

# New methods for downscaling climate information based on a joint empirical-statistical and dynamical downscaling approaches.

## Summary

The global climate community has produced a wide range of results from atmospheric-ocean general circulation models, which are considered as the primary source of information on the future climate change. However, there are still gaps between the spatial resolution of climate model outputs and the point-scale requirement of most of climate change impact studies. Thus, empirical-statistical downscaling (ESD) and dynamical downscaling (DD) techniques continue to be used as alternatives and various models have been made available by the scientific community. They are mainly used to downscale local weather variables such as temperature or precipitation over a region of interest. New methods and strategies based on merging ESD and DD results are proposed in order to increase the quality of the local climate projections with a special focus on seasonal and decadal temperature based on CMIP3/5 experiment. A new freely available ESD R-package developed by MET Norway is used and is presented here.

## Why downscaling?

GCMs are not able to reproduce Climate Information at a local scale because of their coarse resolution and simplifications of physical-based processes.

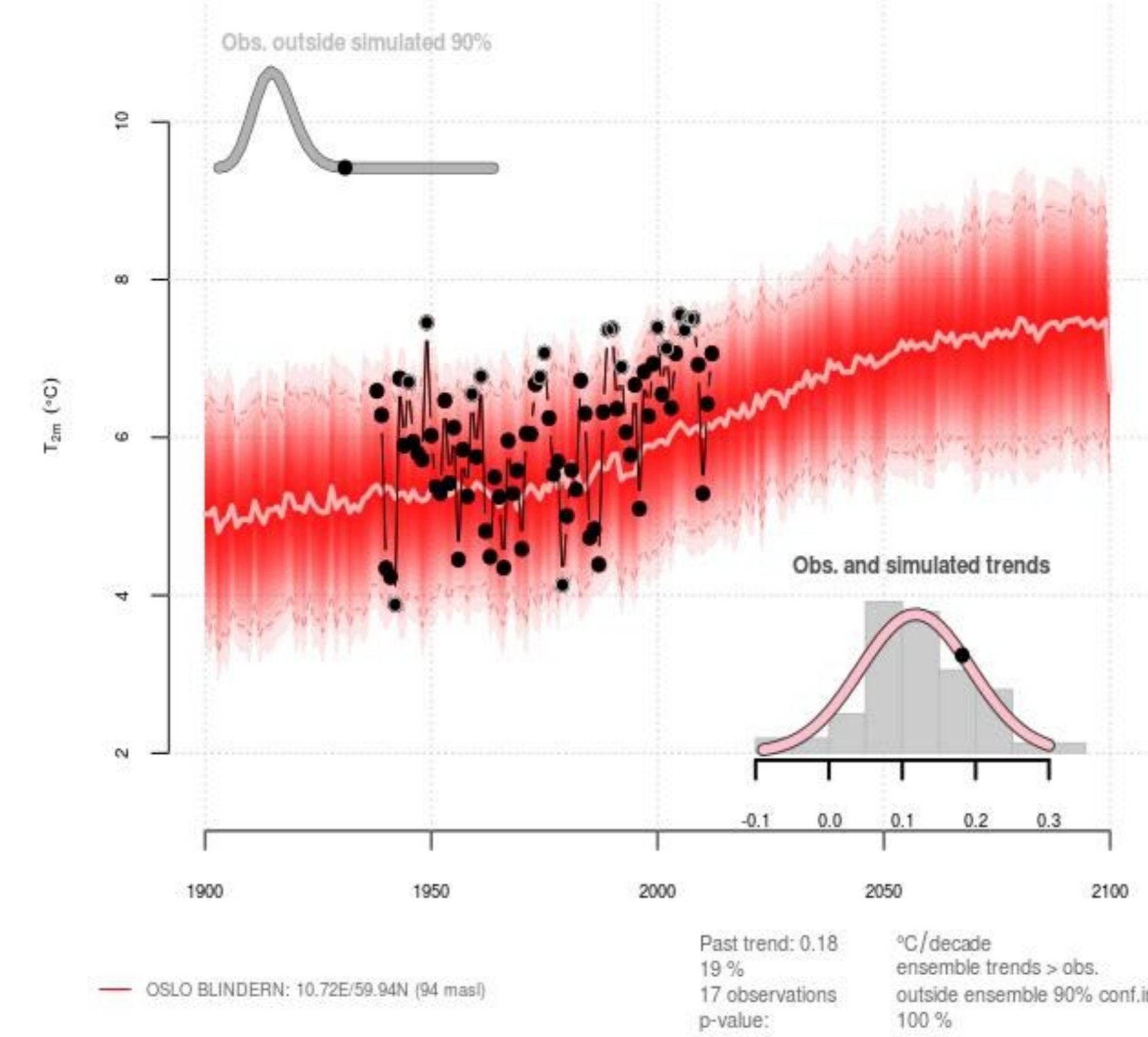
## How to downscale ?

