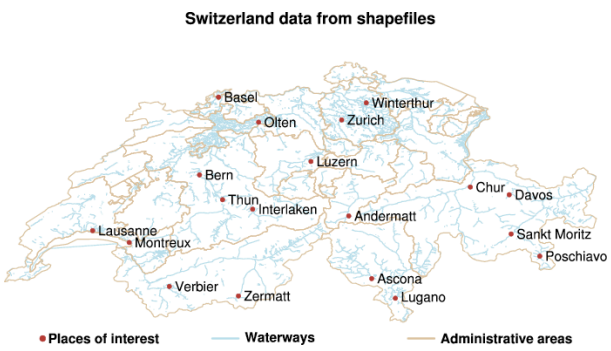
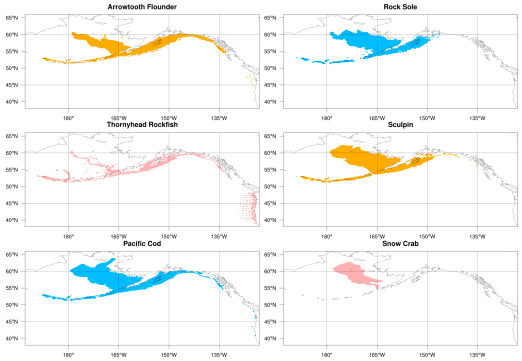
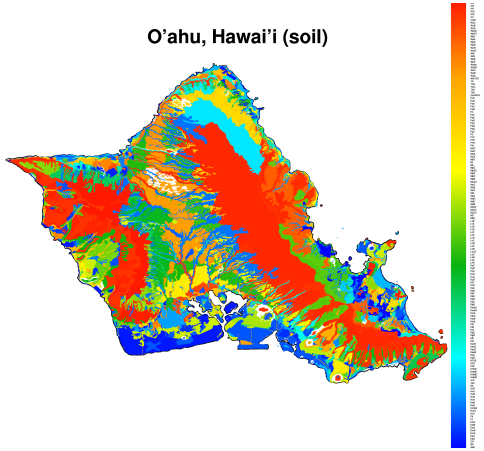
NCL and Shapefiles Webinar

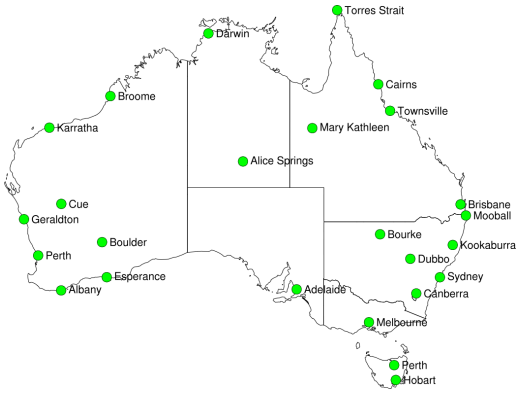
NCAR/CISL VisLab

February 13, 2014
Mary Haley









NCL
NCAR Command Language

CISL

esri

NCAR
NATIONAL CENTER FOR ATMOSPHERIC RESEARCH

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NCL and Shapefiles

- Webinar notes and assumptions
- Shapefile overview
- Example shapefile visualizations
- Demo #1: Examine a couple of shapefiles
- Demo #2: Download and plot shapefile data
- Demo #3: Mask data based on outlines from a shapefile
- Useful links

Notes for live webinar participants

- Type questions in chat window at any time.

  Chat messages may be visible to all participants

  (*Now is a good time to let us know if you are having technical difficulties!*)
- All participants are muted by default.
- You will have opportunity to type comments about the webinar after it is over.
- Webinar will be archived.

Assumptions for this lecture

- You know how to download files using a web browser.
- You are familiar with creating, modifying and executing NCL graphical scripts.
  (If not, you can still follow along.)
- You know basic UNIX commands for saving and moving files or directories.

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What is a shapefile?

From Wikipedia:

http://en.wikipedia.org/wiki/Shapefile

The **Esri Shapefile** or simply a **shapefile** is a popular geospatial vector data format for geographic information systems software. It is developed and regulated by Esri as a (mostly) open specification for data interoperability among Esri and other software products."

A "shapefile" commonly refers to a collection of files with ".shp", ".shx", ".prj", ".dbf", and other extensions on a common prefix name (e.g., "lakes.*"). The actual shapefile relates specifically to files with the ".shp" extension, however this file alone is incomplete for distribution, as these other supporting files are required.

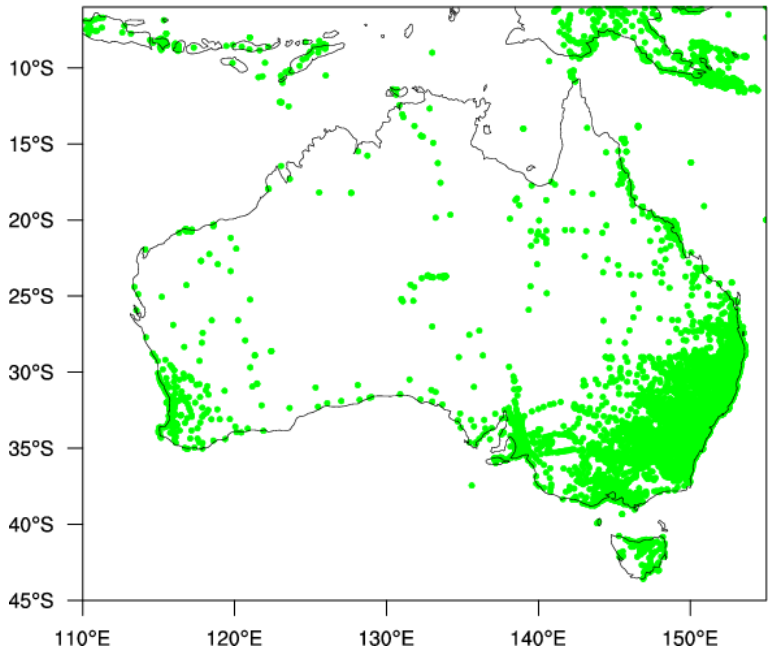
Shapefile naming conventions

- The file must end with ".shp" and have corresponding ".shx" and ".dbf" files
  Ex: "placept.shp", "placept.shx", "placept.dbf"
- You may see other related files, like ".prj", and ".xml". These are informational.
- Keep all files together!

What's in a shapefile?

- Shapefiles consist of three types of geographic data:
  - Point (locations of cities or places of interest, population data, election data)
  - Polyline (**non-closed** boundaries like rivers, roads, trails)
  - Polygon (**closed** geographic boundaries like countries, states, provinces, territories, lakes)
- Only one type per file.
- Unfortunately, not much metadata!

Places of interest



The three types of shapefiles supported by NCL:

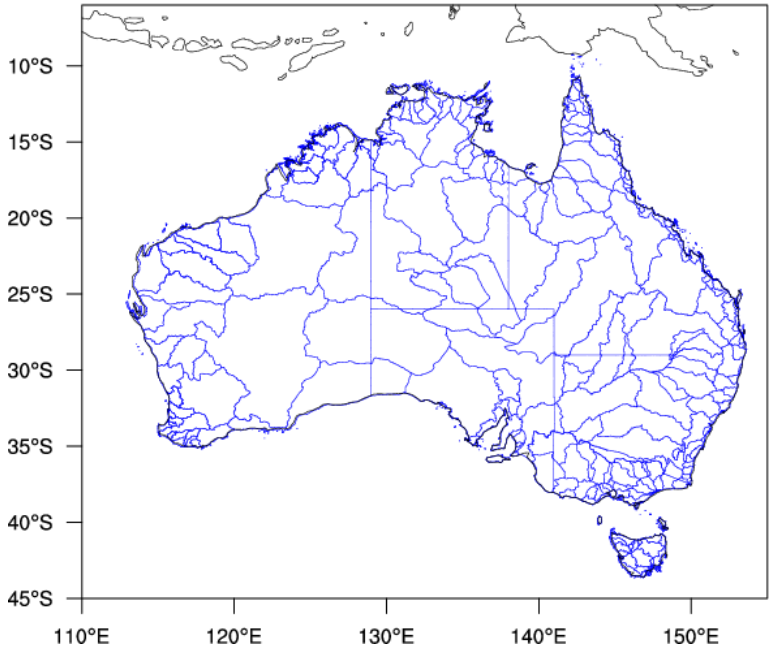
Point – locations of cities, population data

Polyline – rivers, roads, trails

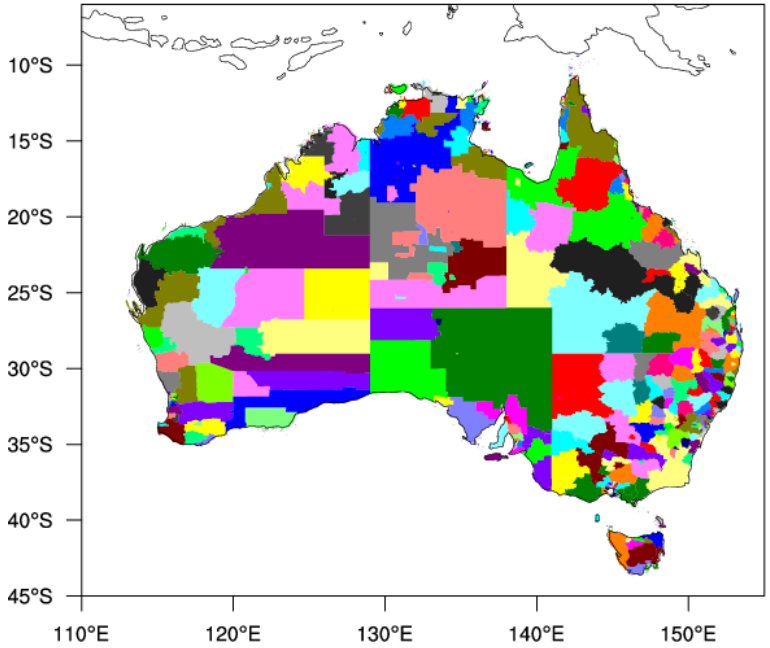
Polygon – counties, lakes

Shapefiles from:
http://e-atlas.org.au/content/au-ga-river-basins-1997
http://www.abs.gov.au/

