

# Gridding and Uncertainties in gridded data: Precipitation Interpolation

Phil Jones, Richard Cornes, Ian Harris and David Lister

Climatic Research Unit

UEA

Norwich, UK

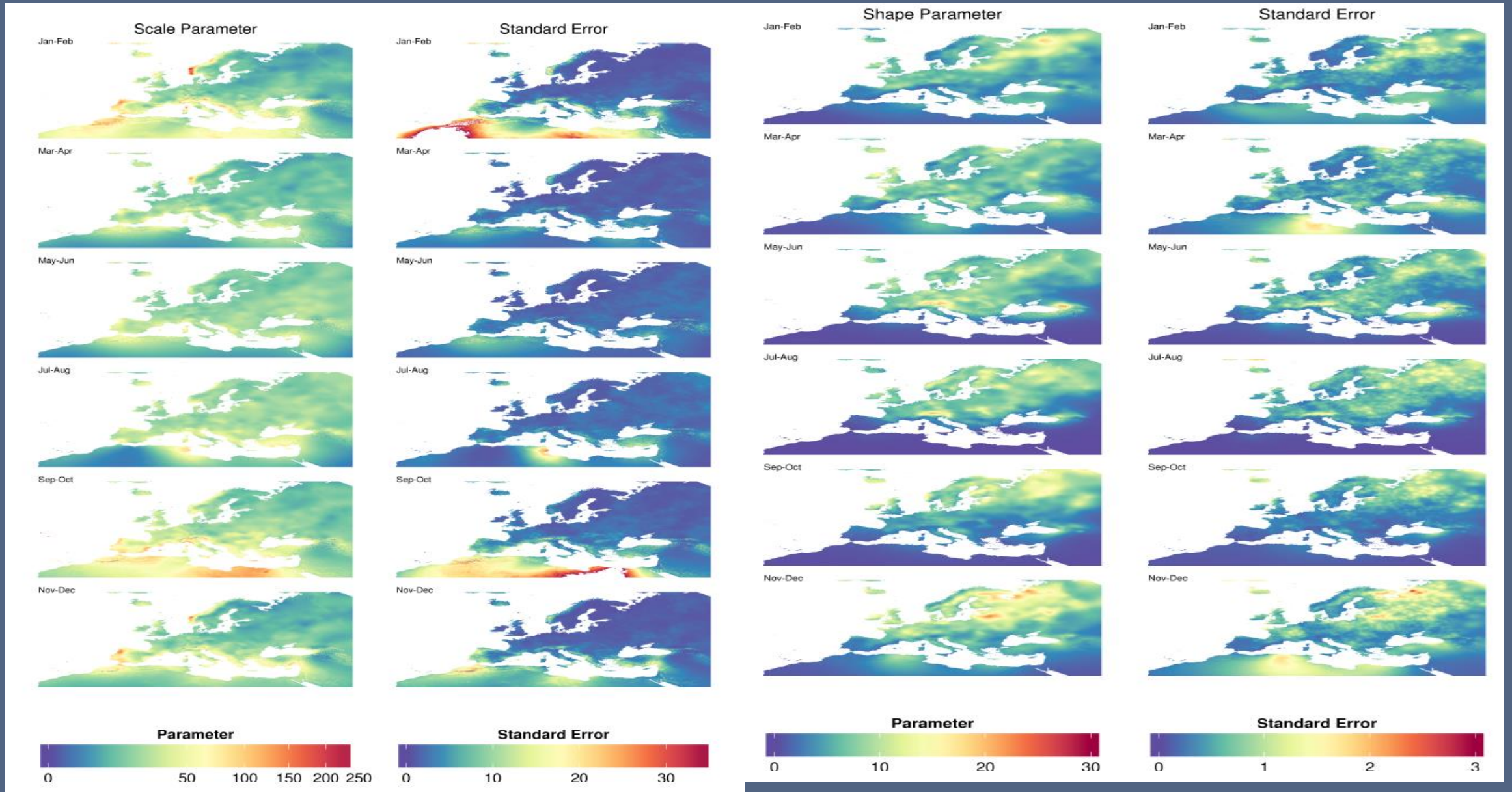
# Issues to be discussed

- Alternative Gridding of Precipitation in E-OBS
- What's in the ECMWF MARS archive for parts of Europe?
- Issue of potentially updating digitized data from North Africa from this source
- Updating CRUTEM4 data and also CRU TS3.22 for inclusion of scPDSI in the BAMS Annual Reports of the Climate
- Making CRU TS 3.22 data available in a similar way to CRUTEM4
- Updating CRU CY datasets
- Involved also in the UERRA Deliverable D3.2 including 'Guide on Aggregation of Data and Regridding'

