E-OBS Developments so far

Phil Jones and Richard Cornes

CRU,UEA and KNMI

Summary of Gridding Improvements

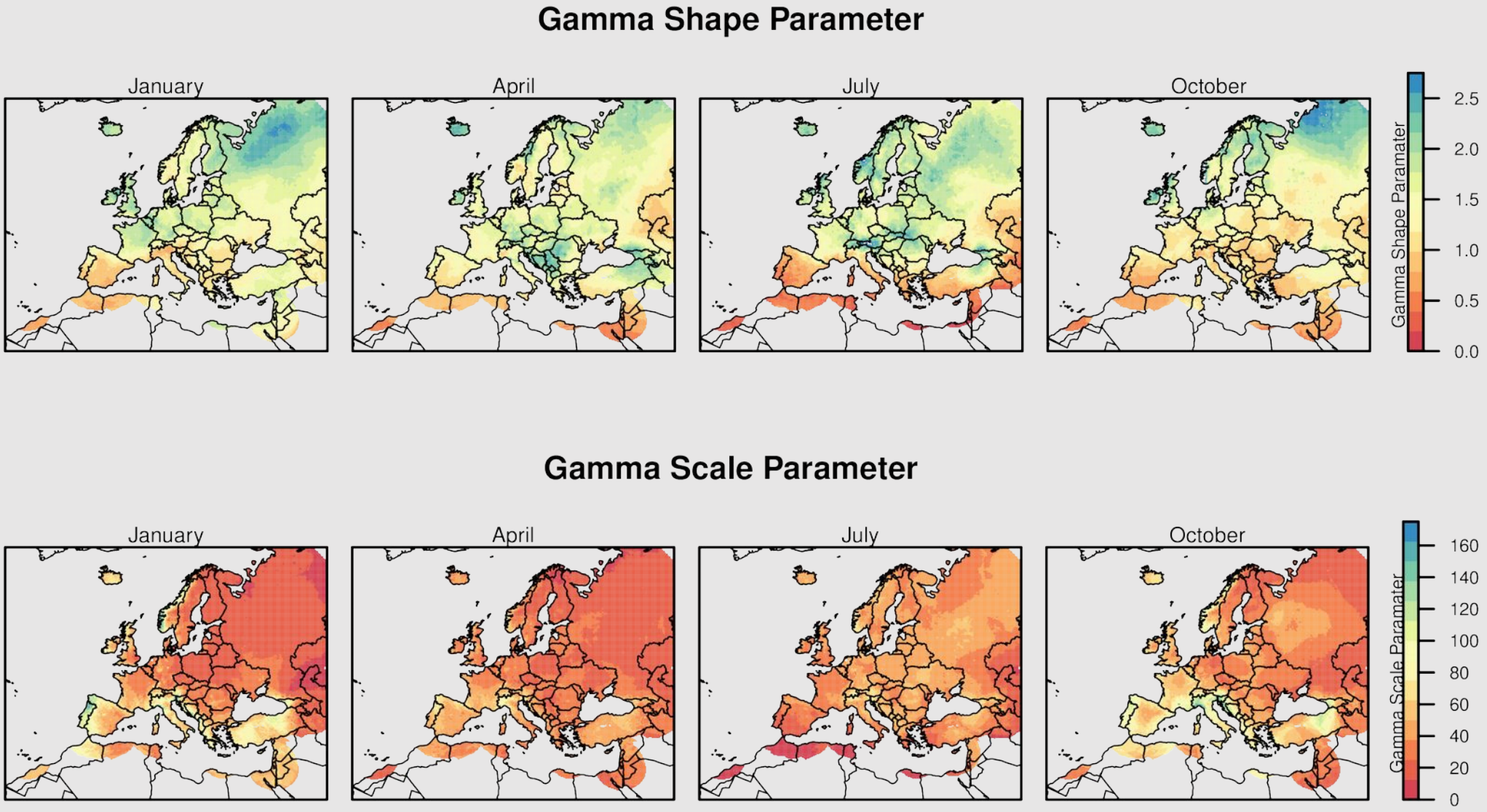
- Gamma Transformation for Precipitation (D1.10)
- Regression Kriging
- Comparisons against NMS High Resolution Datasets
- Ensemble Range (D1.11)
- Box-Averaging
- Incorporating Additional Information (lead in to D1.14)

Current Precipitation Method (Haylock et al., 2008)

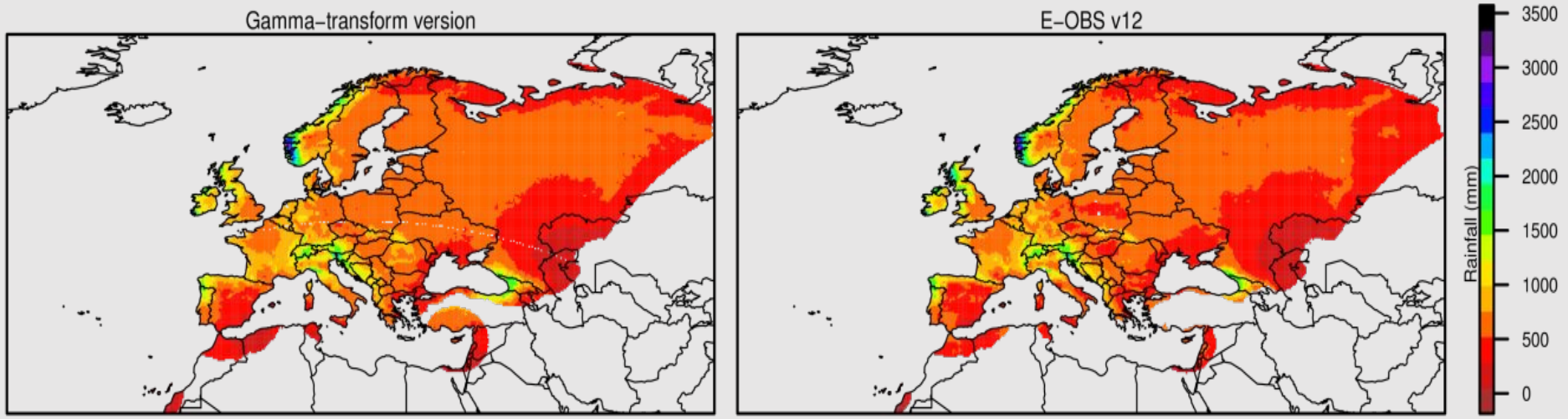
- Monthly totals are gridded (0.1° rotated grid) using a tri-variate thin-plate spline
- Daily precipitation expressed as a proportion of the station monthly total
- Daily values (expressed as proportions) are gridded to the same resolution using Indicator Kriging
- Gridded daily proportions multiplied by the respective gridded monthly totals
- High-resolution gridded rainfall averaged to the 4 coarser resolution grids

