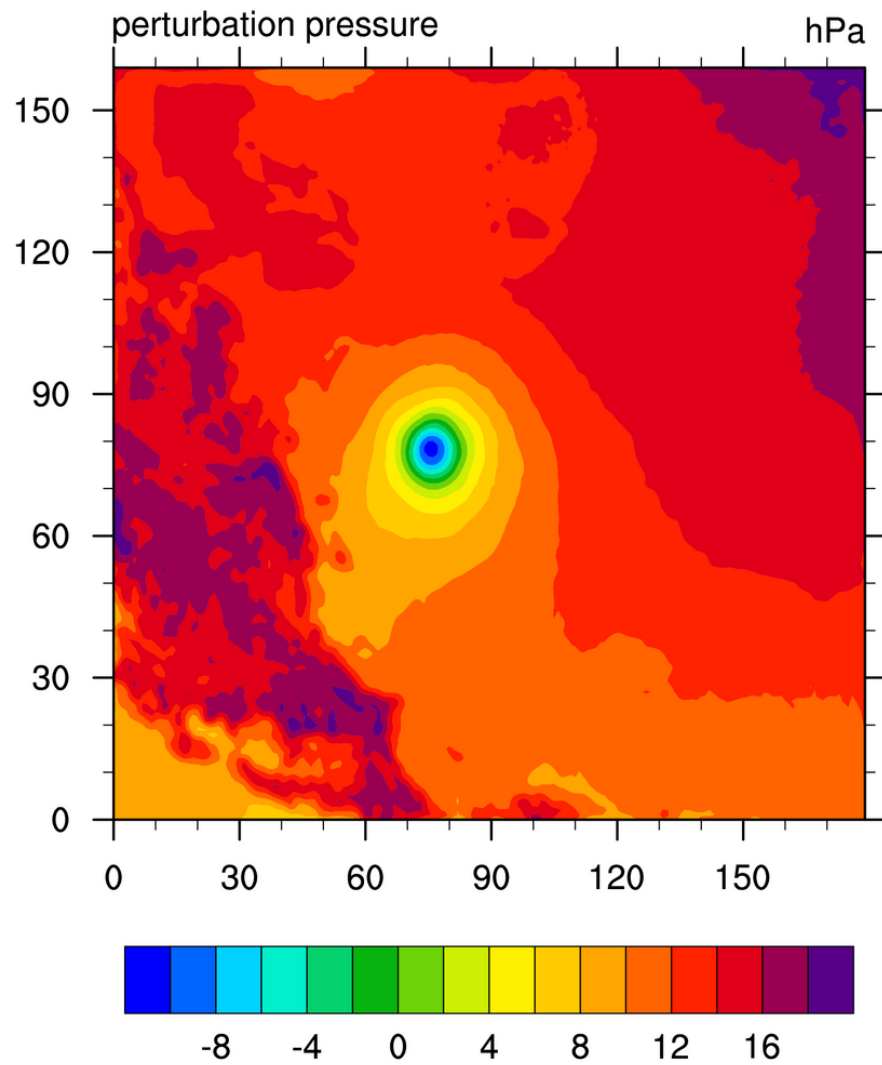


Color-filled contours

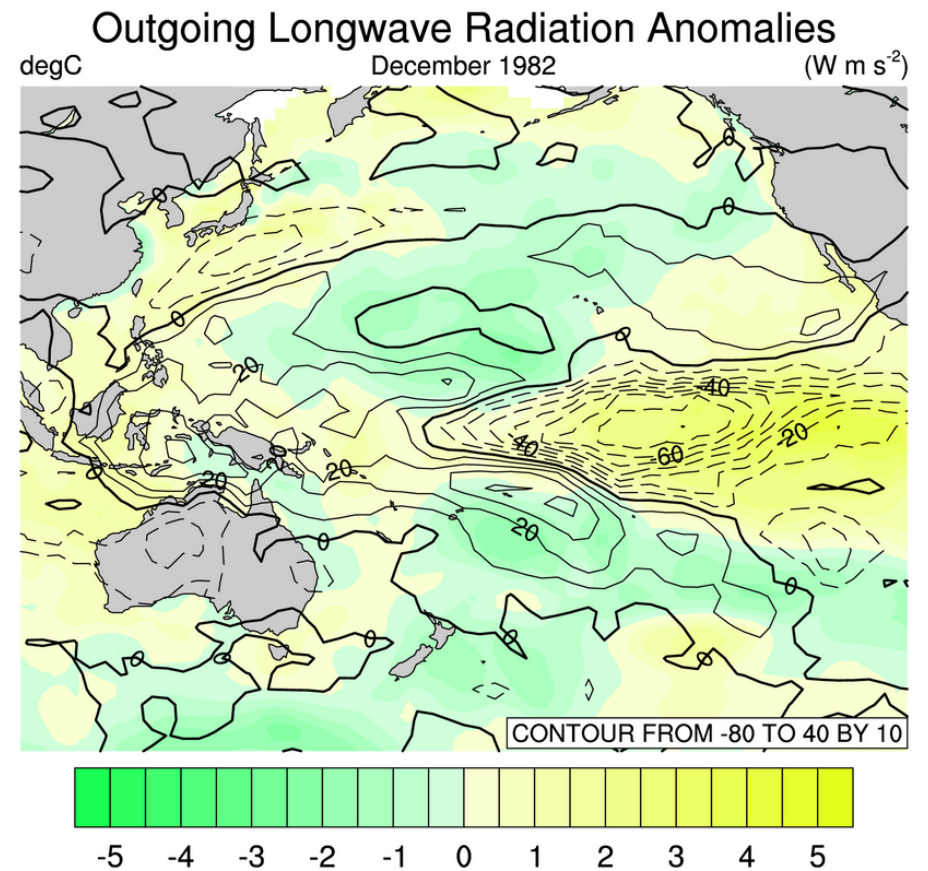
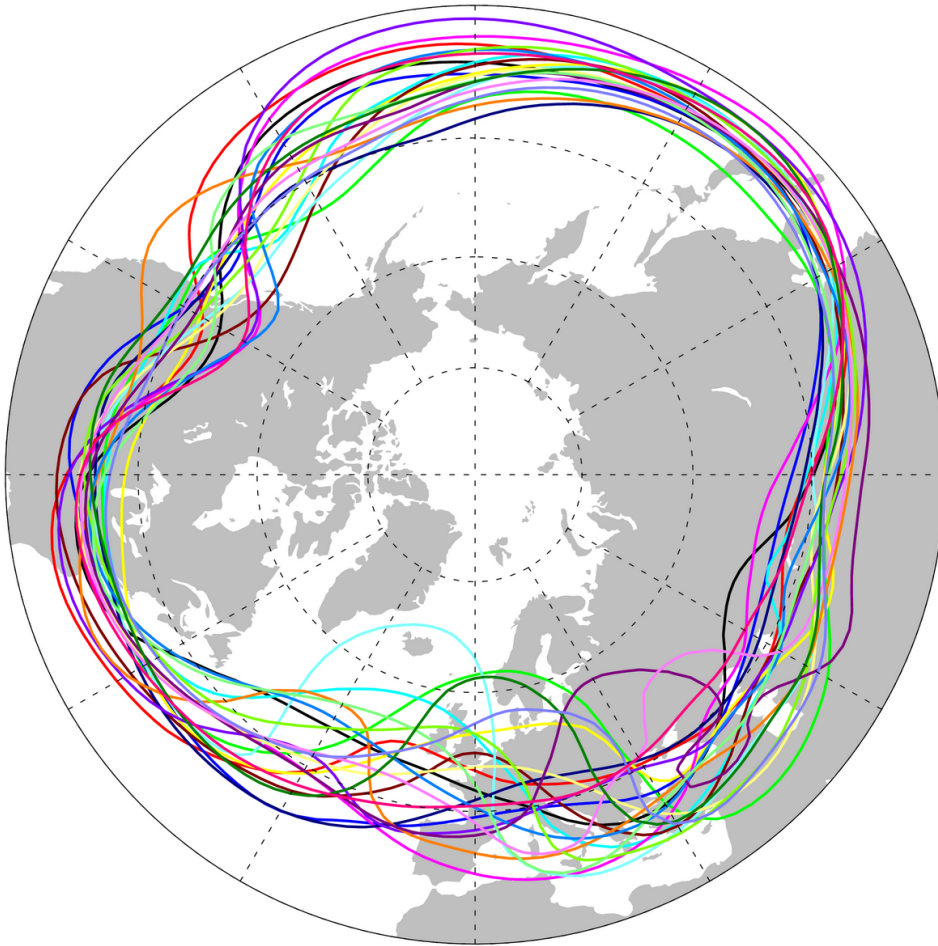


Line, fill, and
pattern
contours

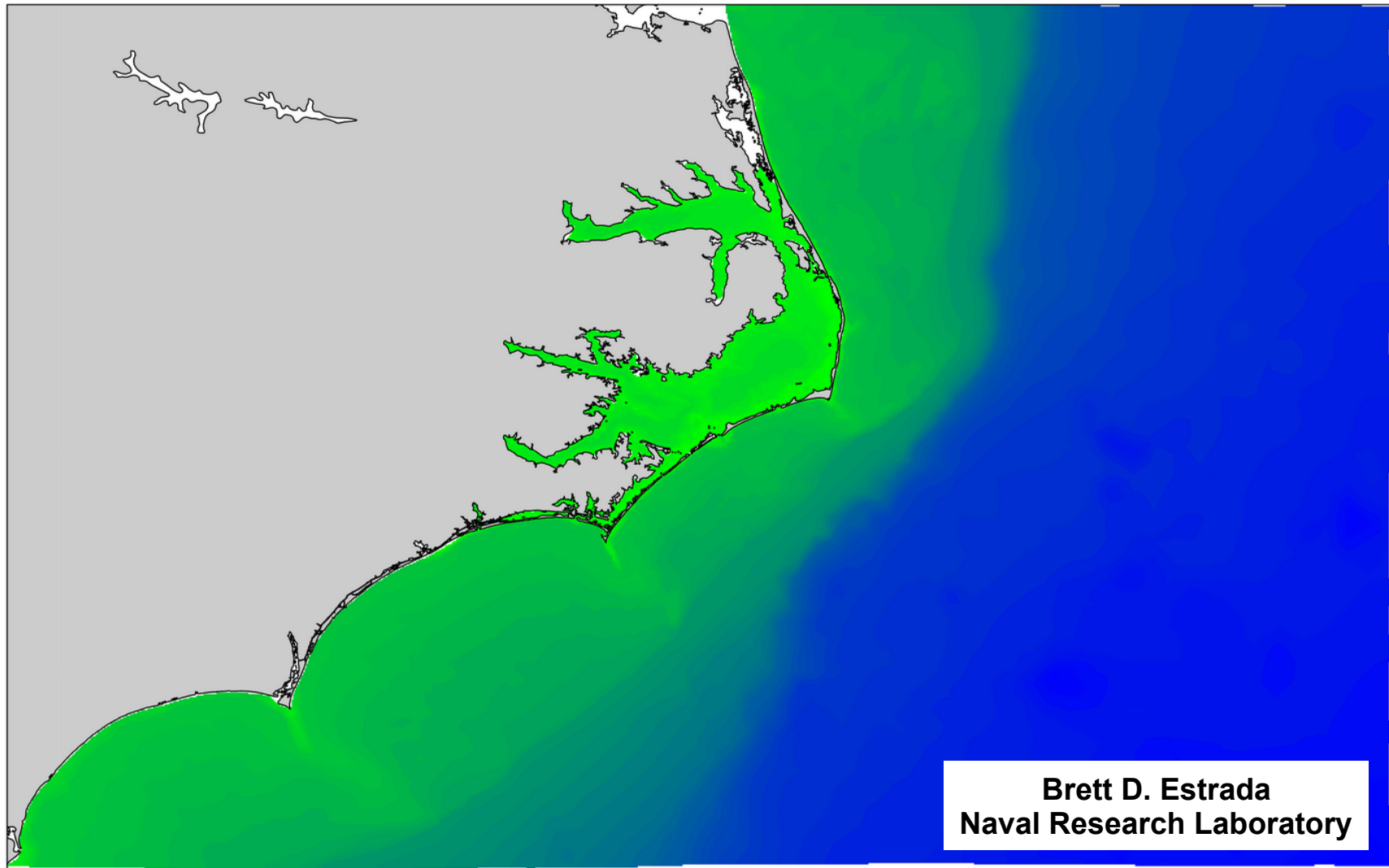
2003-07-15_00:00:00



Contours (line and filled) over a map



North Carolina Coast (depth in meters)



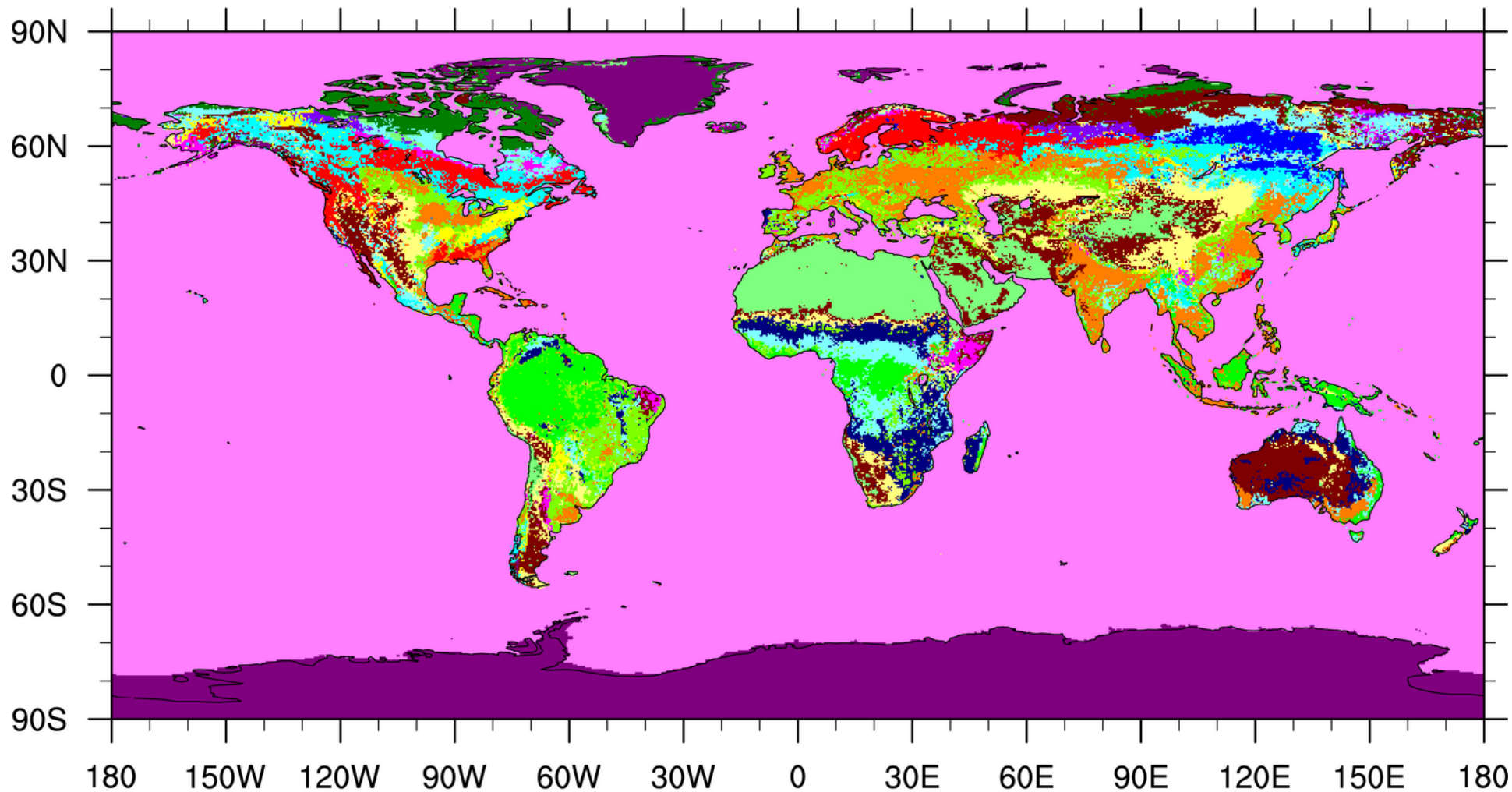
Brett D. Estrada
Naval Research Laboratory



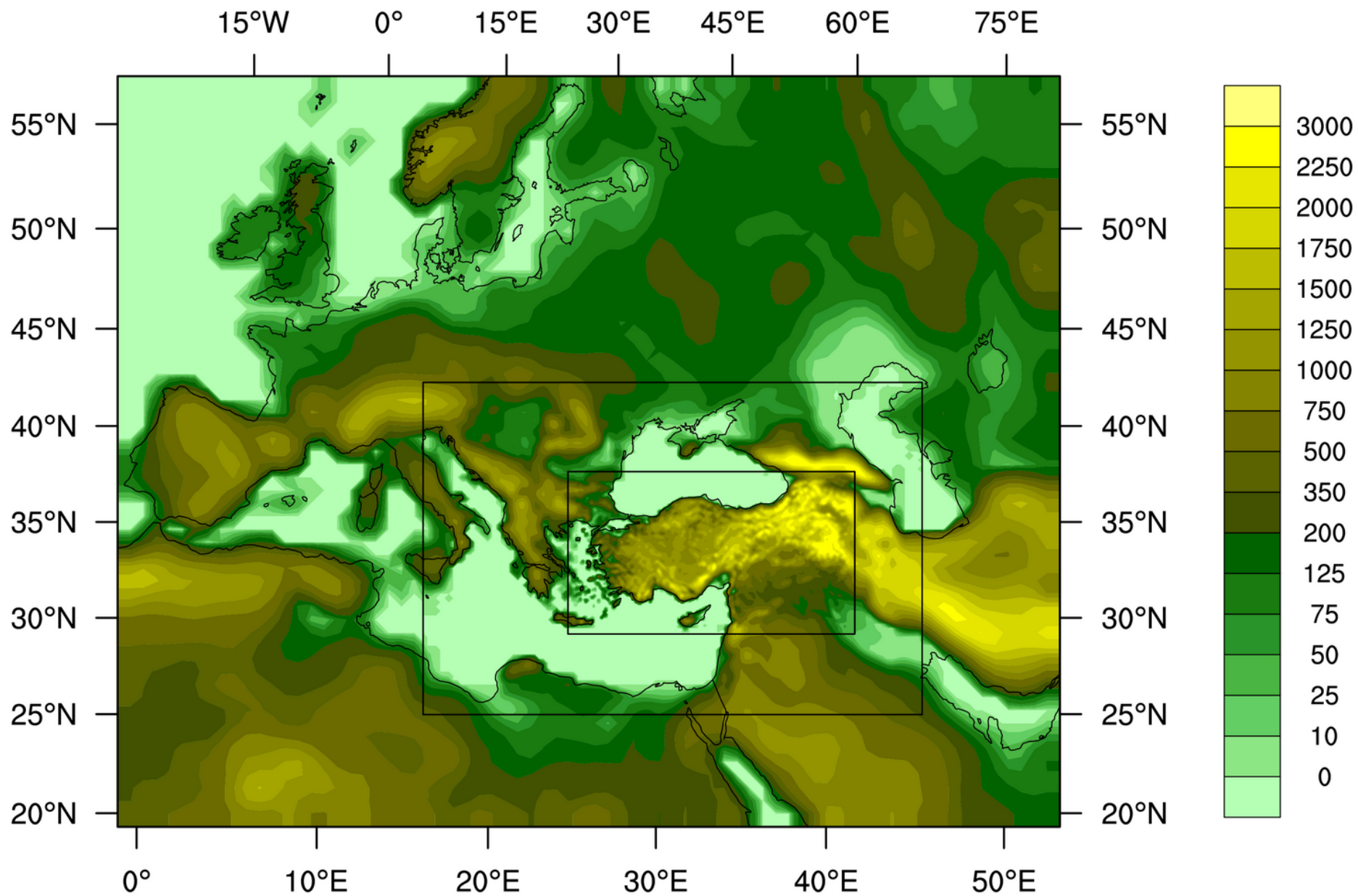
1 4 7 10 25 40 100 400 700 1000 1750 2500 3250 4000 4750

CERES Map Land Classification

IGBPa_1198.map.nc

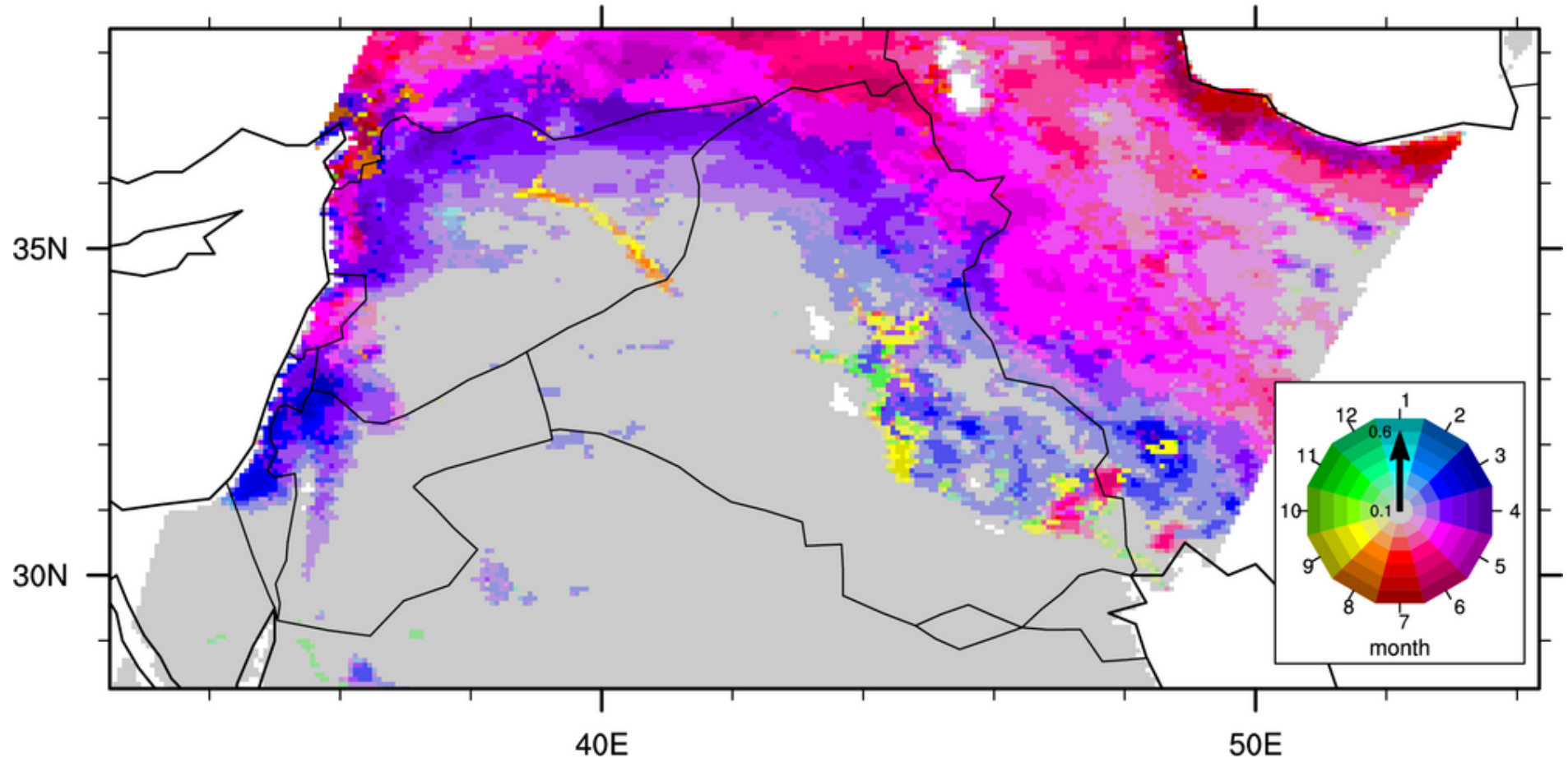


- | | | | | | |
|------------------------|-----------------------|-------------------|-----------------------|-----------------------|------------------------|
| 1 Evergreen Needleleaf | 4 Deciduous Broadleaf | 7 Open Shrublands | 10 Grasslands | 13 Urban and Built-up | 16 Bare Soil and Rocks |
| 2 Evergreen Broadleaf | 5 Mixed Forest | 8 Woody Savannas | 11 Permanent Wetlands | 14 Cropland Mosaics | 17 Water Bodies |
| 3 Deciduous Needleleaf | 6 Closed Shrublands | 9 Savannas | 12 Croplands | 15 Snow and Ice | 18 Tundra |



Ufuk Turuncoglu, ITU
Turkey Climate Change Scenarios

AVHRR NDVI_{max} Timing

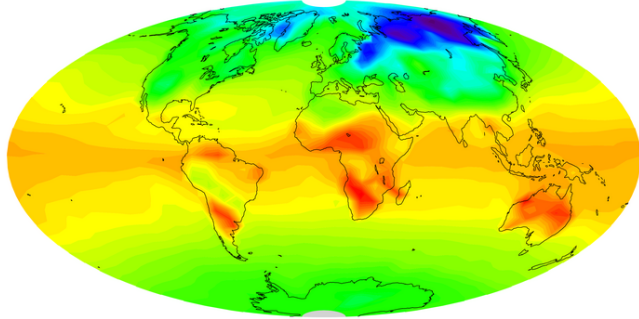


Evans plot - Created by Jason Evans of UNSW.