Local climate is influenced by local geography, large-scale situation, and local small-scale processes (noise):

$$y = f(g, X) + \text{noise}$$

predictands (y) - predictors (X)

## Mean temperature

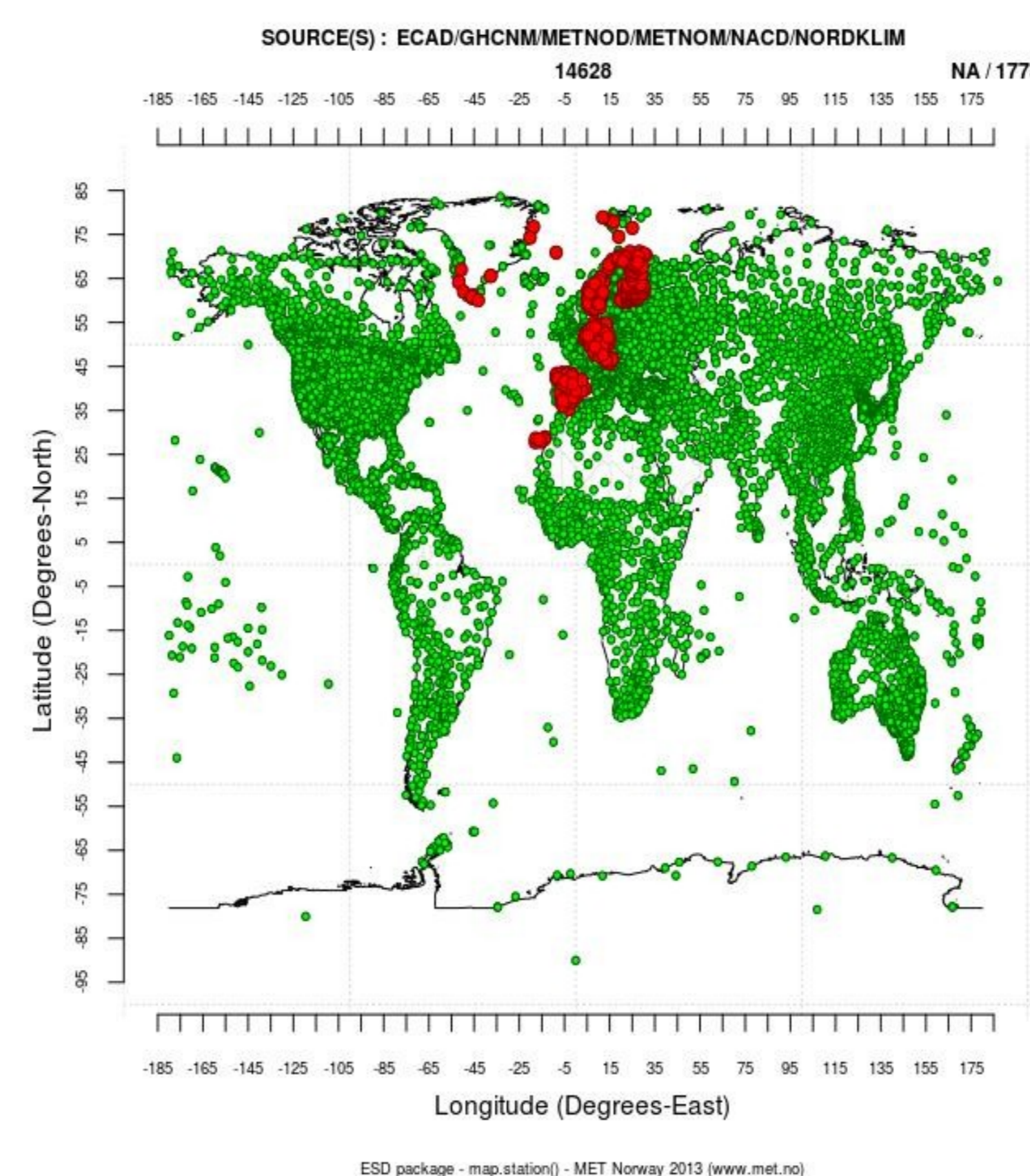