- Changes involved using a gamma transformation of the monthly totals (D1.10)
- Gamma distribution used instead of the monthly mm totals. Fitted using Maximum Likelihood Estimation
- Gridding involved regression kriging using latitude/longitude/elevation
- Later Richard will discuss extending this beyond these three location measures to involve aspect, slope and distance from the coast

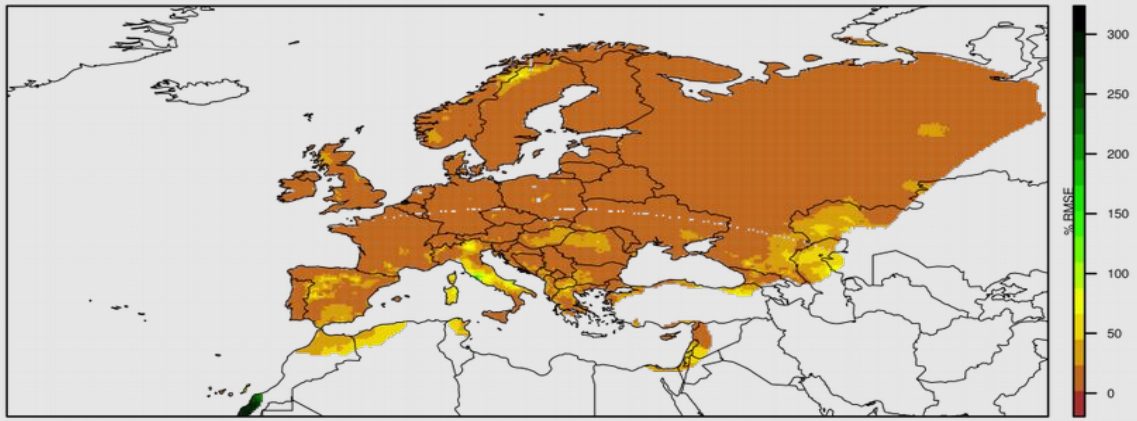
Precipitation Gridding with the Gamma Distribution



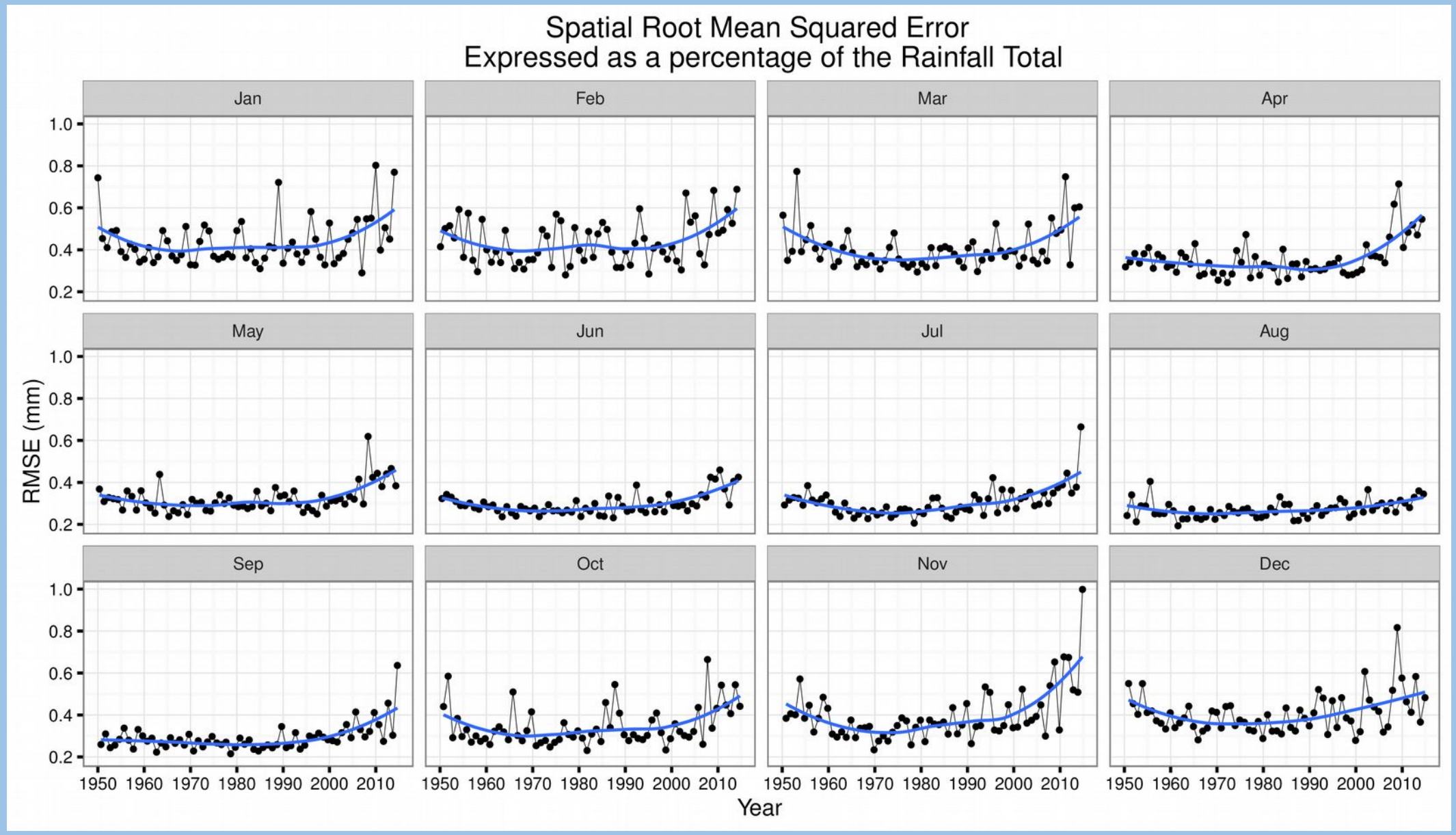
Mean Annual Rainfall Totals (1961 – 2010)



