Development of a COSMO-based, high resolution reanalysis for CORDEX-Europe

Climate group seminar presentation

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Aims & Goals

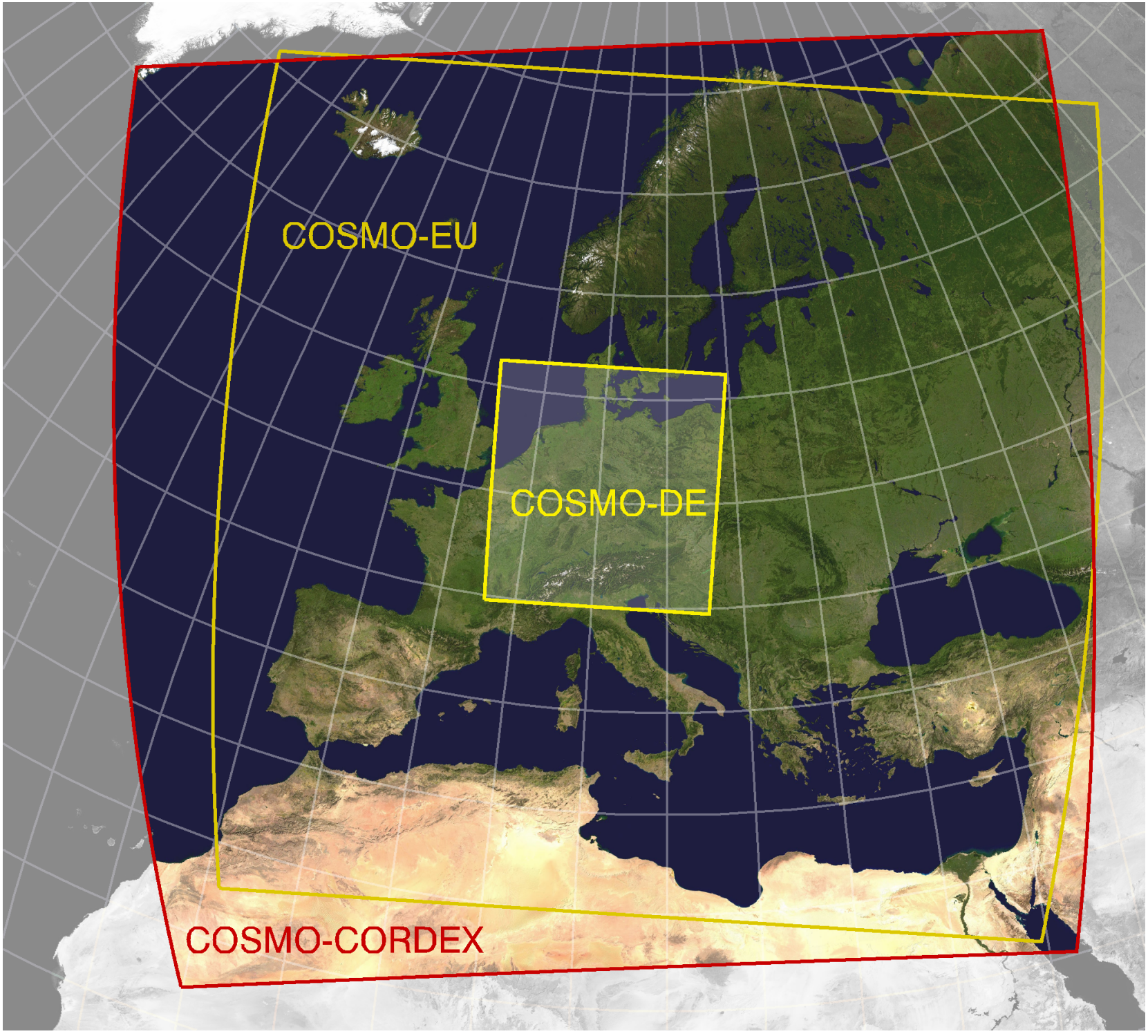
- Quality controlled retrospective analysis of regional climate and its uncertainty for Europe and Germany
- Verification and evaluation of the reanalysis
- Start with 5 years of reanalysis (2007-2011)
- Extend the reanalysis to 30 years (1982-2011)