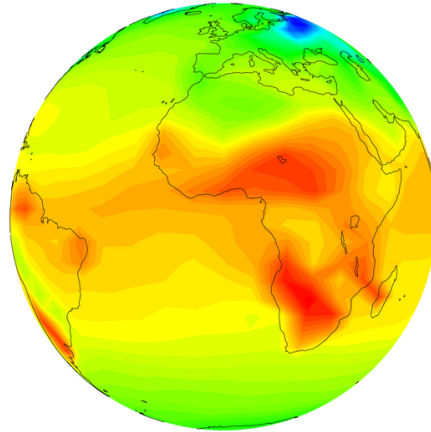
An Evans plot is a way to visualize spatially, two variables of interest, one of which provides some measure of "importance".

16 map projections (8 here)

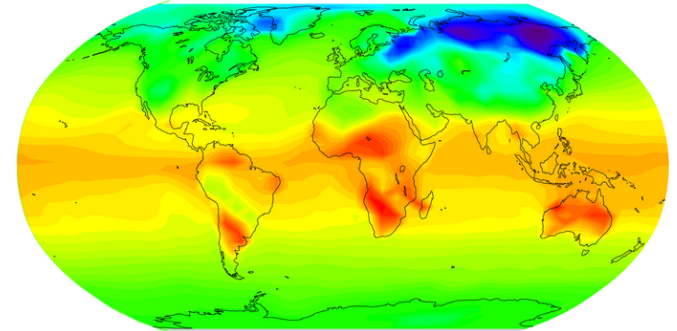
Aitoff



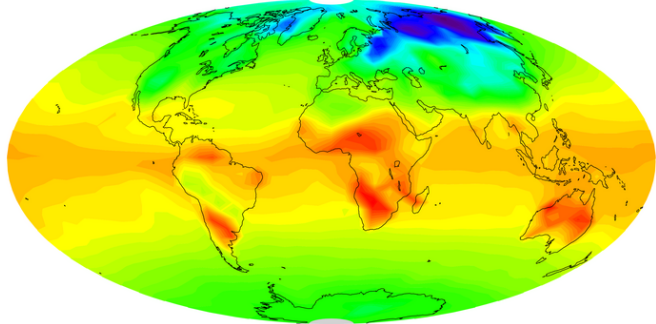
Satellite



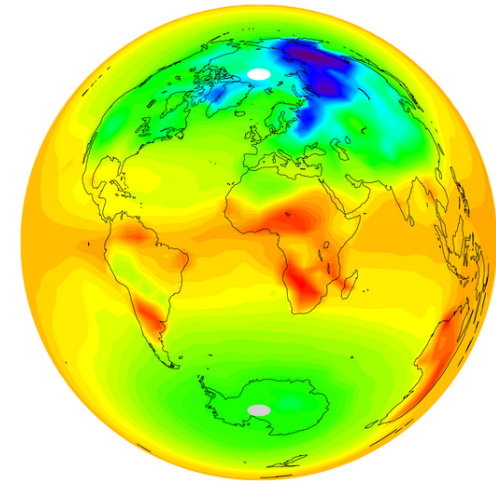
Robinson



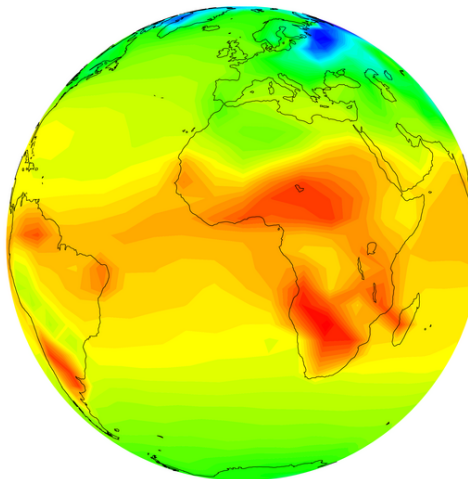
Hammer



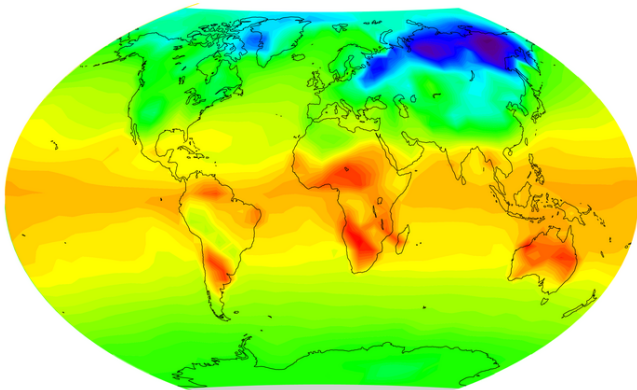
LambertEqualArea



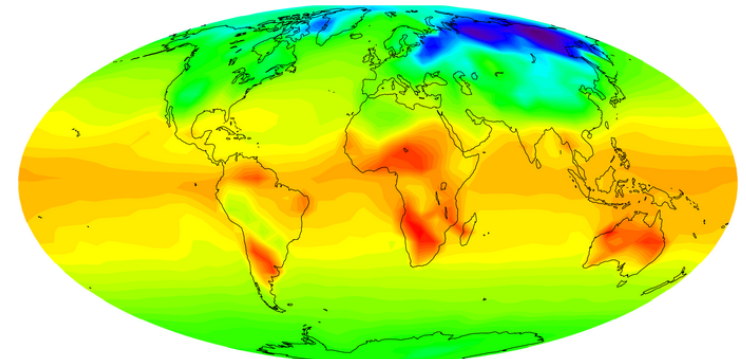
Orthographic



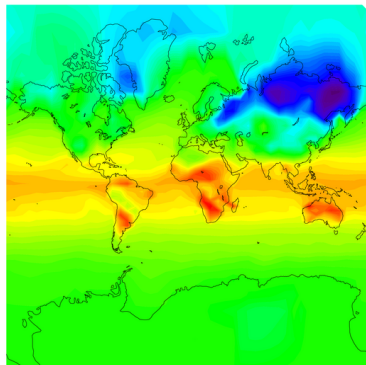
WinkelTripel



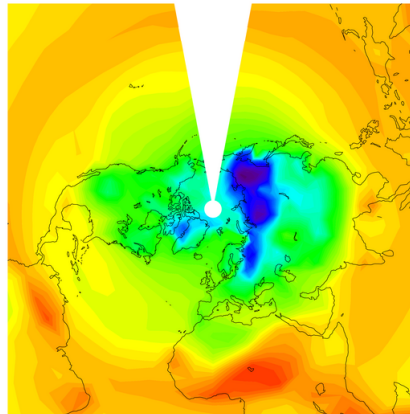
Mollweide



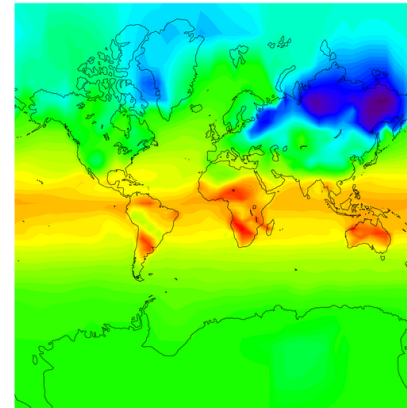
Mercator



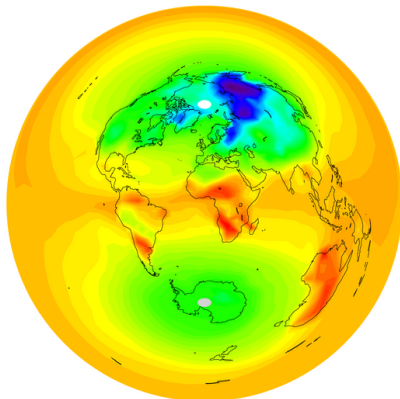
LambertConformal



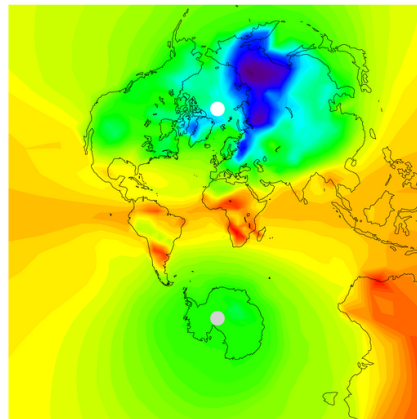
RotatedMercator



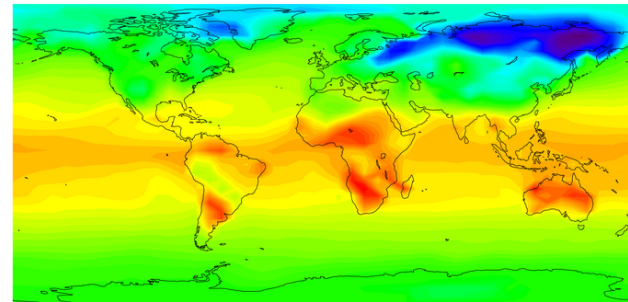
AzimuthalEquidistant



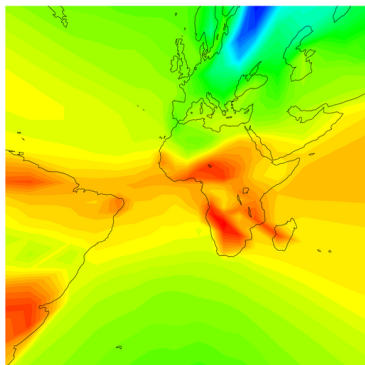
Stereographic



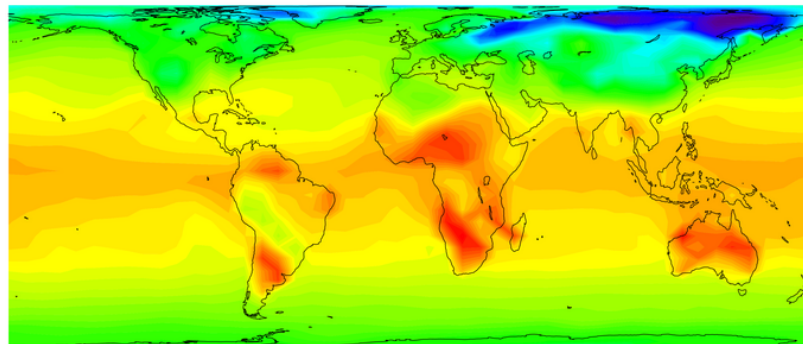
CylindricalEquidistant



Gnomonic

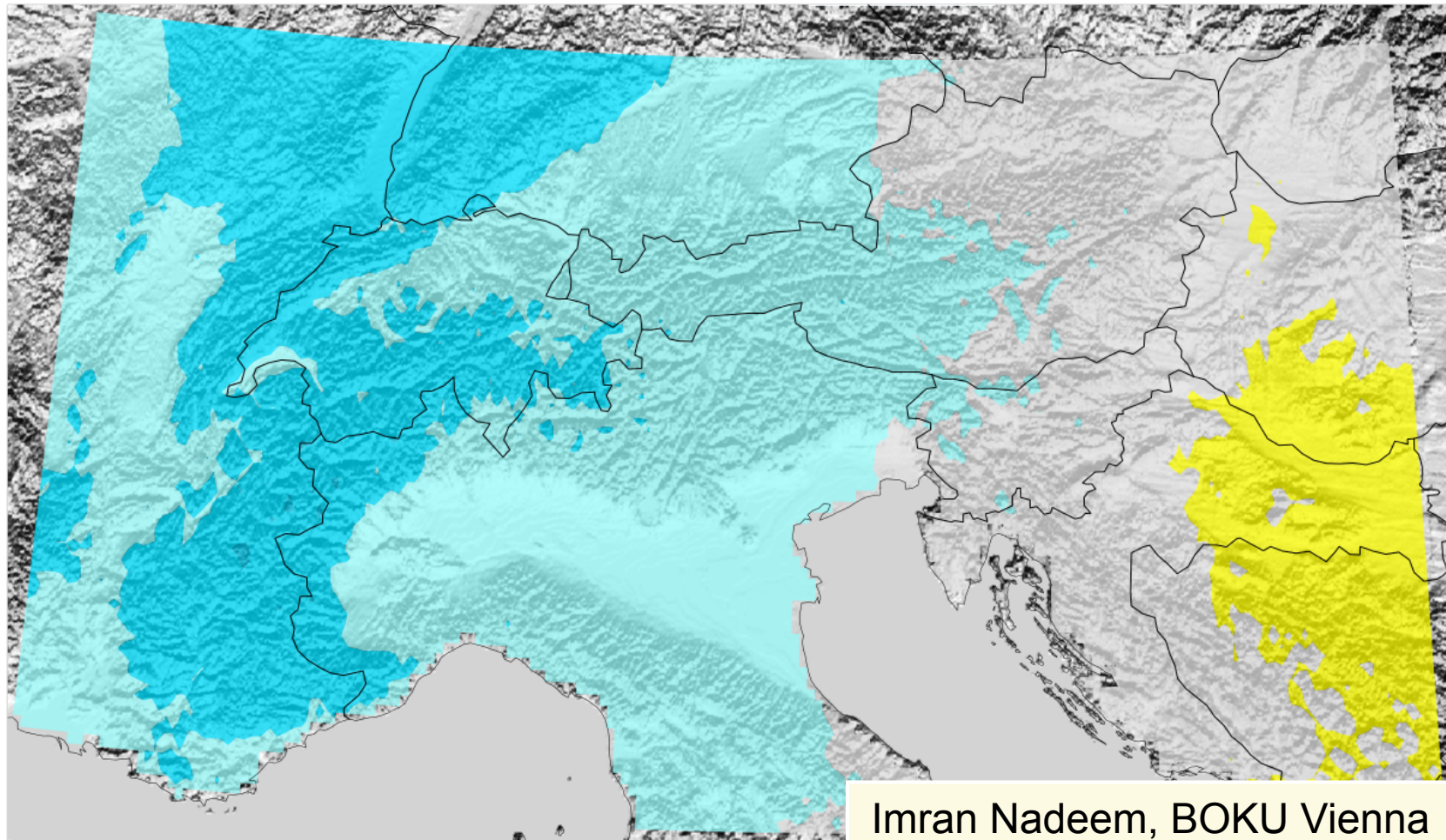


CylindricalEqualArea



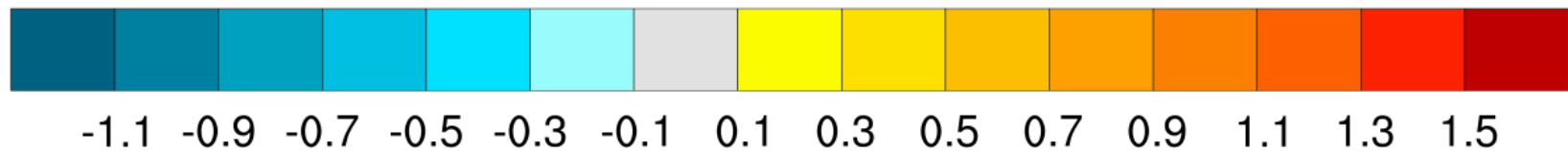
Transparency and image overlay

Anomalies of yearly mean temperature in °C 1819

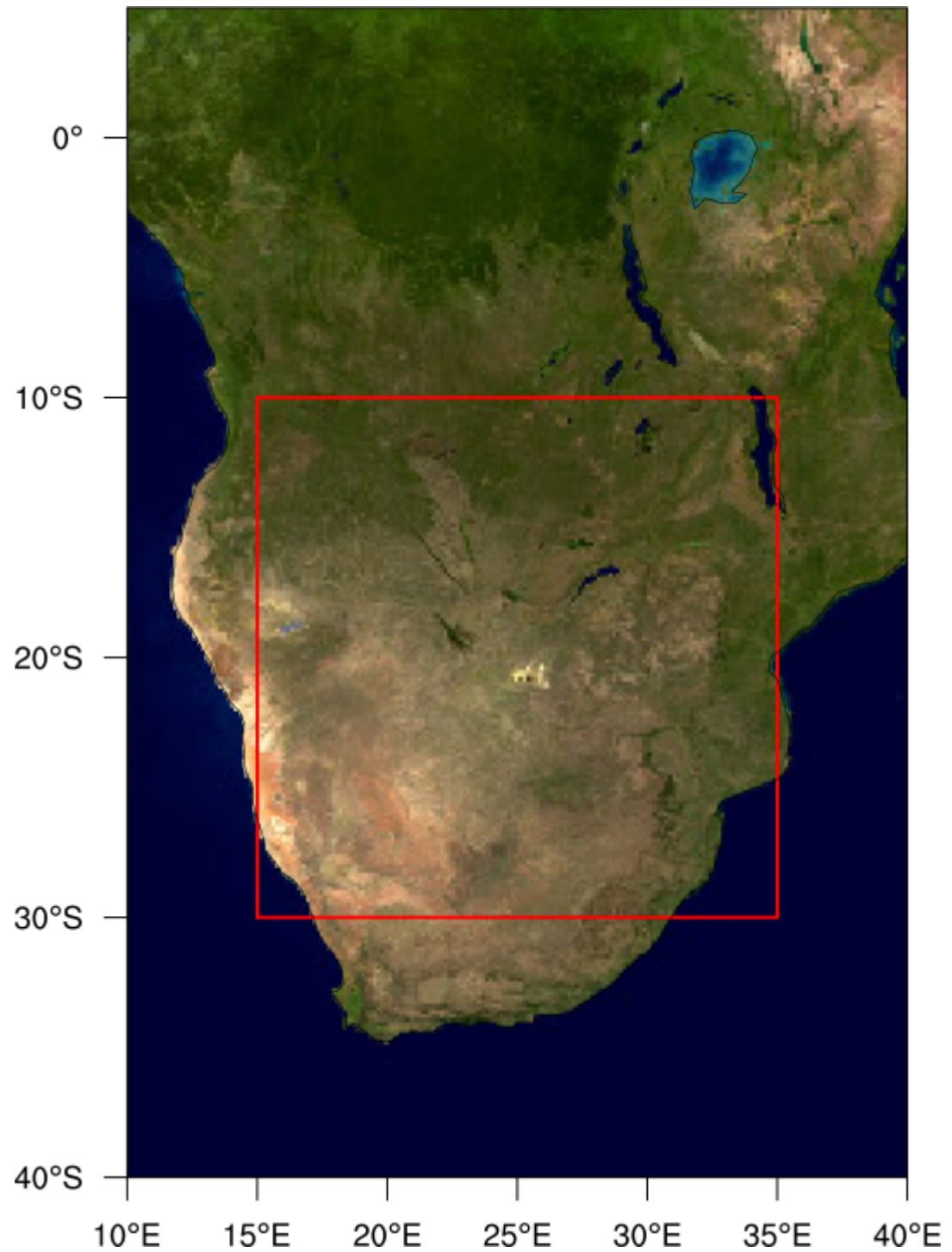


Imran Nadeem, BOKU Vienna

Source: Histalp Dataset, ZAMG



Import existing
JPEG images

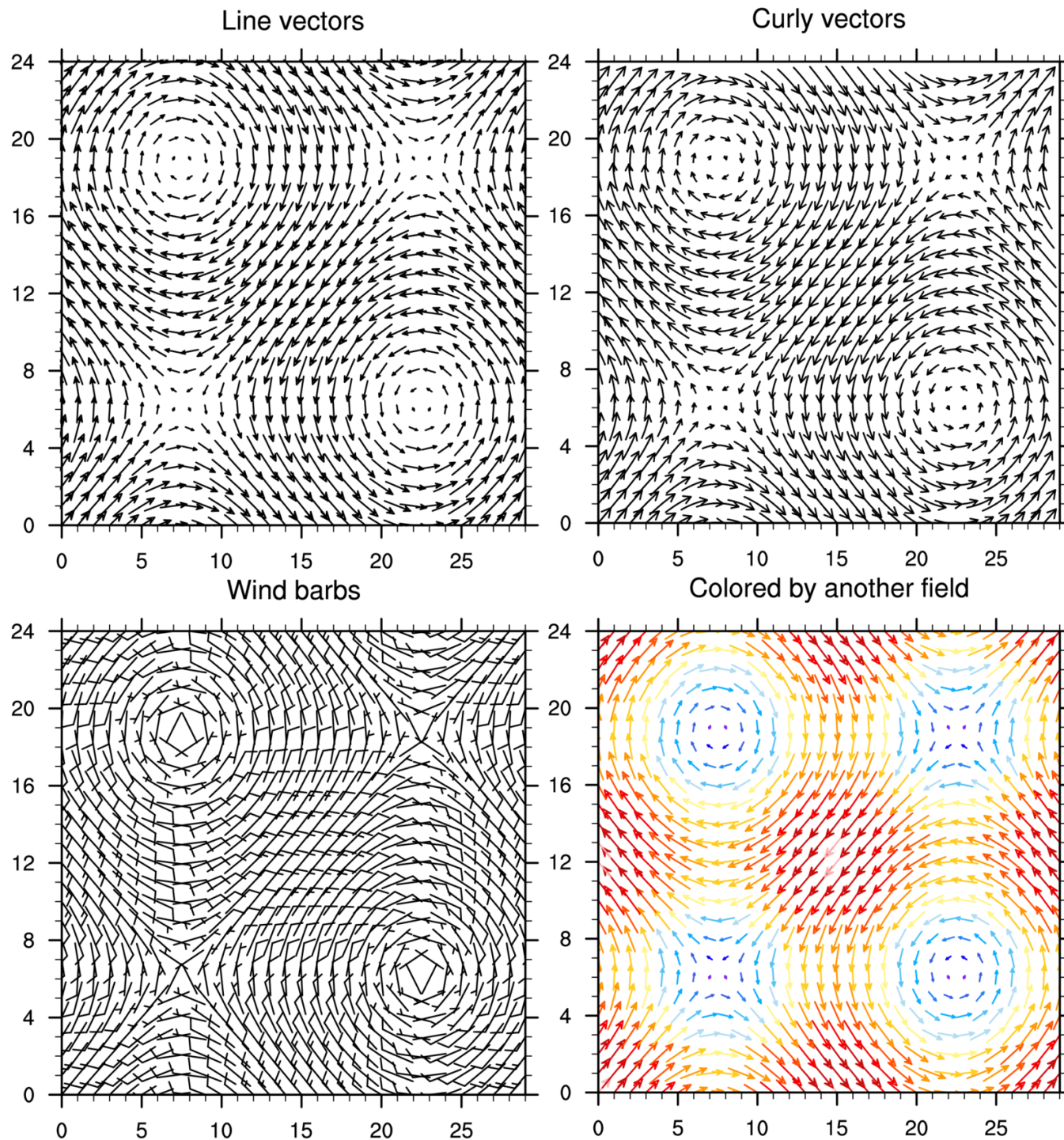


Types of graphics you can create with NCL

- XY
- Contour
- **Vector**
- Streamline
- Overlays
- Primitives
- Specialized plots