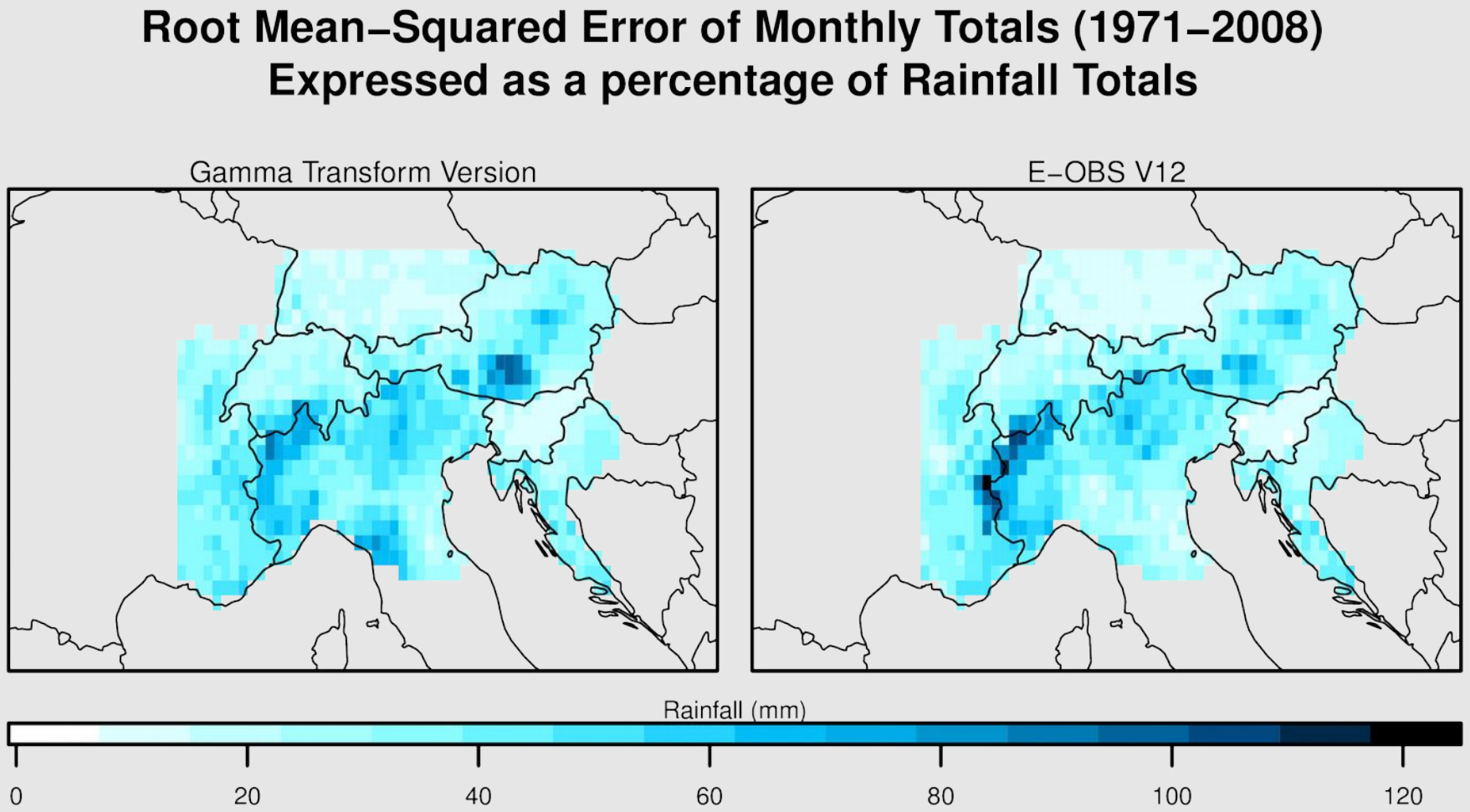
Annual Root Mean Squared Error between E–OBS versions (1961 – 2010)



RMSE across the whole domain, expressed as a percentage of average total rainfall each year