1 The reanalysis framework

2 Verification of the reanalysis

Framework

- **COSMO-CORDEX**
  - Horizontal resolution of 0.055° ($\sim$ 6.16 km)
  - 40 vertical levels
  - 3-hourly boundary data from ERA-Interim
  - Continuous data assimilation via nudging
  - Soil moisture analysis (**SMA**) daily at 00 UTC
  - **SST** analysis at 00 UTC + **Snow** analysis every 6 hours
  - Hourly 3D-Output, 15min 2D-Output (incl. SYNSATs)
- **COSMO-DE**
  - Horizontal resolution of 0.025° ($\sim$ 2.8 km)
  - 50 vertical levels
  - Hourly boundary data from COSMO-CORDEX
  - Continuous data assimilation via nudging
  - Continuous Latent heat nudging **LHN**
  - **SST** analysis at 00 UTC + **Snow** analysis every 6 hours
  - Hourly 3D-Output, 15min 2D-Output (incl. SYNSATs)


COSMO-EU
COSMO-DE
COSMO-CORDEX

Current status

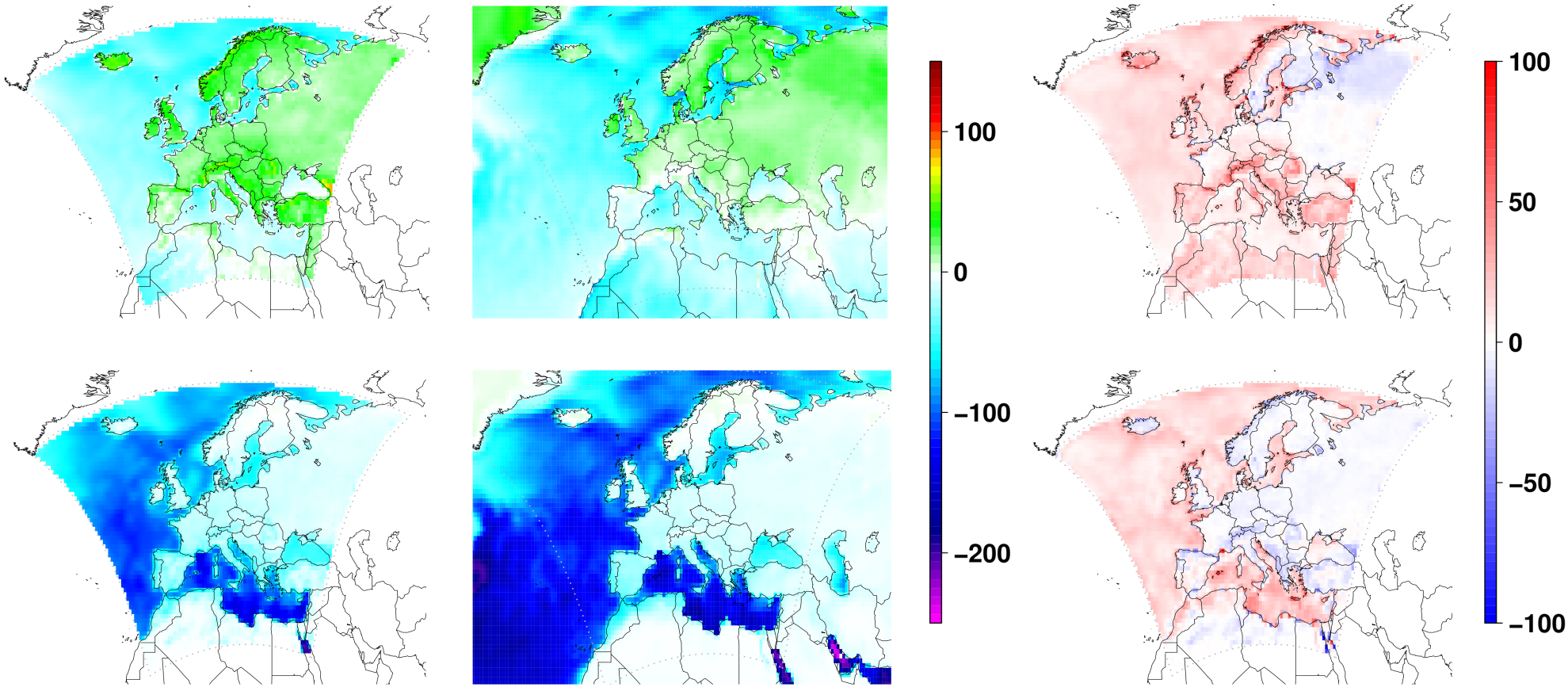
- Portable Script-based system has been set up
- Computation time at ECMWF and DKRZ
- At ECMWF: $\sim$ 16 days of reanalysis in one computation day
- At DKRZ: $\sim$ 7 days of reanalysis in one computation day
- So far 2 months spin-up (Nov-Dec 2010) and 2 months reanalysis (2011) finished for COSMO-CORDEX