# Alternative Precipitation Gridding

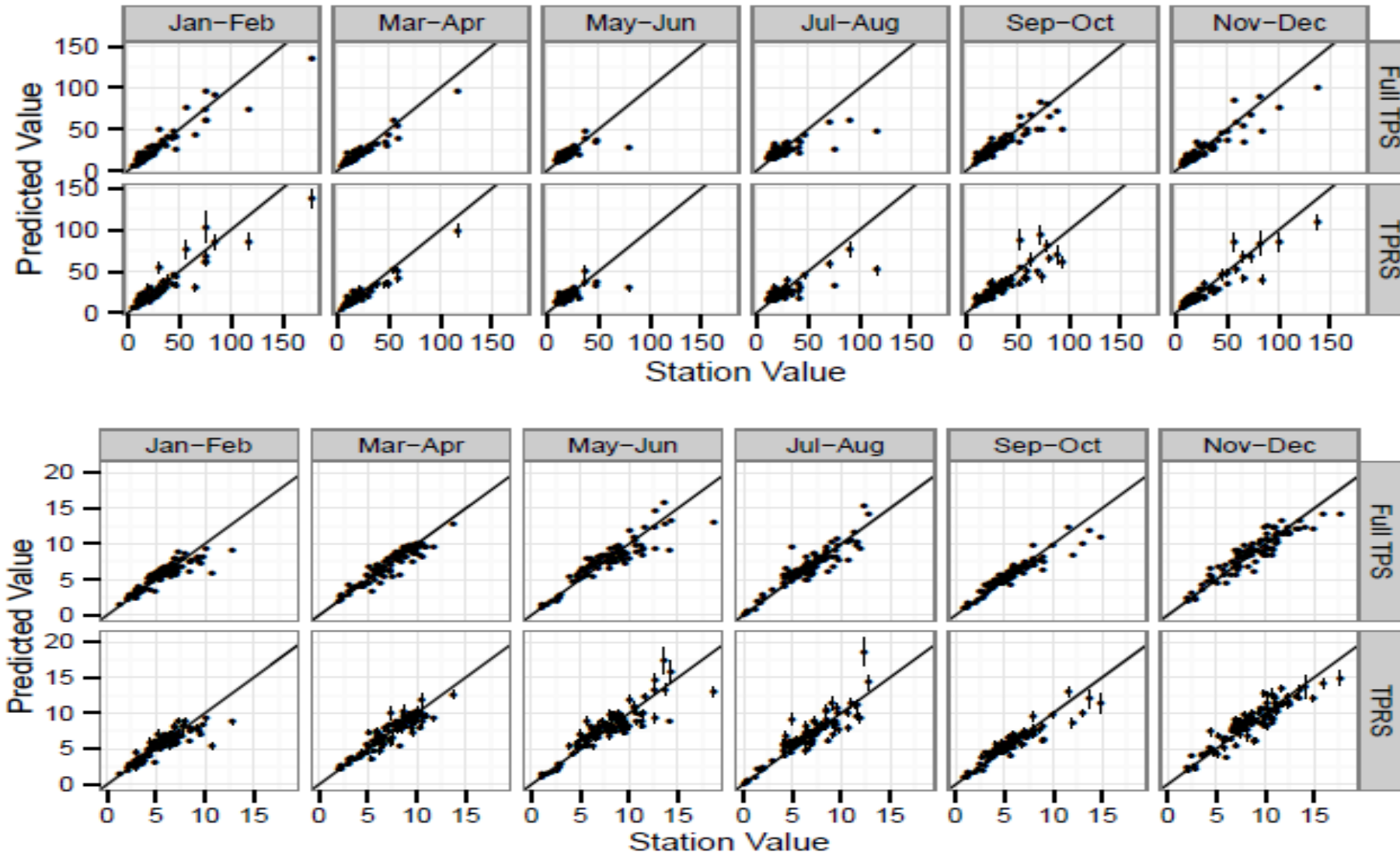
- Comparison with current E-OBS (version 10), as in Haylock et al (2008)
  - Current method grids monthly precipitation in mm, then the daily as % of the monthly total (method ensures daily grids sum to monthly)
  - Uses splines to interpolate monthly precipitation totals (using elevation and latitude/longitude), with kriging for the daily percentages of monthly totals
  - The variant here transforms the bi-monthly totals (JF, MA, etc) using a Gamma Distribution producing shape and scale parameters, so each months total becomes a value between 0 and 1
  - Interpolation of shape and scale values to the grid is based on the 1961-90 period
  - Interpolation of the individual bi-monthly transformed values then occurs, with everything then being transformed back to mm values (requires incomplete gamma function)
  - Daily interpolation is the same as in the old version, except the daily values are %s of the bi-monthly totals
  - Bi-monthly totals work better in the dry summer months in North Africa and the Middle East
  - Aim is to see if maps of extreme measures derived from gridded products can look like maps of the same measures from original station data (gridding the extremes or gridding the stations)
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- Comparisons of a number of extreme measures with E-OBS, as well as with smaller regions of Europe where gridding has been undertaken with much denser precipitation networks than E-OBS (Alps, Norway and Spain)