River Basins



Indigenous Areas



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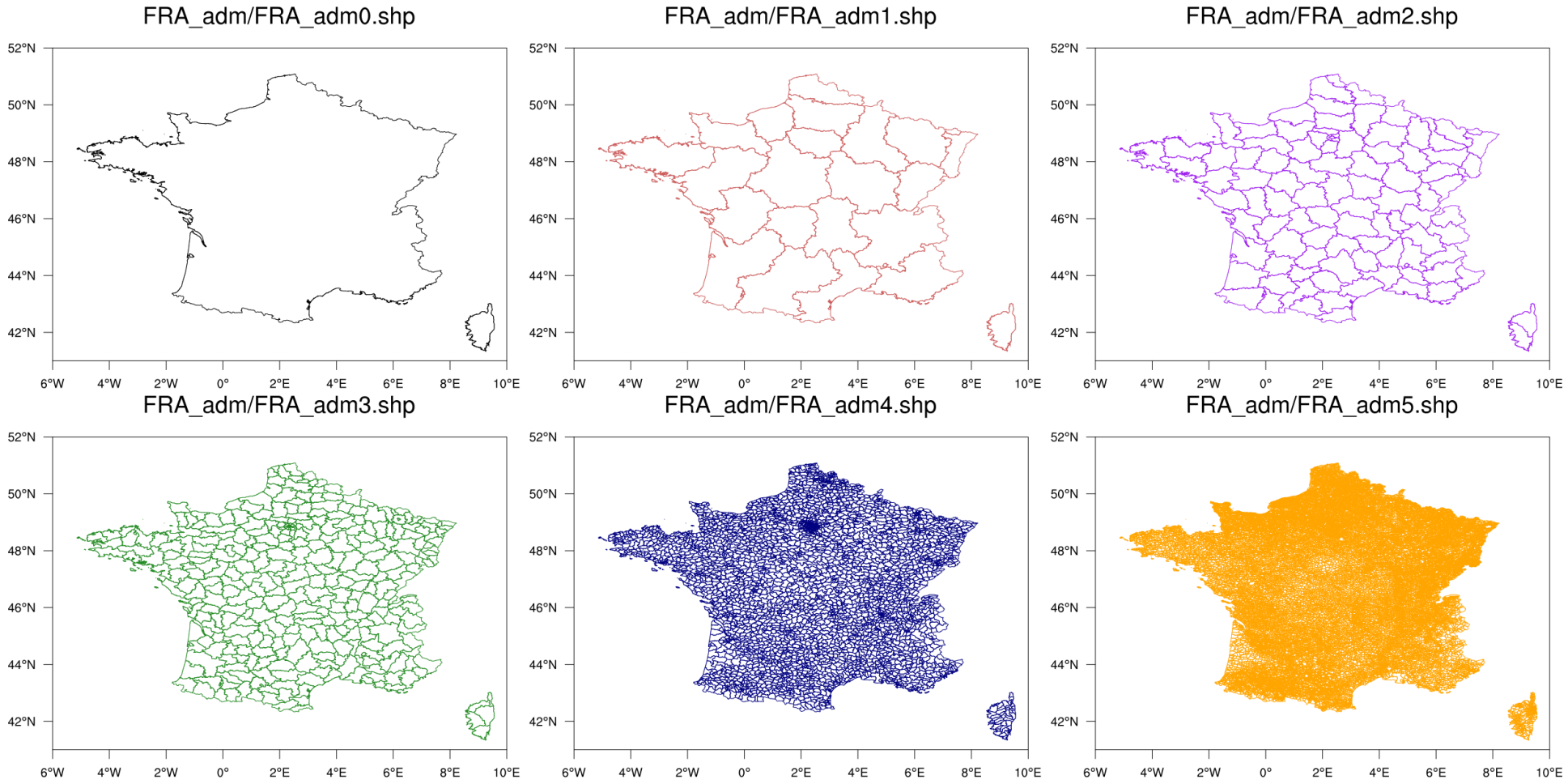
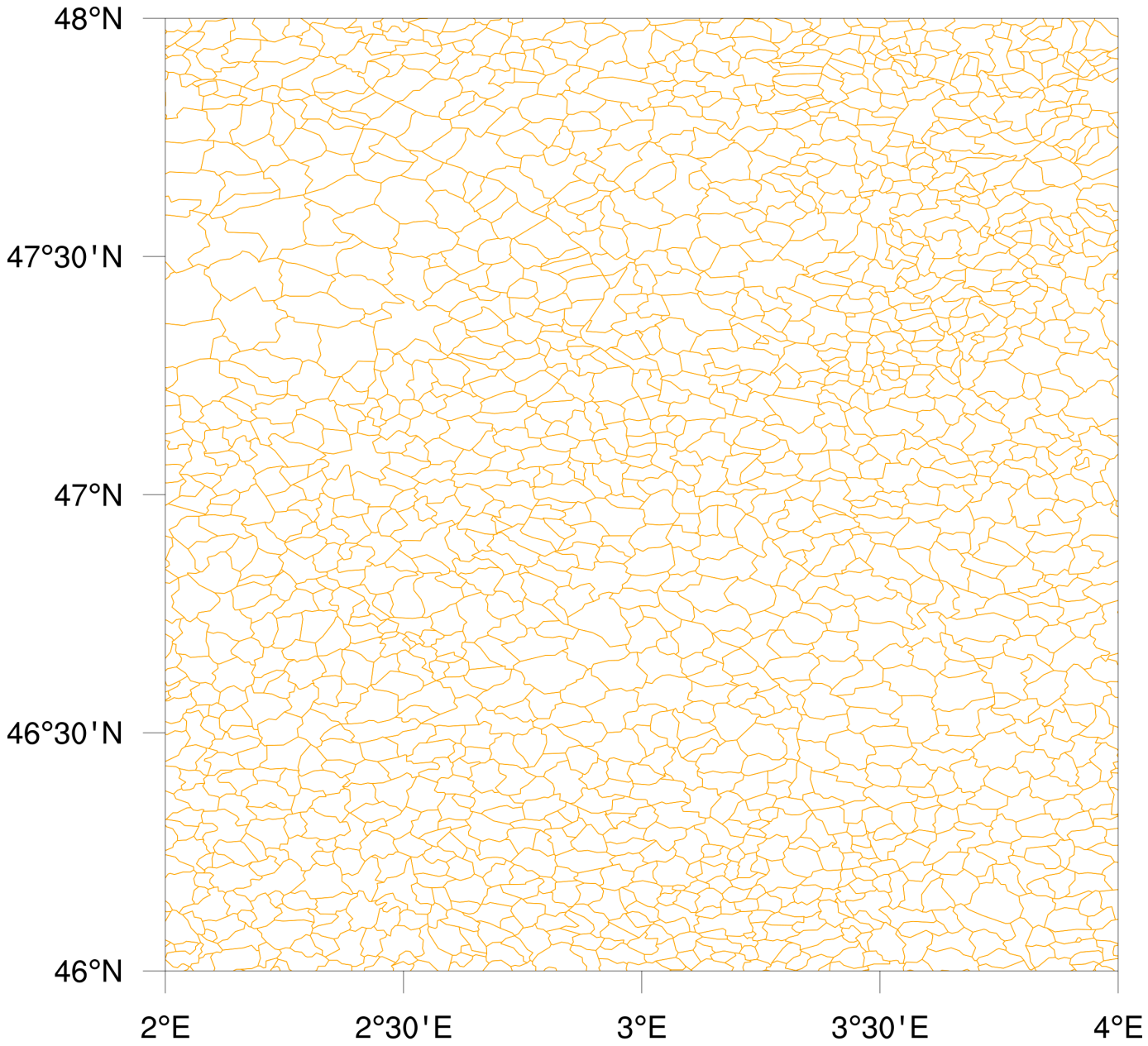


Global Administrative Areas database (http://www.gadm.org) offers consistent administrative boundaries at many levels. The level 0 database (nations) is good to use for global or mesoscale results, level 1 is the first level of sub-national administration (typically states/provinces and territories)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

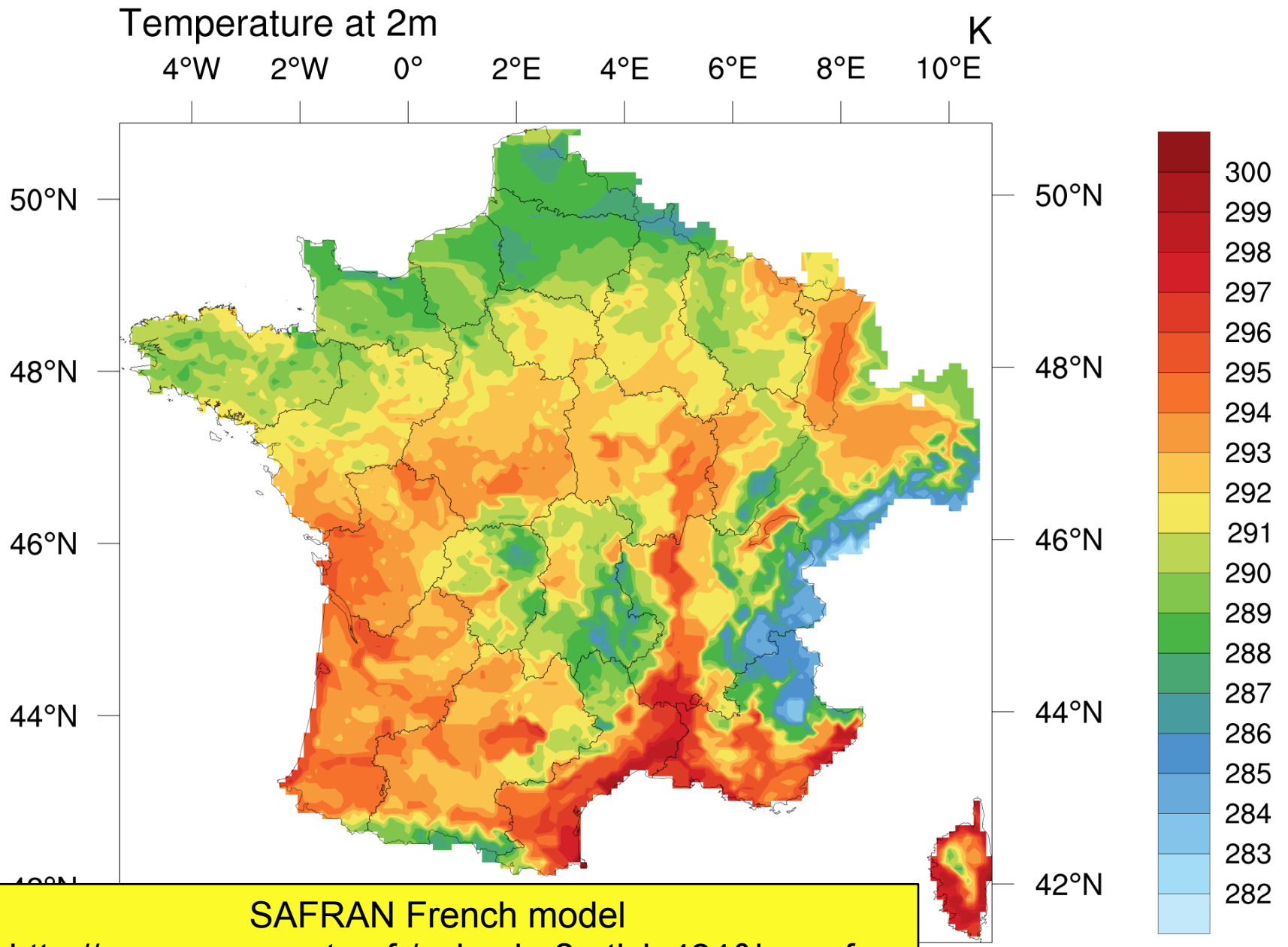
Zooming in on FRA_adm5.shp

Note: in NCL V6.2.0, polygon and polyline shapefiles will draw *much* faster.

7.35 seconds versus 537 seconds!