1 The reanalysis framework

2 **Verification of the reanalysis**

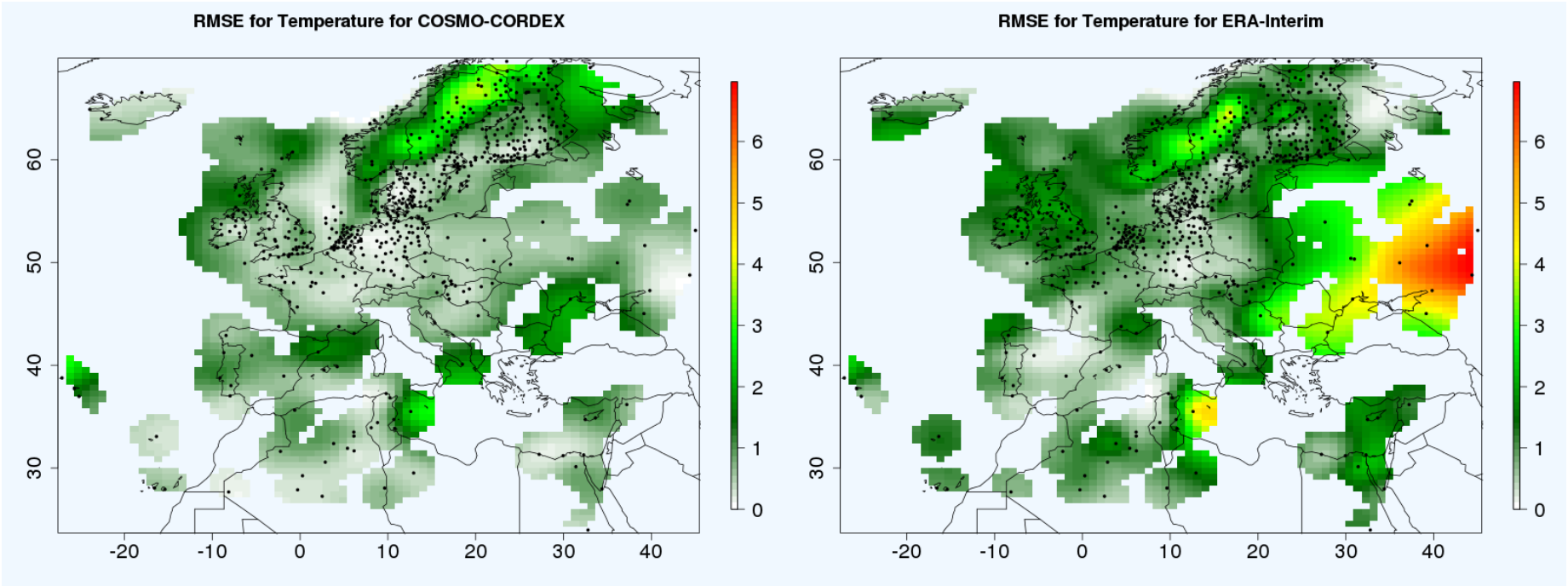
Heat fluxes

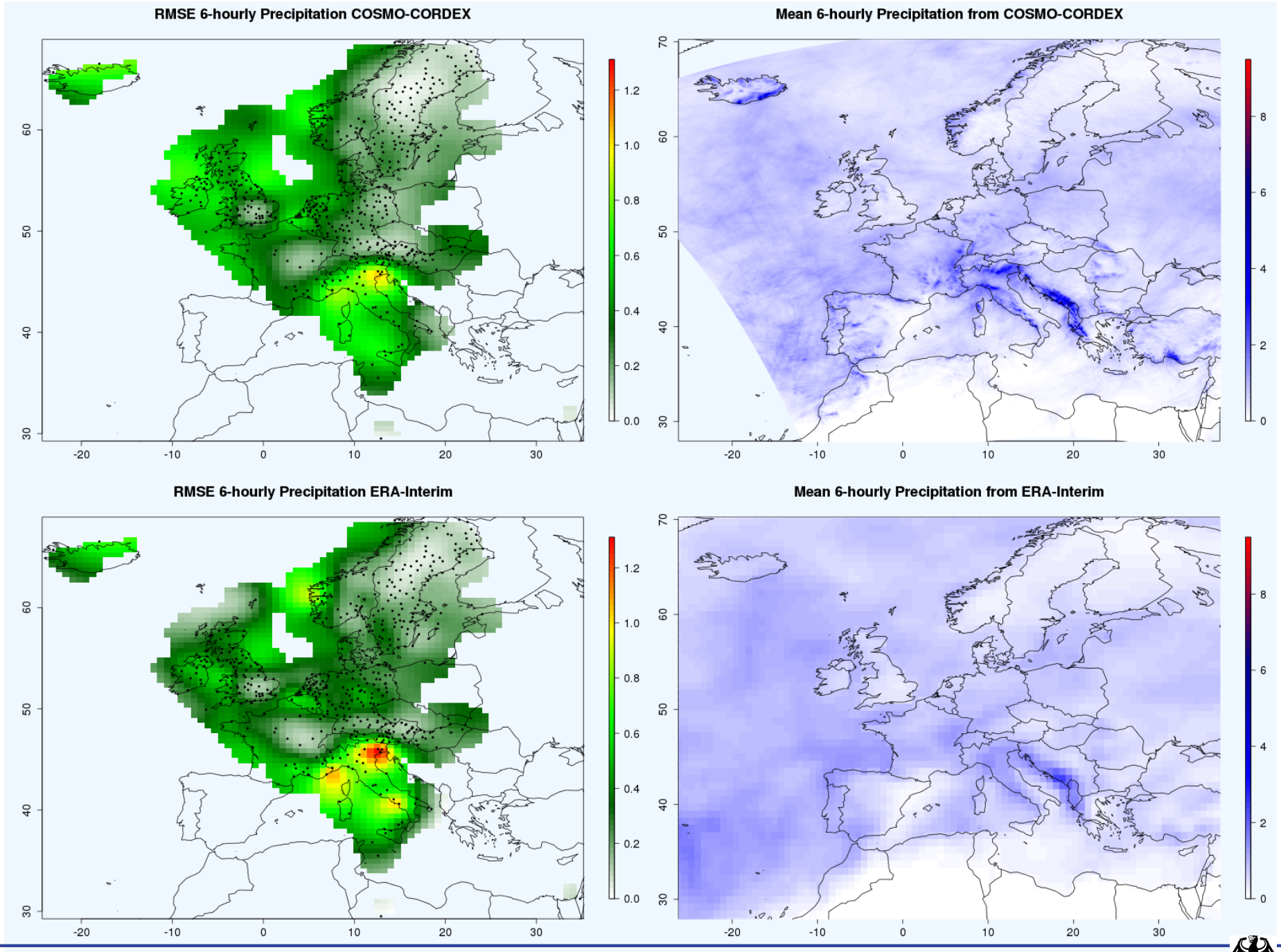
- Mean values from Nov-Dec 2010



RMSE for Temperature and Precipitation

- Mean values from Nov-Dec 2010
- Nearest gridpoint method
- Only stations with height differences < 100m




RMSE 6-hourly Precipitation COSMO-CORDEX
Mean 6-hourly Precipitation from COSMO-CORDEX
RMSE 6-hourly Precipitation ERA-Interim
Mean 6-hourly Precipitation from ERA-Interim