Assessment against Alpine Precipitation Dataset

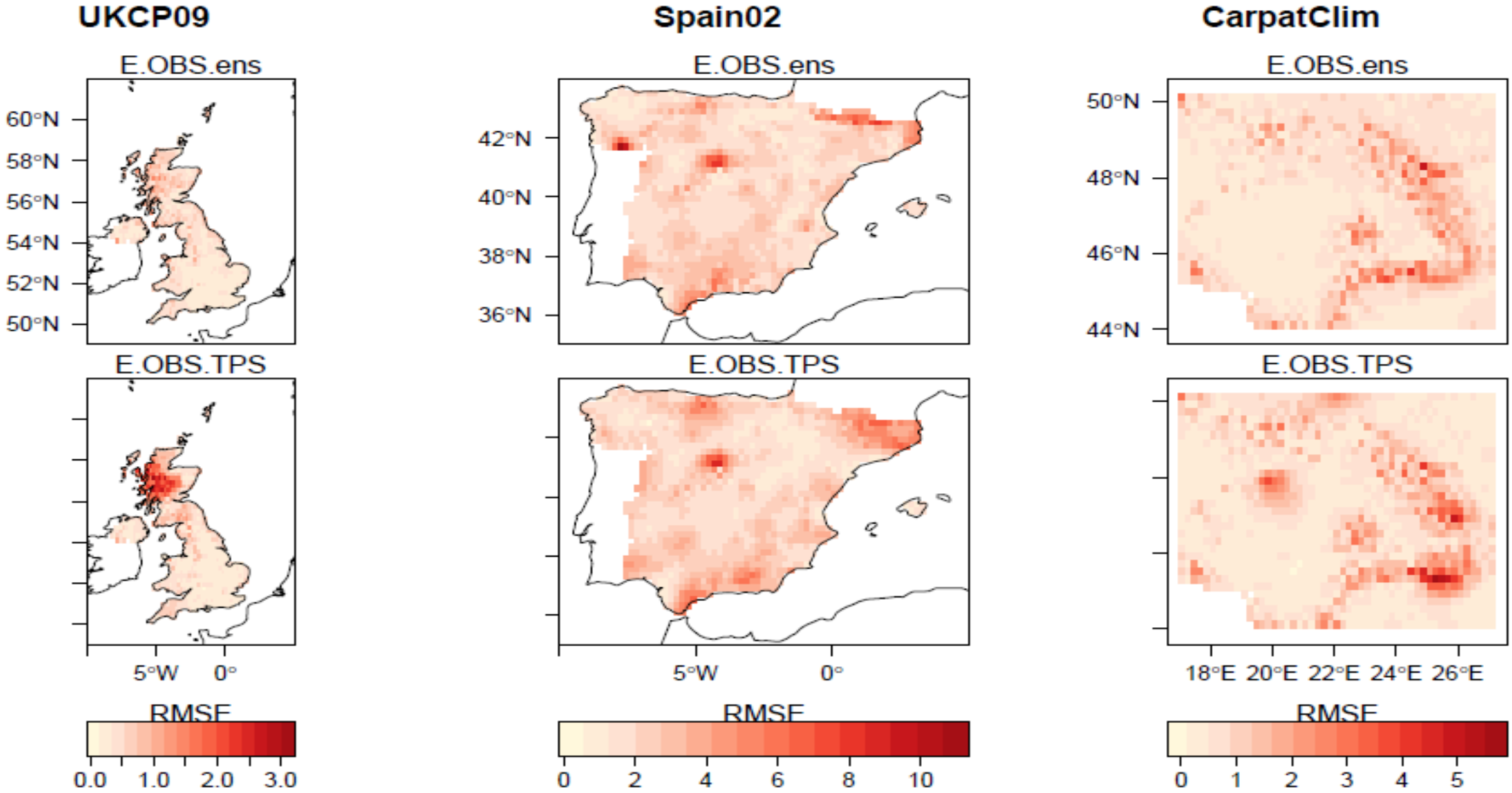


Ensemble Means

- D1.11 produced 100 Realizations of an Ensemble (Station density determines the Ensemble spread, so not similar to an RCM Ensemble). Will be released in early 2017 as a beta version (all members, or as ensemble mean and ensemble spread?)

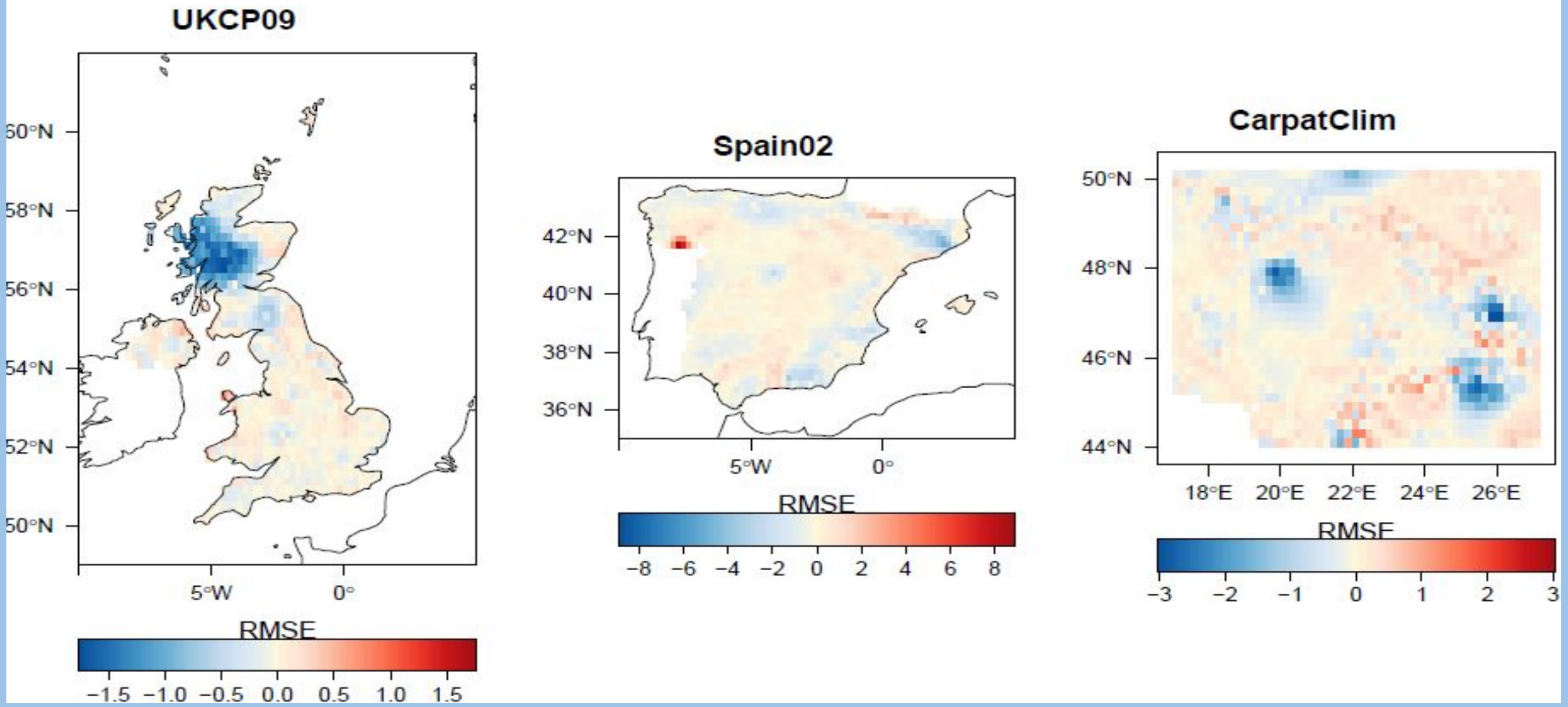
- Compared the gridding improvements against NMS derived products, which use much greater stations densities than available to E-OBS
- NMSs have more data and also more stations at different elevations and potentially other attributes, so help regression kriging
- Results illustrated over three regions of Europe: UKCP09 (UK gridded data on a 5 by 5km grid, for 1961-2010, Spain02 dataset and Carpatclim). Other comparisons are being undertaken for Norway and France.