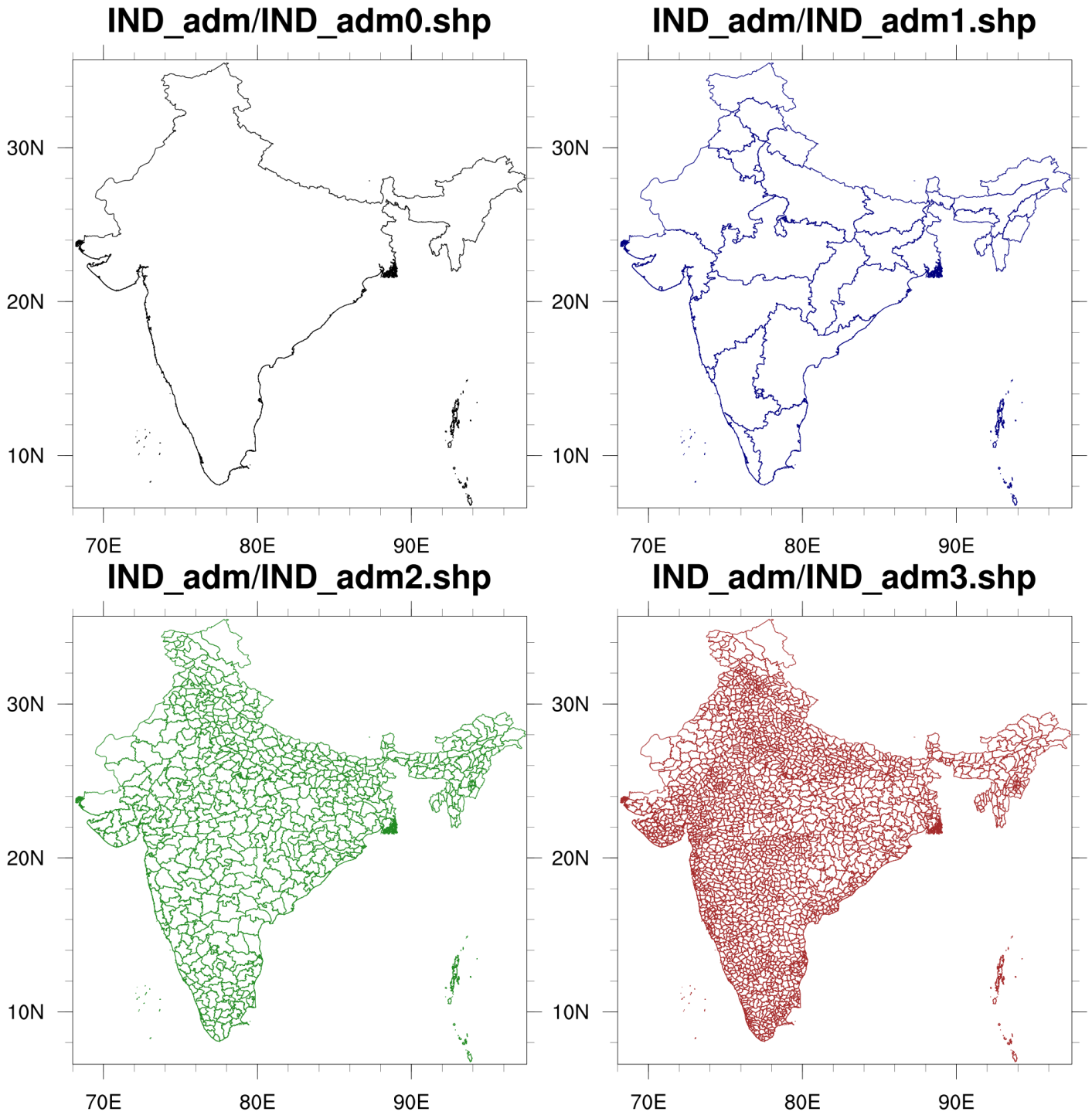
ForcT.DAT_france_0001.nc

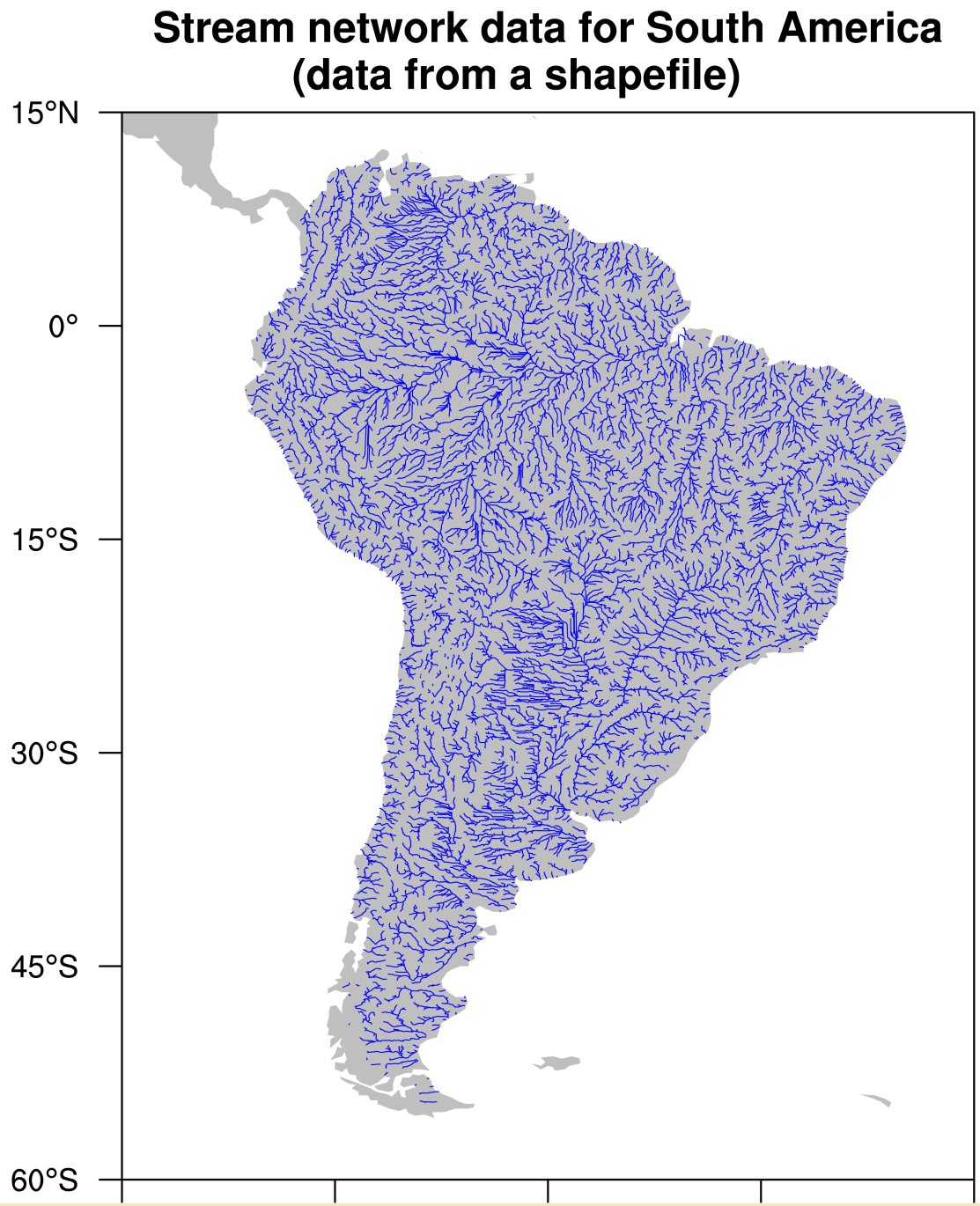


SAFRAN French model

http://www.cnrm.meteo.fr/spip.php?article424&lang=fr

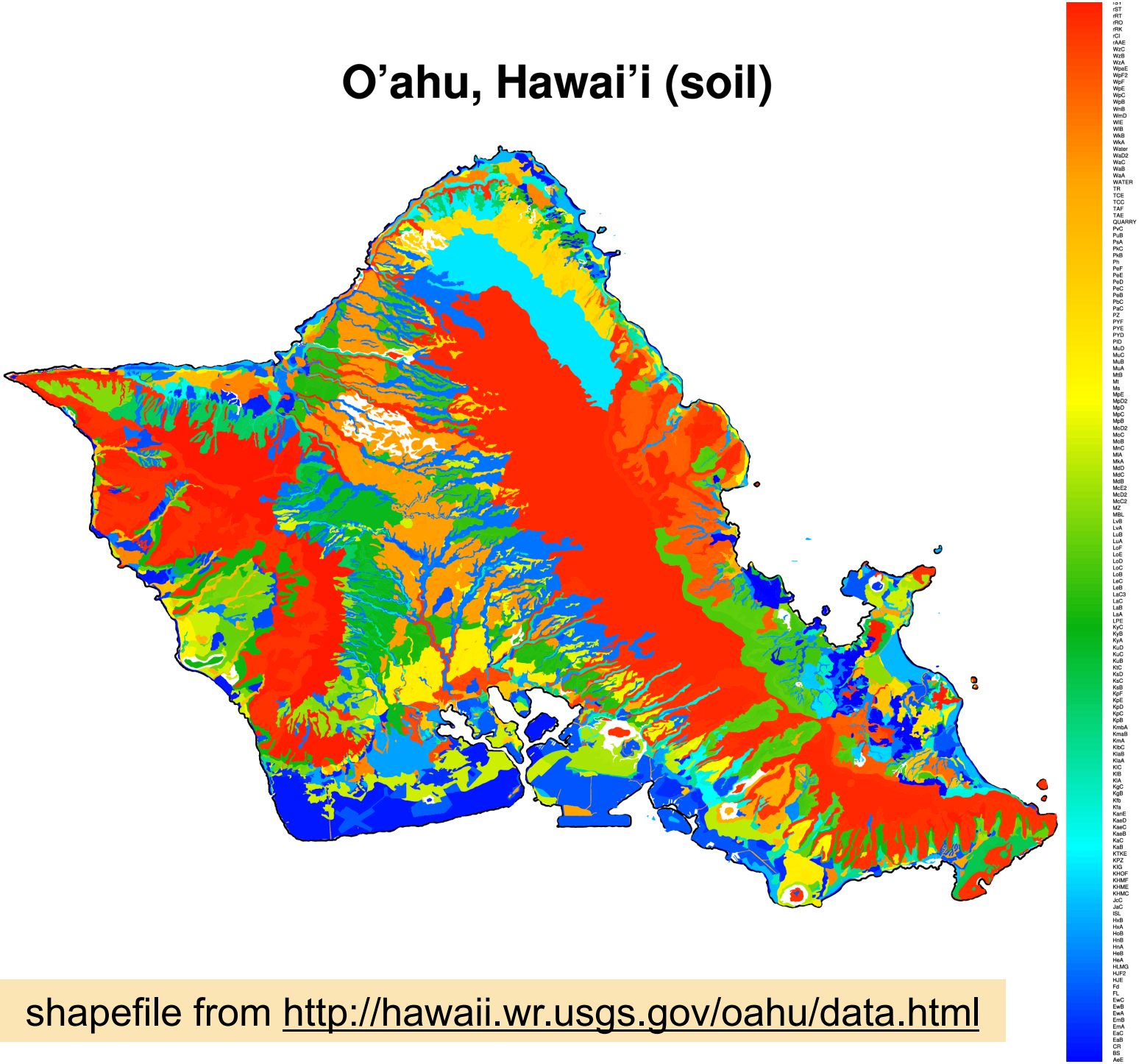
Data provided by Clotilde Dubois of Météo-France


IND_adm/IND_adm0.shp
IND_adm/IND_adm1.shp
IND_adm/IND_adm2.shp
IND_adm/IND_adm3.shp
30N
20N
10N
70E
80E
90E

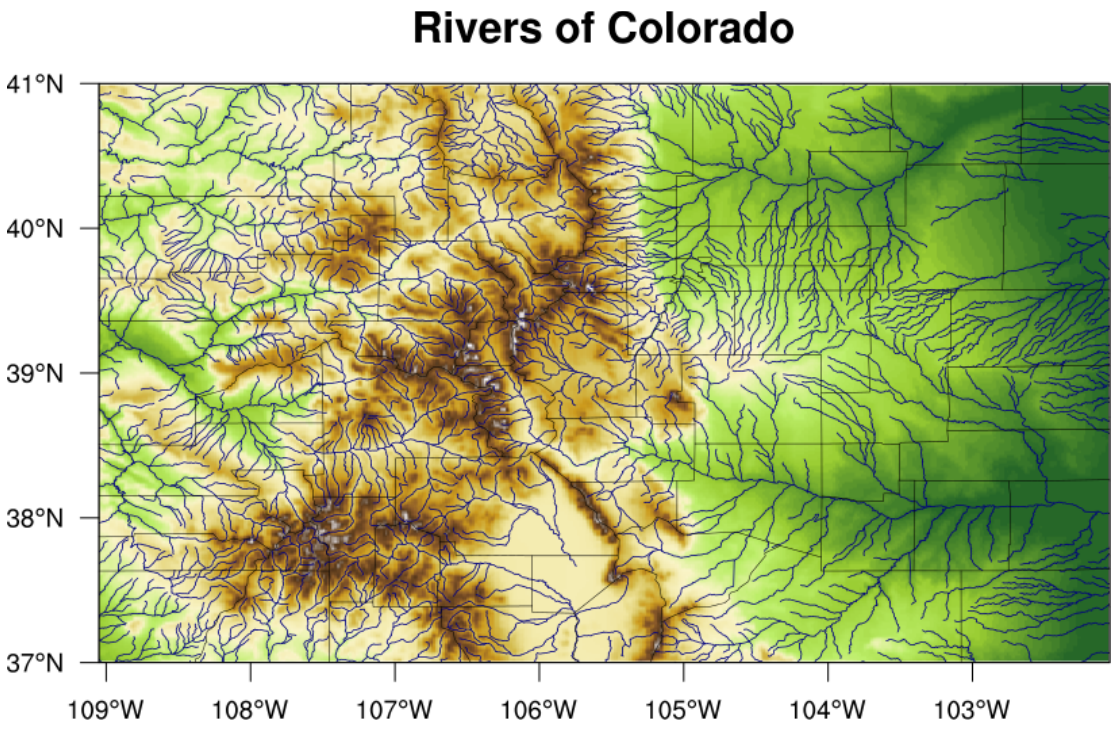


http://eros.usgs.gov/#/Find_Data/Products_and_Data_Available/gtopo30/hydro/samerica