# Scale and Shape Parameters for Bi-Months calculated for the period 1961-90



Estimating the Scale (top) and Shape (bottom) parameter by leaving some stations out.  
Two different ways of performing the interpolation of the parameters across Europe – Thin Plate Regression Splines and Full Thin Plate Splines

Results a little  
susceptible to  
which sites are  
left out



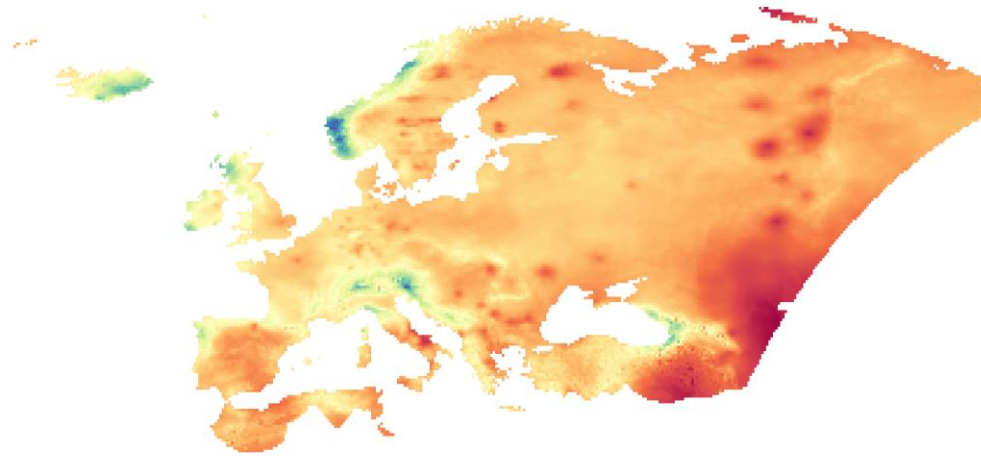
# Extreme Measure used – R95Ptot

- R95Ptot is the annual rainfall total occurring from days greater than the 95th percentile of raindays (fitted for each bi-monthly period)
- R95Ptot is a metric from the ETCCDI suite of extremes, but it isn't one of the most extreme ones
- Metric calculated at the same resolution in the new and current version of E-OBS
- Calculated at the highest resolution over the Alps, Norwegian and Spanish datasets and comparison by looking at maps (so no degradation of the more highly-resolved grids)
- Over much of Europe it is difficult to see the differences, but these are evident for locations where very heavy daily precipitation values occur

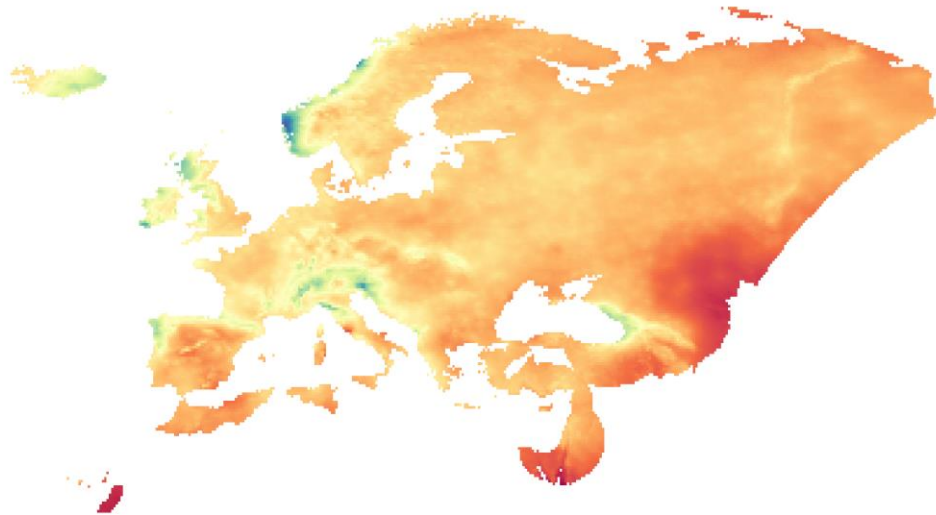


## Climdex R95PTOT

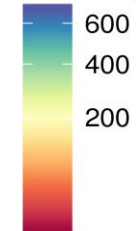
Gamma Transform



E-OBS V10



Rainfall (mm)



Comparison of R95PTOT using the Gamma Transform method and the current E-OBS version