Root Mean Squared Error (RMSE)

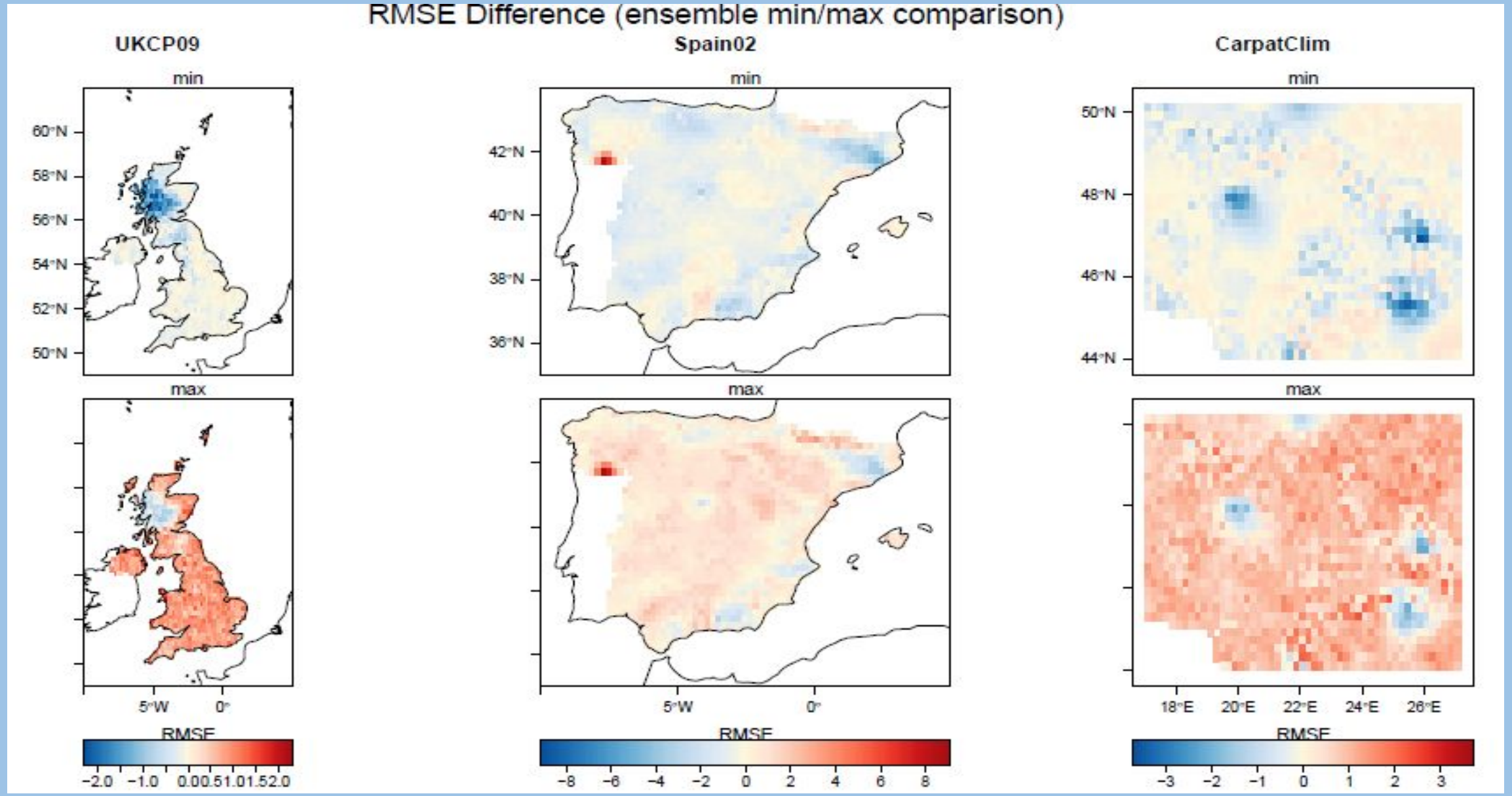


Units ℃ and calculated over the 1971-2009 period. TPS is old version and .ens is the ensemble average. Larger RMSE values in data sparse regions in the older version.