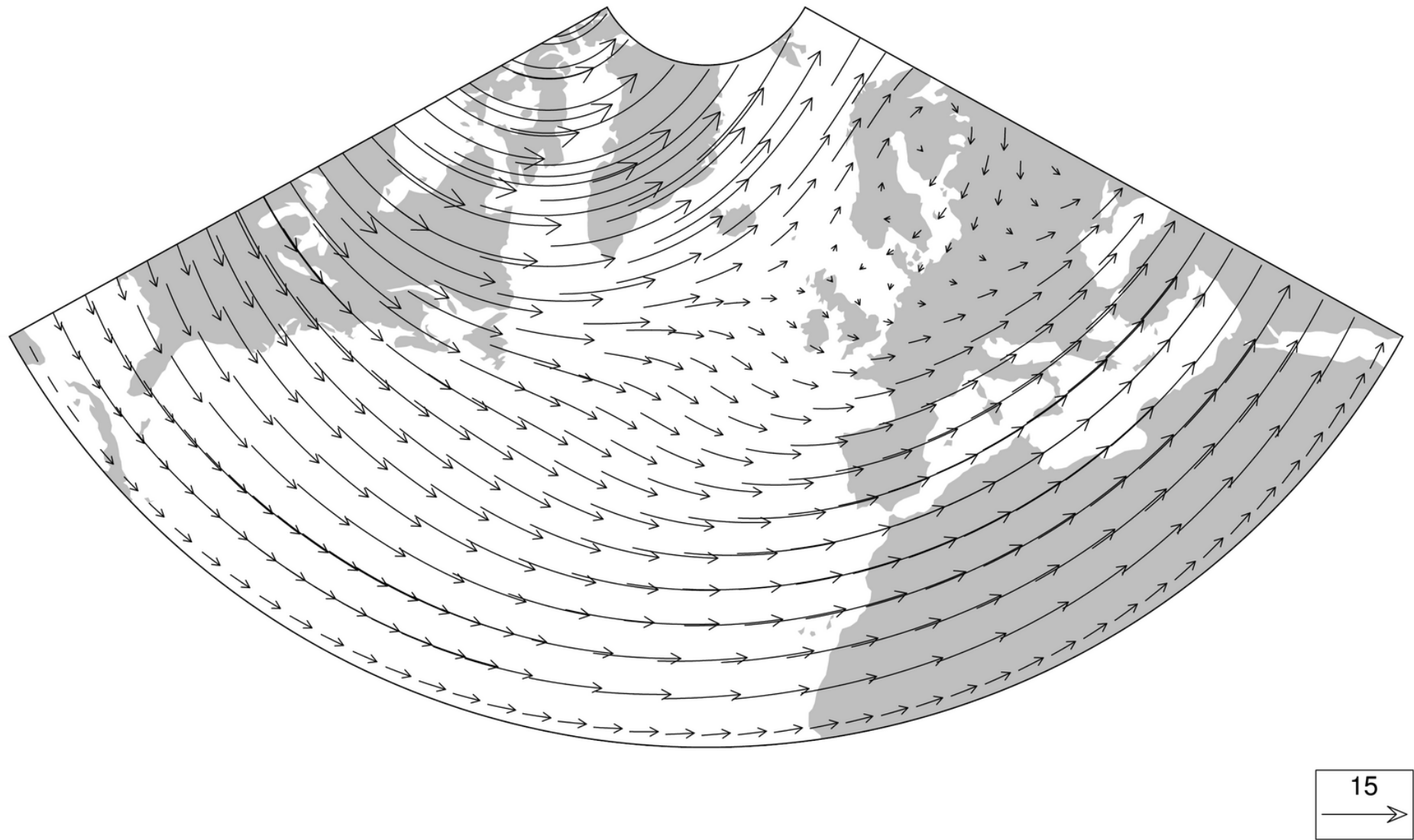
Vector types

1. Line
2. Curly
3. Wind barb



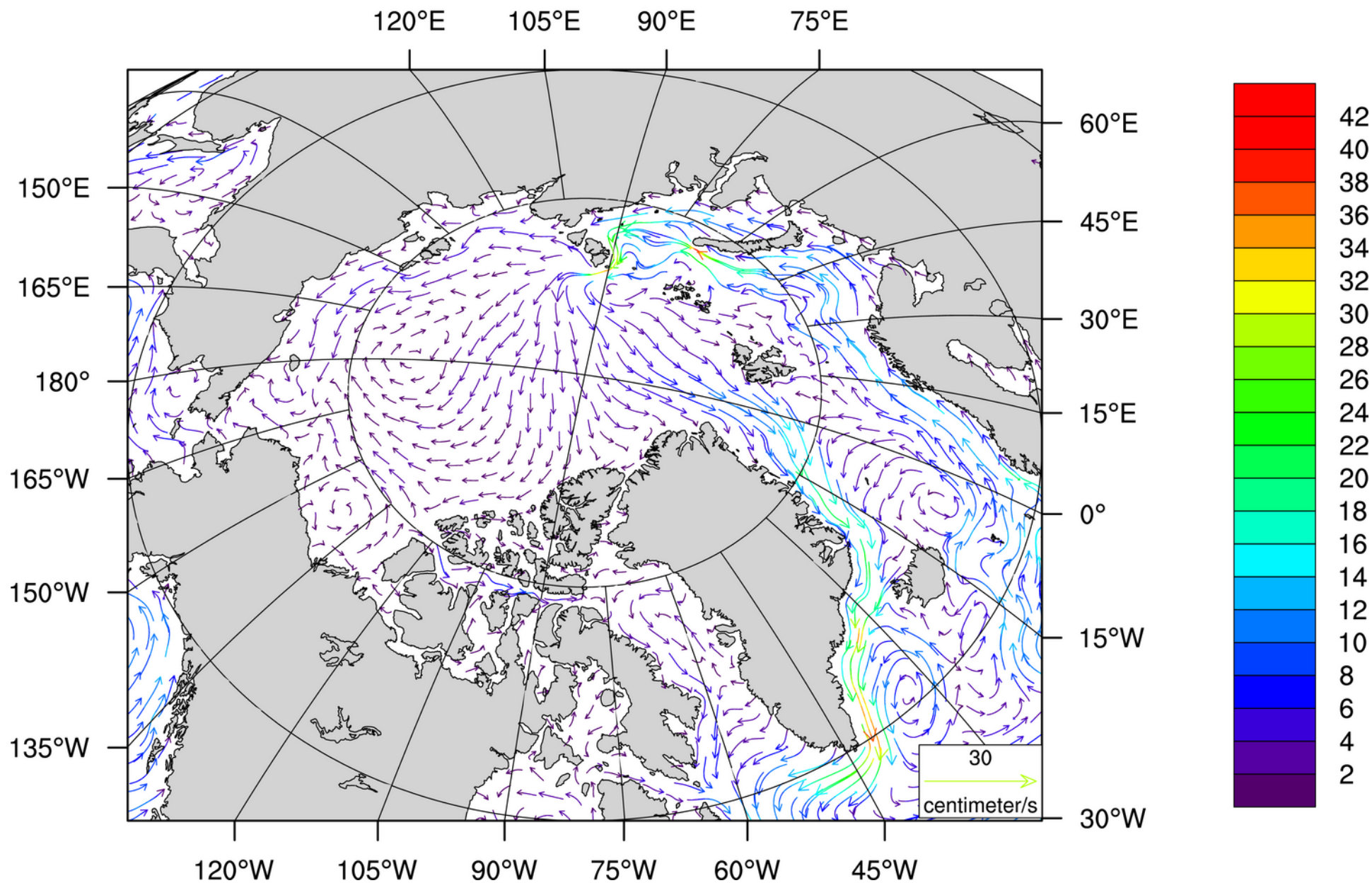
Winds

m/s



**masked lambert
conformal plot**

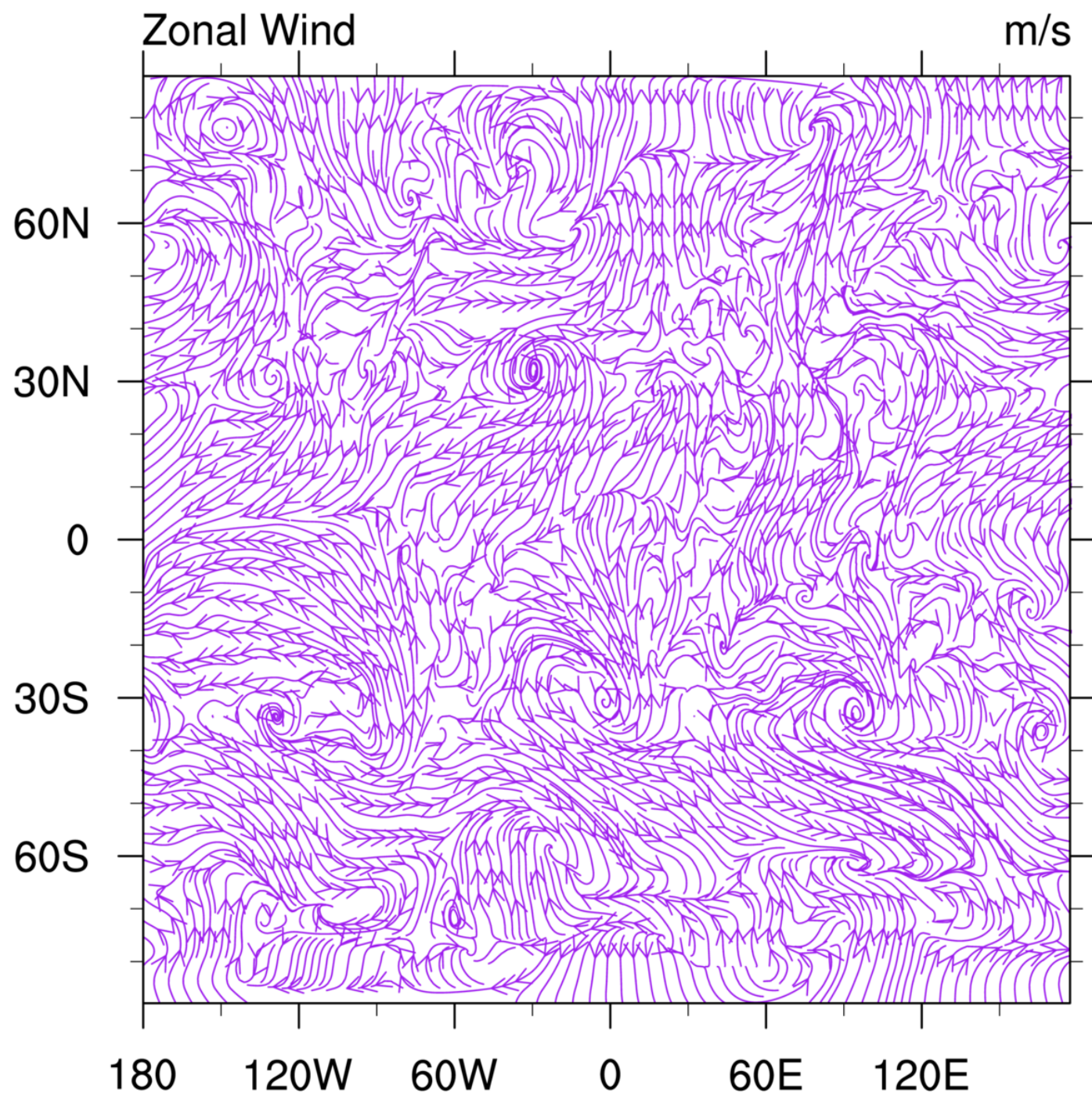
Curly vectors colored by magnitude



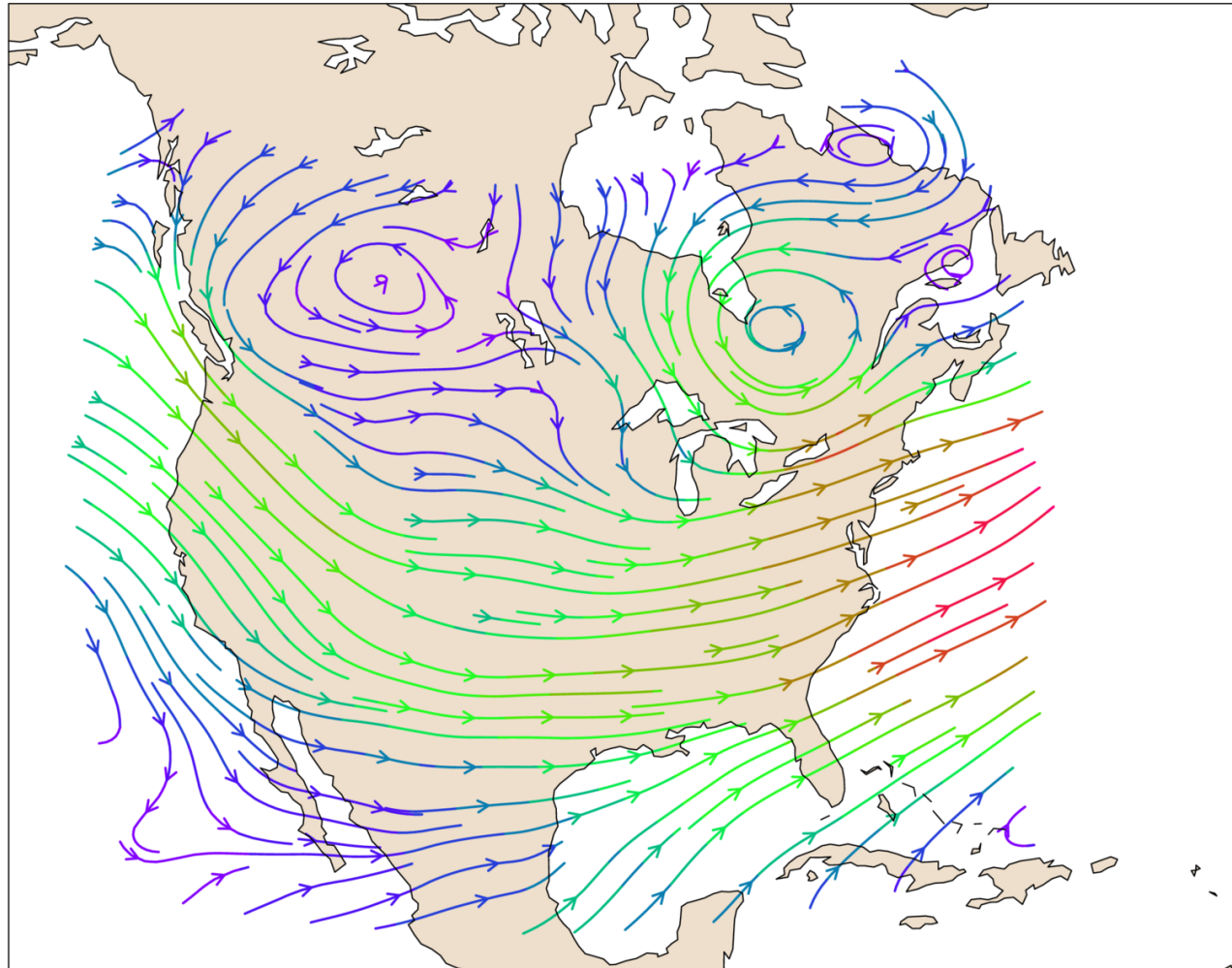
Courtesy Dave Brown, NCAR/CISL

Types of graphics you can create with NCL

- XY
- Contour
- Vector
- **Streamline**
- Overlays
- Primitives
- Specialized plots



Streamlines colored by magnitude



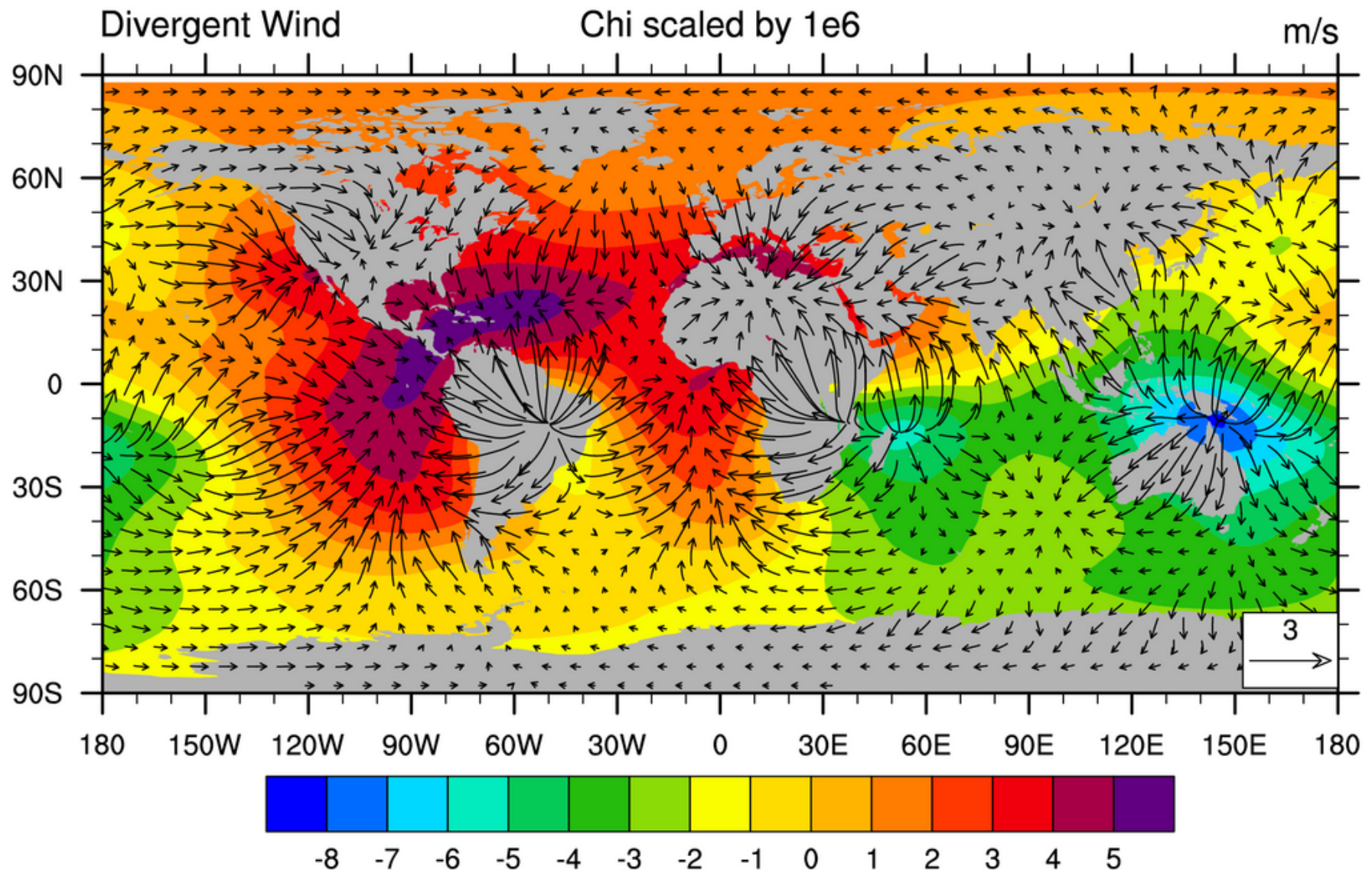
4 8 12 16 20 24 28 32 36 40 44 48

Types of graphics you can create with NCL

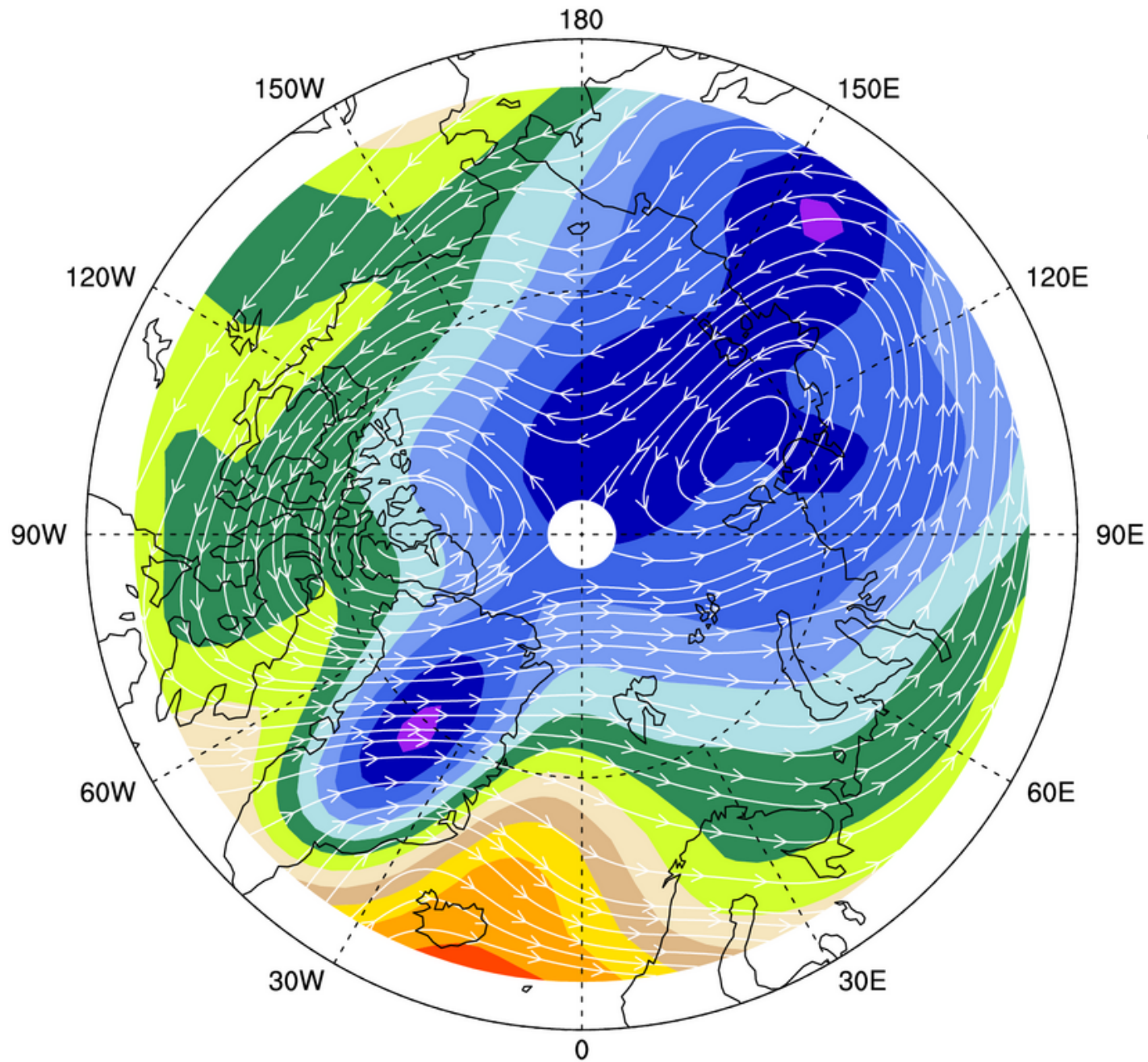
- XY
- Contour
- Vector
- Streamline
- **Overlays**
- Primitives
- Specialized plots