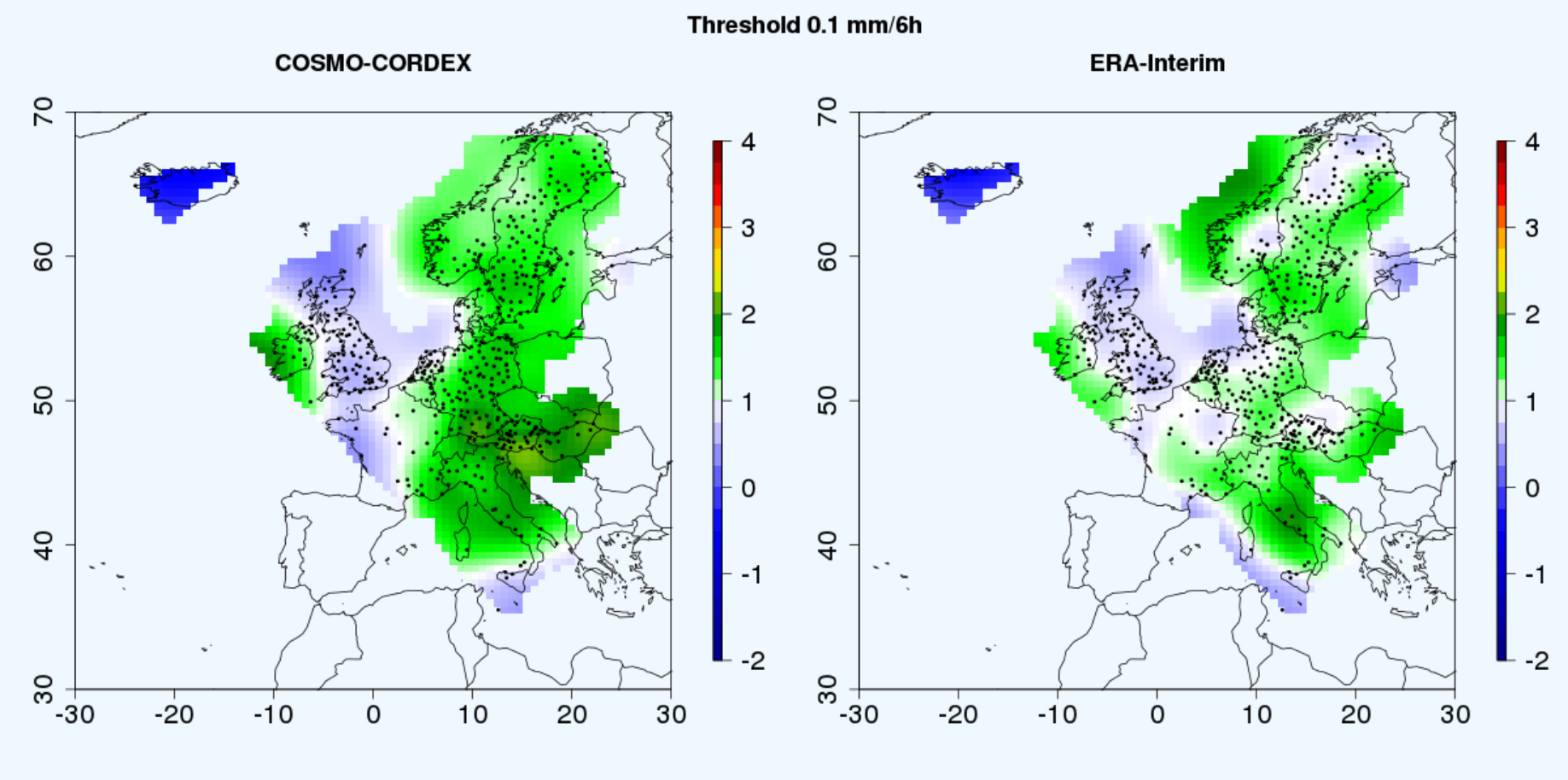
Precipitation

- For the verification of precipitation we also considered the