RMSE Difference (ensemble mean comparison)



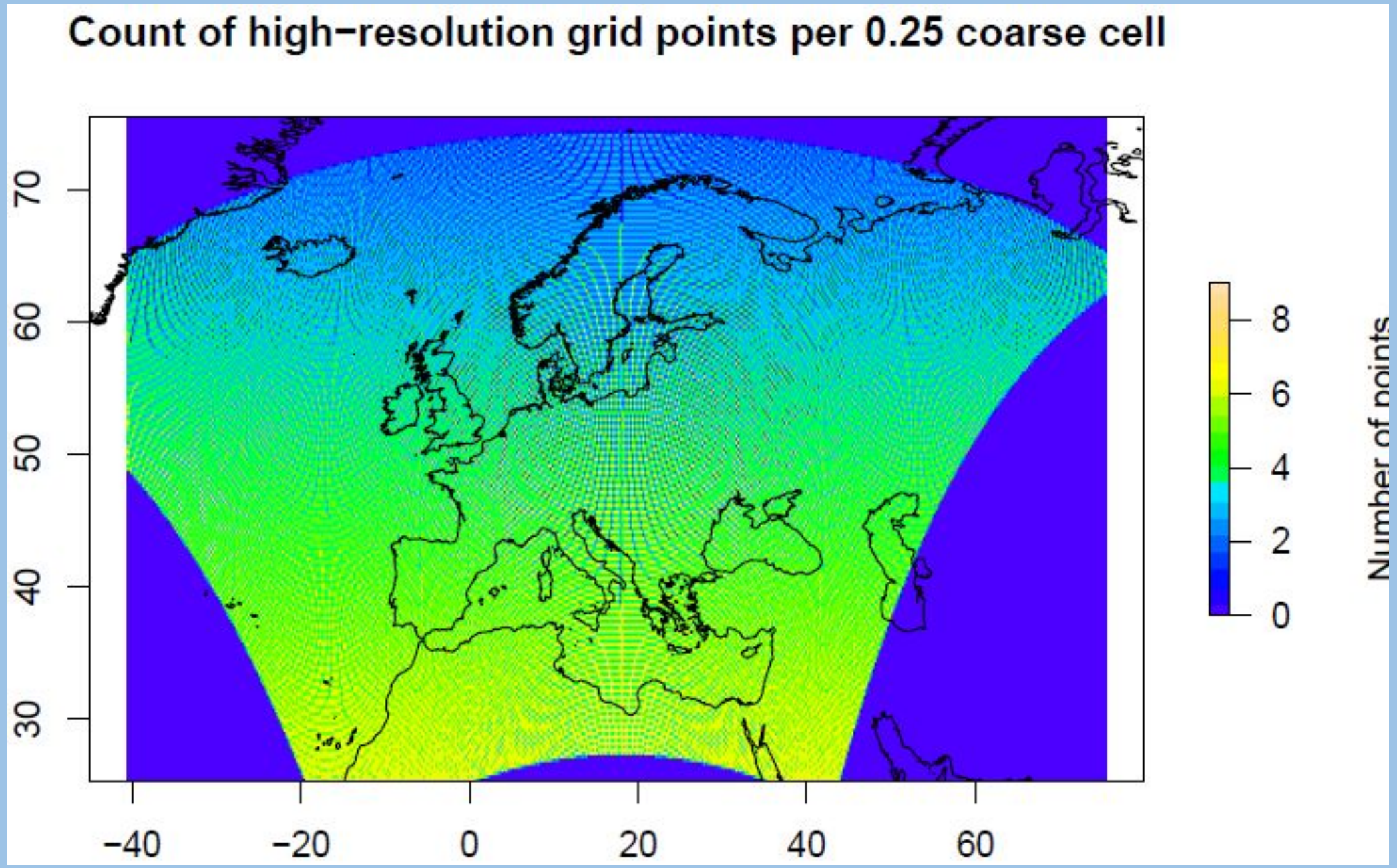
Differences between the RMS of the ENS and the E-OBS old relative to the NMS data



Max and min RMSE between the NMS data and E-OBS across the Ensemble. Values calculated for each grid cell.