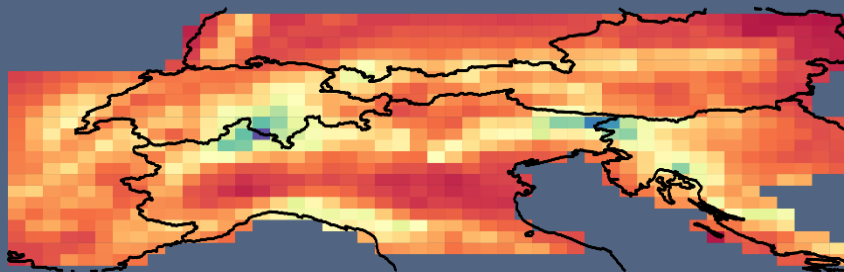
Precipitation totals plotted with a square-root transformed scale

R95PTOT is the annual total precipitation on days > 95th percentile of daily precipitation amounts

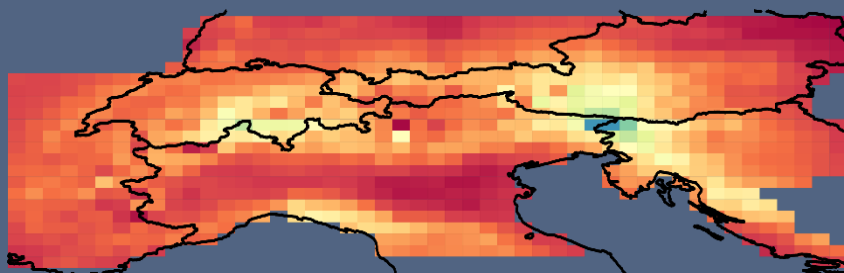
Gamma Transformed results indicate a wider range of extremes (e.g. an enhanced rain shadow over Sweden). Greater speckling may indicate some problematic values and the new method is more prone to these

Climdex R95PTOT

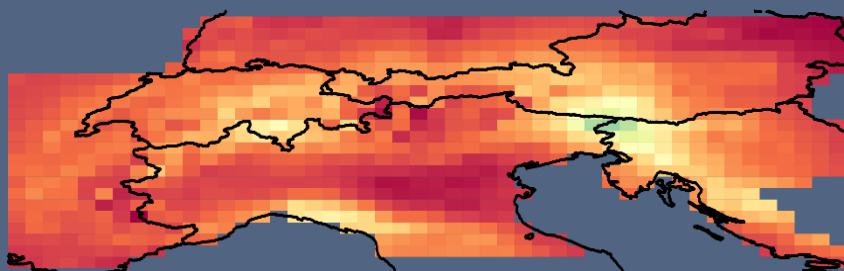
Alps High-Resolution



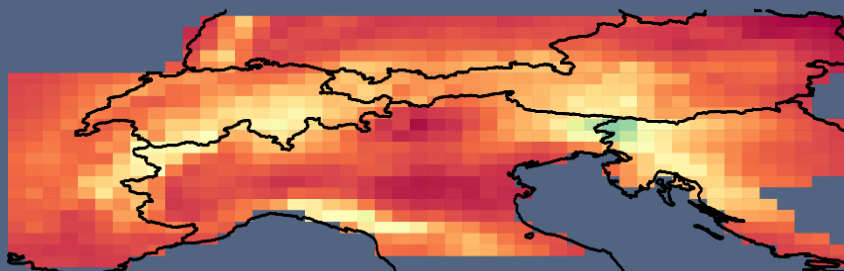
Gamma Transform



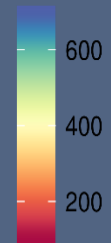
Month Totals



E-OBS V10



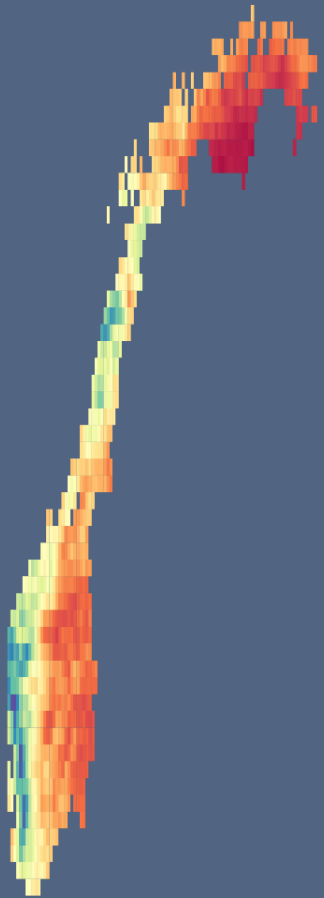
Rainfall (mm)



Similar results here, but for the Alps we can compare with the High-Res dataset developed by MeteoSwiss. These are slightly better produced in the Gamma Transformed version

