

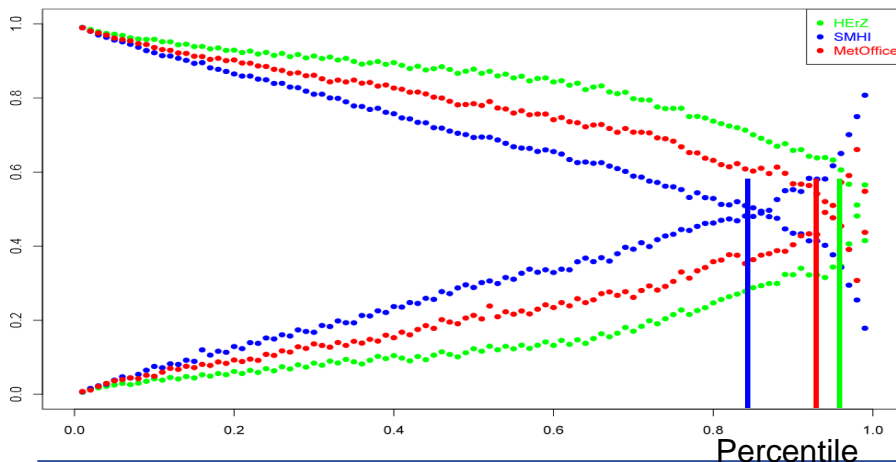
Evaluation of Radiation from CM SAF satellite data against the COSMO-REA6 regional reanalysis

Michael Borsche, Andrea Kaiser-Weiss, Frank Kaspar,
(DWD)

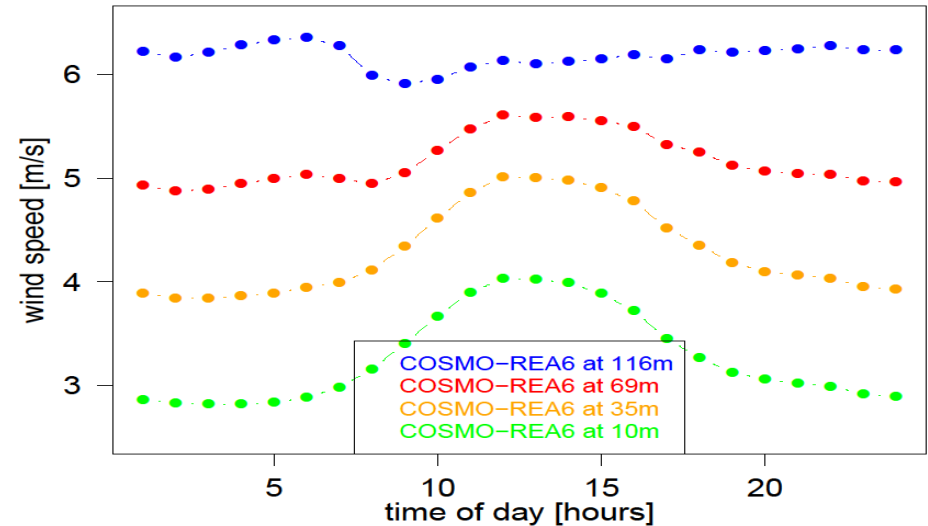
Wind Speed

- RRA compared well against point measurements
- Added value for users at heights previously not available

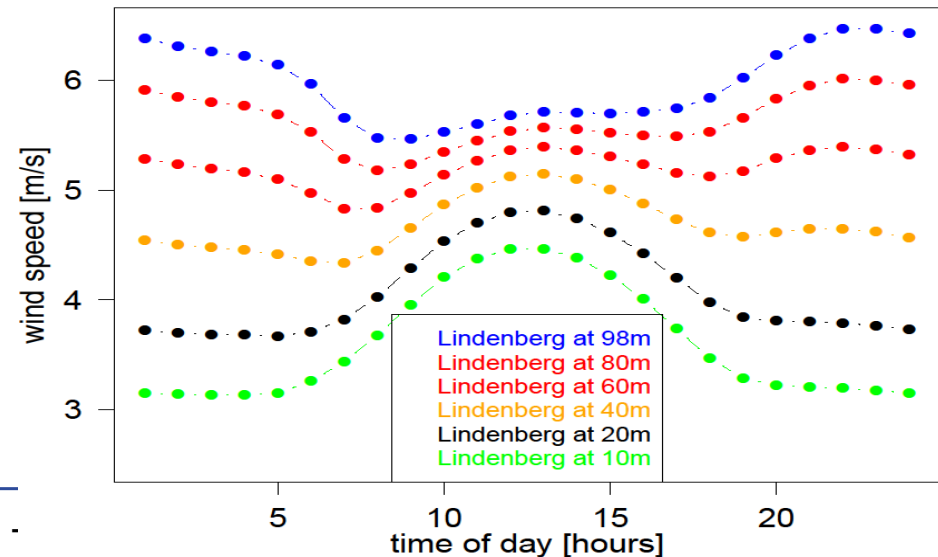
Hit rate vs false alarm ratio of hourly means at Hannover