Multiple overlays (contours and vectors)

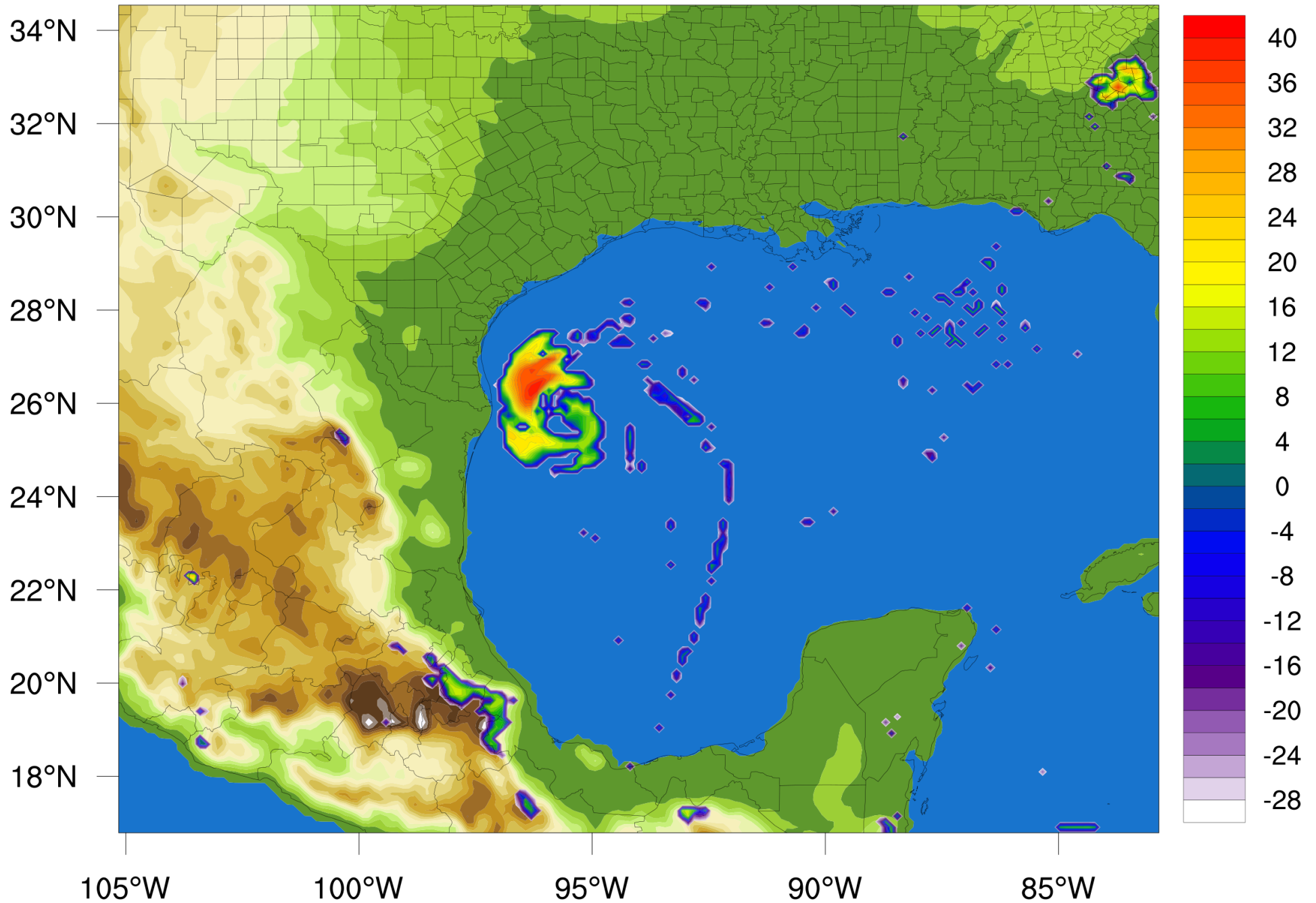
Velocity Potential via Spherical Harmonics



Streamlines over contours

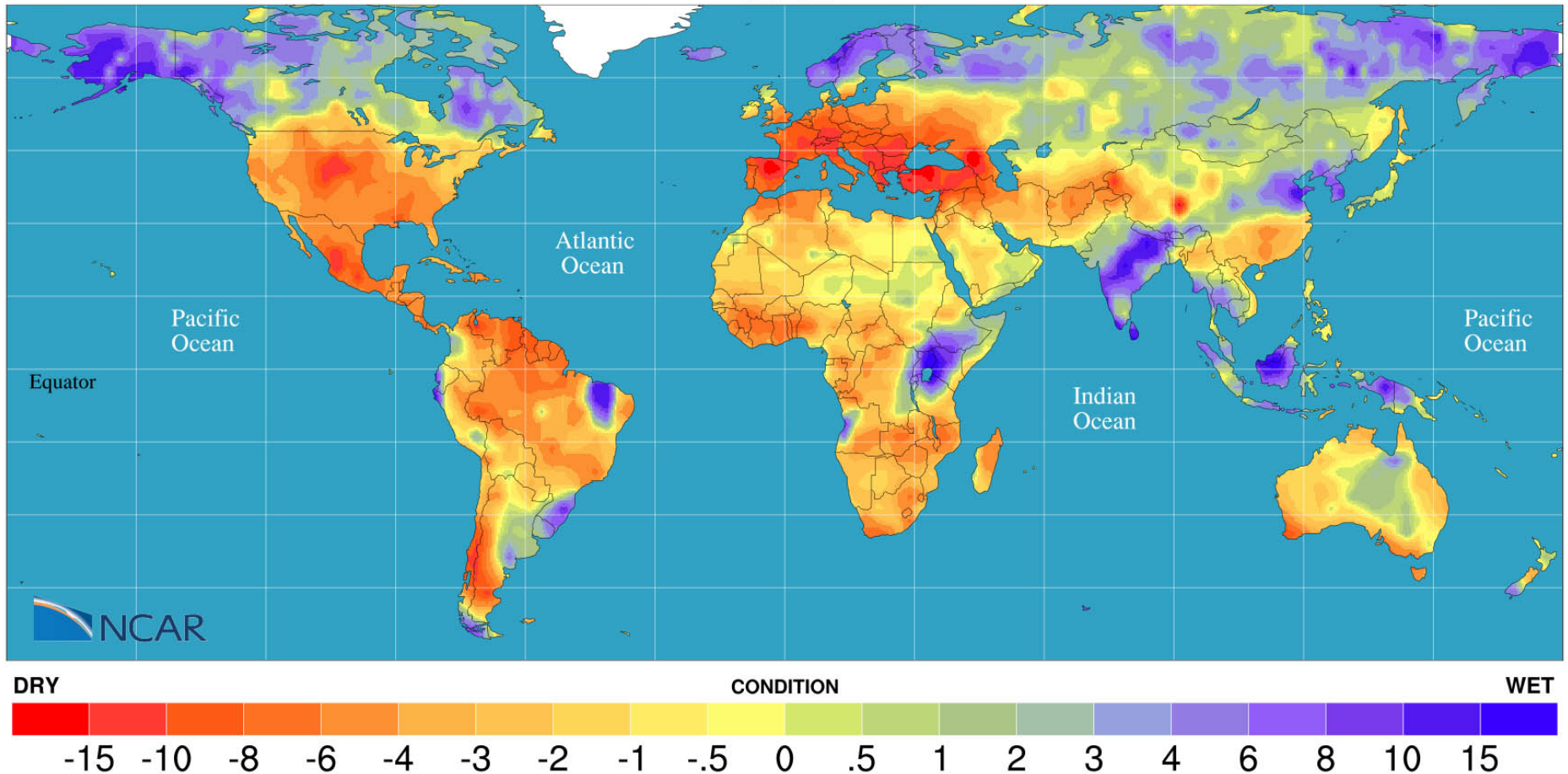


Reflectivity (dBZ) at level = 0.996

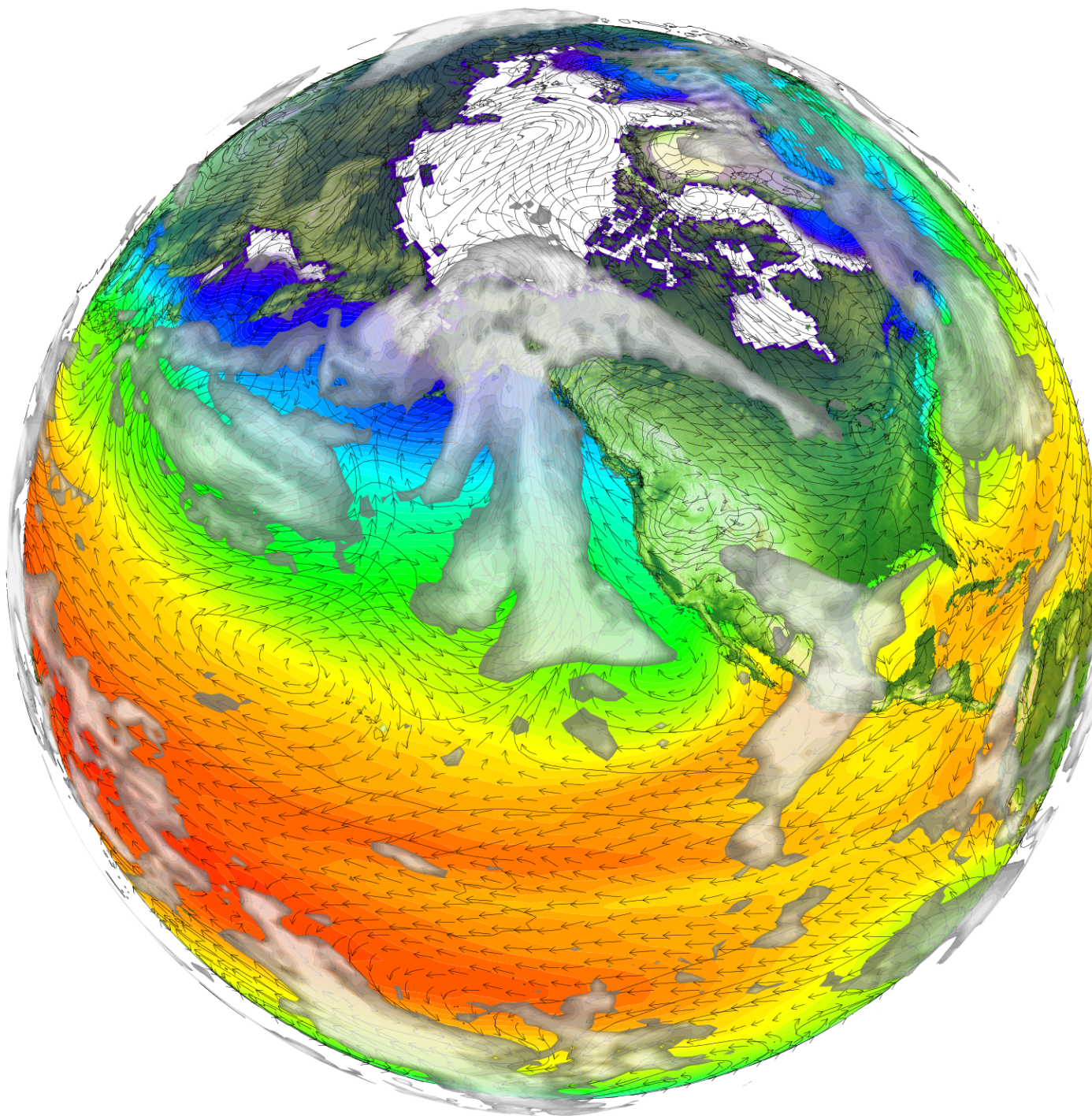


Palmer Drought Severity Index (PDSI)

Year 2099



Aiguo Dai (NCAR Earth System Lab)
Dai, A., 2001, Drought under global warming: A review.
Wiley Interdisciplinary Reviews: Climate Change, 2, 45-65
Data from the WCRP CMIP3 multi-model dataset.
Image generated by Tim Scheitlin (NCAR/CISL) using
NCL, Blender, and FinalCut Pro.



CCSM4 data
Six fields overlaid:

Ice thickness
(filled contours)

Sea surface temperature
(filled contours)

Topo map
(filled contours)

Sea level pressure
(line contours)

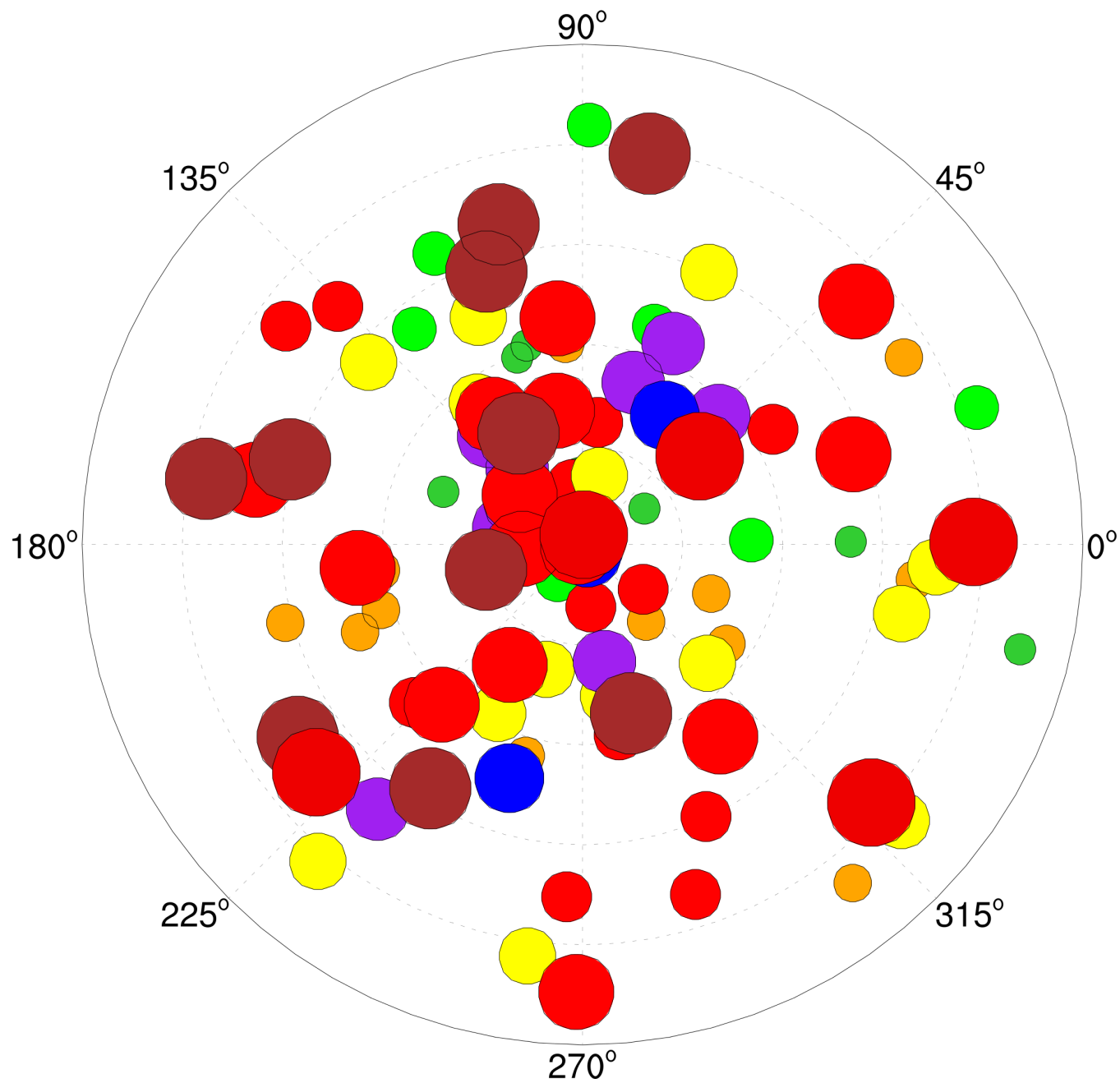
UV winds

Vertically-integrated
clouds (partially
transparent
filled contours)

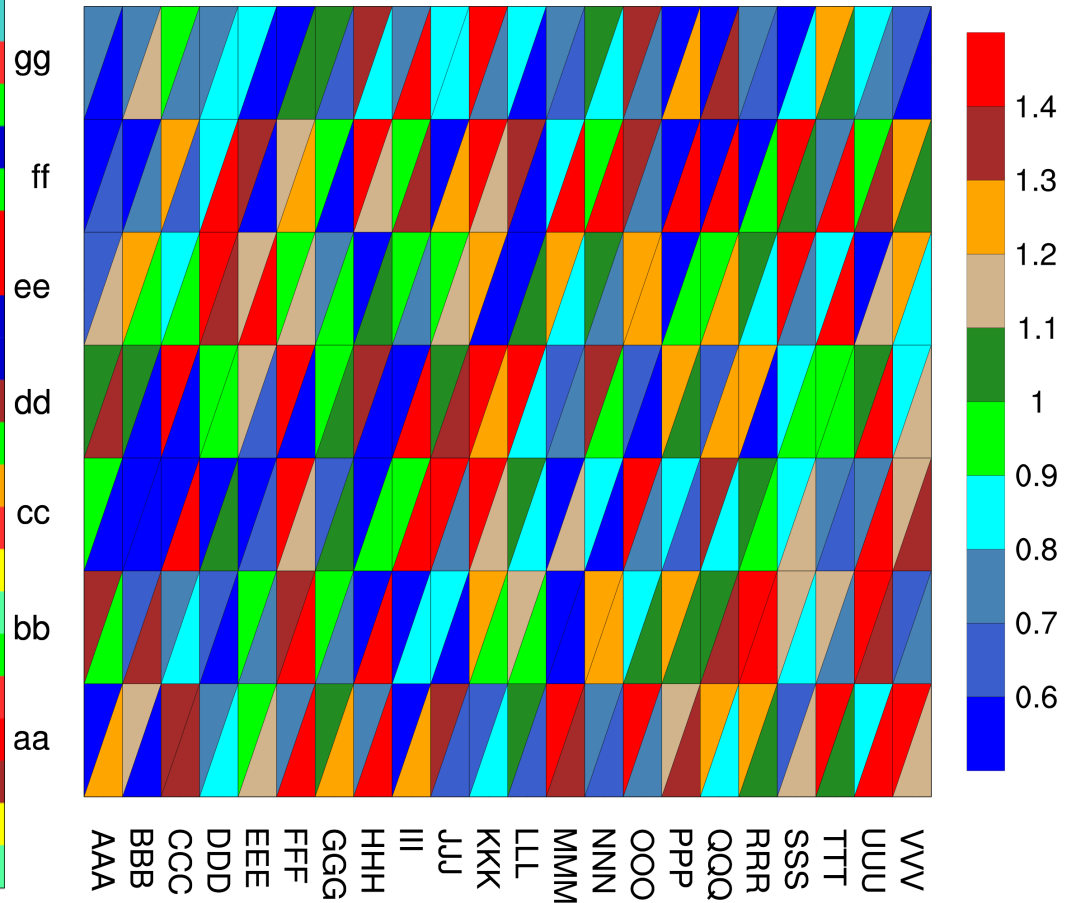
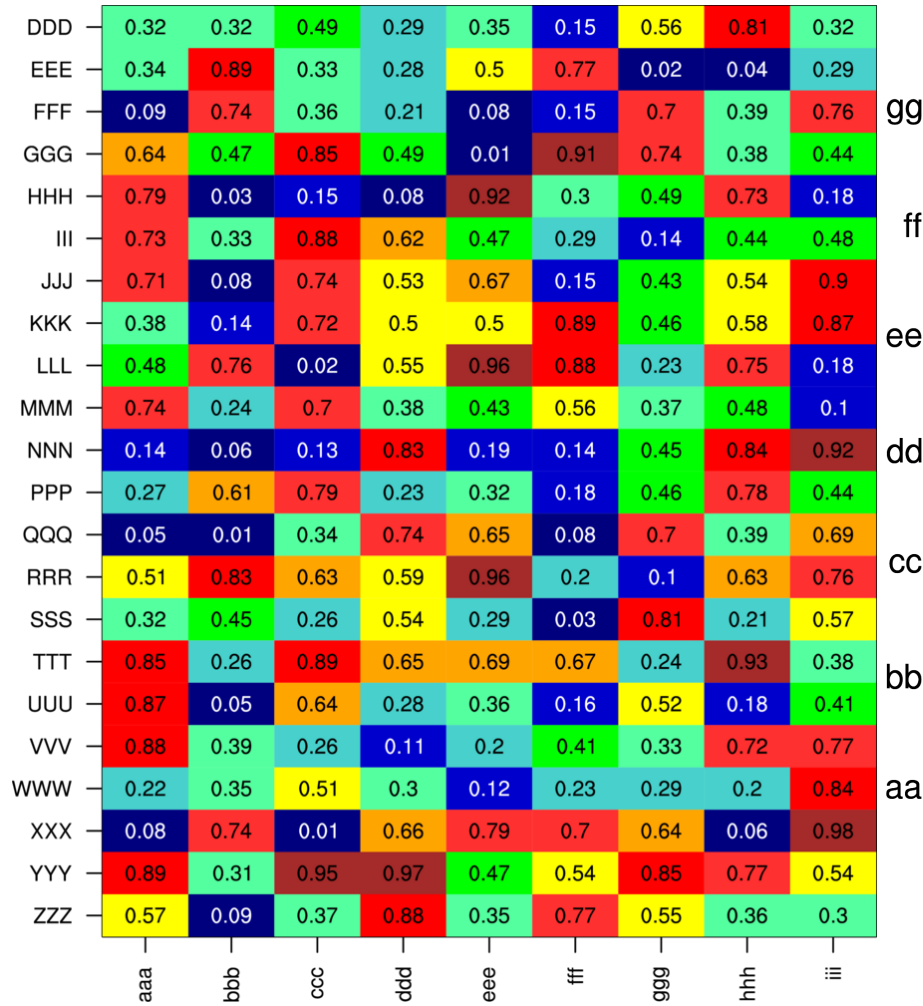
Types of graphics you can create with NCL