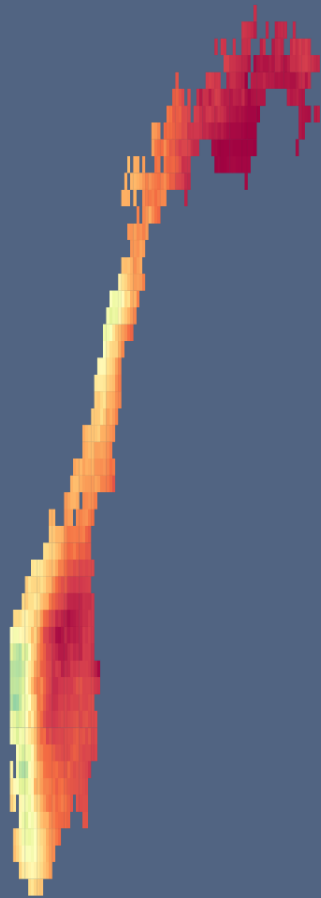


Norway High-Resolution

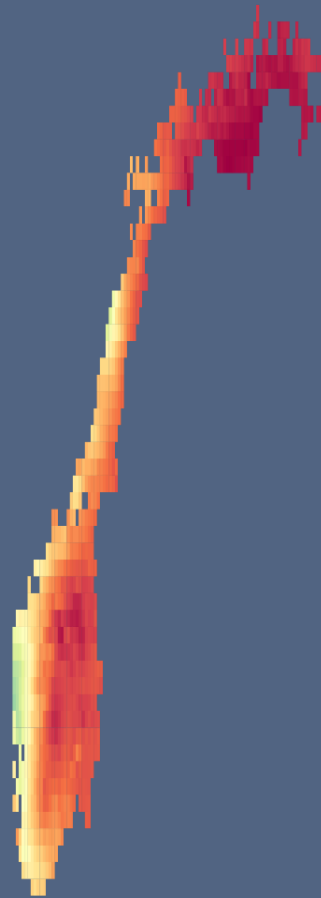


Climdex R95PTOT

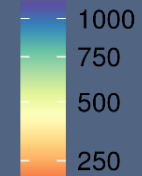
Gamma Transform



E-OBS V10

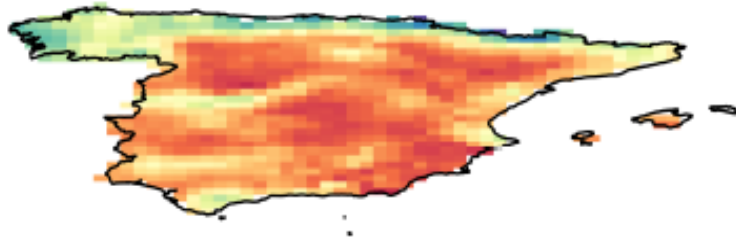


Rainfall (mm)

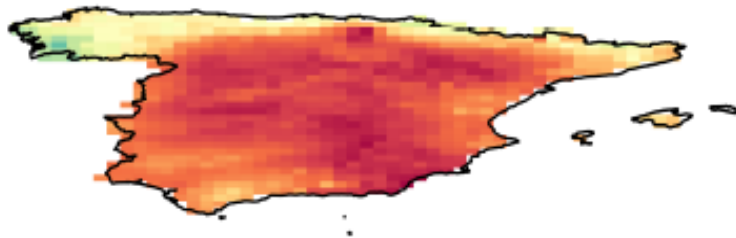


Another region of very high precipitation to look at is Norway, where we can also compare with DNMI high-resolution dataset. As with the Alps, the Gamma-Transformed version does slightly better. The extension of high values extends further south along the Norwegian coast

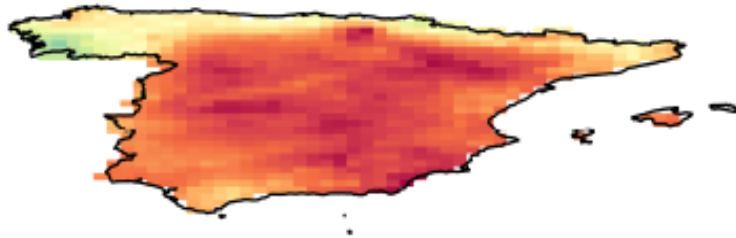
High-Resolution Spain02



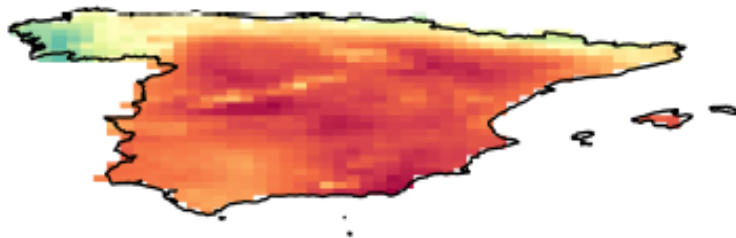
Gamma Transform



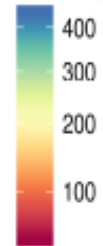
Month Totals



E-OBS V10



Rainfall (mm)