Daily cycle of COSMO-REA6 wind speed at tower location Lindenberg



Lindenberg wind speed



Outline

- Motivation to use regional reanalysis: wind (recap)
- New parameter: radiation
- Evaluation of COSMO-REA6 against CM SAF SARA-H
- Conclusions: RRAs do not need to shy the comparison

Surface Solar Radiation Dataset – Heliosat (SARAH)

→ Variables

- Global irradiance (SIS)
- Surface Direct Irradiance (DNI, SID)
- Effective cloud albedo (CAL)

→ Resolution

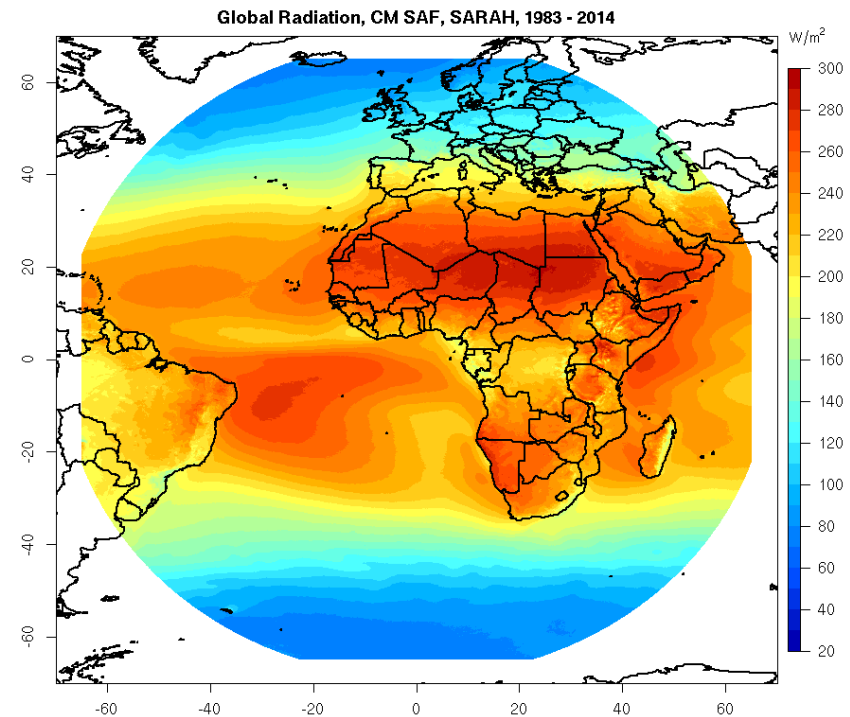
- Spatial: $0.05^\circ \times 0.05^\circ$
- Temporal: hourly means, daily means, monthly means

→ Coverage

- Spatial: METEOSAT-Prime Full disk
- Temporal: 1983 to 2015

→ Satellites / Instruments

- METEOSAT 2 to 10 (MVIRI/SEVIRI)



Presentation by
Uwe Pfeifroth, Thursday, MC2 @ 9:30 am
(Spatial Climatology)

Regional Reana COSMO-REA6: 1997-2014 @ 6.2km

Model:

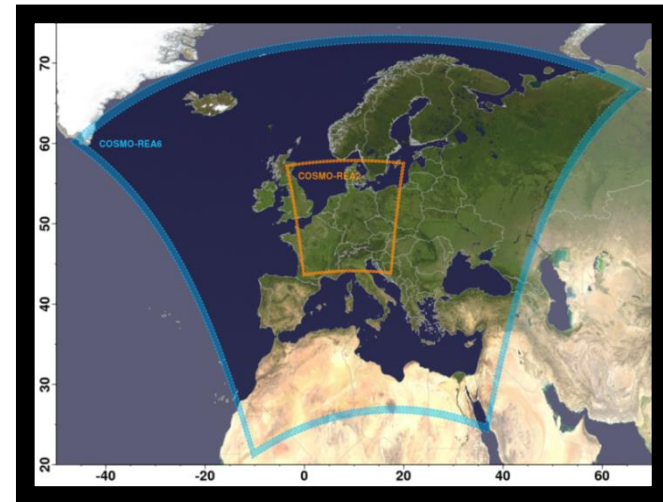
- COSMO-EU v4.25
- 40 layer up to 23 km
- grid = double resolution of CORDEX-EUR11