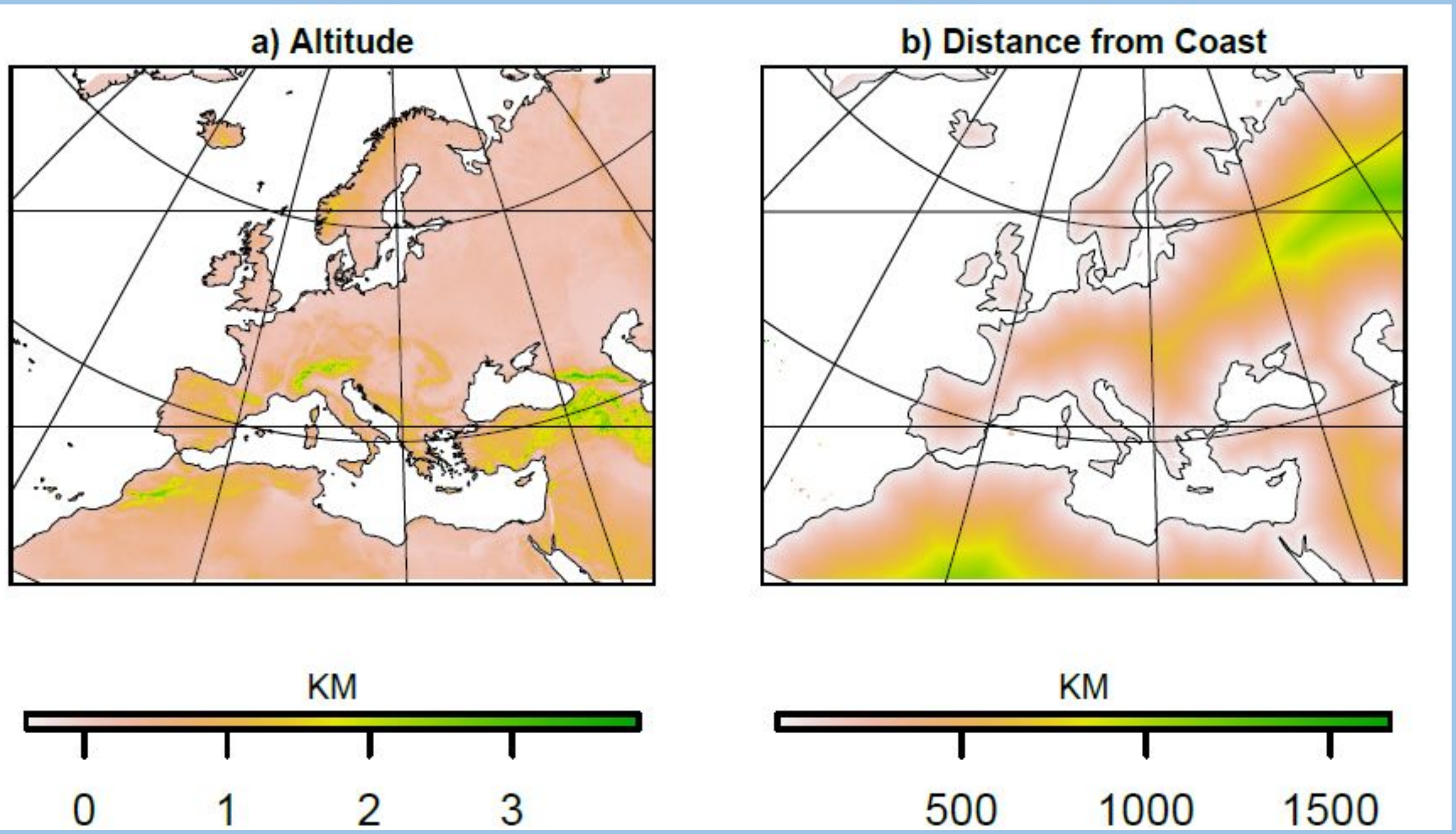
Box-Averaging Effect (also in D1.11)

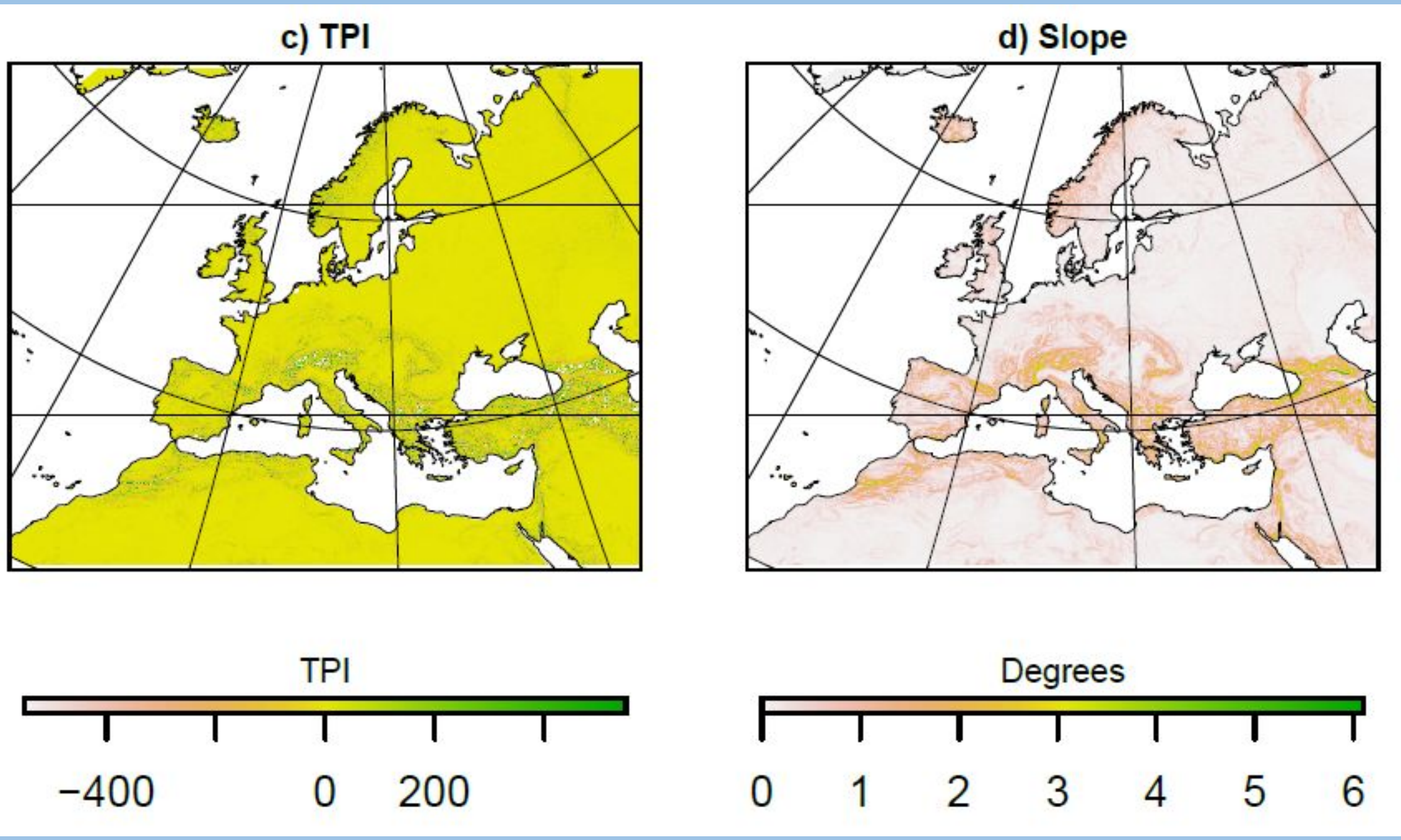
- E-OBS produces several grids (0.25° and 0.5° regular latitude/longitude and 0.22° and 0.44° rotated pole grids)
- All come from the basic 0.1° by 0.1° master grid in rotated pole format
- The final four E-OBS grids are produced from this master grid, but this means that further north the coarser grids are produced from fewer 0.1° by 0.1° master grid points in this rotated pole arrangement. Results in northern parts of Europe will be improved by using a Lamberts Equal Area-projected master grid, rather than one based more on a Mercator projection
- But still outstanding questions about the resolution and grid origin for data users