## Spain02 Dataset

The high-resolution dataset (Spain02) has a thin strip of high precipitation values for R95Ptot along the north coast, which is not reproduced that well by the other datasets – which seem to only have high values in Galicia

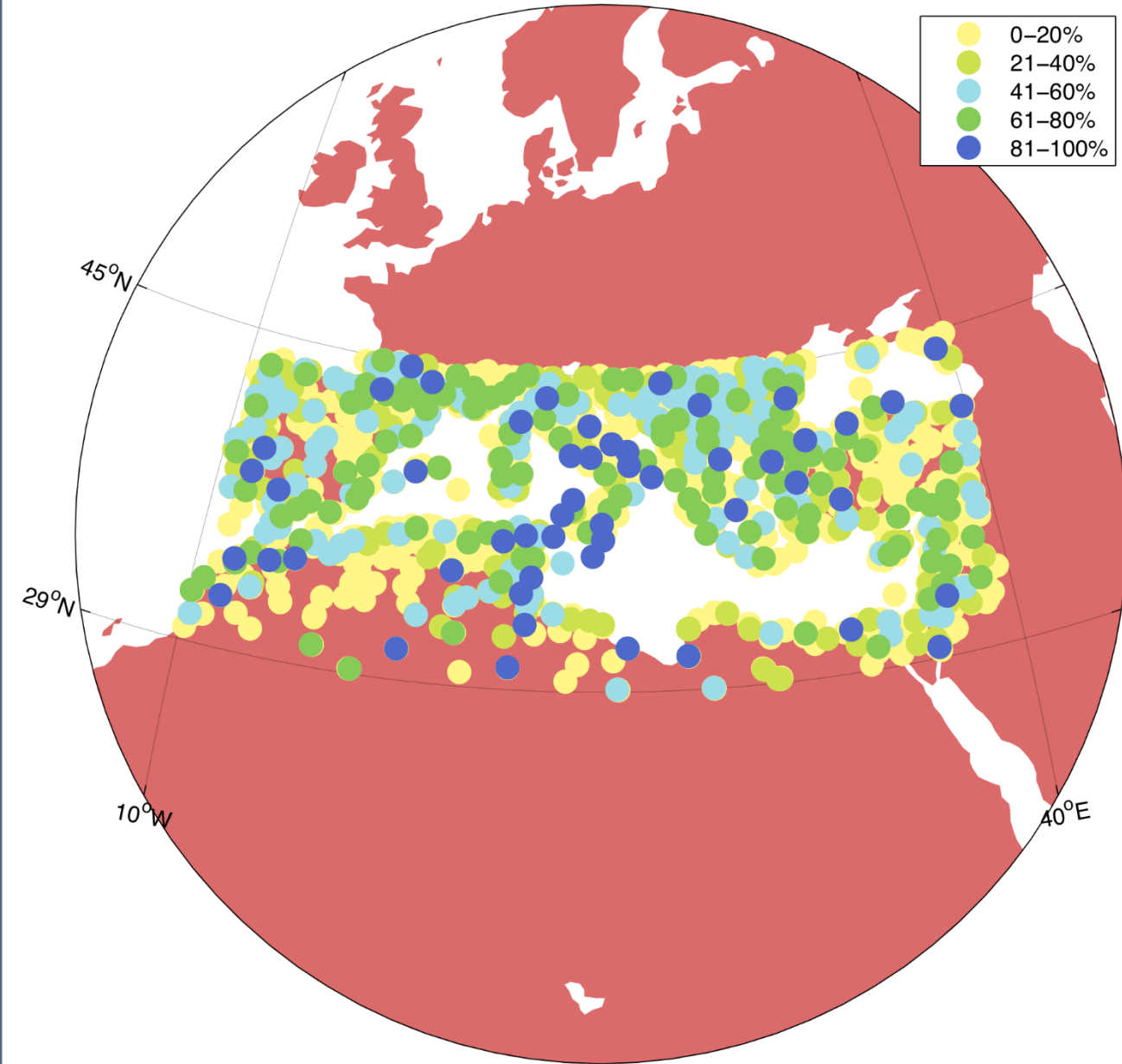
# Summary/Recommendations

- Difficult to see, but the transformation appears to produce results that look more like regions where gridded products have access to many more stations than E-OBS
- Results very dependent on station data availability, so need to check how well the approach works in more sparsely covered regions