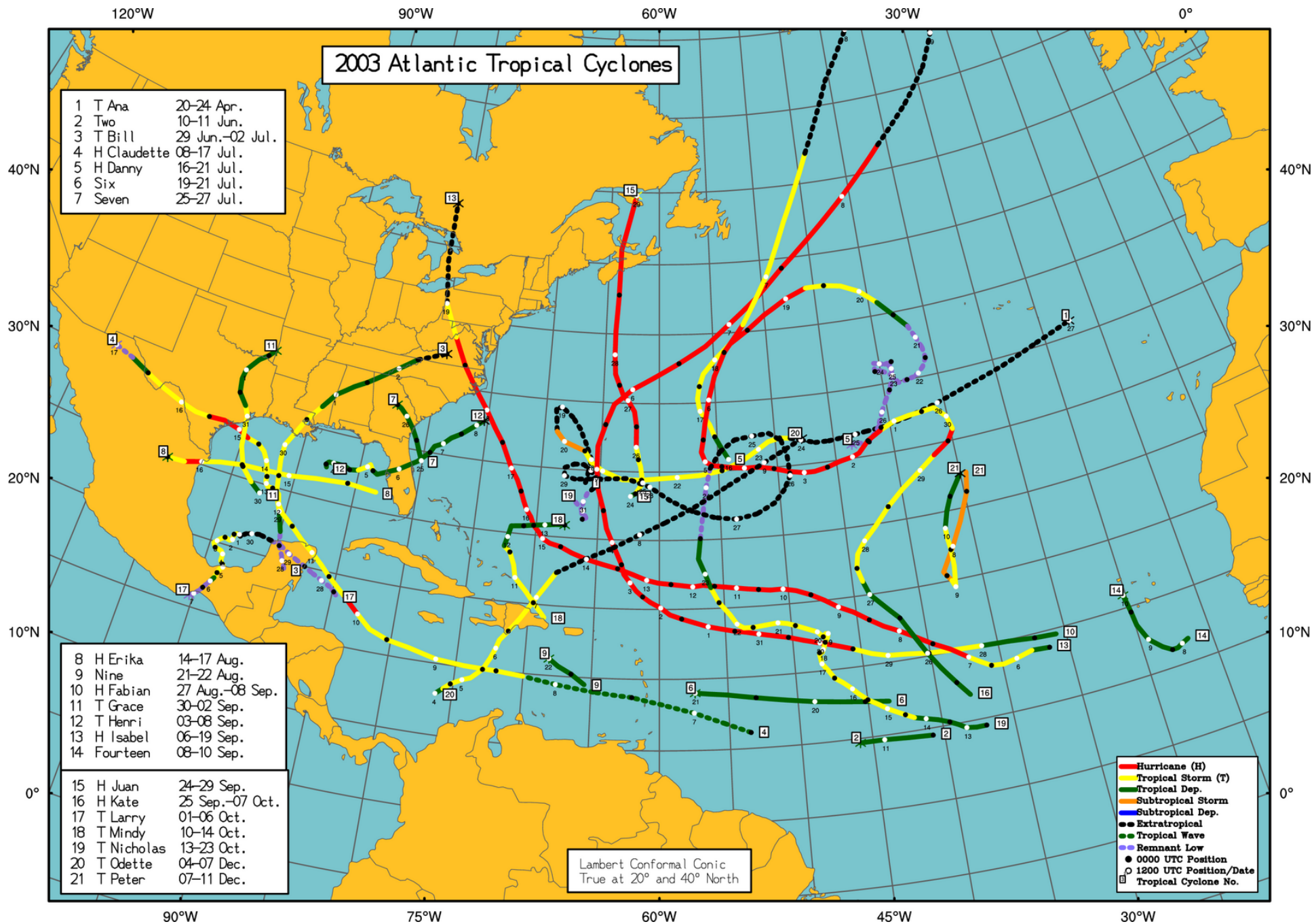
- XY
- Contour
- Vector
- Streamline
- Overlays
- Primitives (markers, lines, text, polygons)
- Specialized plots

Radial background with markers



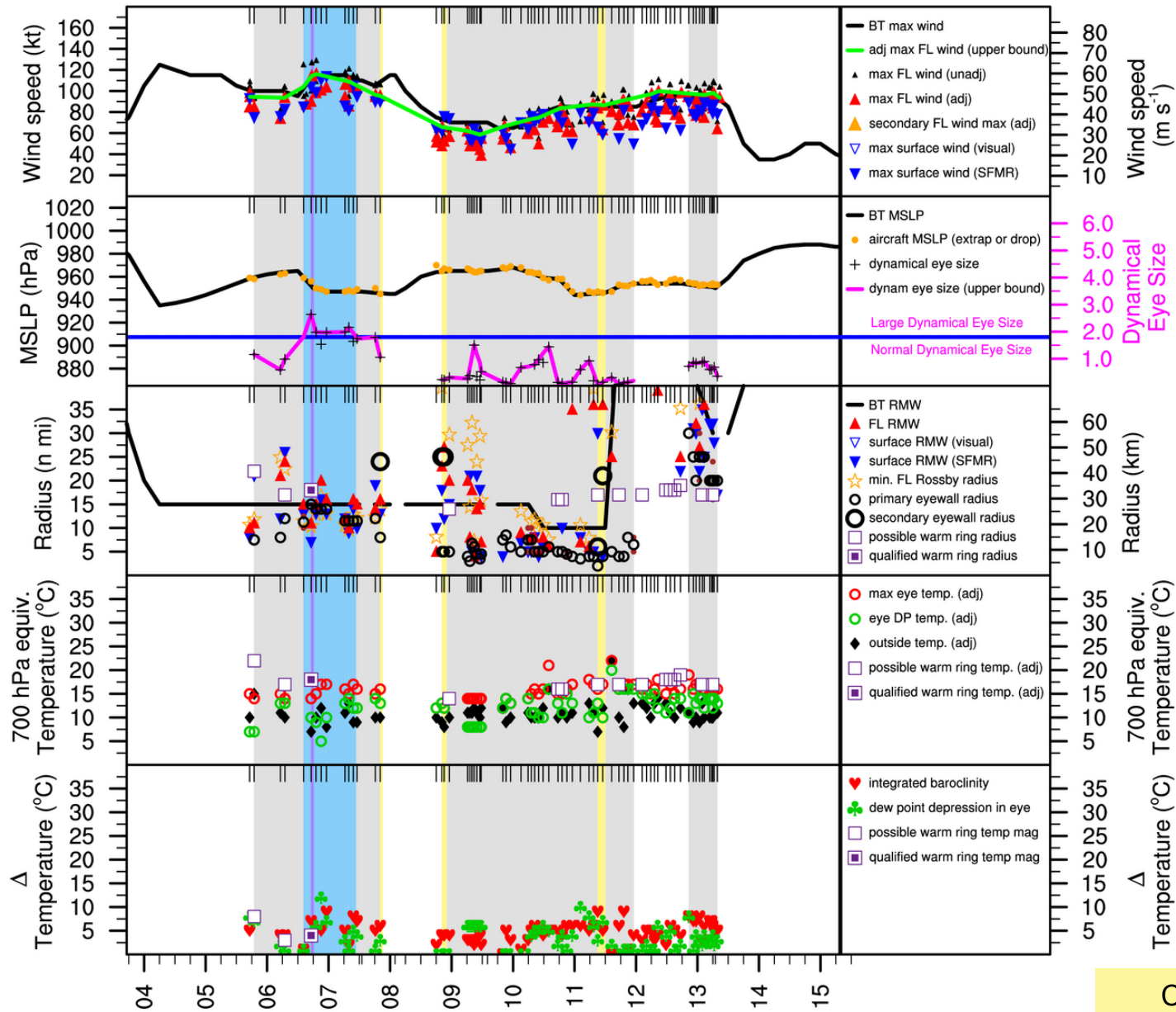
Filled polygons with text





Graphic by Jonathan Vigh, NCAR/ASP

IKE (AL092008)



Eye formation period

Eye reported by aircraft

Dynamically-large eye

Date / Time (UTC)

Concentric eyewalls

Warm ring

Courtesy of
Jonathan Vigh
Post-doc, NCAR

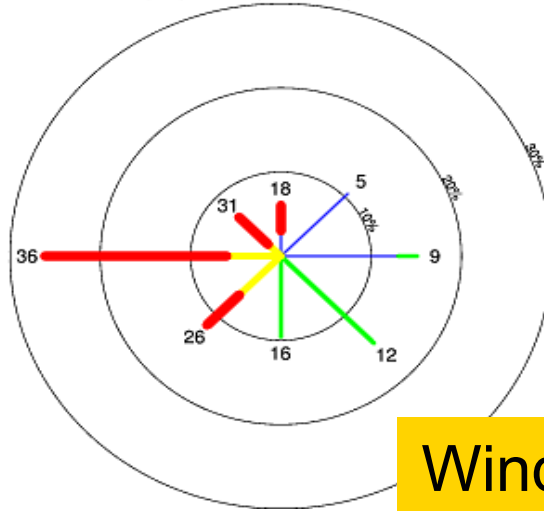
Types of graphics you can create with NCL

- XY
- Contour
- Vector
- Streamline
- Overlays
- Primitives
- **Specialized plots**
 - Skew T, WRF, wind roses, panels, shapefiles

Special Templates and Scripts

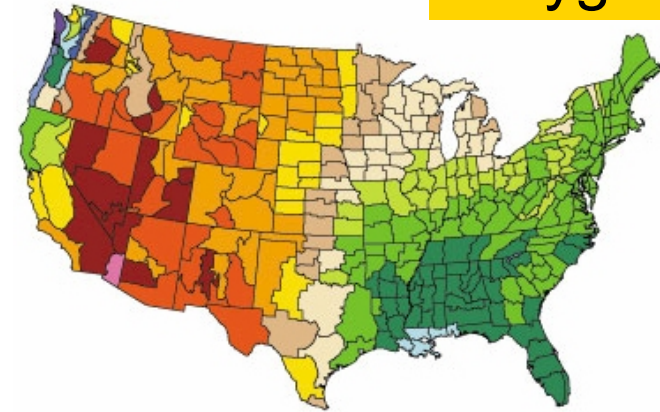
Wind Rose: Color + Variable Thickness

SpdAve=21 SpdStd=13 DirAve=257 Calm= 0.5%
Frequency circles every 10%. Mean speed indicated.

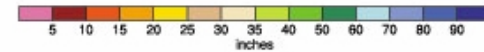


Wind Rose

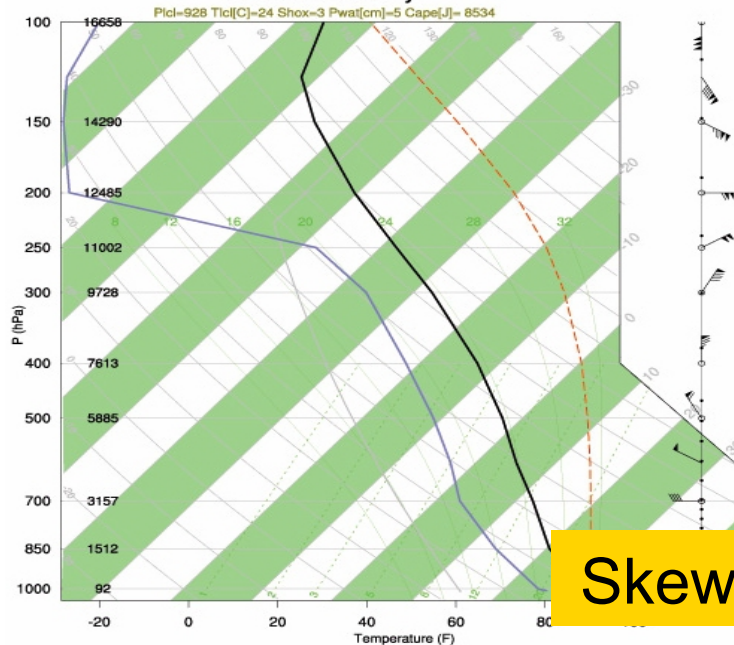
Average Annual Precipitation
Computed for the period 1880-1999
NCDC climate division



Polygons

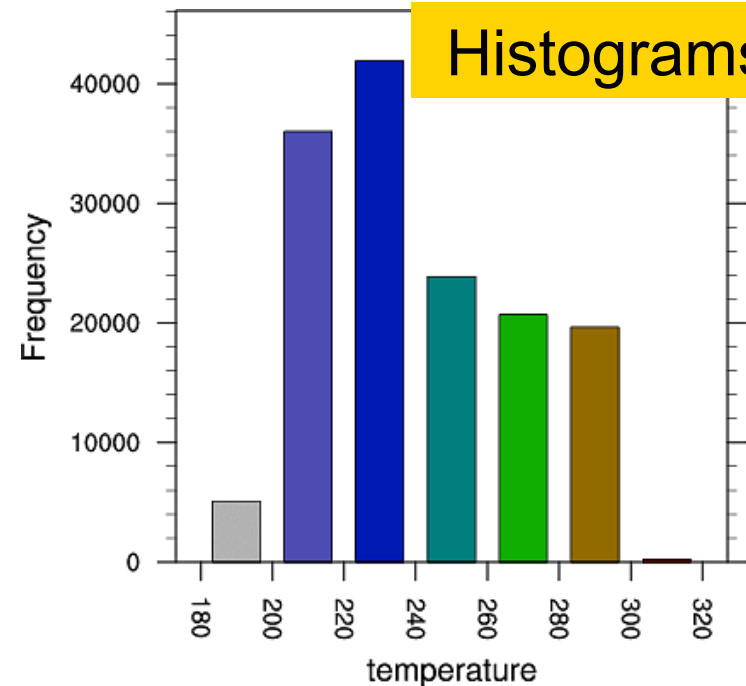


Raob Data only

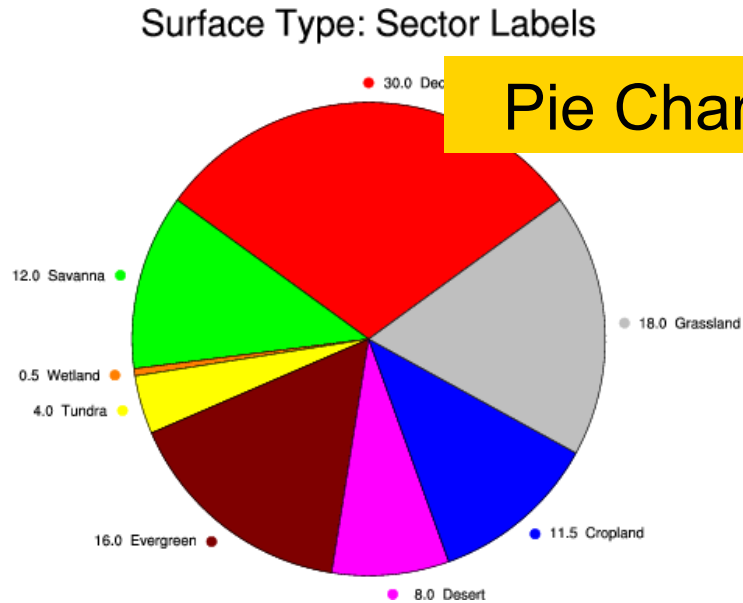


Skew T

Histograms

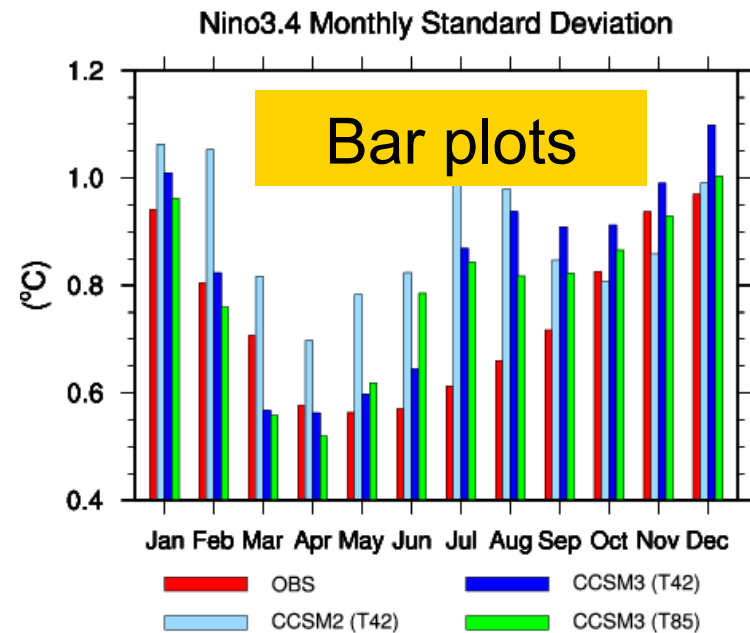
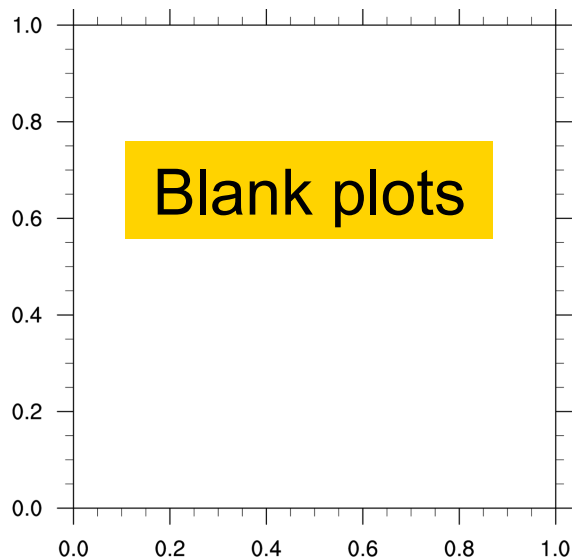


More Special Templates and Scripts



CAM METRICS	Case A	Case B
	ANN	ANN
SLP_ER		1.129
Tsfc_ER		0.996
Prc_GP		0.016
Prc 30S-30N_GPCP	1.172	1.134
LW_ERS	1.064	1.023
SW_ERS	0.966	0.962
U300_ERA40	1.079	1.048
Guess_BOGUS	0.781	0.852
RH_NCEP	1.122	0.911
LHFLX_ERA40	1.000	0.835
TWP_ERA40	0.998	0.712
CLDTOT_NCEP	1.321	1.122
O3_NASA	0.842	0.956
Q_JMA	0.978	0.832
PBLH_JMA	0.998	0.900
Omega_CAS	0.811	1.311

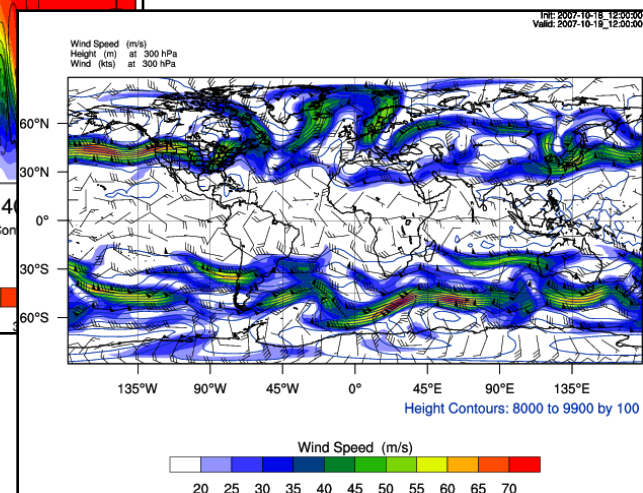
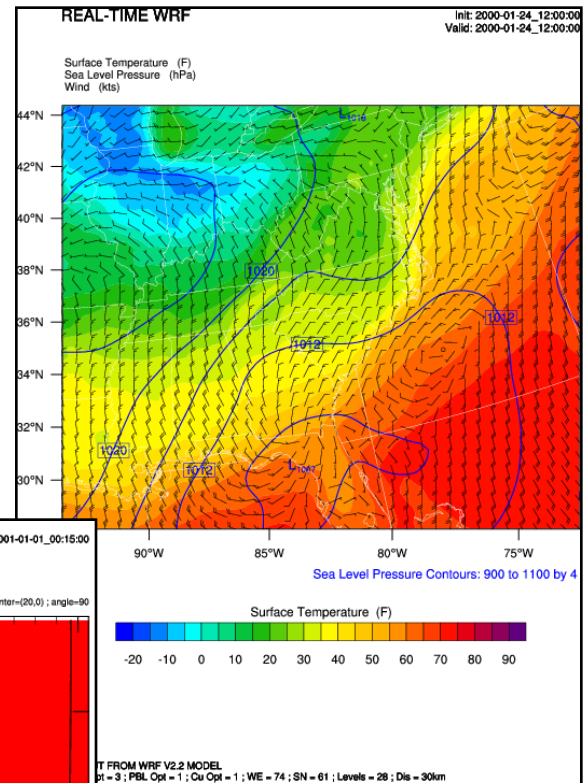
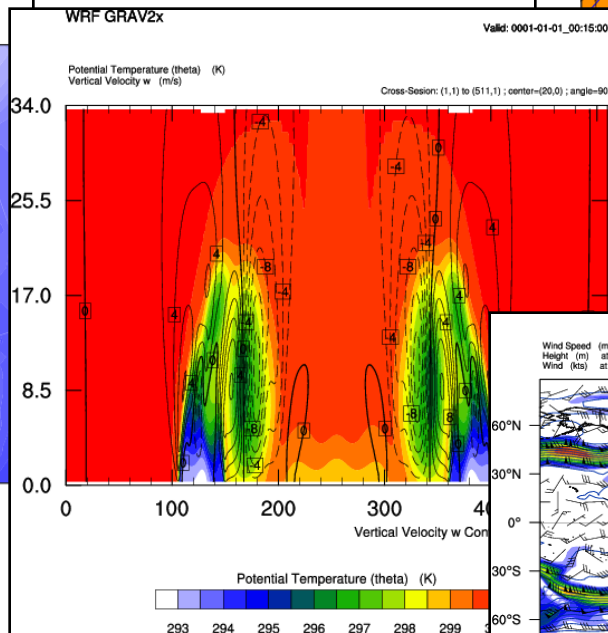
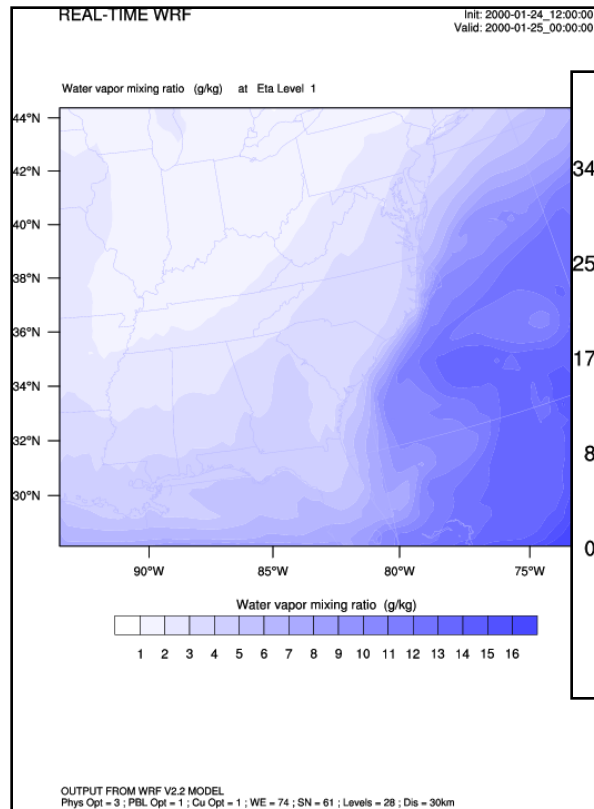
Tables