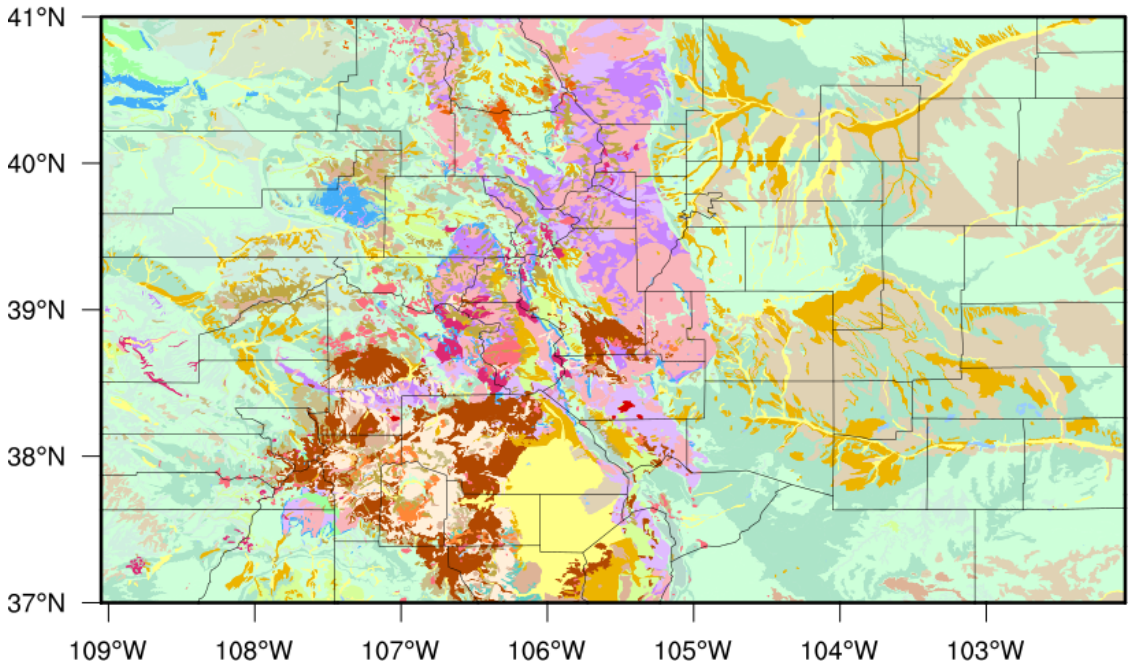
O’ahu, Hawai’i (soil)



shapefile from http://hawaii.wr.usgs.gov/oahu/data.html

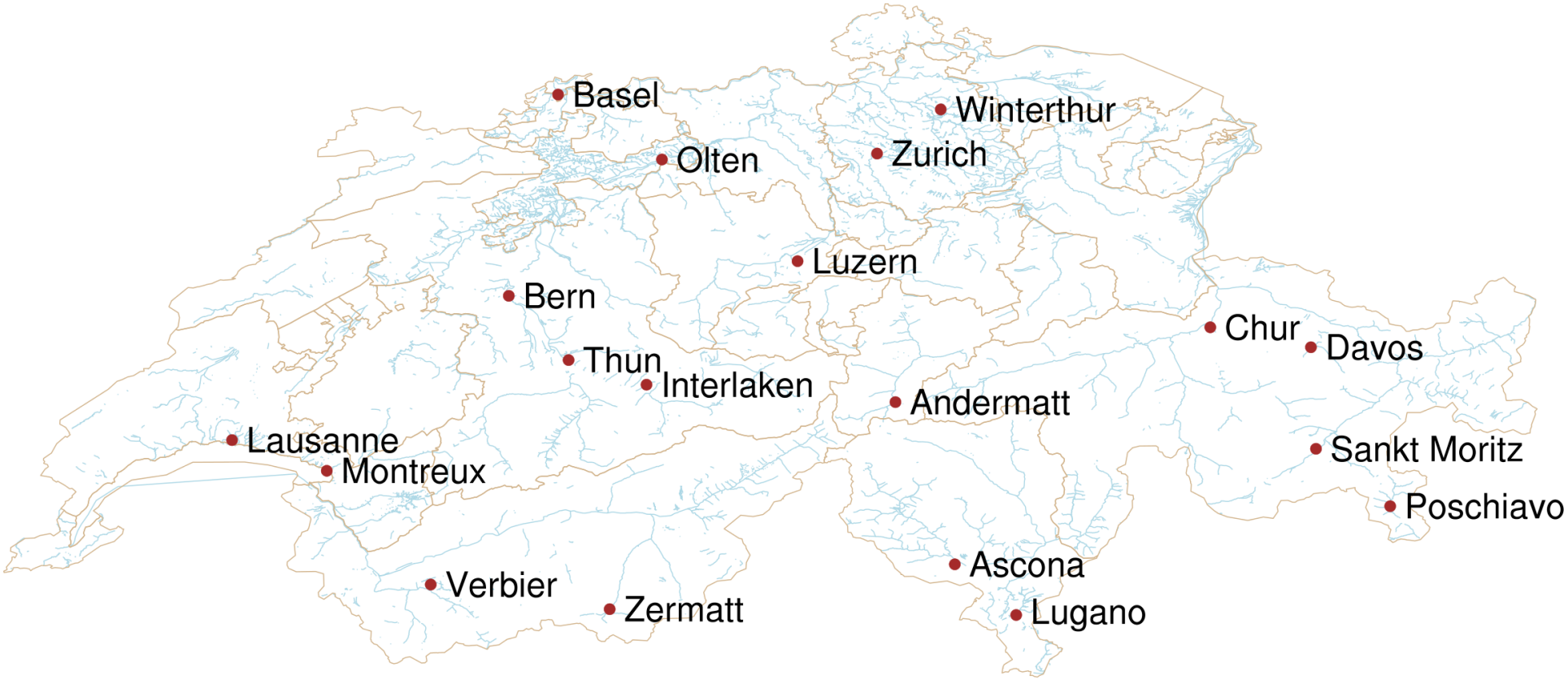


Rivers of Colorado:
http://www.nws.noaa.gov/geodata/
/catalog/hydro/html/rivers.htm



Geologic features in Colorado
http://mrdata.usgs.gov/geology/
state/

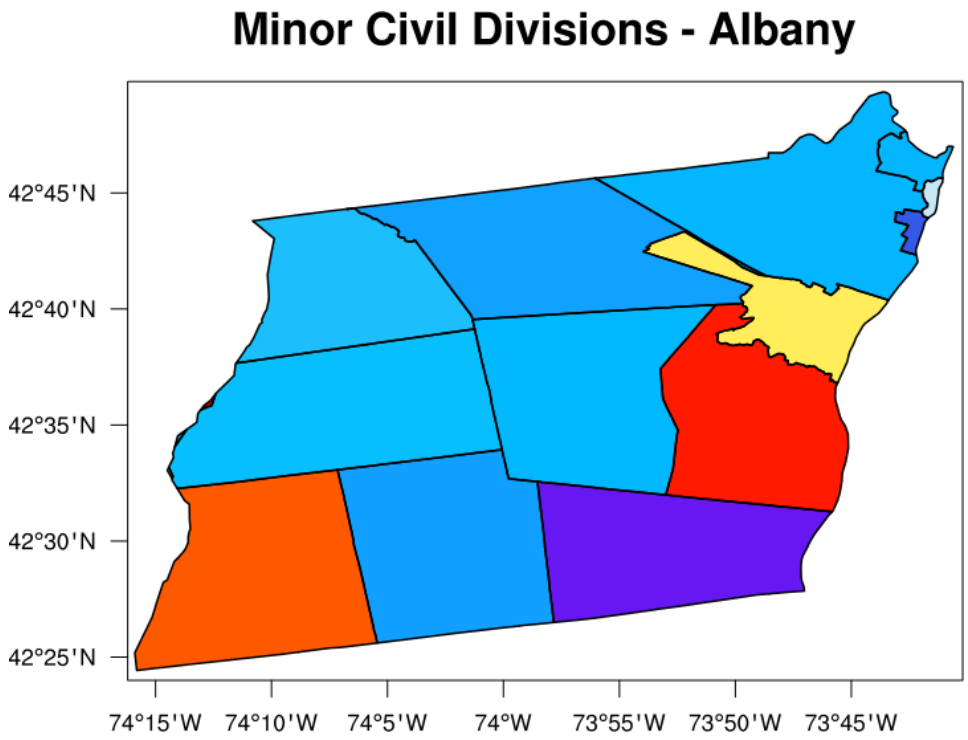
Switzerland data from three different shapefiles

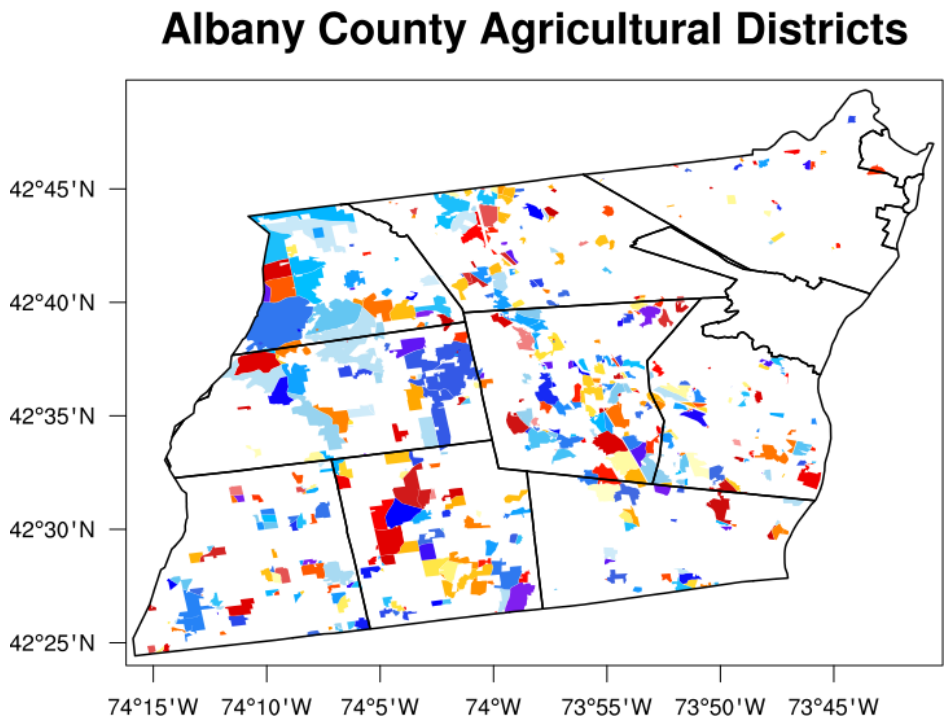


Data from:

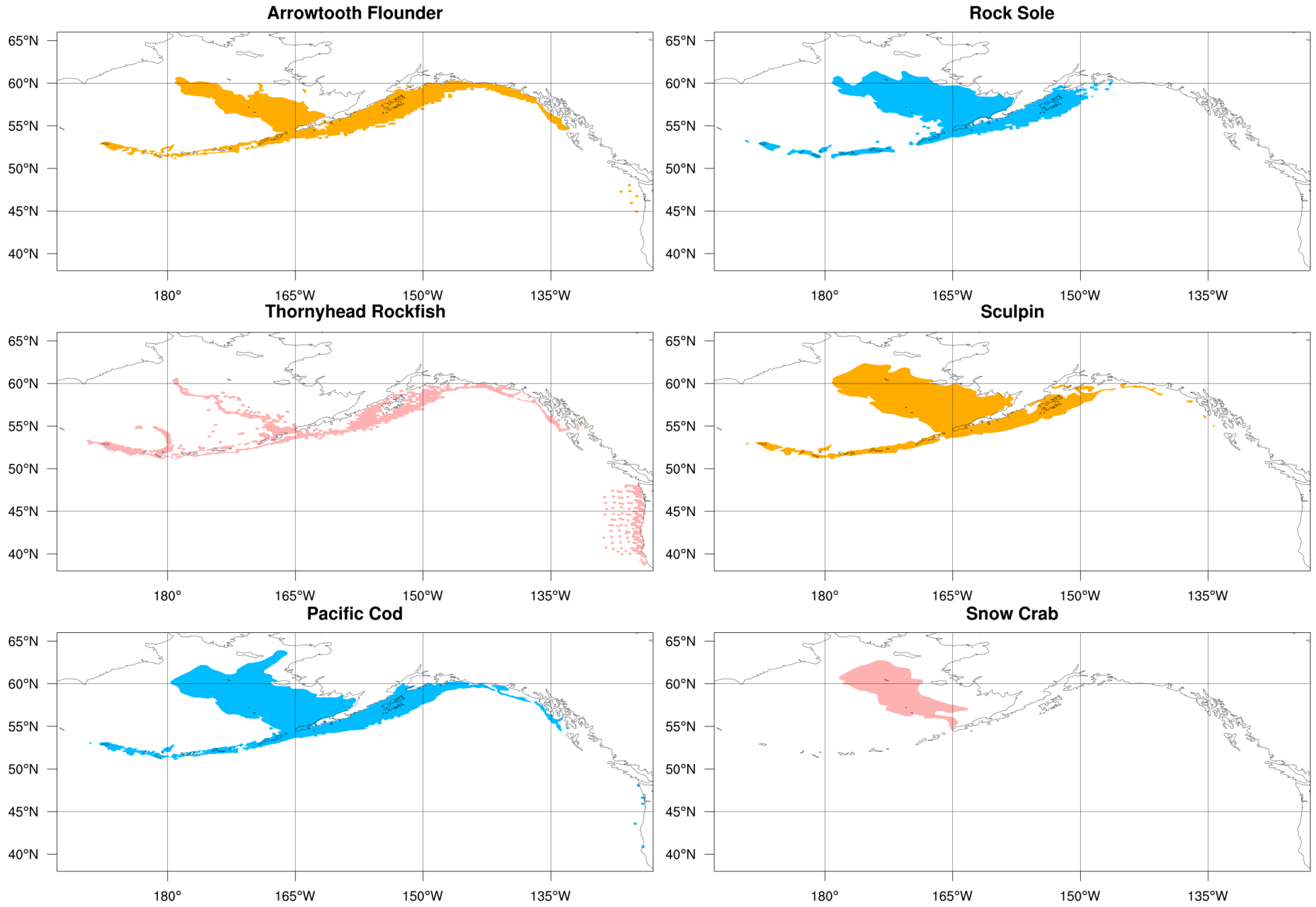
http://download.geofabrik.de/osm/europe/

http://www.gadm.org/country





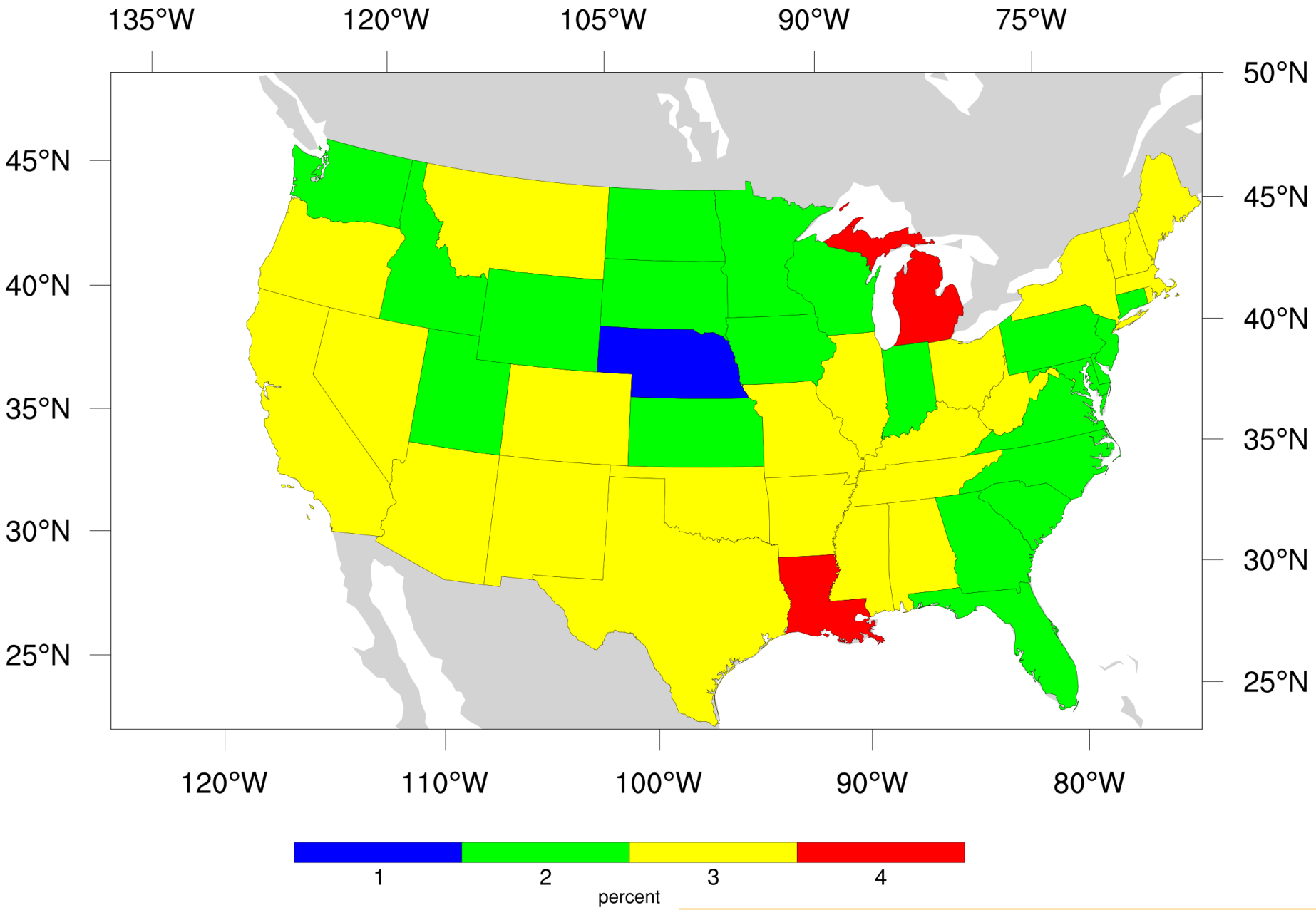
http://www2.census.gov/cgi-bin/shapefiles/
http://cugir.mannlib.cornell.edu/



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

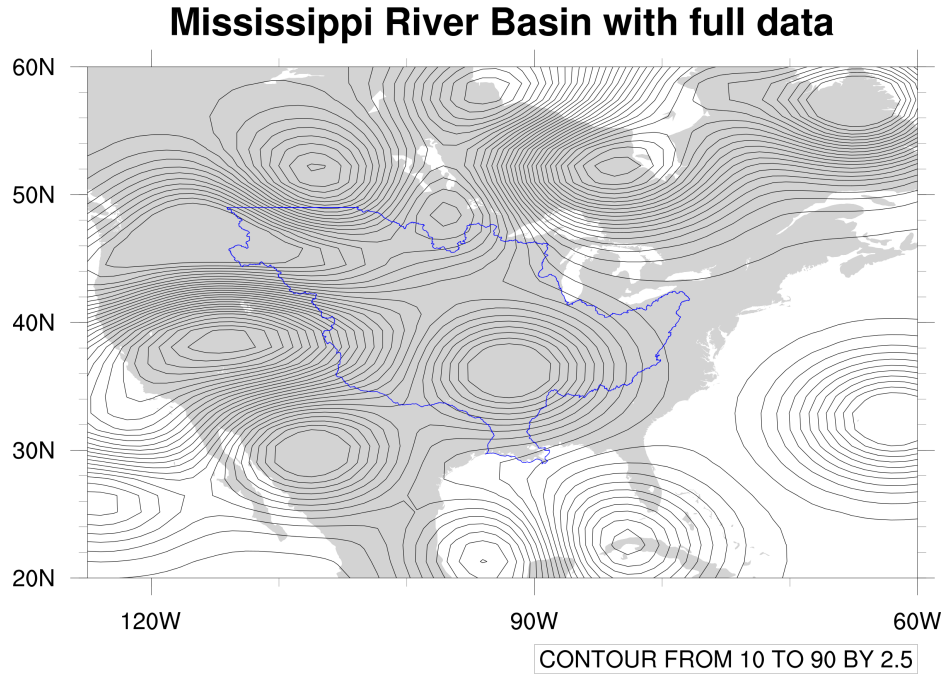
http://alaskafisheries.noaa.gov/habitat/efh/efhshp/default.htm