## What to downscale ?

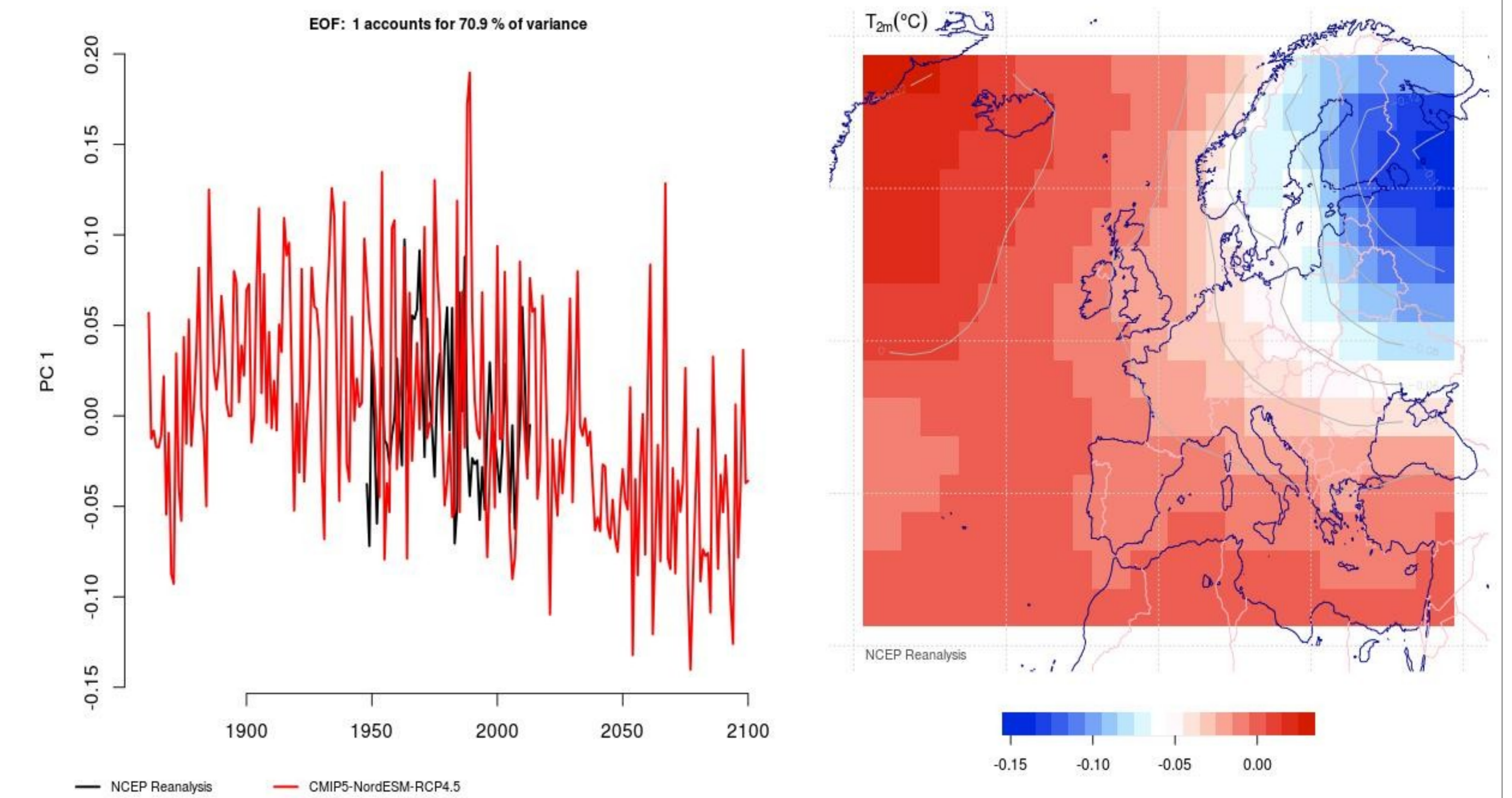
Climate statistics or climate variables

- For temperature mean, sd, autocorrelation, ...
- For precipitation mean, wet-day mean, wet-day frequency, number of consecutive dry days, ...