log-Odds-Ratio θ:

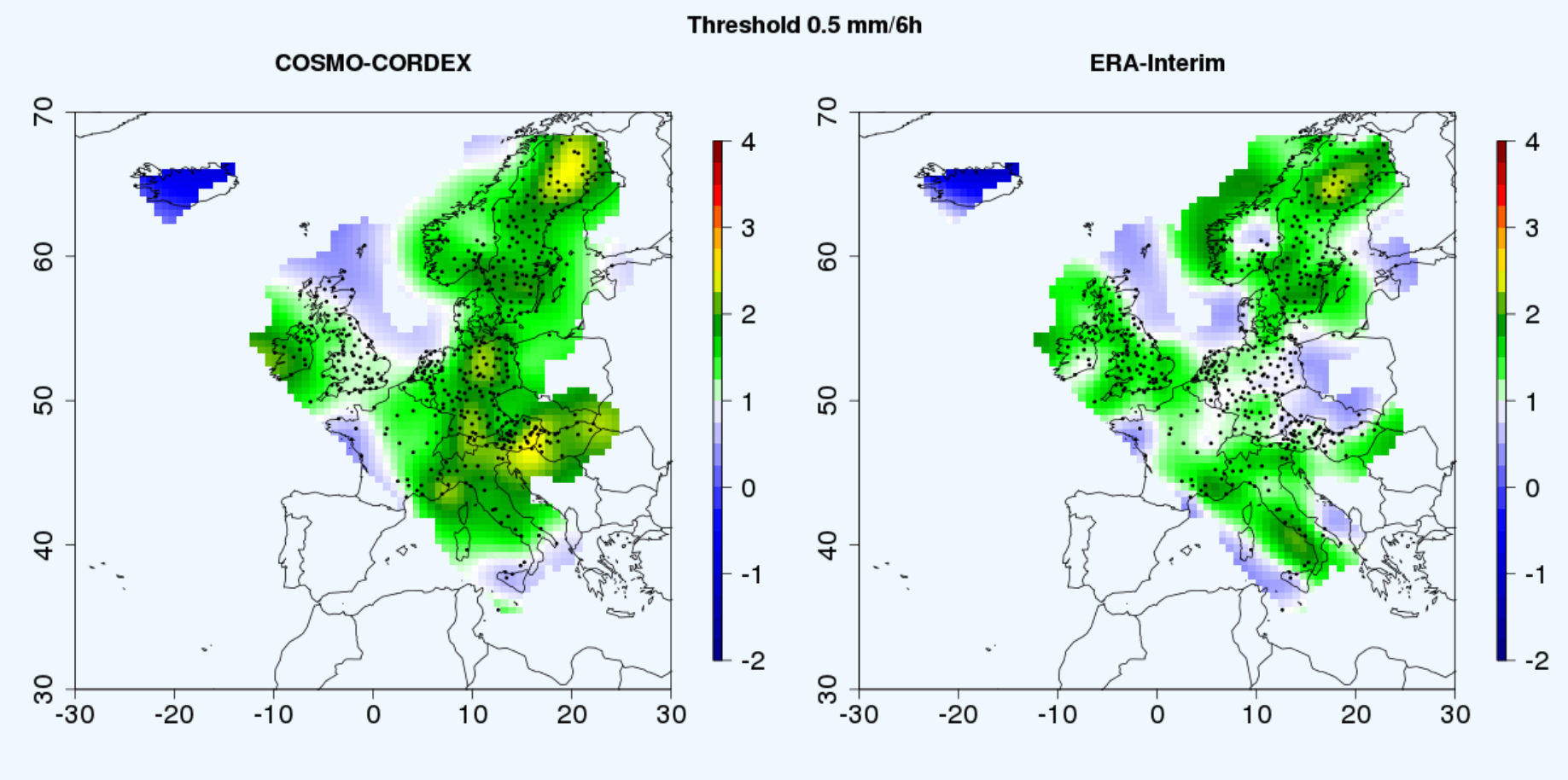
$$\theta = \frac{H}{1-H}\left(\frac{F}{1-F}\right)^{-1}$$