Boundary conditions:

- ERA-Interim 3 hourly LBC
- Snow, SST, Soil Moisture Analyses (off-line)

Observations:

- Nudging of radiosondes, aircraft-, windprofiler-, synop-, ship-, DRIBU-observations



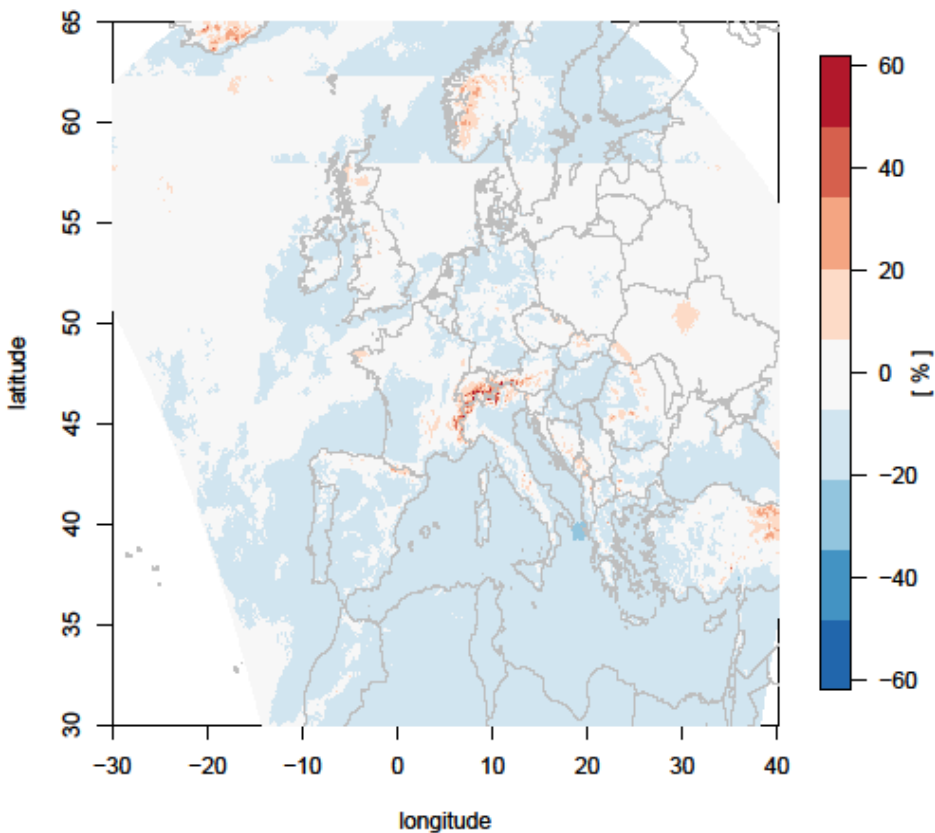
Bollmeyer, C., Keller, J. D., Ohlwein, C., Wahl, S., Crewell, S., Friederichs, P., Hense, A., Keune, J., Kneifel, S., Pscheidt, I., Redl, S., and Steinke, S.: Towards a high-resolution regional reanalysis for the European CORDEX domain, Q. J. R. Meteorol. Soc., doi: 10.1002/qj2486, 2014.