## Global datasets



## Common EOF analysis

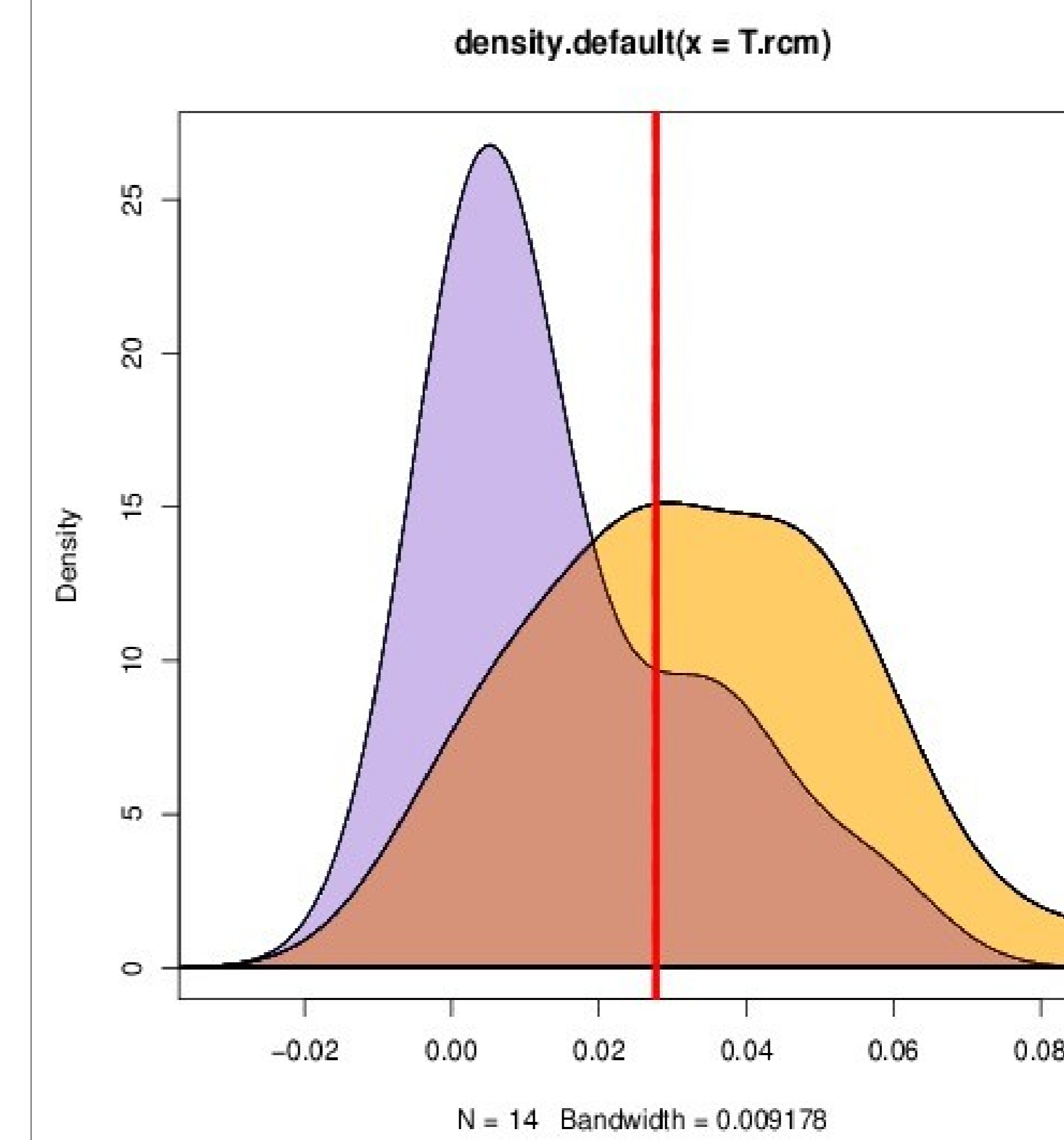


## Simple commands

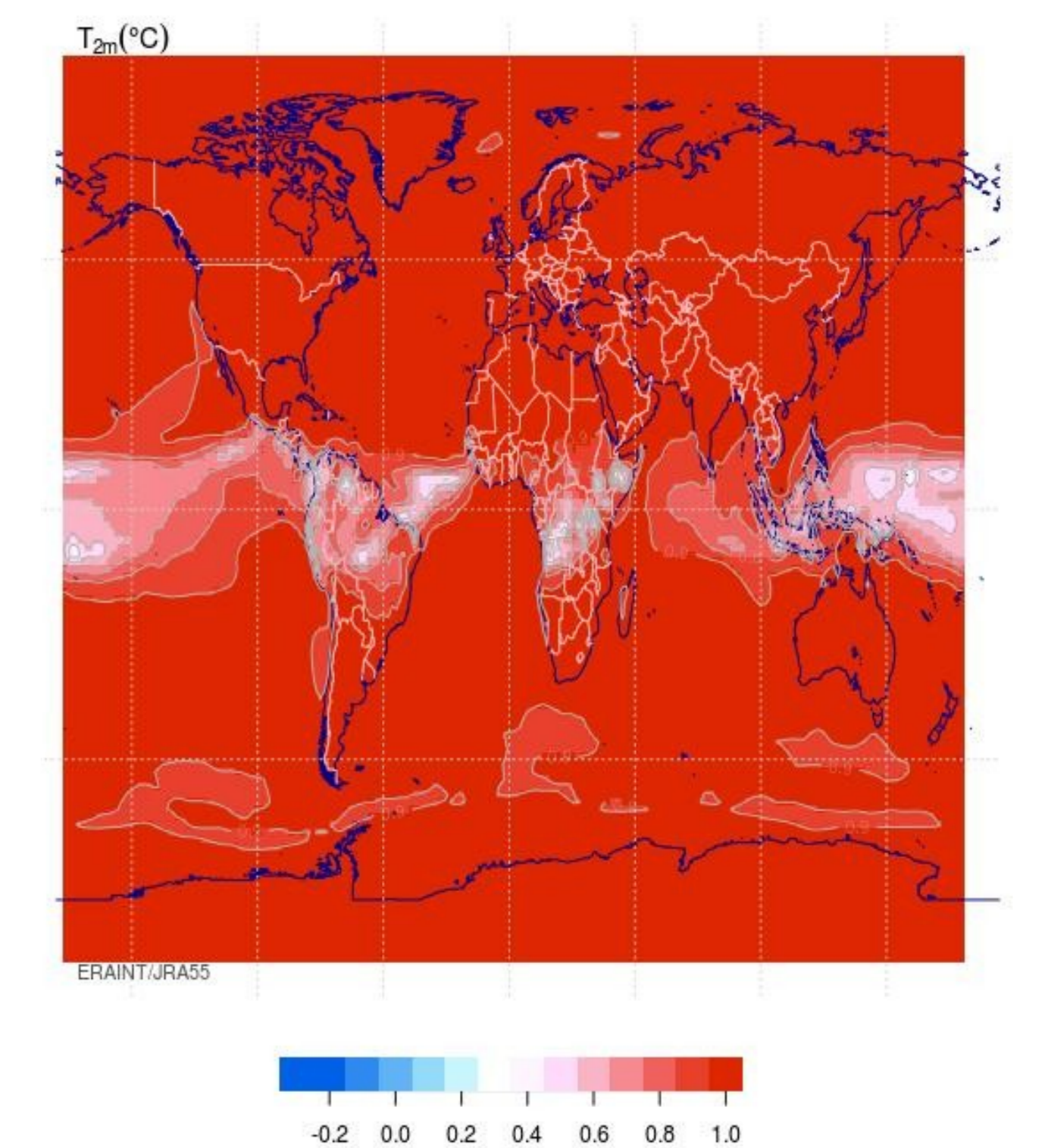
```

Read reanalysis and GCM 2m-temperature
rea ← t2m.NCEP(lon=c(-40,40),lat=c(30,70))
gcm ← t2m.NorESM.M(lon=c(-40,40),lat=c(30,70))
Combine in time to compute common EOFs
X ← combine(t2m,T2m)
ceof ← EOF(X,it=1)
plot(ceof)
    
```