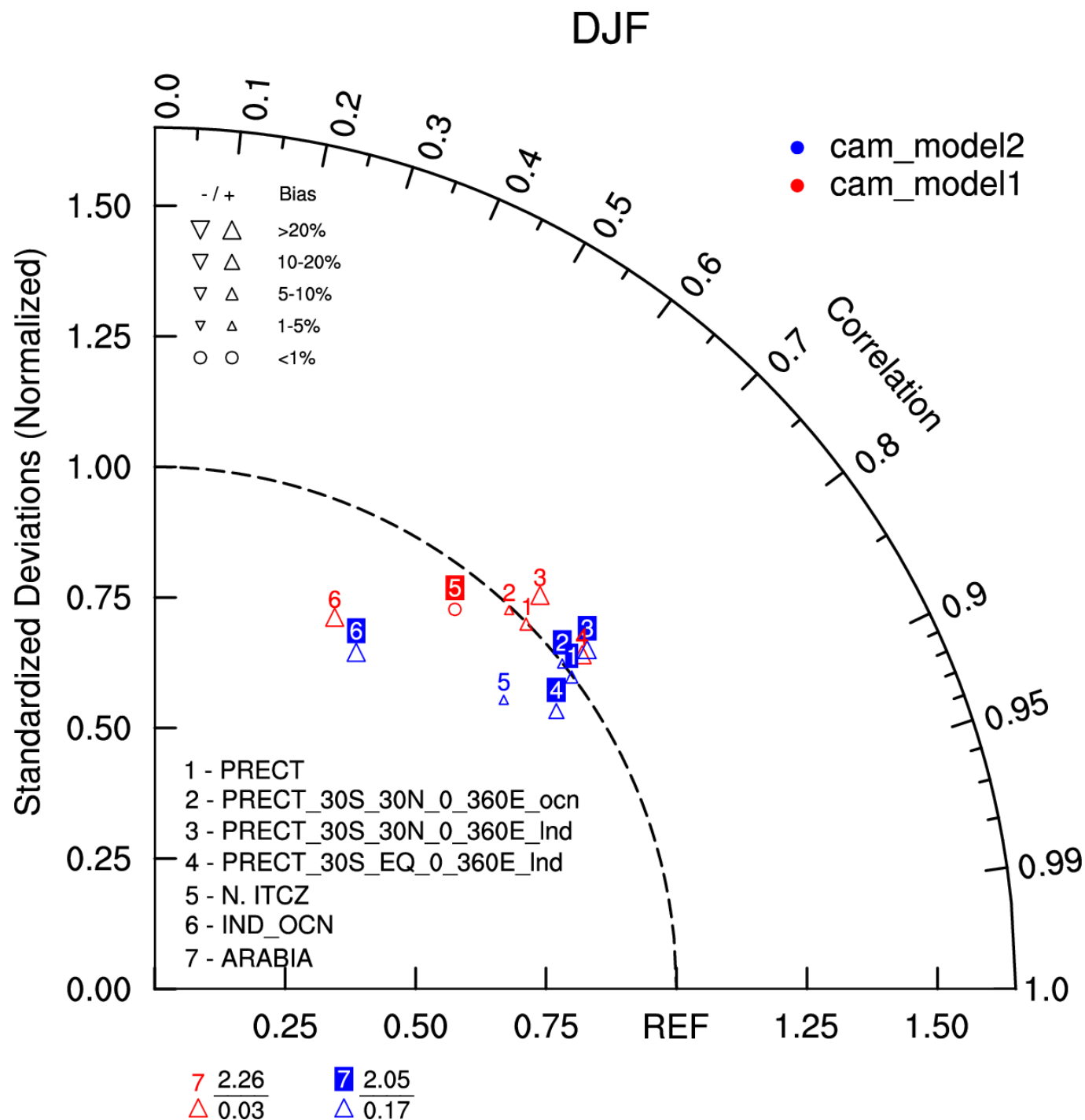
WRF plot templates

wrf_contour • wrf_map • wrf_vector •
wrf_map_overlays • wrf_overlays

<http://www.mmm.ucar.edu/wrf/OnLineTutorial/Graphics/NCL/>
[NCL_examples.htm](#)



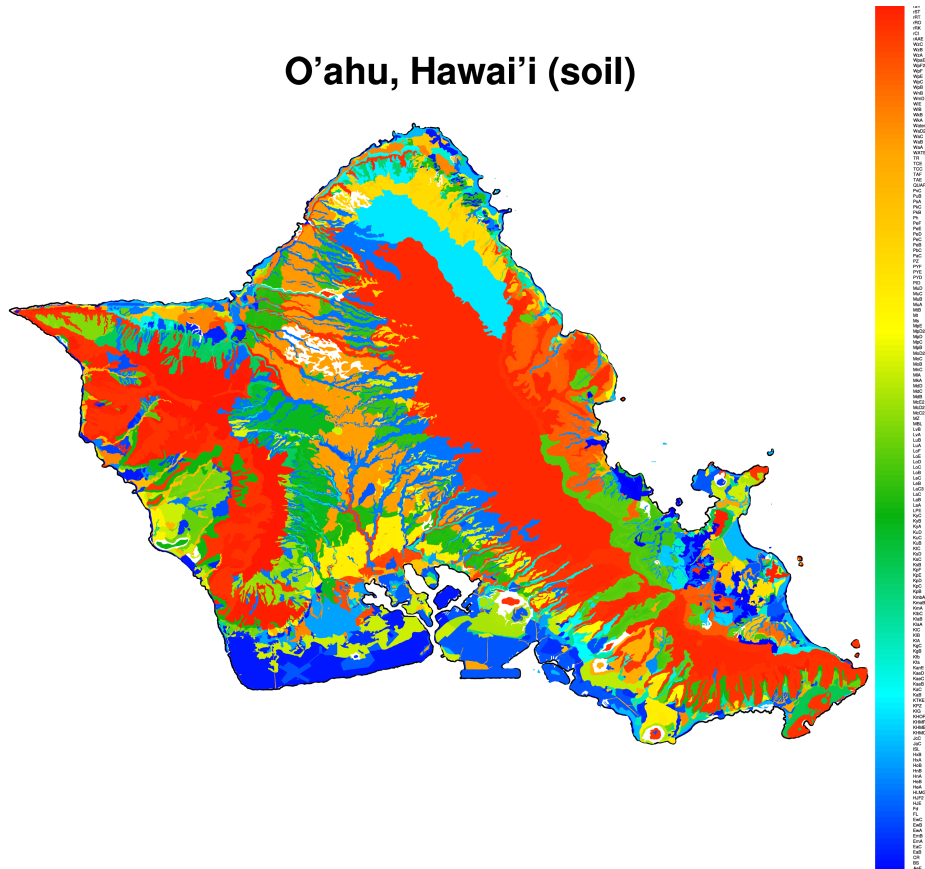
Taylor diagram
 Courtesy of
 Dennis Shea and
 Adam Phillips,
 CGD



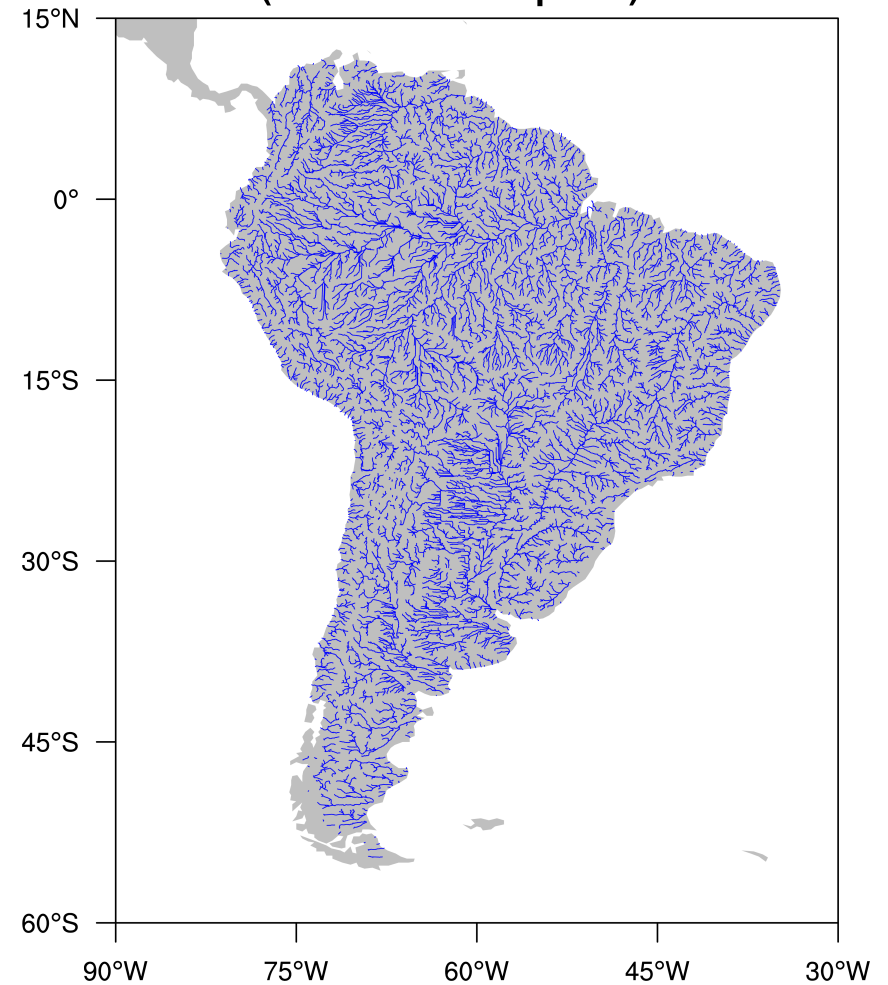
The ESRI Shapefile is a popular geospatial vector data format for GIS software.

Numerous (and free) shapefiles can be found by googling on the web.

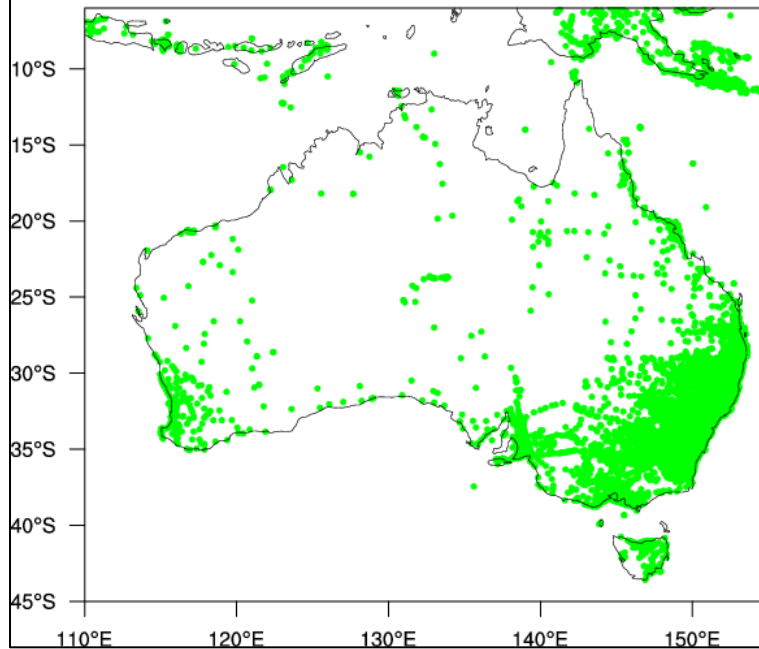
O'ahu, Hawai'i (soil)



**Stream network data for South America
(data from a shapefile)**



Places of interest



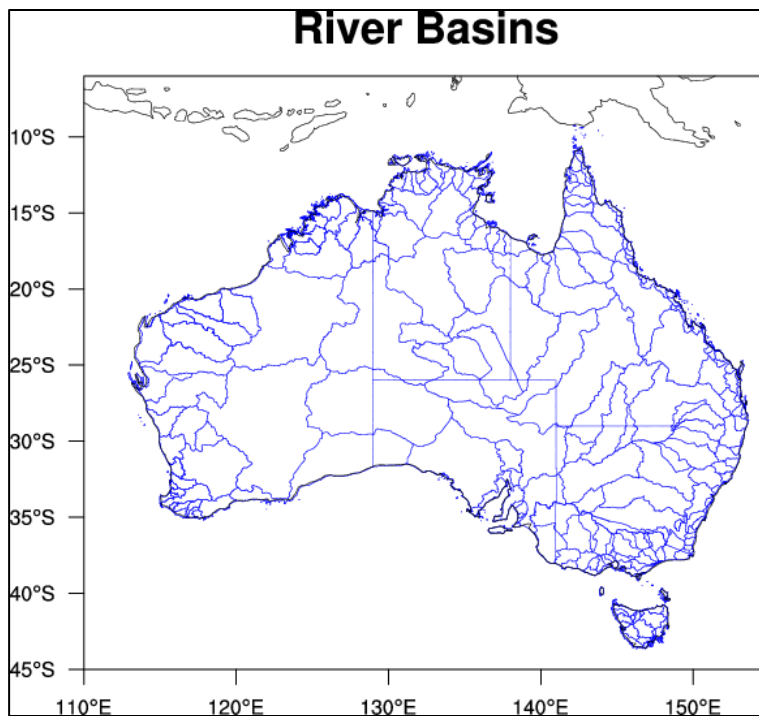
The three types of shapefiles supported by NCL:

Point – locations of cities, population data

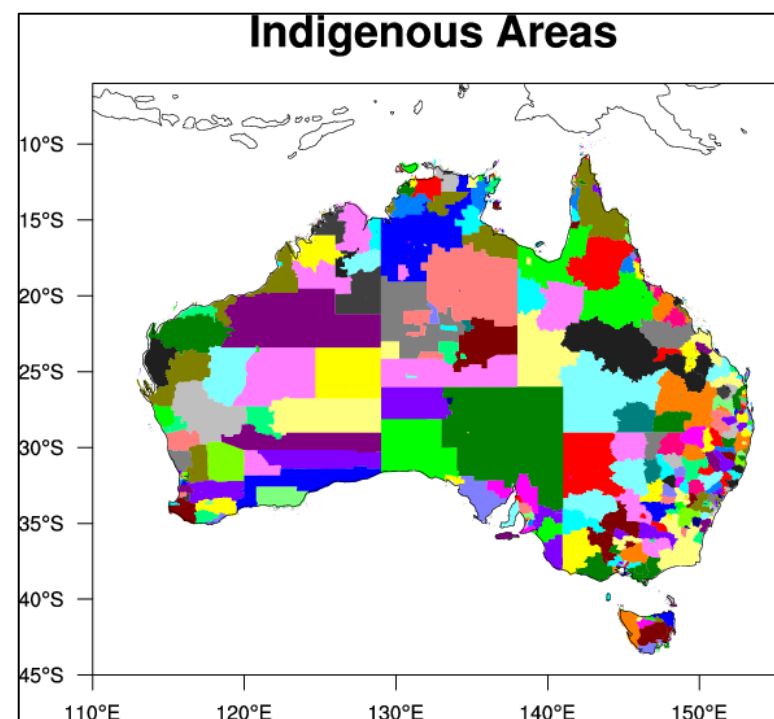
Line – rivers, roads, trails

Polygon – counties, lakes

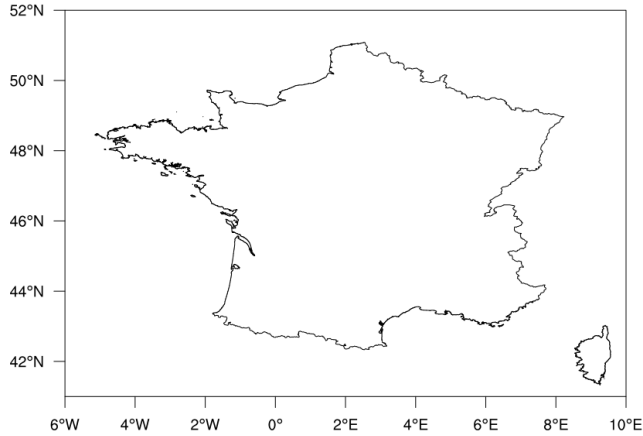
River Basins



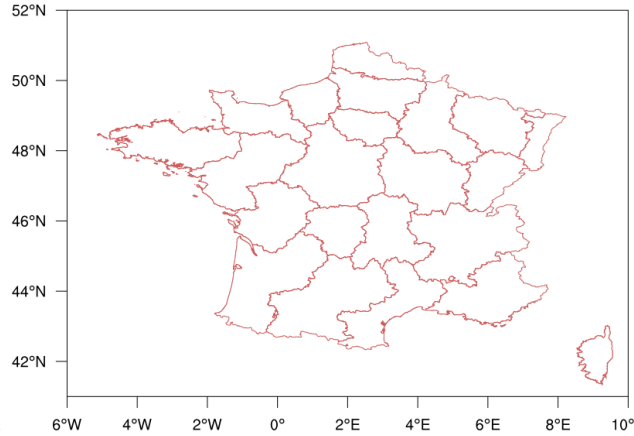
Indigenous Areas



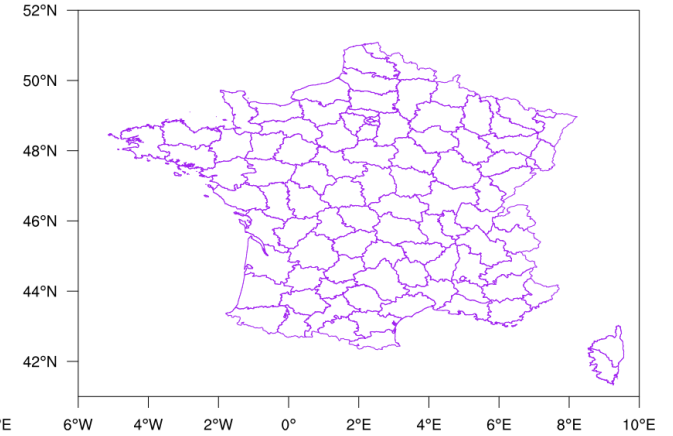
FRA_adm/FRA_adm0.shp



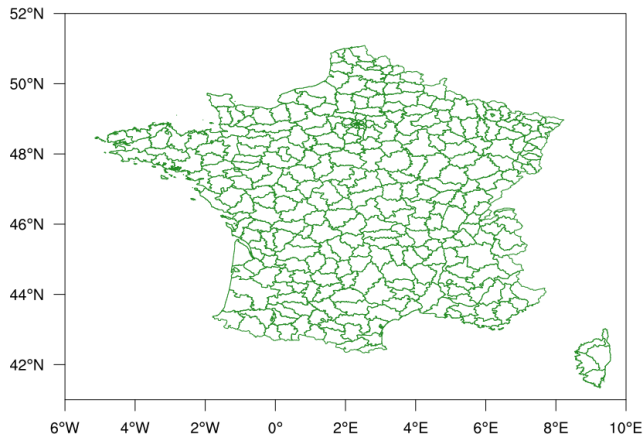
FRA_adm/FRA_adm1.shp



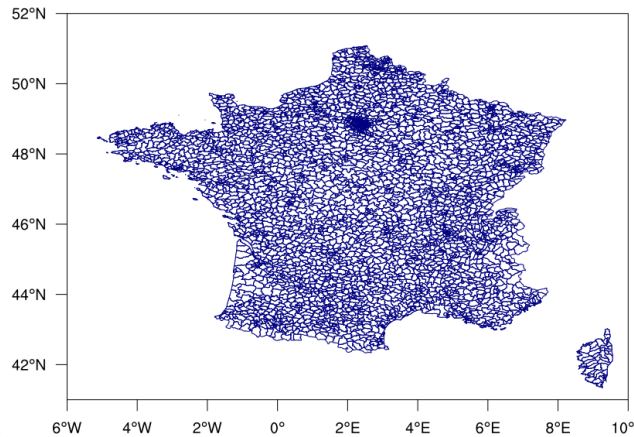
FRA_adm/FRA_adm2.shp



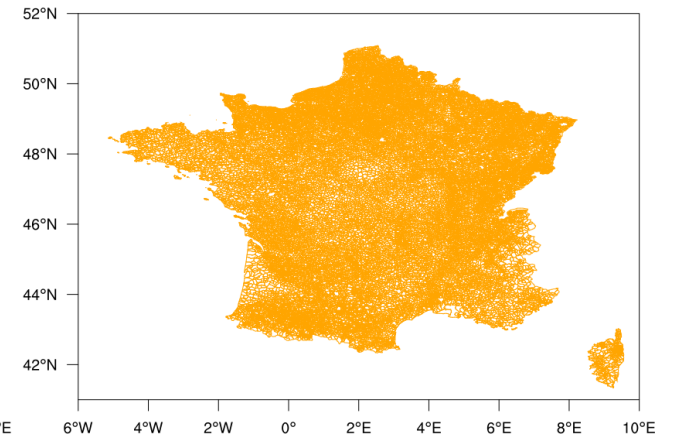
FRA_adm/FRA_adm3.shp



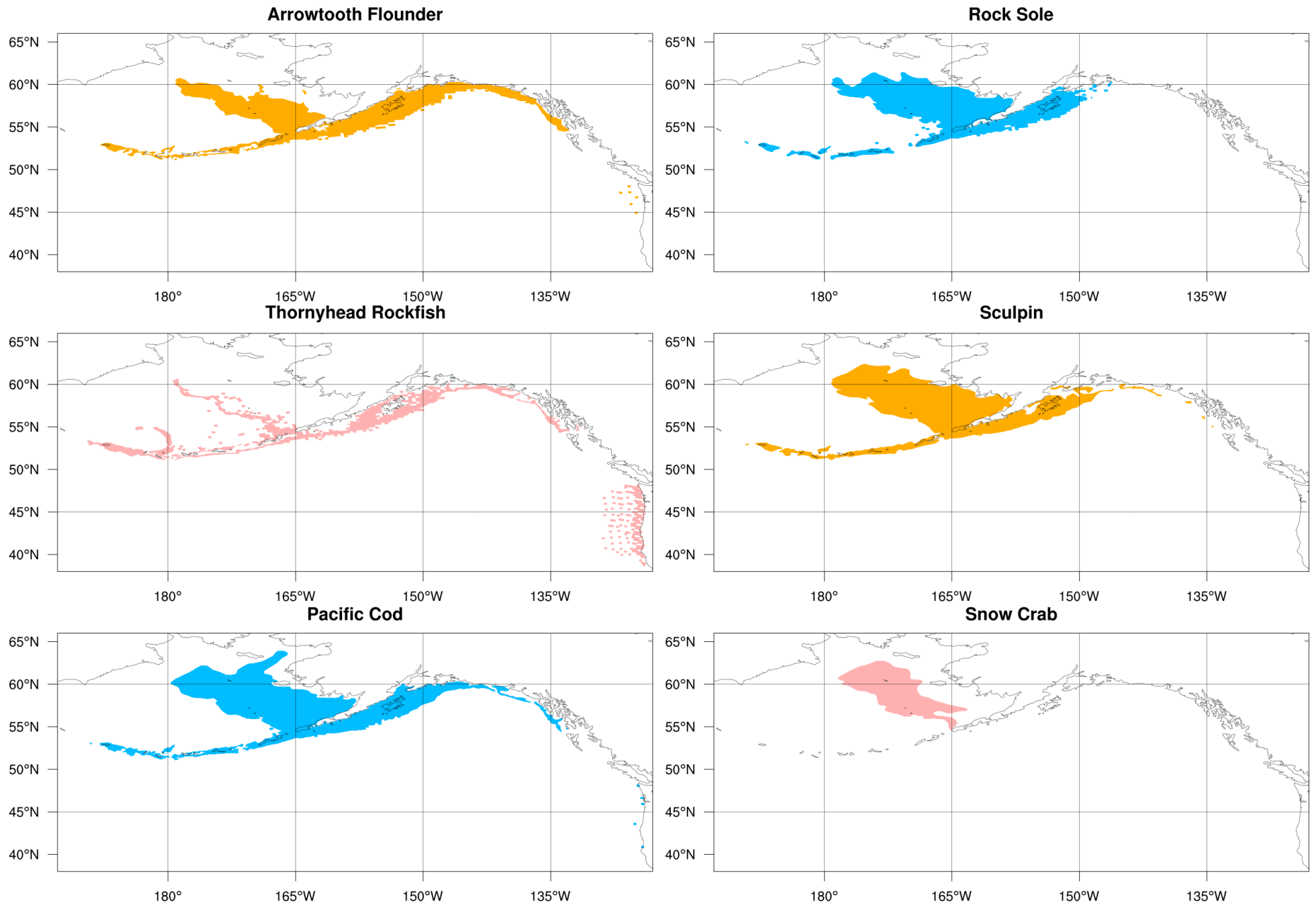
FRA_adm/FRA_adm4.shp



FRA_adm/FRA_adm5.shp



Global Administrative Areas database (<http://www.gadm.org>) offers consistent administrative boundaries at many levels. The level 0 database (nations) is good to use for global or mesoscale results, level 1 is the first level of sub-national administration (typically states/provinces and territories) while level 2 offers the second level of administration and is potentially useful for high-resolution plots.