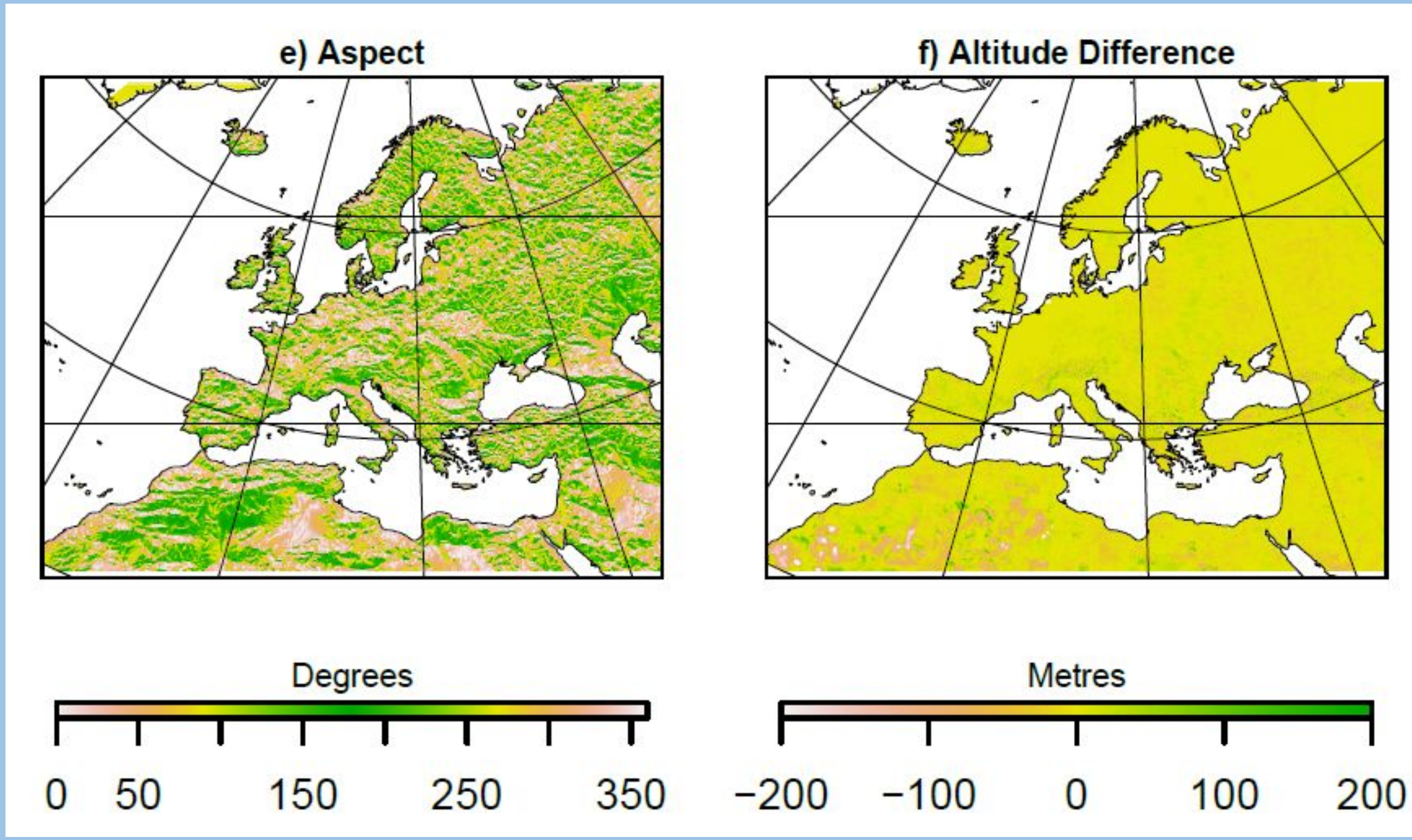

Count of high−resolution grid points per 0.25 coarse cell
70
60
50
40
30
−40
−20
0
20
40
60
8
6
4
2
0
Number of points

Incorporating Additional Environmental Parameters in the Gridding

- Latitude
- Longitude
- Altitude
- Distance from coast
- Distance from water bodies
- Topographic Position Index (TPI, a measure of the grid-box centre compared to the grid-box average – so will pick up valleys and ridges)
- Slope (angle)
- Aspect (angle)
- Altitude Difference (newer GMTED2010 and older GTOPO30 DEMs). Differences with NMS grids often greater with improved DEM, as the NMS often uses the older DEM
- Different combinations of these parameters for temperature variables and for precipitation


a) Altitude
b) Distance from Coast
KM
0
1
2
3
KM
500
1000
1500


c) TPI
d) Slope
TPI
−400
0
200
Degrees
0
1
2
3
4
5
6


e) Aspect
f) Altitude Difference
Degrees
0
50
150
250
350
Metres
−200
−100
0
100
200