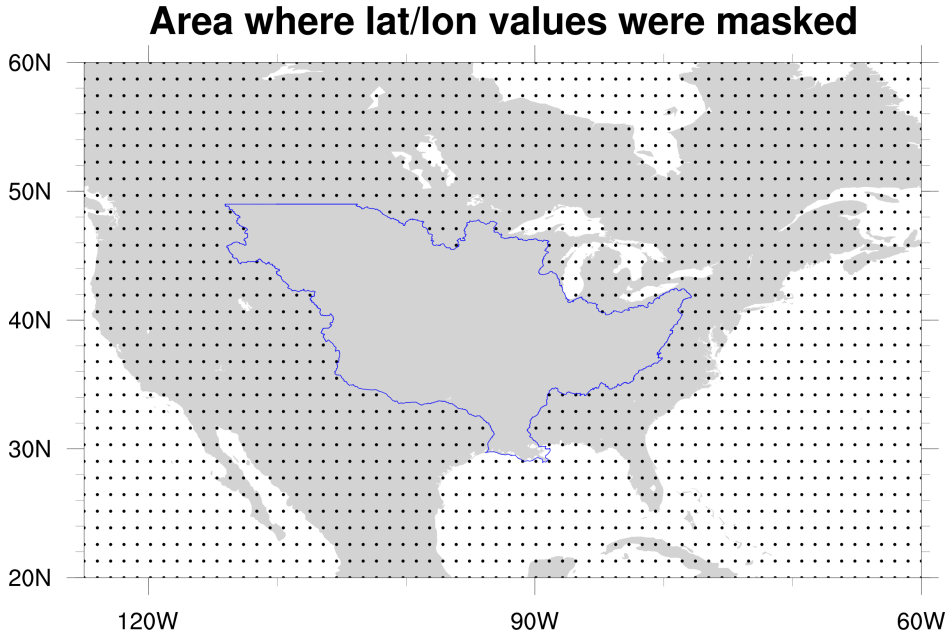
Percentage unemployment, by state



http://www.nationalatlas.gov/atlasftp.html

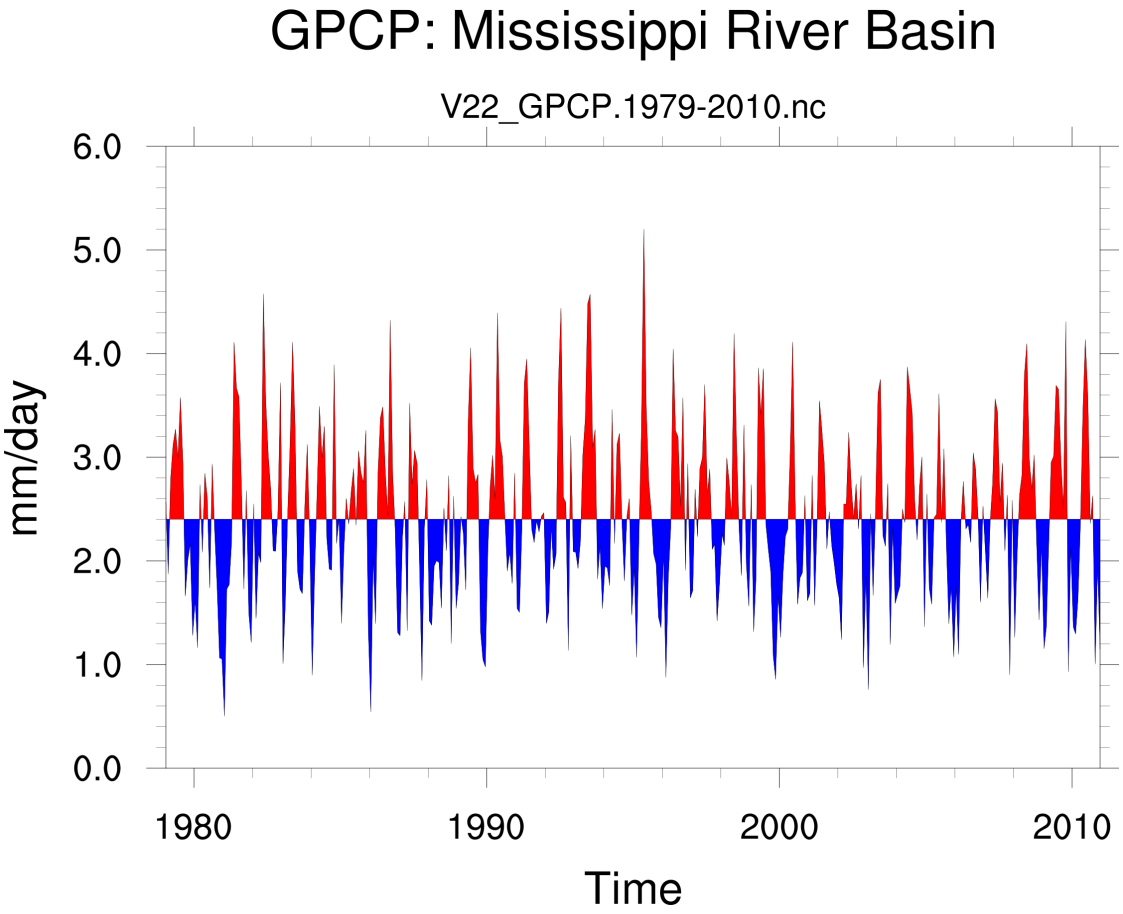
A popular use for shapefiles: Masking data arrays based on outlines in a shapefile

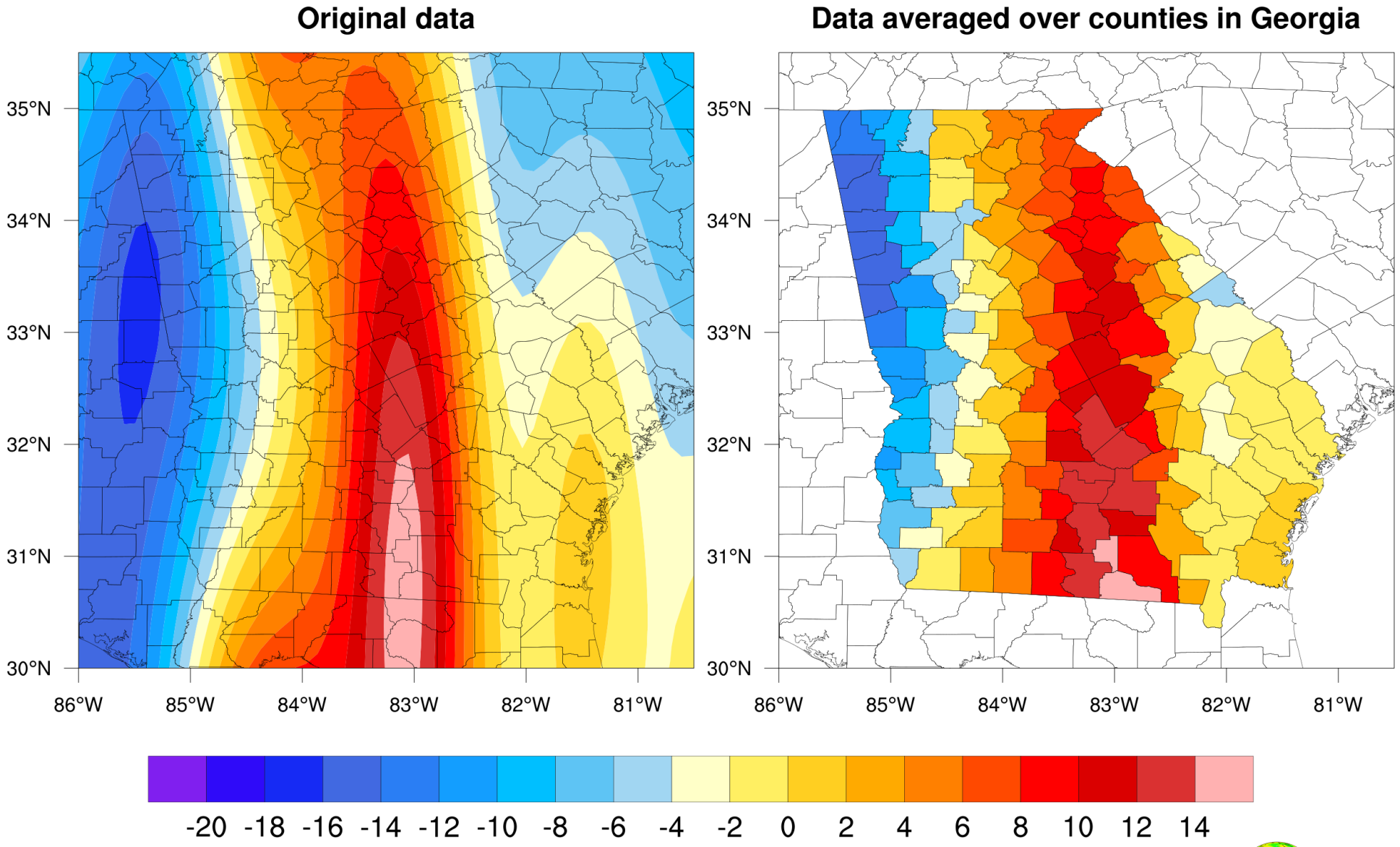




Use this mask to compute the areal mean time series of monthly precipitation for the Mississippi River Basin.

The data is the monthly GPCP.

