Spatial Methods Lab

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[1] Thanks to RCM team

Background

- Observations
- Variograms and model output
- Regridding/downscaling uncertainty.

Loading packages

```
# some setup
library( fields)

## Loading required package:  spam
## Loading required package:  grid
## Spam version 1.0-1 (2014-09-09) is loaded.
## Type 'help( Spam)' or 'demo( spam)' for a short introduction
## and overview of this package.
## Help for individual functions is also obtained by adding the
## suffix '.spam' to the function name, e.g.  'help( chol.spam)'.
##
## Attaching package:  'spam'
##
## The following objects are masked from 'package:base':
##
##    backsolve, forwardsolve
##
## Loading required package:  maps
```

North American rainfall

The NorthAmercianRainfall dataset is a high quality station data set that has the mean summer (JJA) precipitation for 1950-2010. NorthAmericanRainfall$precip is the rainfall in (mm) (divide by 254 for inches). For the US Midwest estimate where the summer rainfall drops to around 2286 mm (e.g. find the contour line.) This threshold (9 inches) marks the change from regular crops and dry land farming. Try anything simple first and then try fitting a spatial process.

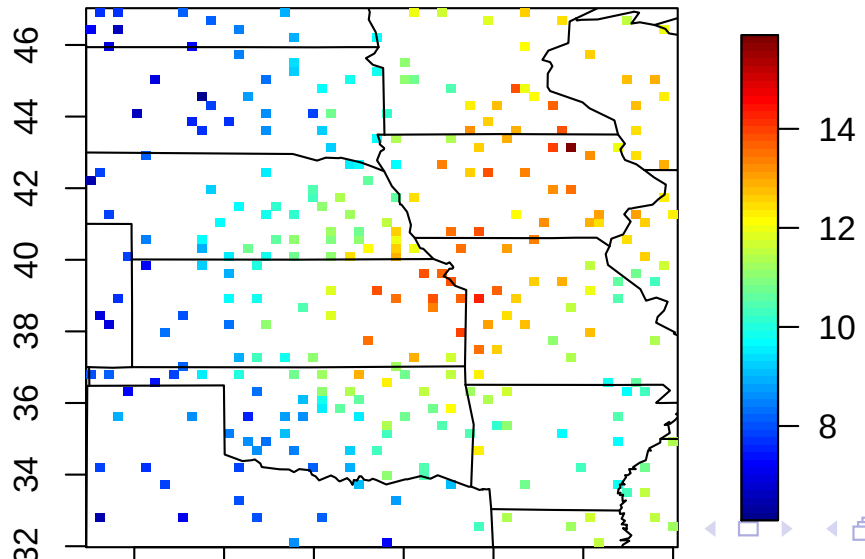
```
data( NorthAmericanRainfall)
names( NorthAmericanRainfall)

##  [1] "longitude"  "latitude"   "precip"     "elevation"
##  [5] "precipSE"   "trend"      "trendSE"    "type"
##  [9] "projection" "x.s"
```

North American rainfall (continued)

Here is a suggestion to reduce the size of the data set focusing on the US Midwest. NOTE: here I convert the precip to inches.

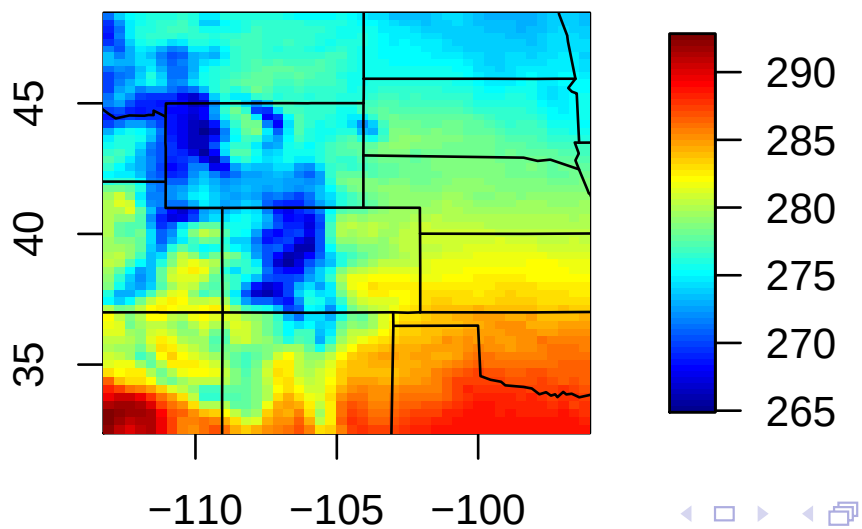
```
x<- cbind( NorthAmericanRainfall$longitude, NorthAmericanRainfall$latitude)
y<- NorthAmericanRainfall$precip
y<- y/254
# select out the subset of locations from reat Plains
ind <- (x[,1] <= -90)& (x[,1]>= -103) & (x[,2] >= 32) & (x[,2] <= 47)
x<- x[ind,]
y<- y[ind]
quilt.plot( x, y)
US( add=TRUE)
```



Downscaling gridded data

The R file WRFSpring.rda has the average spring temperatures (MAM) for the Rocky Mountain subregion based on the WRFClimate experiment. "meanMAM" "WRFelev" "WRFGrid" "WRFLoc" are the temperatures, elevations, locations, and the lon/lat grid. Fit a spatial model to these locations and try predicting onto a finer grid. See also the function fastTps (set theta to be 3.0) for a fast spatial interpolator.

```
load( "WRFSpring.rda")
image.plot( as.surface( WRFLoc, meanMAM))
US( add=TRUE)
```



Variograms for WRF simulations.

The WRFTempDaily is an R daily data set that is a subset of the WRFClimate simulation for the first year and over the Rocky Mountains.
tDaily is an array that has dimensions lon, lat and time (1:365)
How does the spatial dependence vary over the year? How about over space?
To find variograms for these gridded data try the more efficient vgram.matrix function but do not set the "R" argument too large!

```
load("WRFTempDaily.rda")
# plot for the 10th  day
data10<- tDaily[,,10]
image.plot( lon,lat, data10 )
US( add=TRUE)
```