The "Alaska Essential Fish Habitat Species" shapefile was downloaded from:

<http://alaskafisheries.noaa.gov/habitat/efh/efhshp/default.htm>

Shapefiles useful for masking data

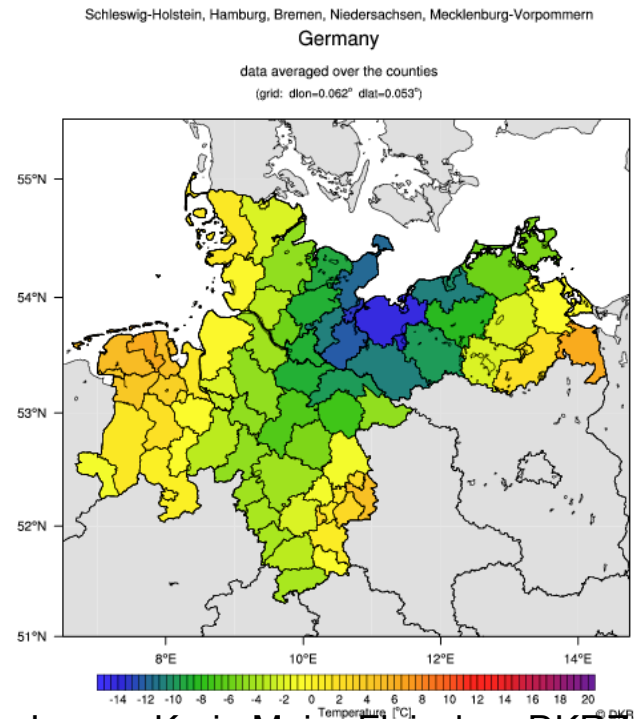
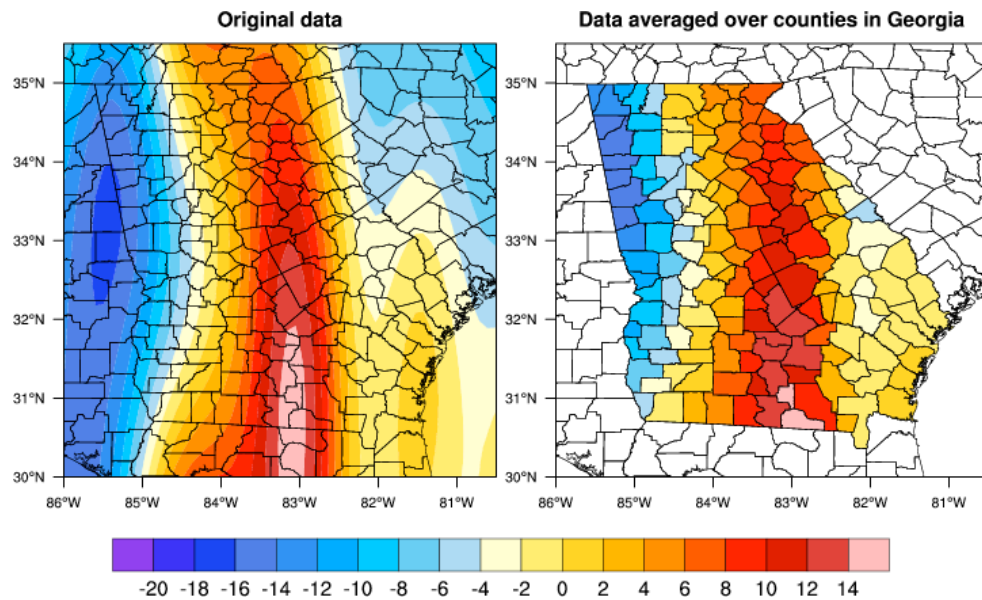
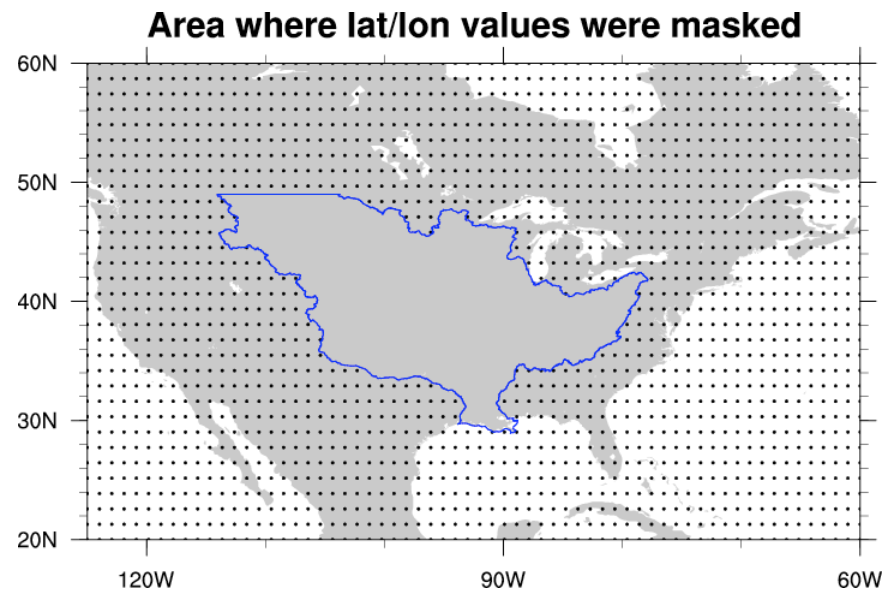
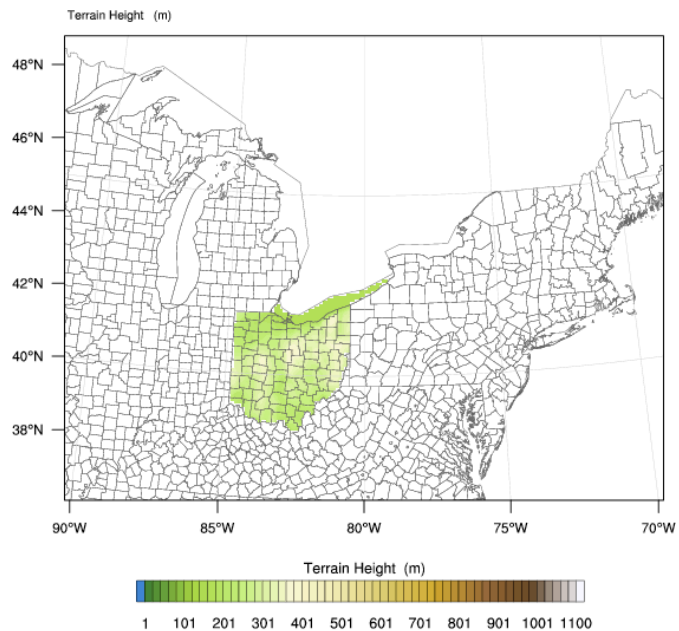
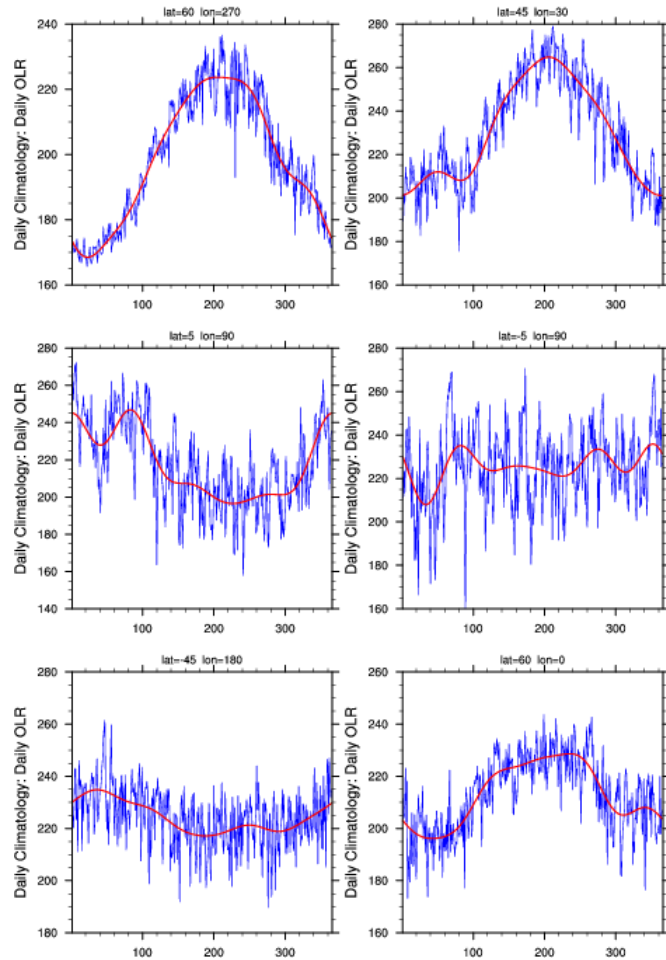


Image: Karin Meier-Fleischer, DKRZ

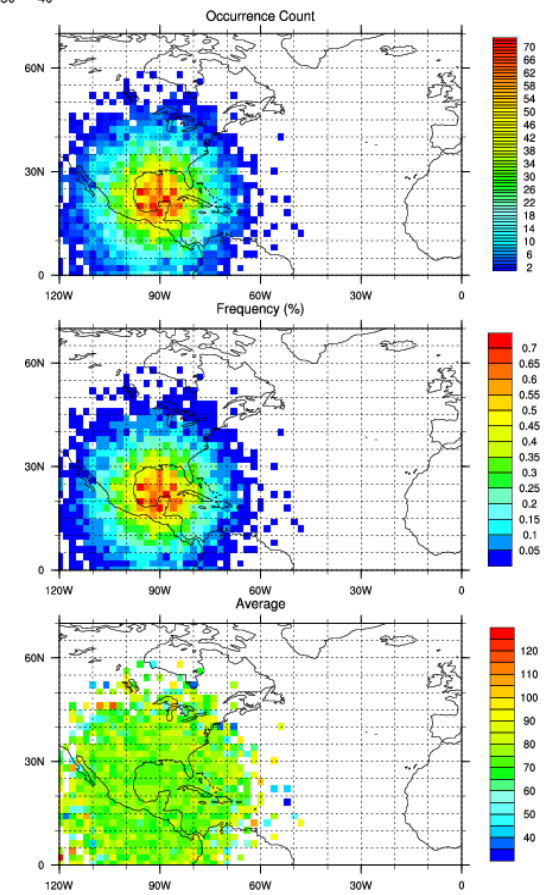
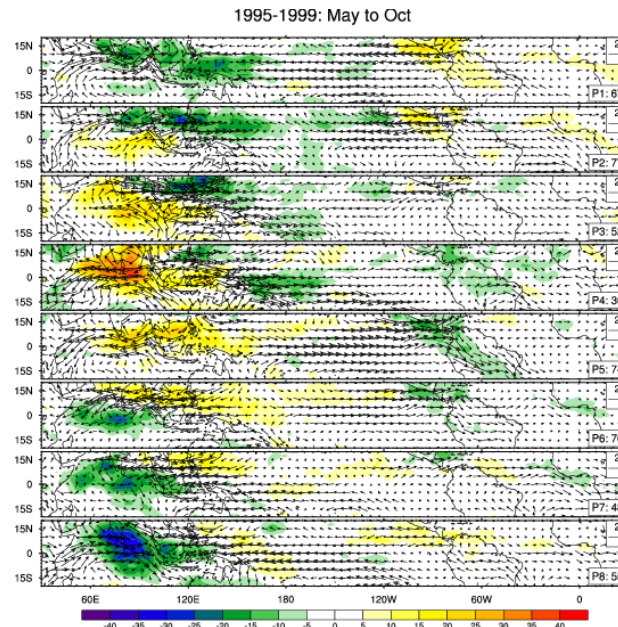
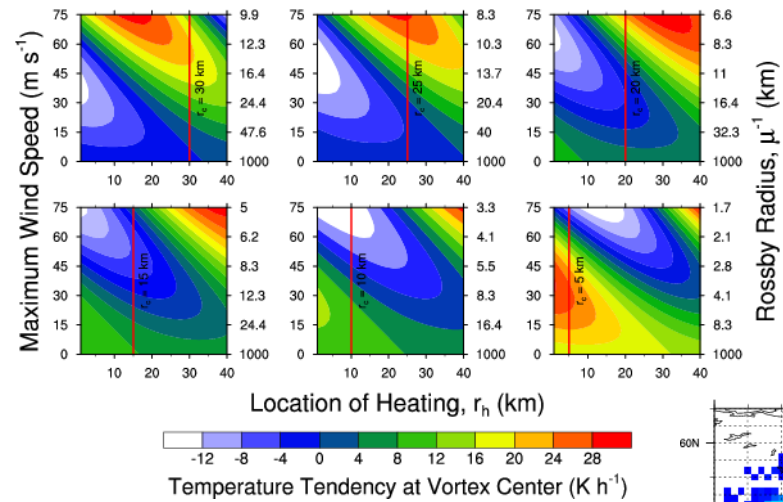


Panel plots – multiple plots on a page

OLR: Raw/Smooth Daily Climatology: 1994-1998

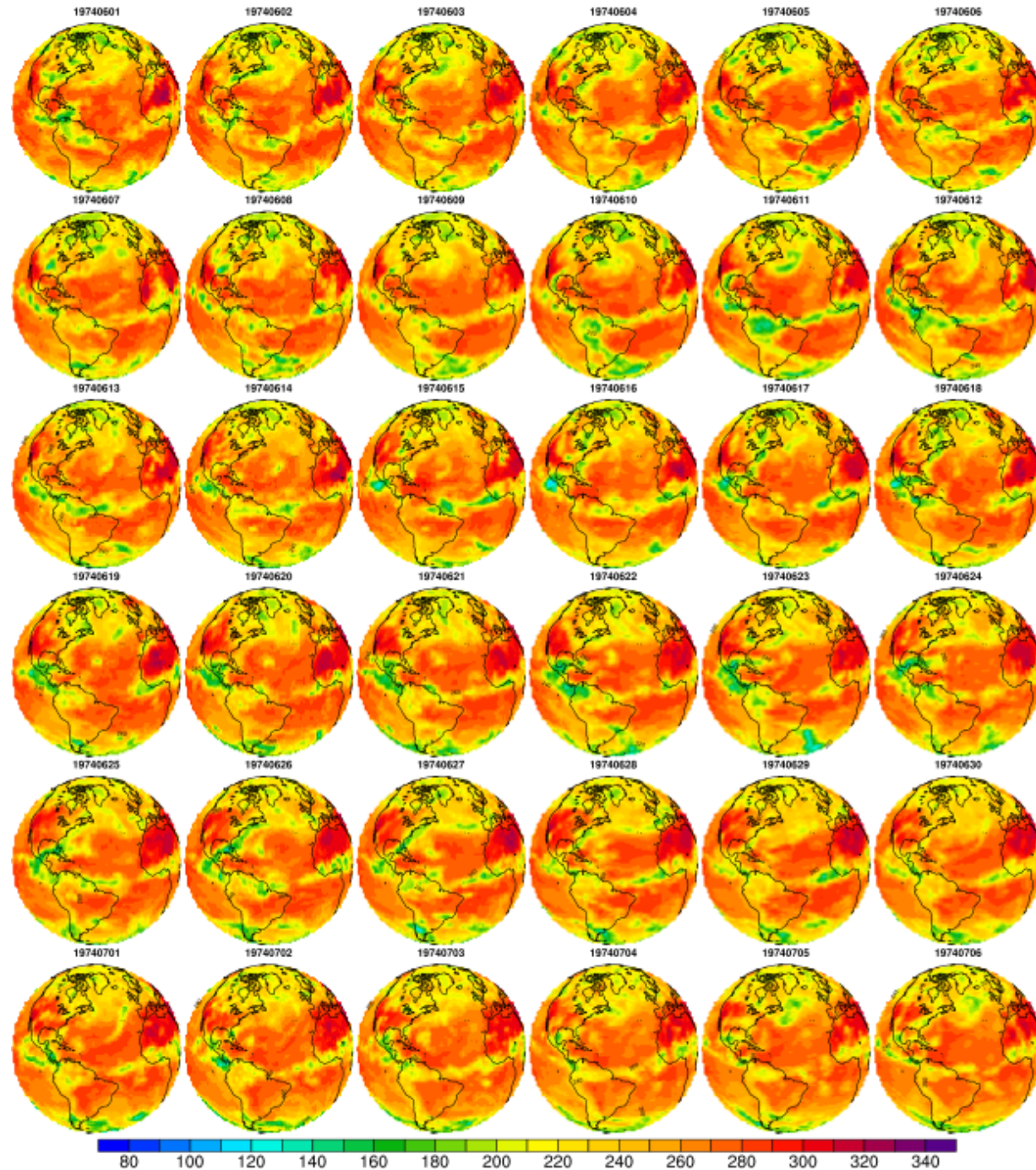


Variation of $T_t(0)$ with Heating Location and Rossby Radius



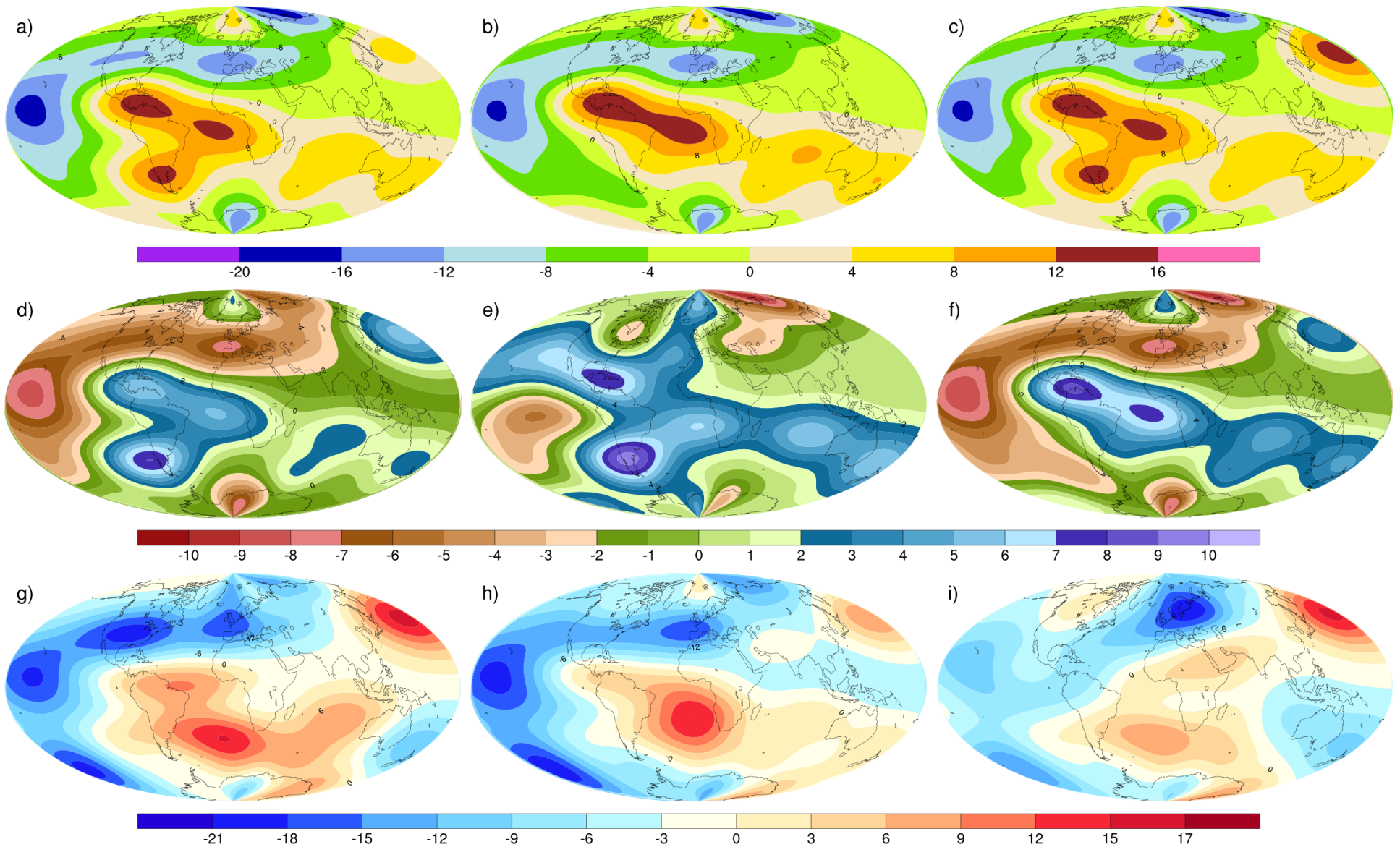
Daily OLR (W/m^2)