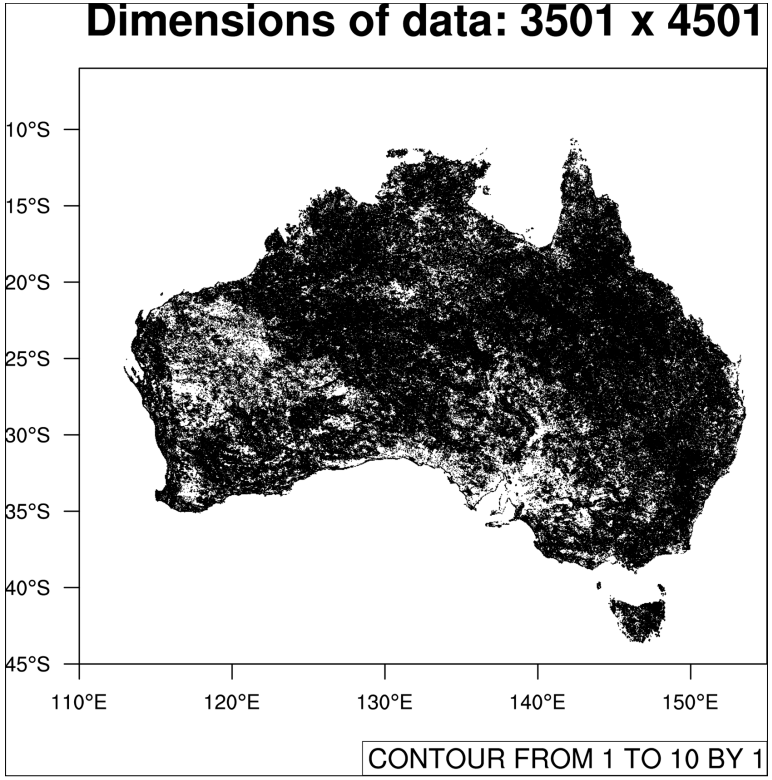


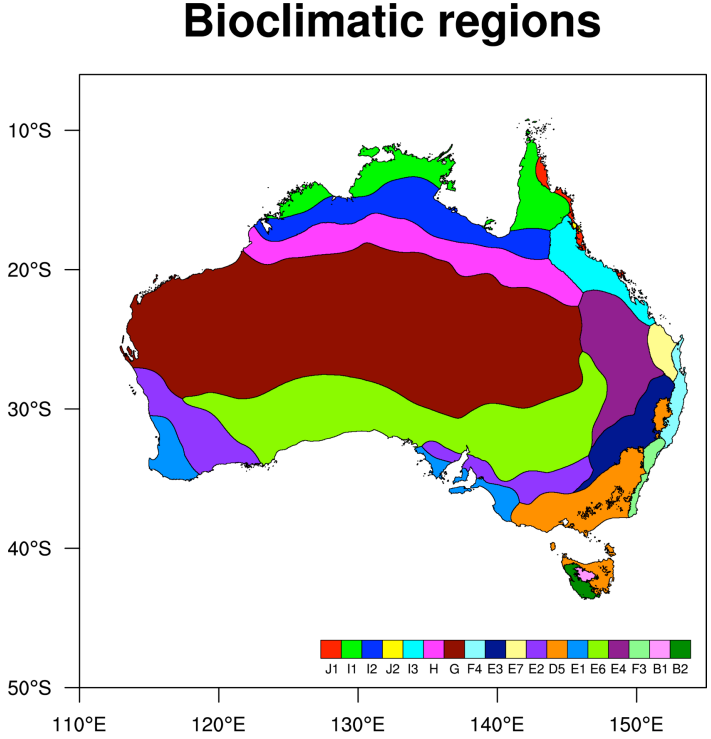


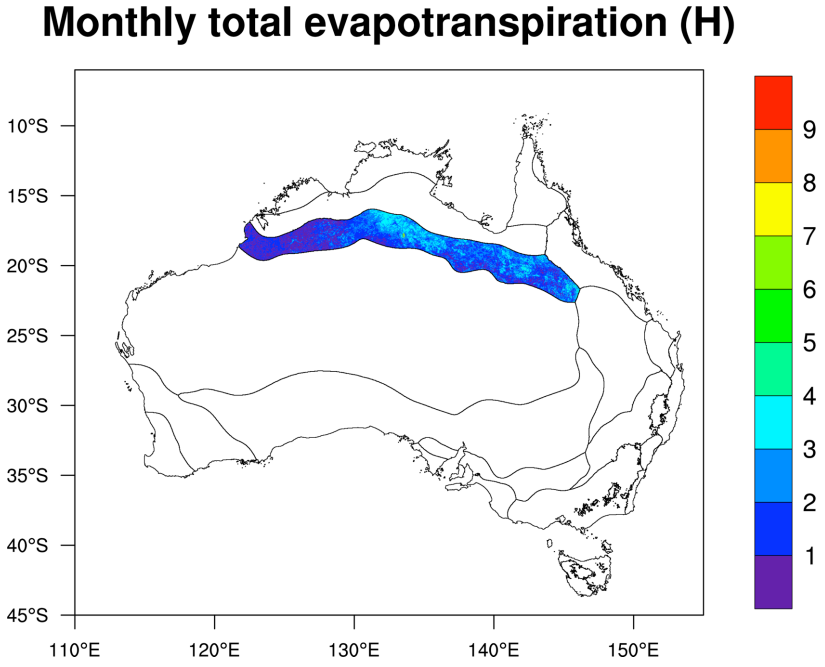
CISL

NCL and Shapefiles

NCL

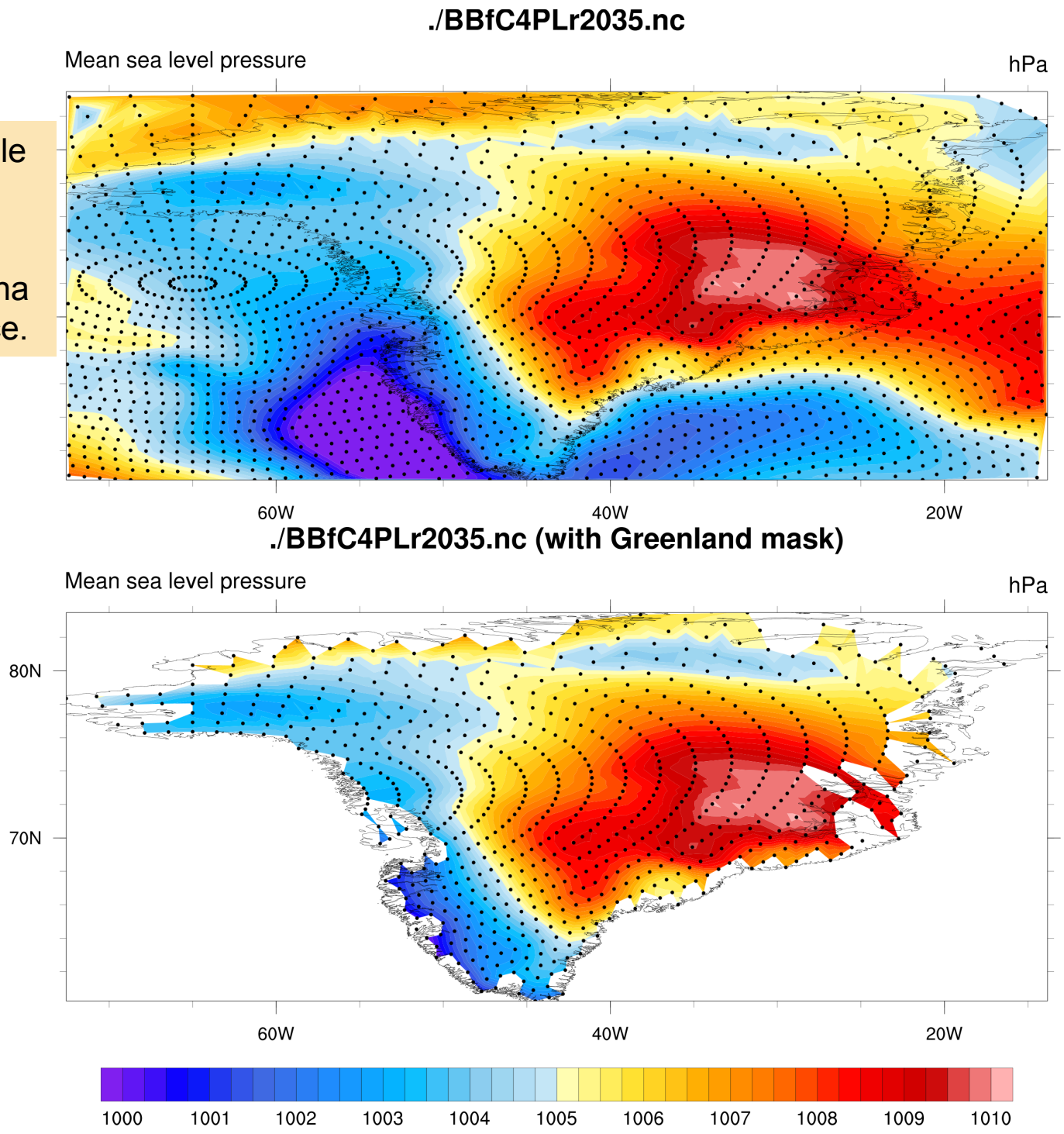

Dimensions of data: 3501 x 4501
10°S
15°S
20°S
25°S
30°S
35°S
40°S
45°S
110°E
120°E
130°E
140°E
150°E
CONTOUR FROM 1 TO 10 BY 1


Bioclimatic regions
10°S
20°S
30°S
40°S
50°S
110°E
120°E
130°E
140°E
150°E
J1 I1 I2 J2 I3 H G F4 E3 E7 E2 D5 E1 E6 E4 F3 B1 B2


Monthly total evapotranspiration (H)
10°S
15°S
20°S
25°S
30°S
35°S
40°S
45°S
110°E
120°E
130°E
140°E
150°E
9
8
7
6
5
4
3
2
1

Used Greenland shapefile from gadm.org

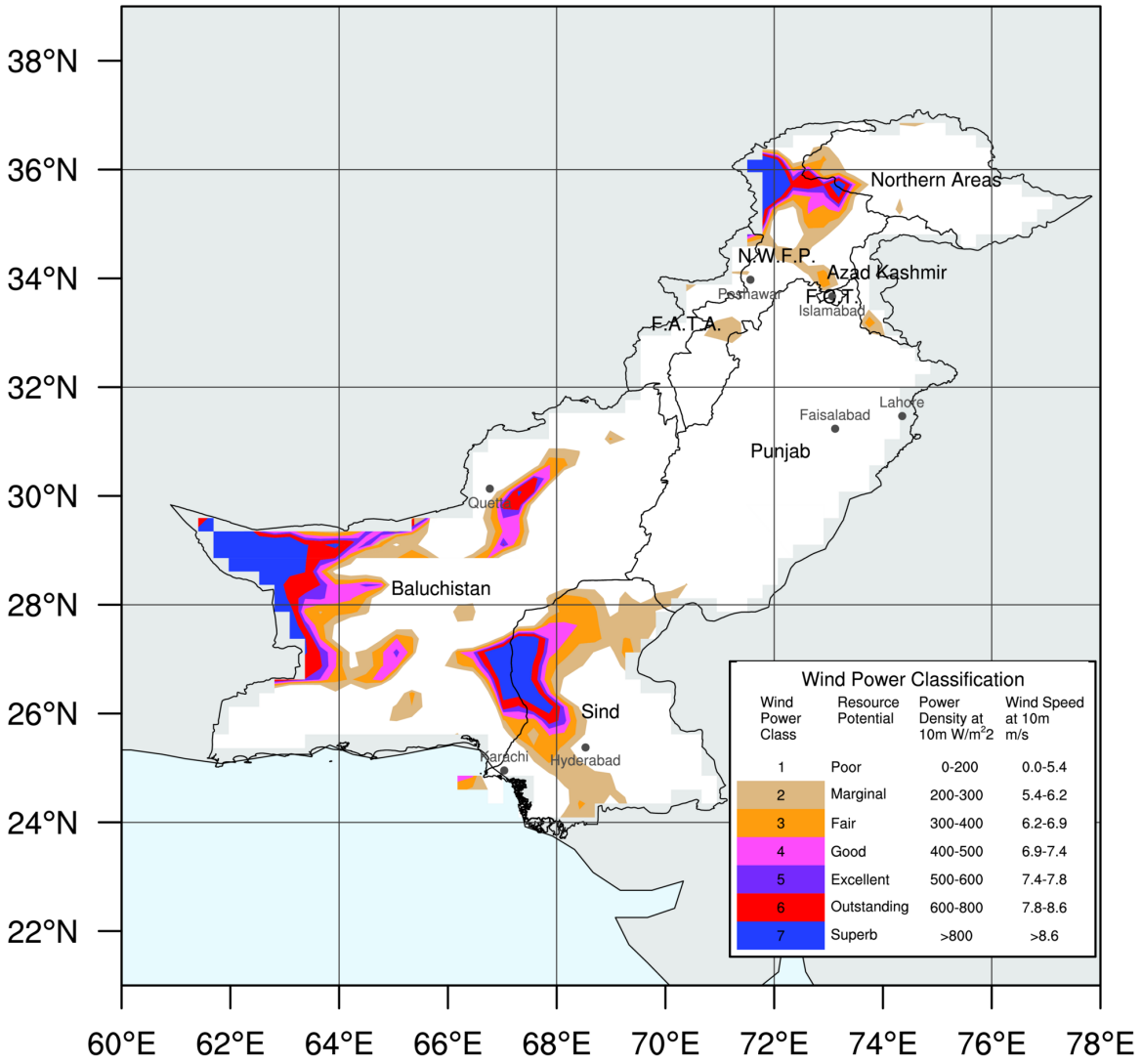
Data is from ARPEGE model, courtesy of Silvana Buarque of Météo-France.



2005-10-11_17:24:27

This example makesuse of several shapefiles of differing resolutions and contents to mask data along county borders.

Shapefiles from http://www.diva-gis.org/gdata



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DEMO #1

Examine some shapefiles using ncl_filedump

Antarctic ice shelves data from:

http://www.naturalearthdata.com/downloads/50m-physical-vectors/50m-antarctic-ice-shelves/

More data can be found at:

naturalearthdata.com – Click on "Get the Data"

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DEMO #2

Download country shapefiles from
http://gadm.org
and add to an NCL map plot.

Use the chat window to suggest a country.