## Comparing the trend



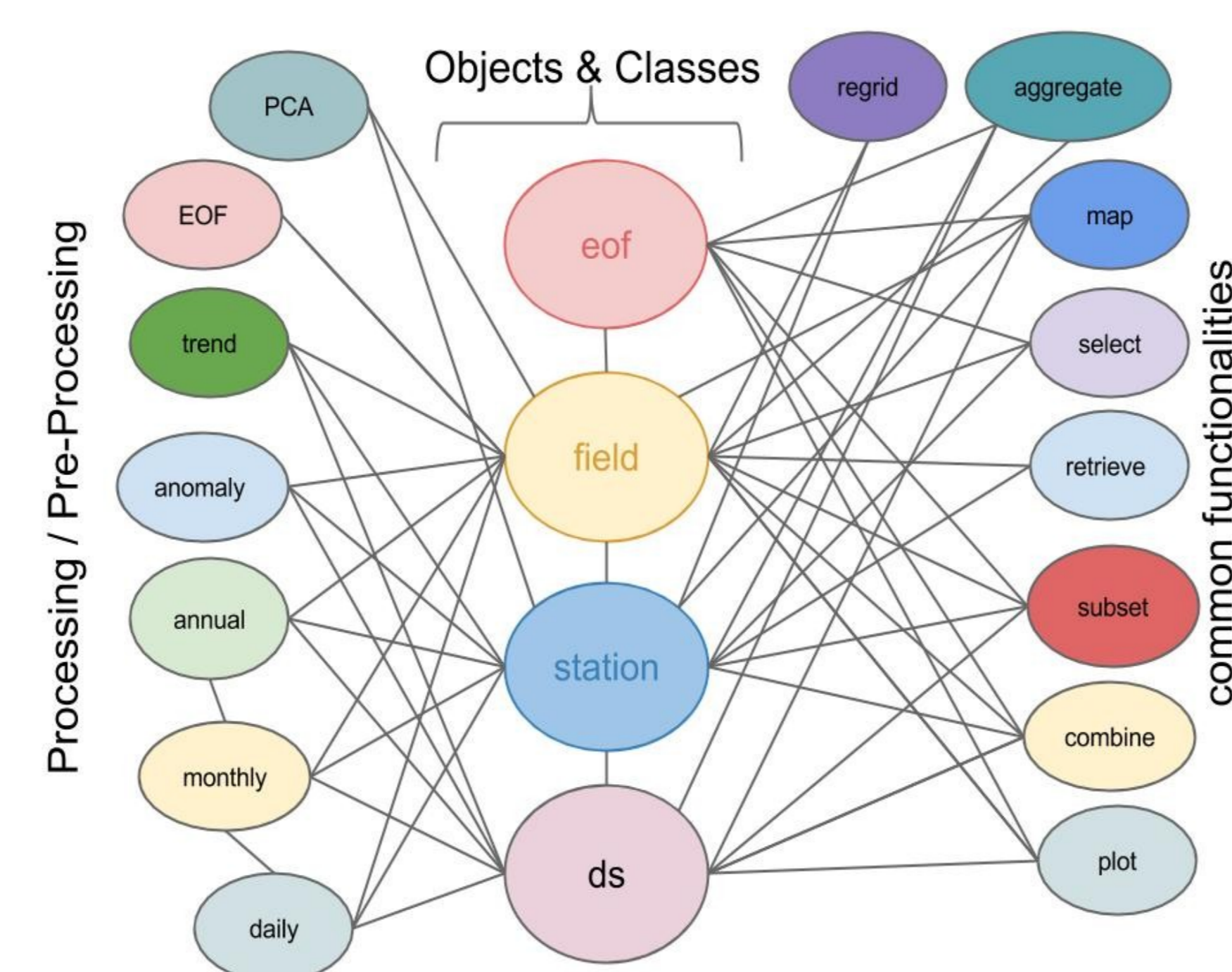
## Correlation maps



## Try the new ESD R package

- Downscale climate information (variable or parameter) from large (global) to local scales (station),
- Empirical-statistical relationships between a set of predictands and predictors,
- Free package based on R programming language,
- Quick statistical analysis
- Tailored package for different users,
- Flexible
- Traceability of the results and methods used

## ESD functionalities



## R.ClimateAnalysis

## Contact