- $H = \frac{a}{a+c}$ is the Hit Rate and $F = \frac{b}{b+d}$ is the False Alarm Rate
- Contingency table with different precipitation thresholds
- The signal is significant with 95% confidence if $\theta - 2\sigma > 1$, where σ is the standard error

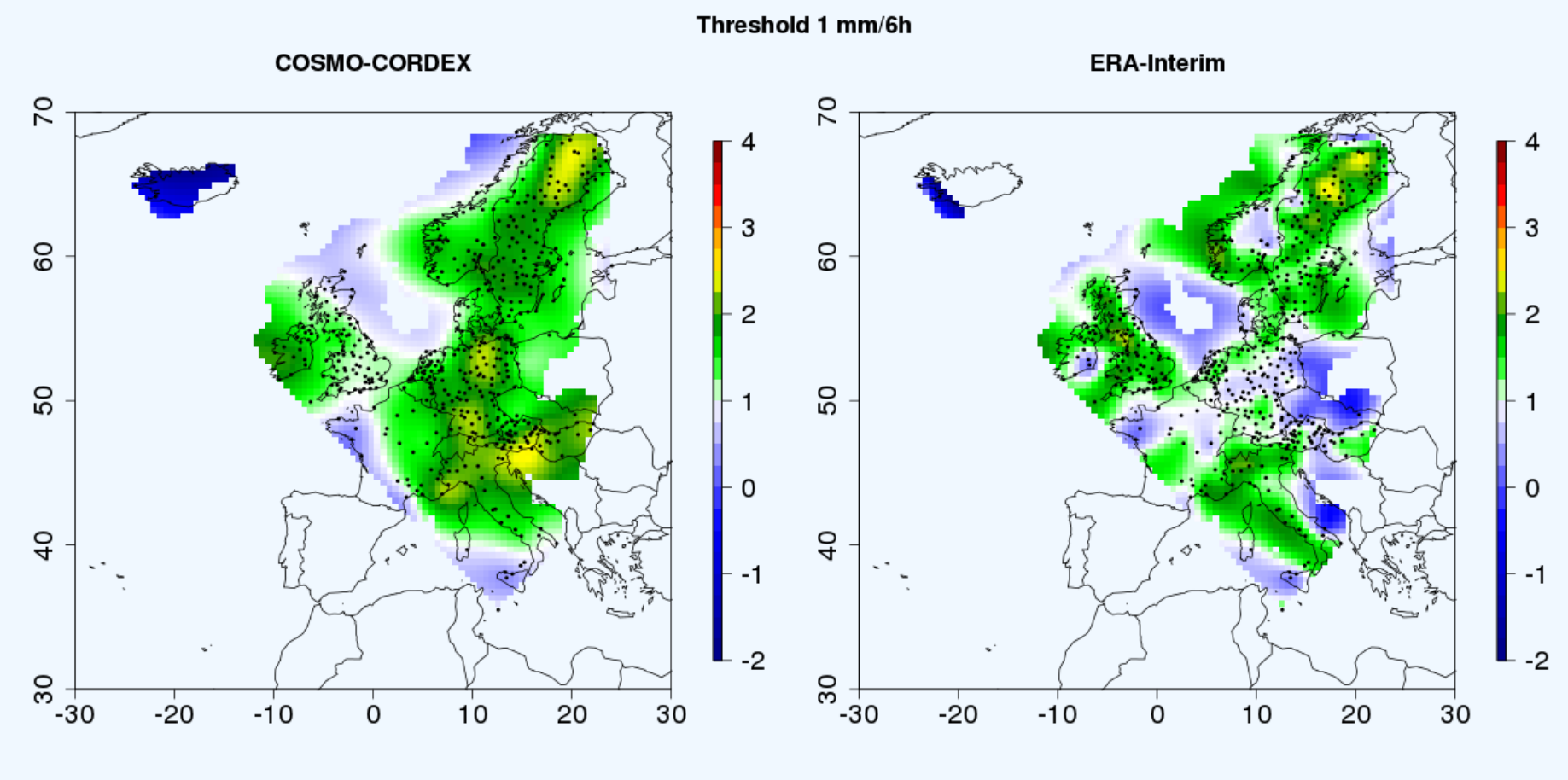