I will use "demo_map.ncl" and "sf_latlon.ncl"
downloaded from:

http://www.ncl.ucar.edu/Training/Webinars/NCL_and_Shapefiles/

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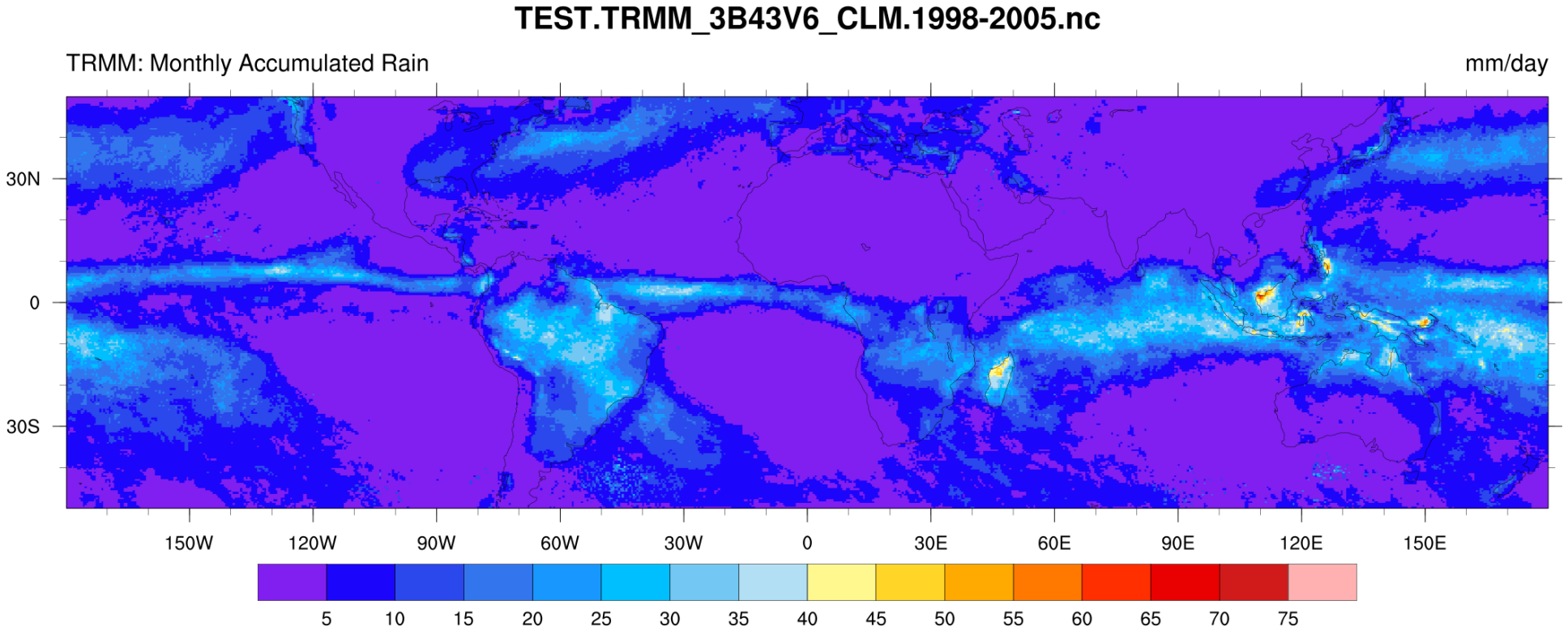
DEMO #3

Mask a precipitation contour plot using a shapefile.

Using shapefile "BOL_adm0.shp" (Bolivia) downloaded from gadm.org/country.

See "mask_gadm.ncl" found at:

http://www.ncl.ucar.edu/Training/Webinars/NCL_and_Shapefiles/



CISL

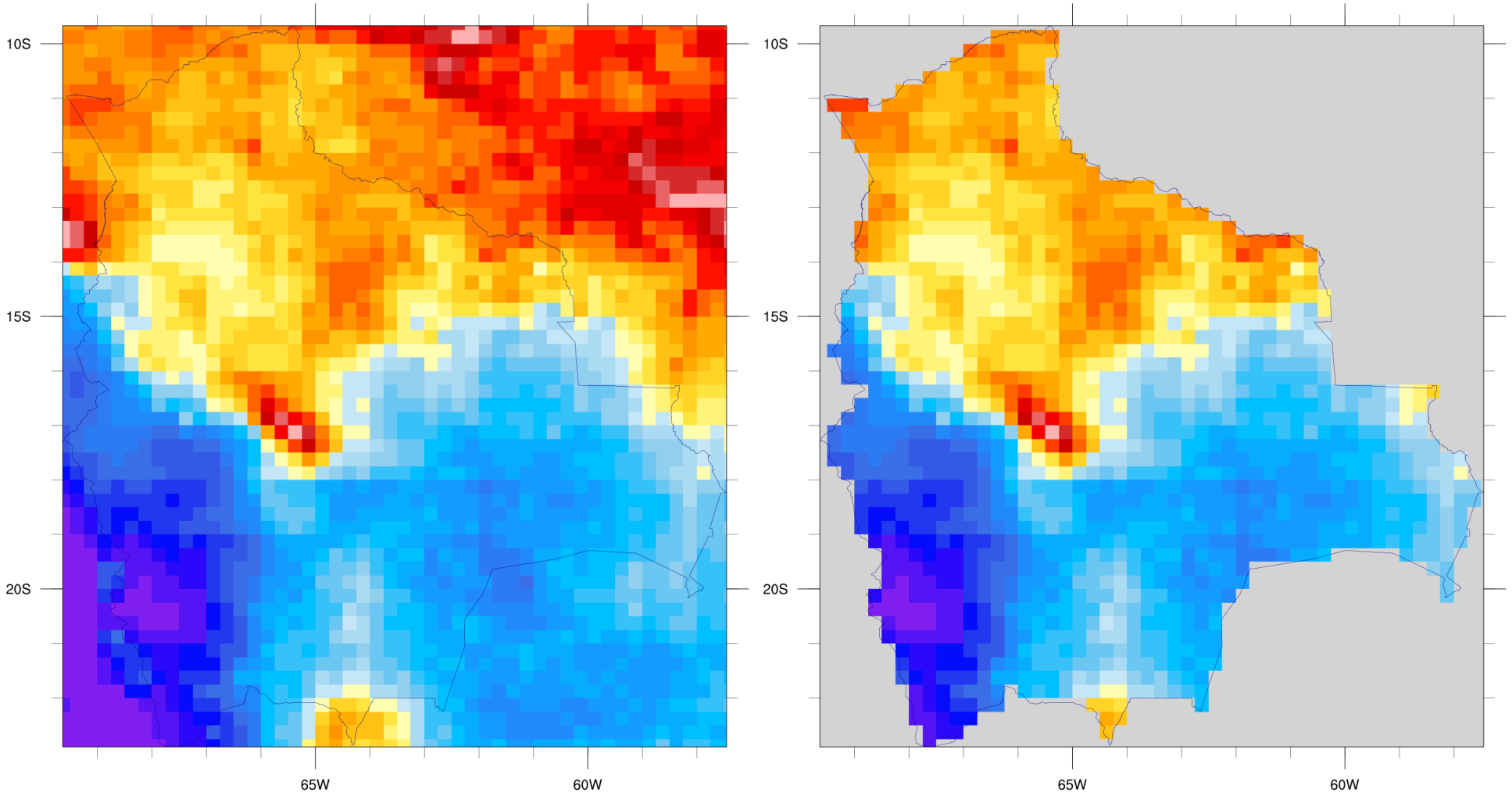
NCL and Shapefiles

NCL

TRMM: Monthly Accumulated Rain (mm/day)

original data zoomed in

with country mask



NCL and Shapefiles

Continuation of previous example.

This example masks the data by given names in a XXX_adm1.shp shapefile, instead of just by lat/lon values.

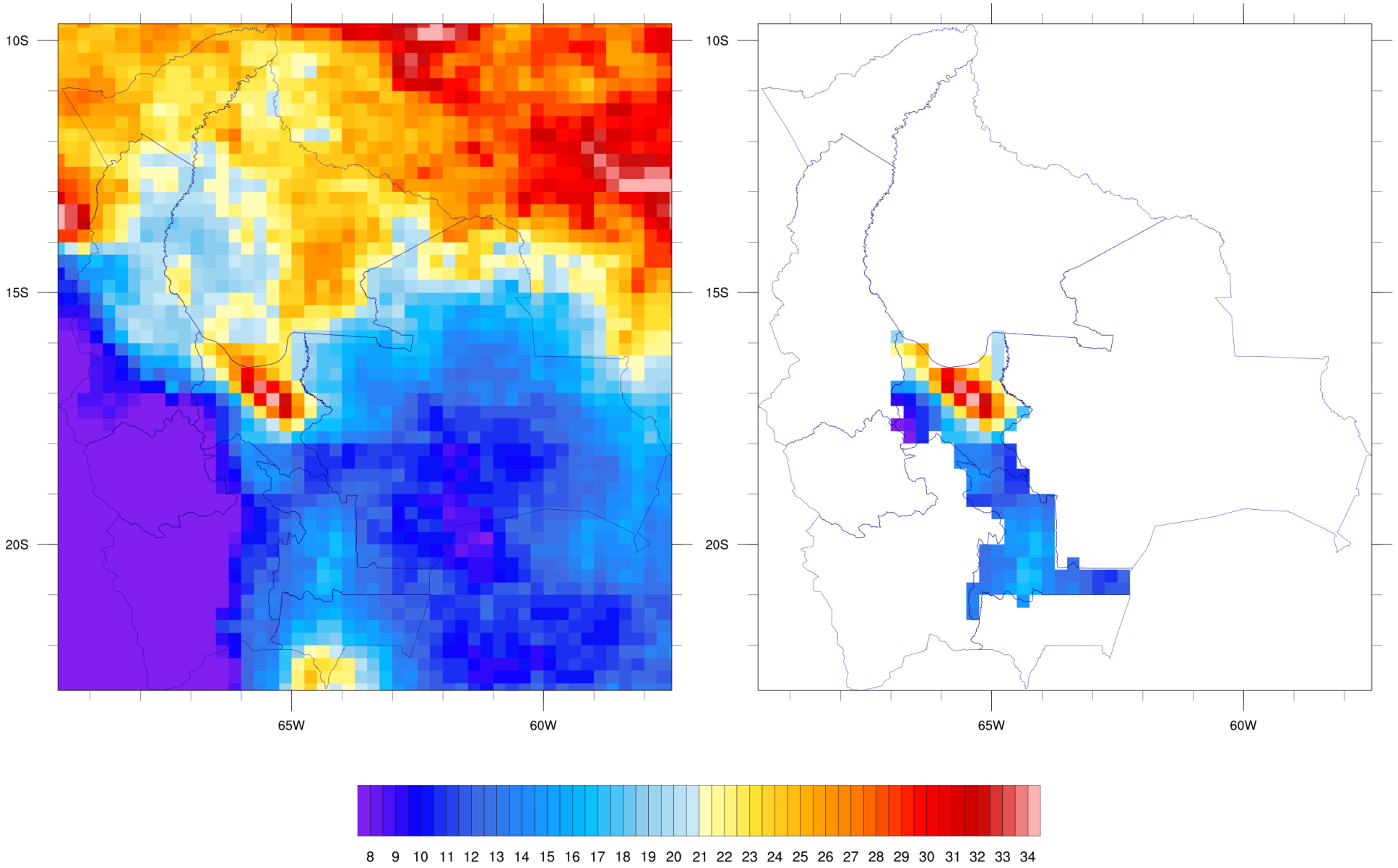
See "mask_gadm_by_name.ncl" found at:

http://www.ncl.ucar.edu/Training/Webinars/NCL_and_Shapefiles/

TRMM: Monthly Accumulated Rain (mm/day)

original data zoomed in

Chuquisaca,Cochabamba



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Useful links

- Examples of using NCL with shapefiles

  http://www.ncl.ucar.edu/Applications/shapefiles.shtml

- Esri shapefile technical description

  http://www.esri.com/library/whitepapers/pdfs/shapefile.pdf

- Esri home page

  http://www.esri.com

- Wikipedia page on shapefiles

  http://en.wikipedia.org/wiki/Shapefile

Places to download free shapefiles

Using “google” works well.
Be sure to use “shapefile” in keyword search:

“shapefile extreme weather events”

“shapefile large lakes”

“shapefile ufo sightings”

Places to download free shapefiles

- Natural Earth – public domain map dataset available at 1:10m, 1:50m, and 1:110 million scales

  http://www.naturalearthdata.com/features/

- DIVA-GIS – free country level maps, including administrative boundaries, roads, railroads, altitude and land cover

  http://www.diva-gis.org/Data/

- Global Administrative Areas - spatial database of the location of the world's administrative boundaries

  http://www.gadm.org/

- National Elevation Dataset (NED) – a primary elevation data product of the USGS http://ned.usgs.gov/

- NWS provides base maps in the Advanced Weather Interactive Processing System (AWIPS)

  http://www.nws.noaa.gov/geodata/


Special thanks to Tim Scheitlin
for A/V support
Questions?
haley@ucar.edu
http://www.ncl.ucar.edu/Training/Webinars/