OLR file
from
Bob
Setzenfand

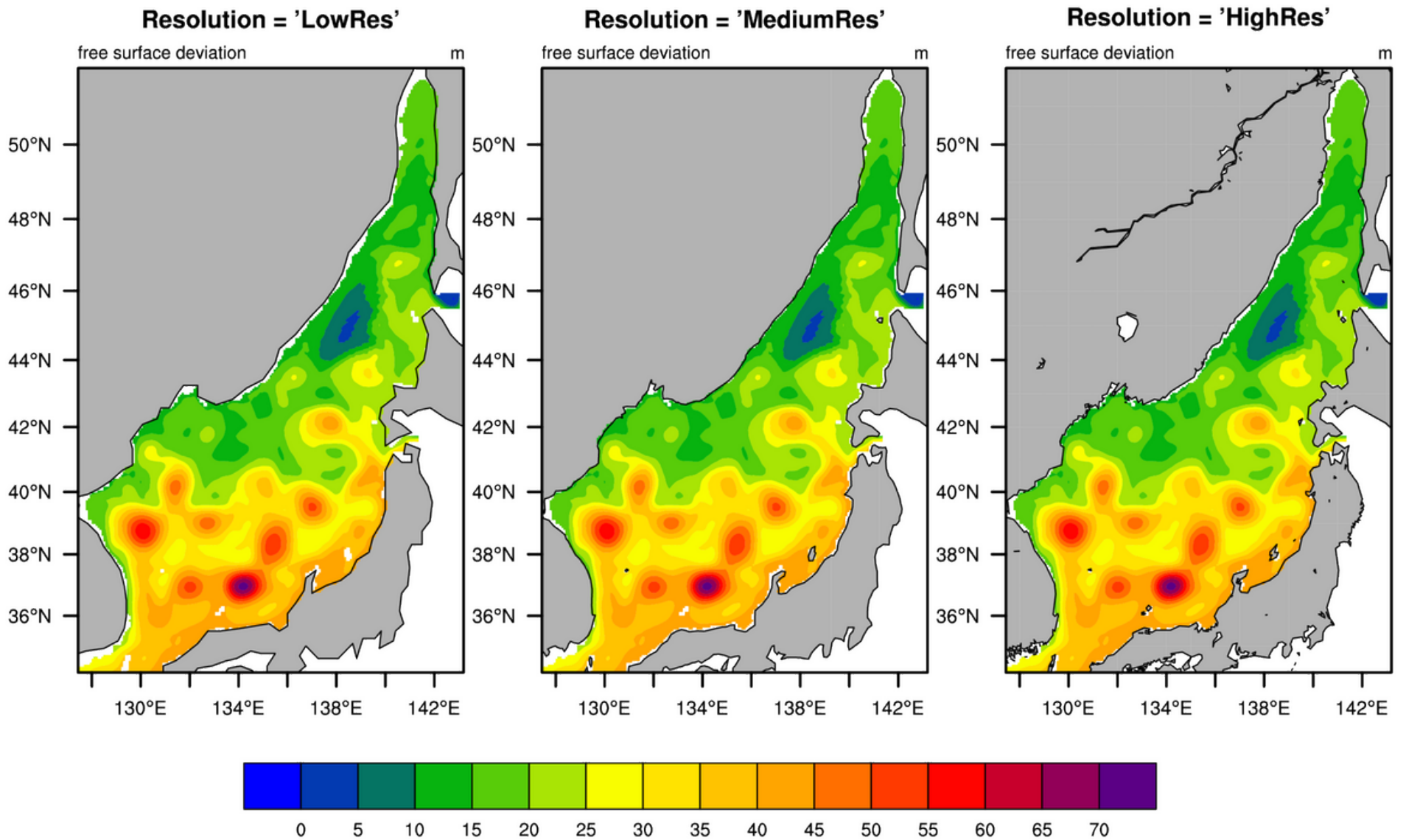


Multiple color maps

Multiple panels on one page, dummy data, 3 different colormaps

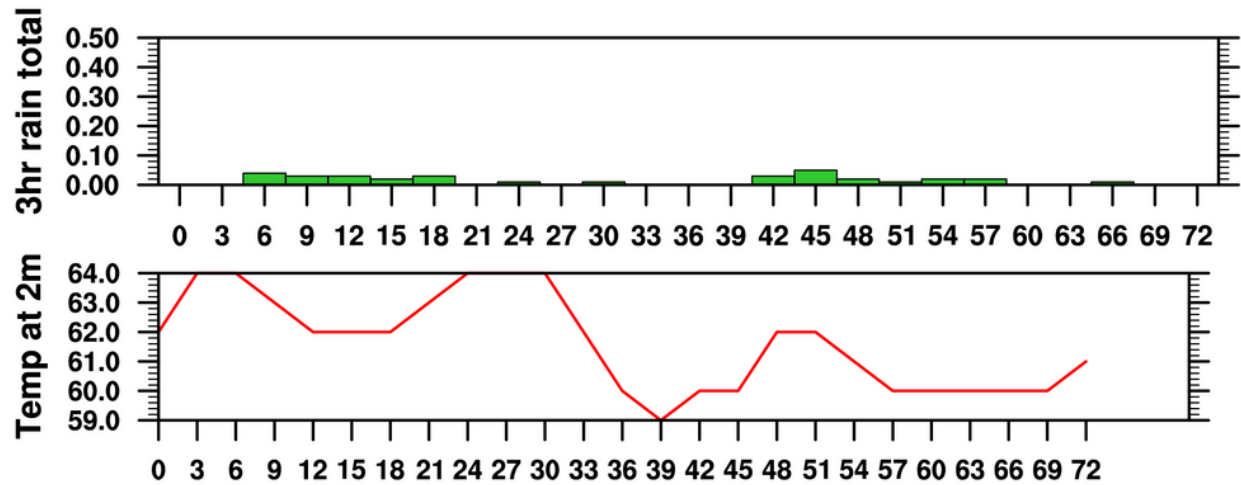
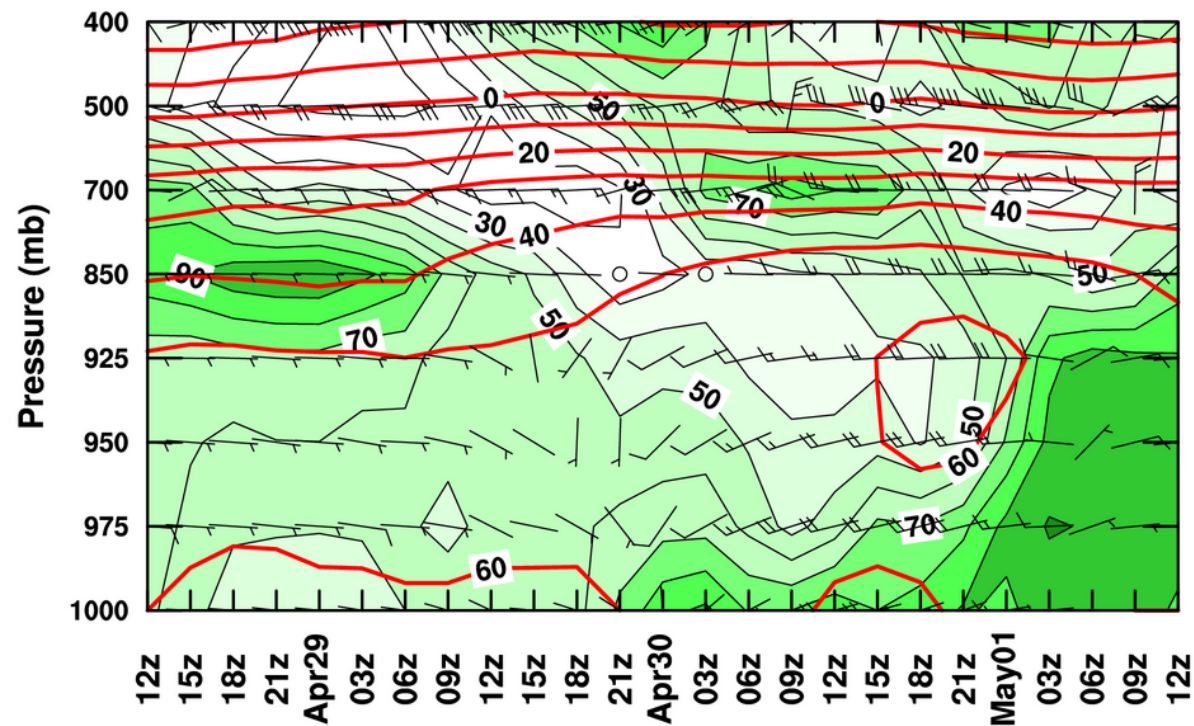


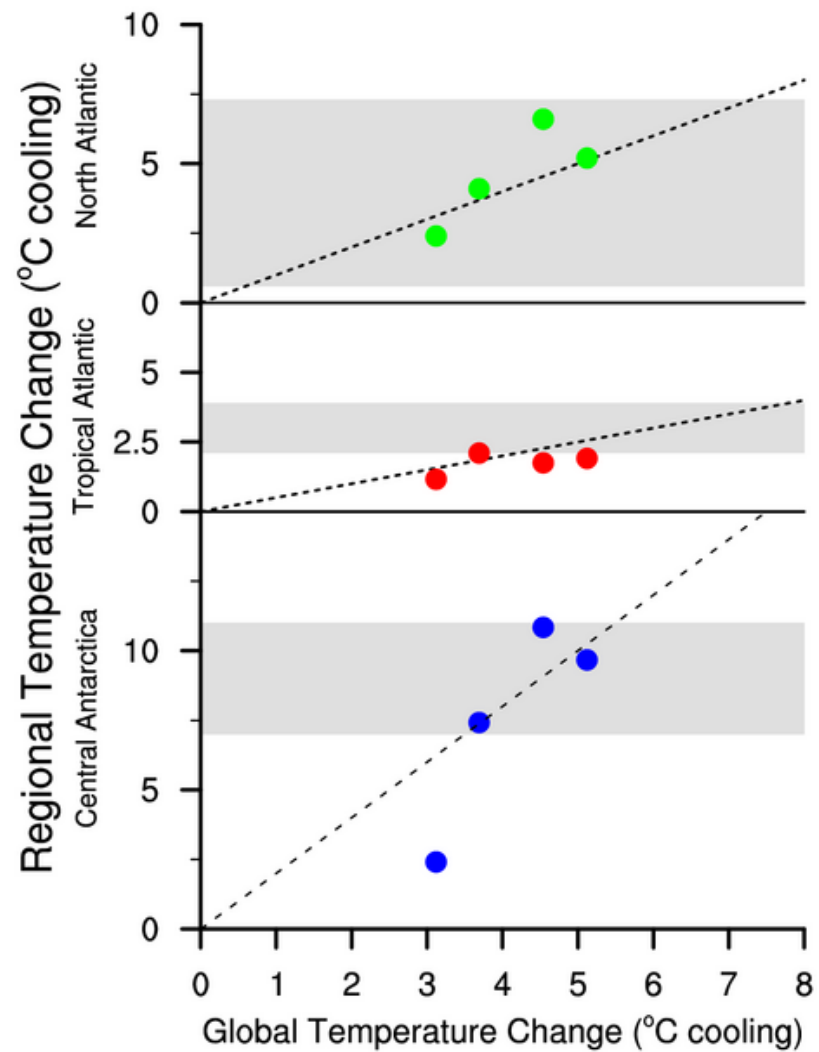
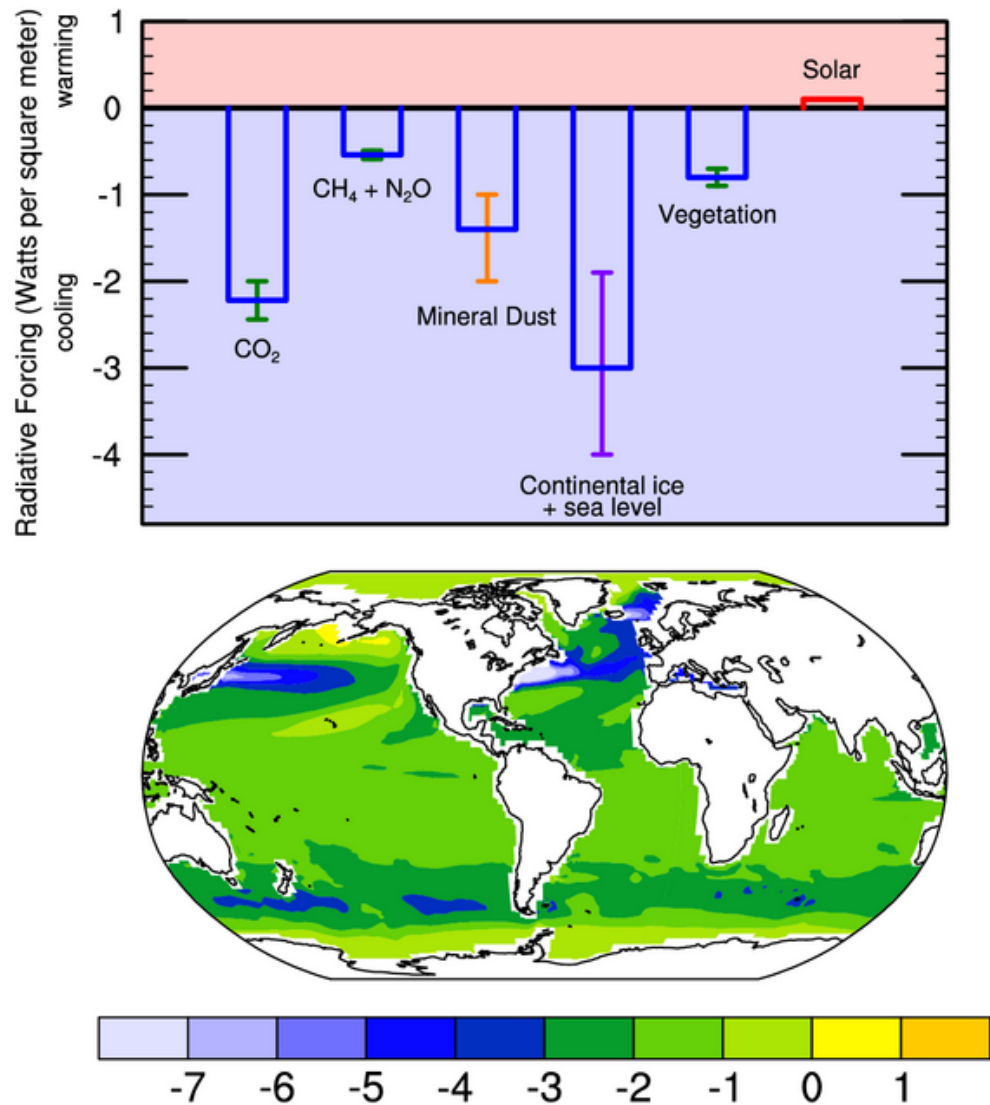
Comparison of coastline resolutions



First two map databases built-in; high-resolution available as simple download

Meteogram for LGSA, 28/12Z

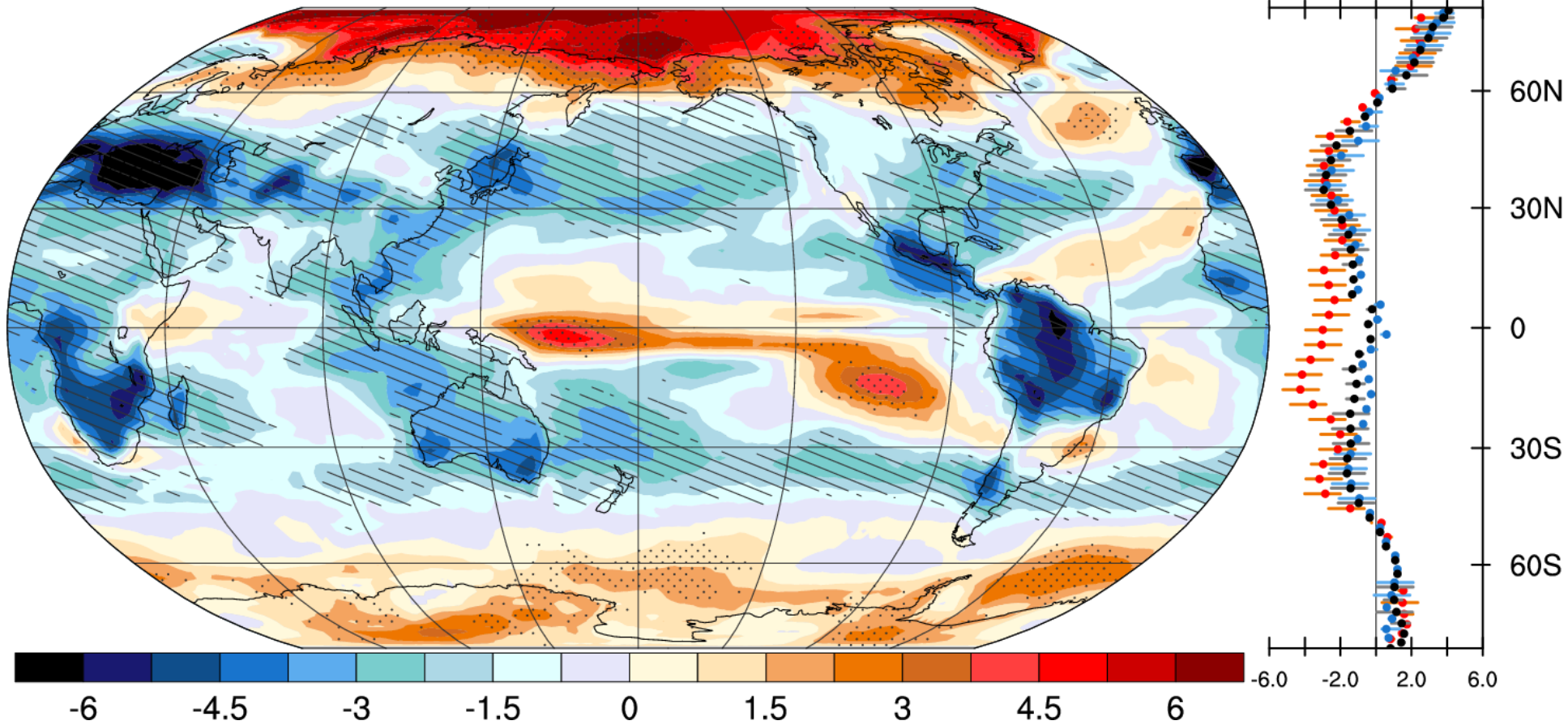




Courtesy Adam Phillips, NCAR CGD

Annual Mean

Cloud % Trend: SRES-A1B: 2000-2100 [% century⁻¹]



John Fasullo, NCAR/CGD

ESMF Regridding

<http://www.earthsystemmodeling.org/>



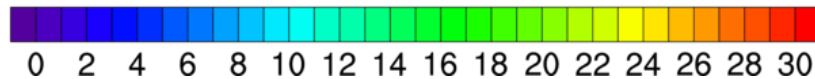
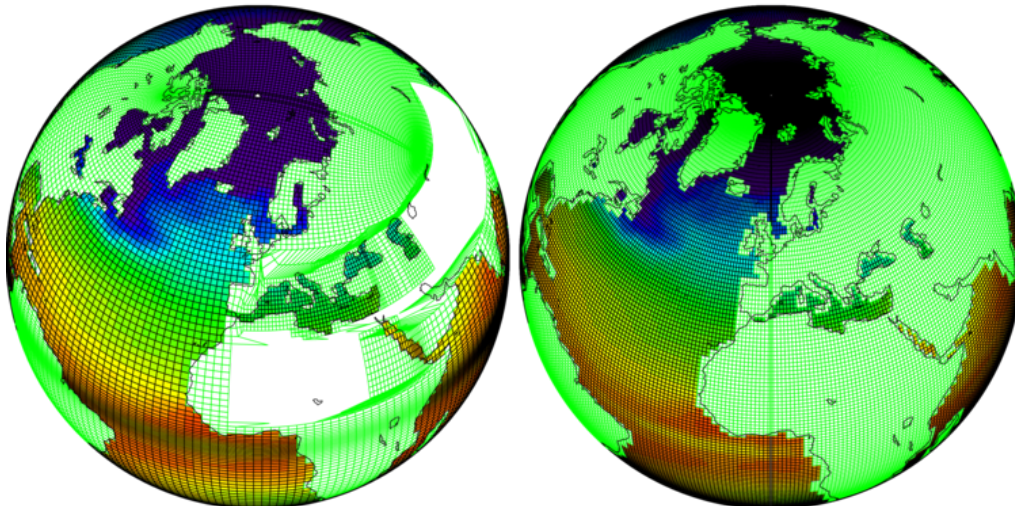
ESMF

Original ORCA grid (149 x 182) regridded to 1 degree (180 x 360)

SST

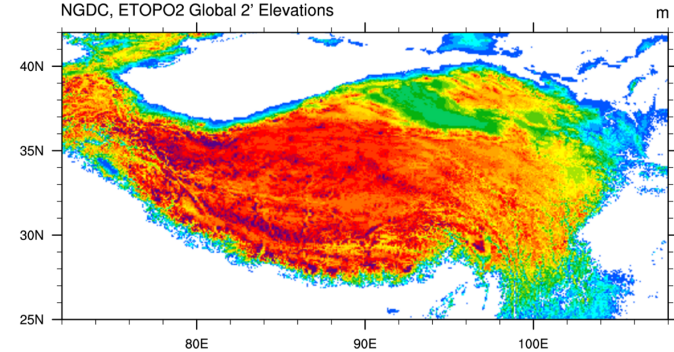
C SST

C



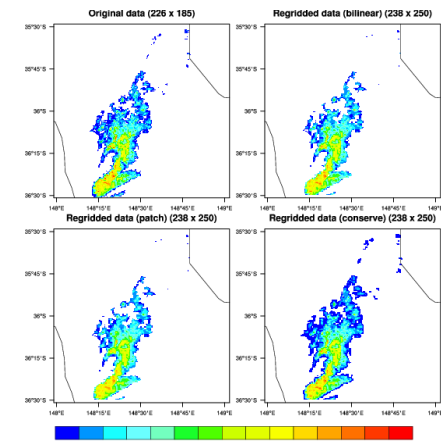
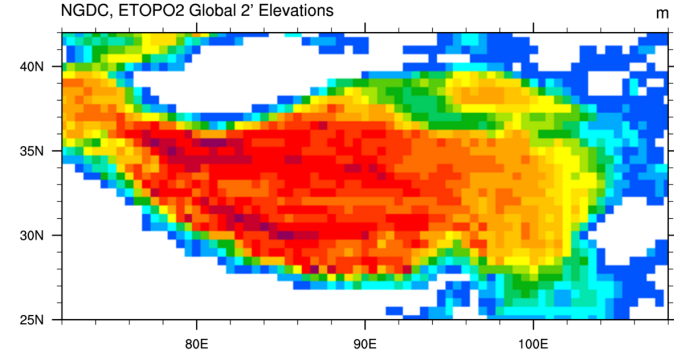
TOPO: Original data 511 x 1081

NGDC, ETOPO2 Global 2' Elevations



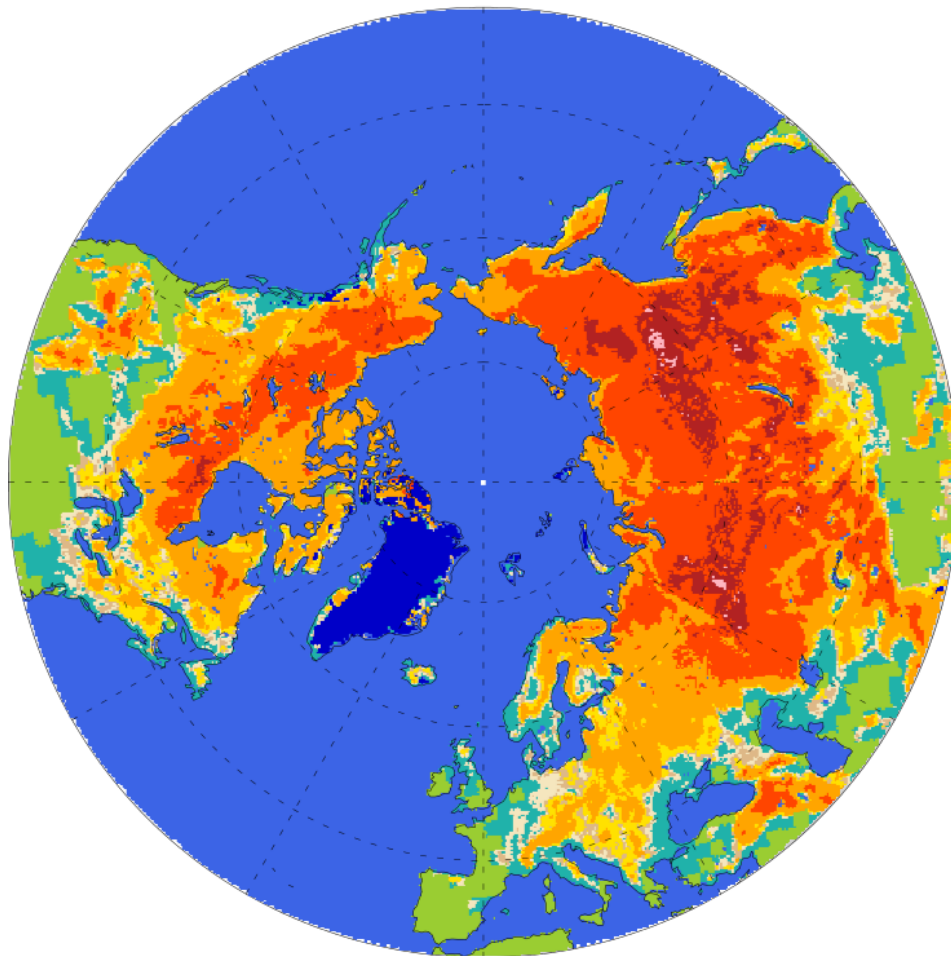
TOPO: Regridded to 0.5 degree 35 x 73 (conserve)

NGDC, ETOPO2 Global 2' Elevations



ESMF Regridding

Original EASE grid (721,721)



Regridded to 0.25 deg grid (359 x 1439)