Precipitation



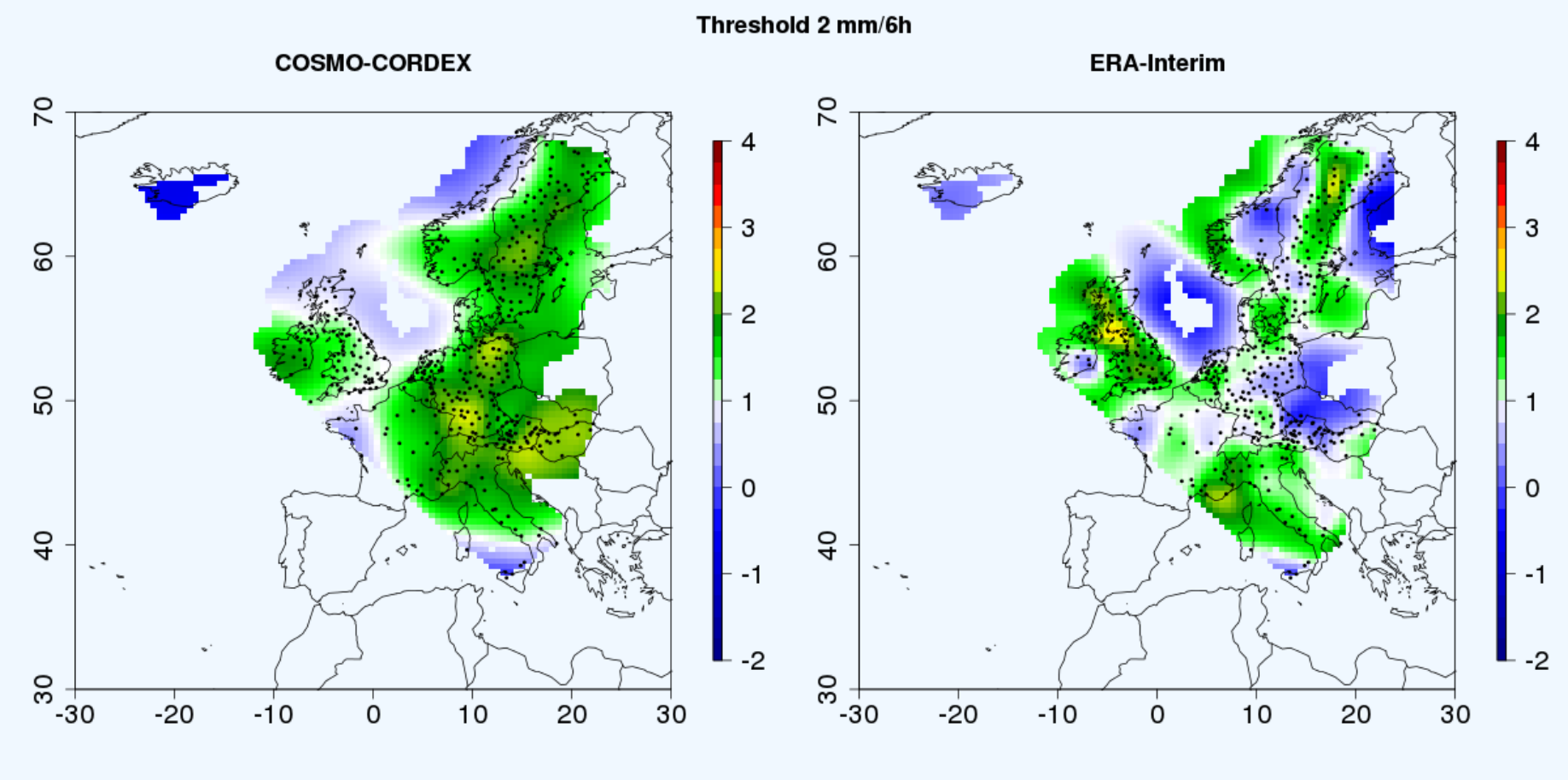
Precipitation



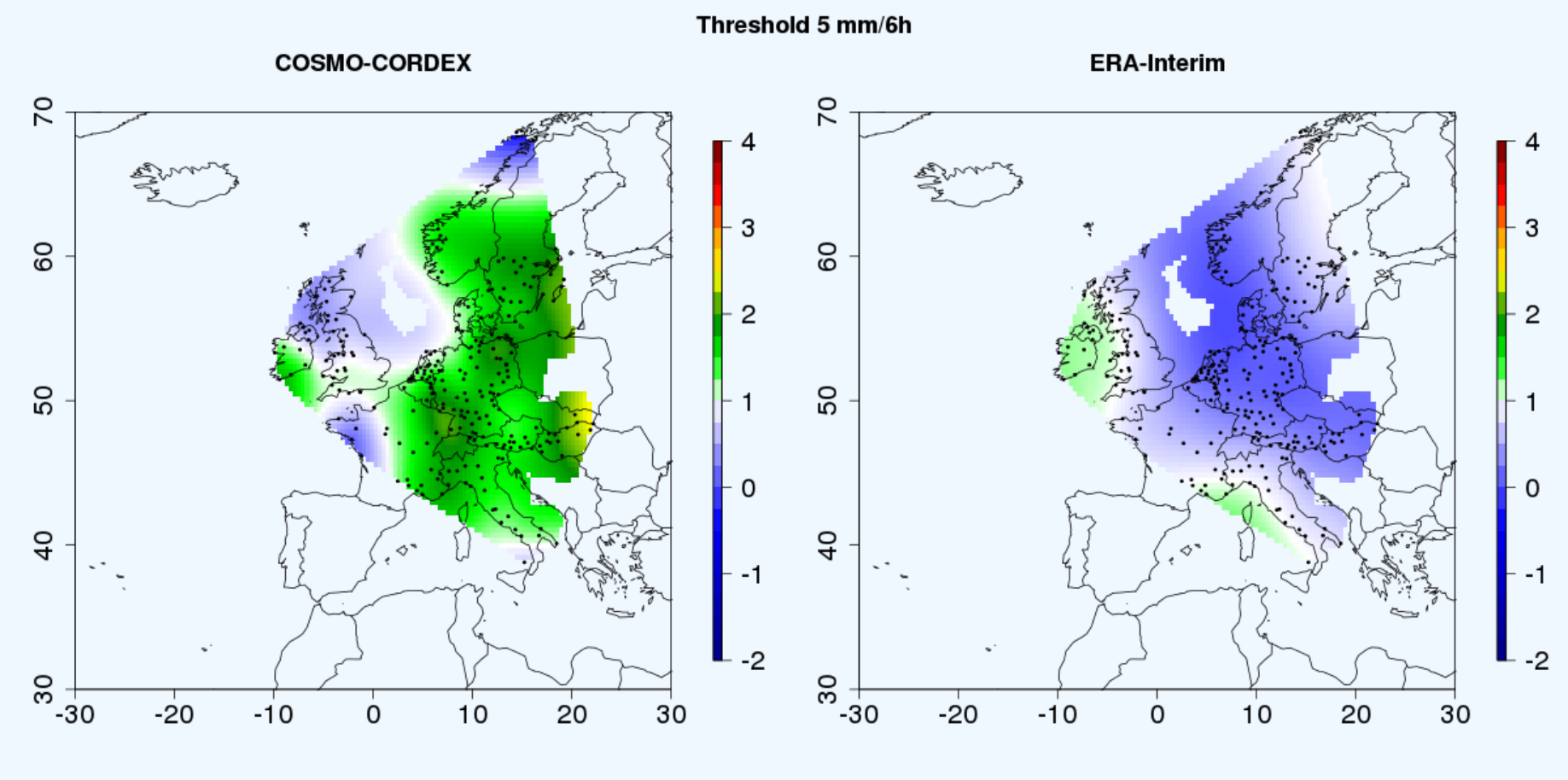
Precipitation



Precipitation



Precipitation



Conclusions

- The reanalysis system has been set up and is running
- Performance seems to be reasonable
- First verifications show encouraging results

Outlook

- Finish five years of CORDEX reanalysis this year
- Compare the CORDEX reanalysis with downscaling experiments
- Use CORDEX to drive the COSMO-DE reanalysis with LHN

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