# Assessment of ECMWF coverage in the Archive

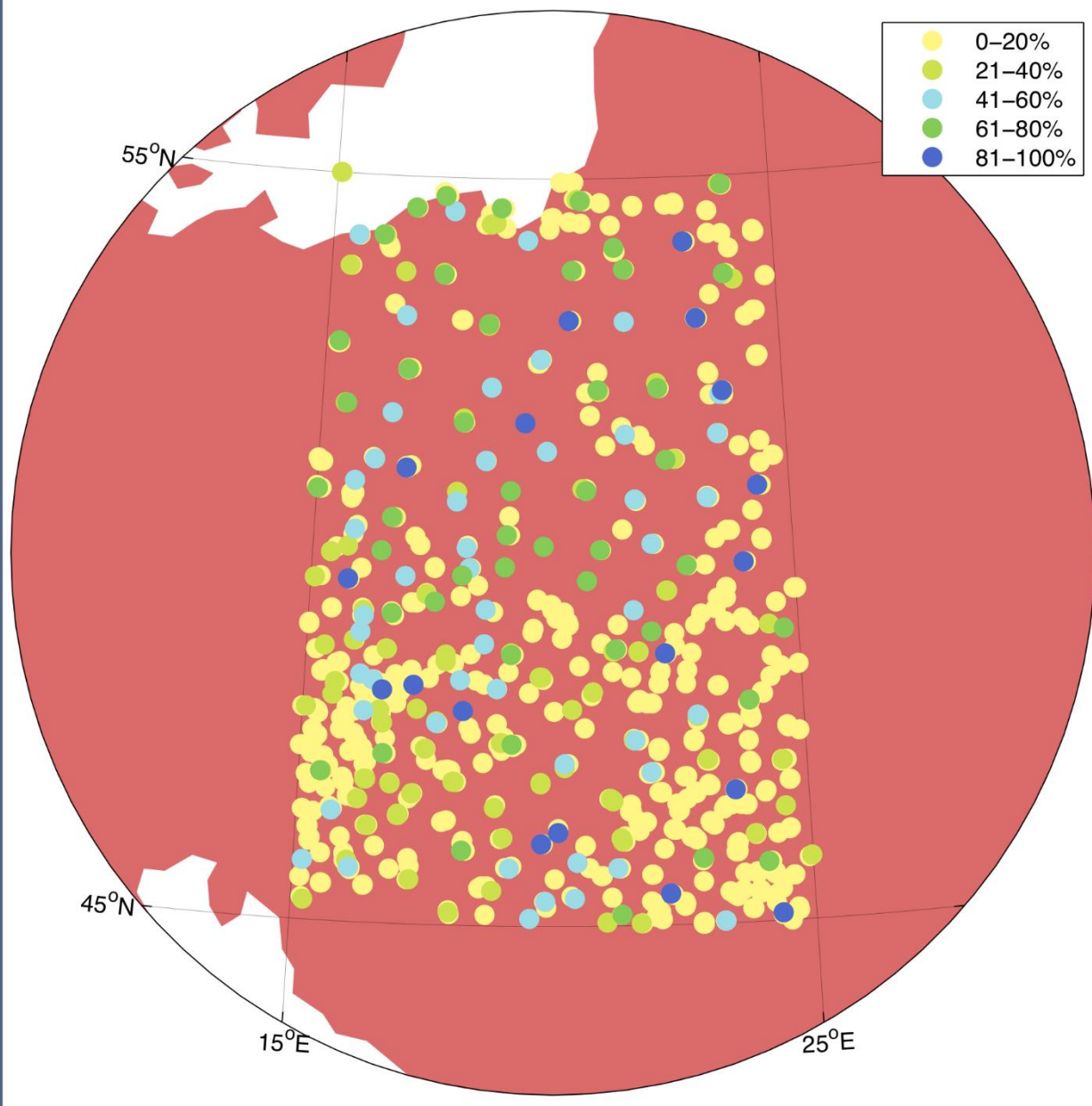
- Necessary to develop software to extract and also add data to the archive (ODB-compliant database)
- Examples of what is in the archive for different regions of Europe
- URV digitized data added for 33 stations in Morocco, Spain, Algeria, Tunisia, Egypt, Cyprus and Lebanon
- Data extends over the 1852-2008 period and is 600K observations covering 57K lines

ecmwfstats.45N.29N.040E.010W.dat (SLP monthly coverage 1960–2010)



Mediterranean. ECMWF archive appears to have more stations that are more complete than might be expected (compared to the other two regions)

ecmwfstats.55N.45N.025E.015E.dat (SLP monthly coverage 1960–2010)

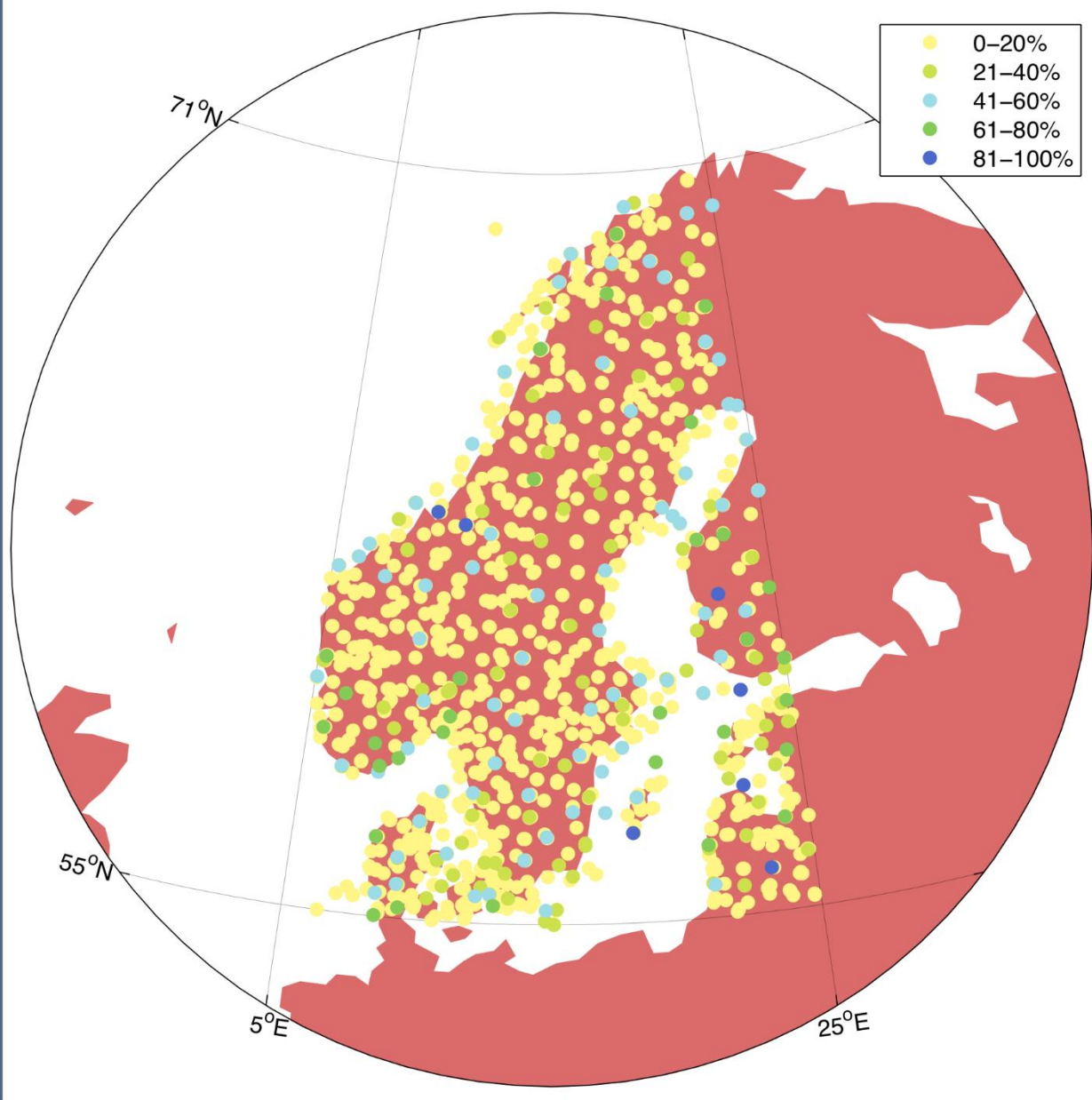


Eastern Europe – from Poland southwards

Archive appears to have less complete stations, but this is very susceptible to what each NMS releases. Poland, for example, releases very few series over the SYNOP network



ecmwfstats.71N.55N.025E.005E.dat (SLP monthly coverage 1960–2010)



## Scandinavia

Here, there appears to be many stations, but most of these are recent series that are relatively short. So many of these are recently installed AWS data

# Other work

- Real-time (or as near as) updating of CRUTEM4 and CRU TS 3.22
- We have already incorporated additional data from Spain, Russia, Norway and also USA and Australia into CRUTEM4. Effort here on adding data using E-OBS monthly averages. Latter involved lots of issues due to monthly averages being calculated differently
- Updating CRU TS 3.22 to the end of 2014, initially to be able to produce scPDSI to the end of the year for inclusion in the BAMS, State of the Climate Report for 2014 Secondly to see what is involved in trying to do this. Does this work involve too much effort as it needs to be re-done a few months later when MCDW and some more station data becomes available?
- Updating CRU CY country averages and making the whole CRU TS series available as a dataset (like CRUTEM4 in Osborn and Jones, 2014)
- Developing the 'Guide on Aggregation of Data and Regridding'
- Osborn, T.J. and Jones, P.D., 2014: The CRUTEM4 land-surface air temperature data set: construction, previous versions and dissemination via Google Earth. *Earth Syst. Sci. Data*, **6**, 61-68, doi:10.5194/essd-6-61-2014.