Evaluation method

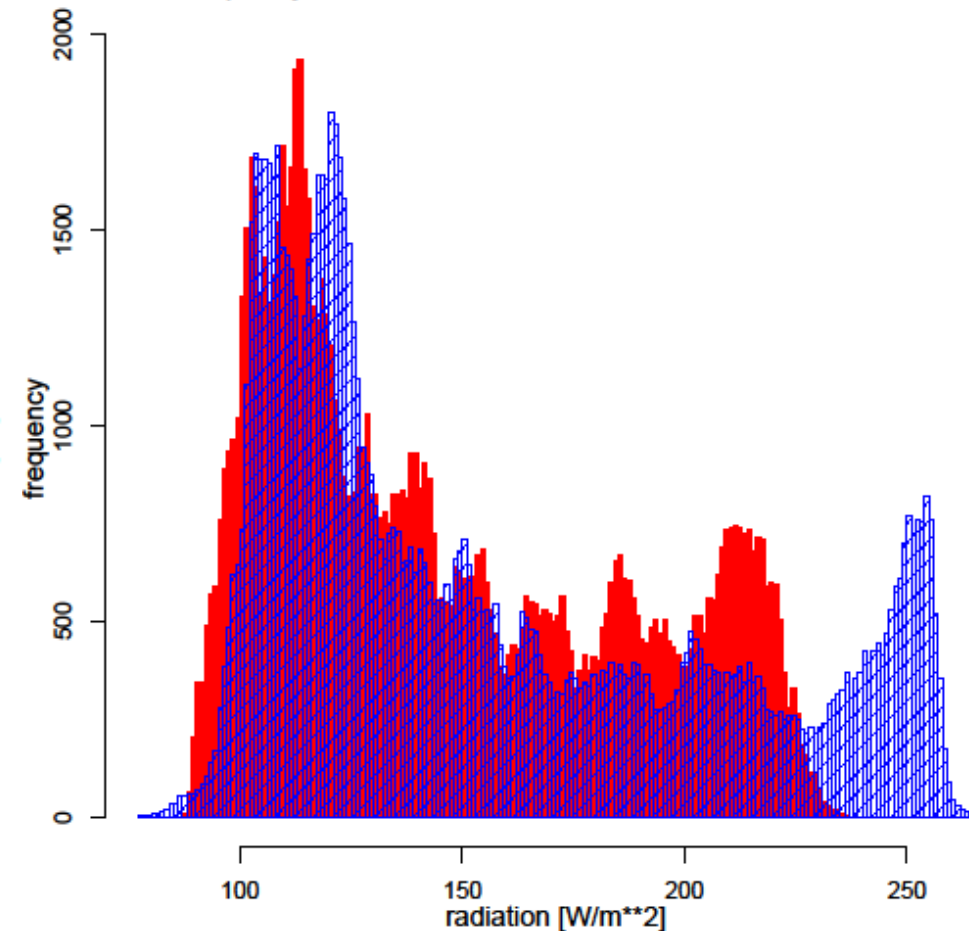
- Common grid of 0.1° spatial resolution (REA6, CM SAF, SMHI, MO)
- Common spatial coverage (domain)
- Common temporal coverage: 2008 (as of now)
- Statistic measures:
 - Relative and absolute differences
 - Scatter plots and frequency distributions
 - Time based correlation

Annual relative difference and distribution

Relative difference in Radiation of G_CREA6 and CM SAF annually

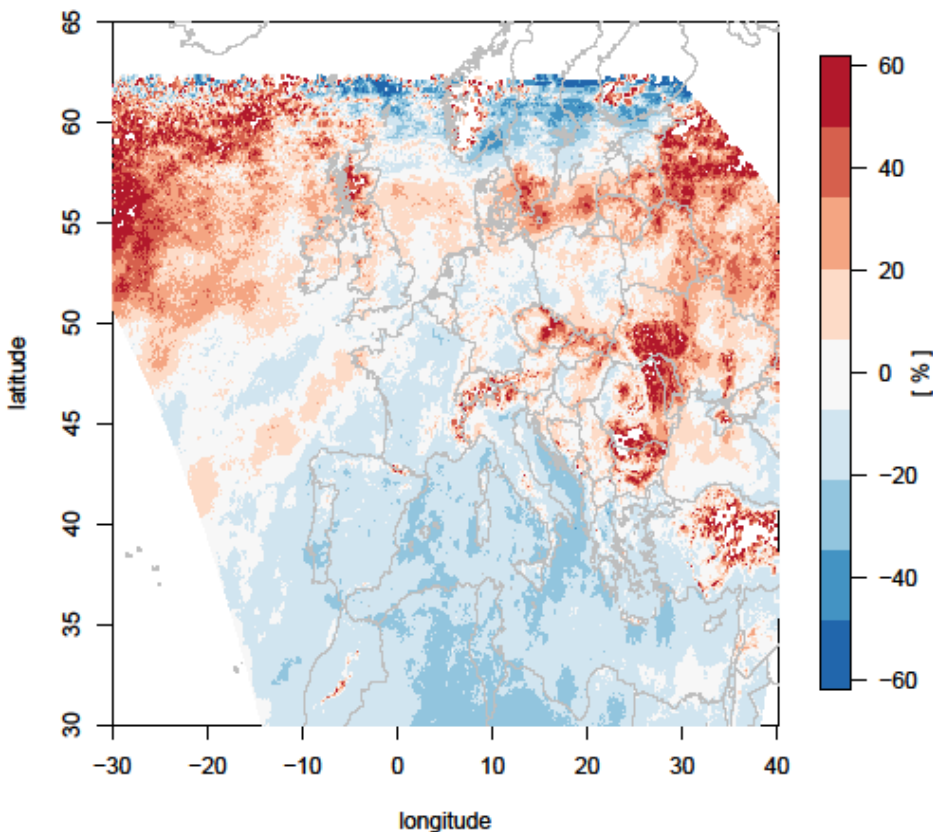


Frequency distribution of COSMO-REA6 and CM SAF in 2008

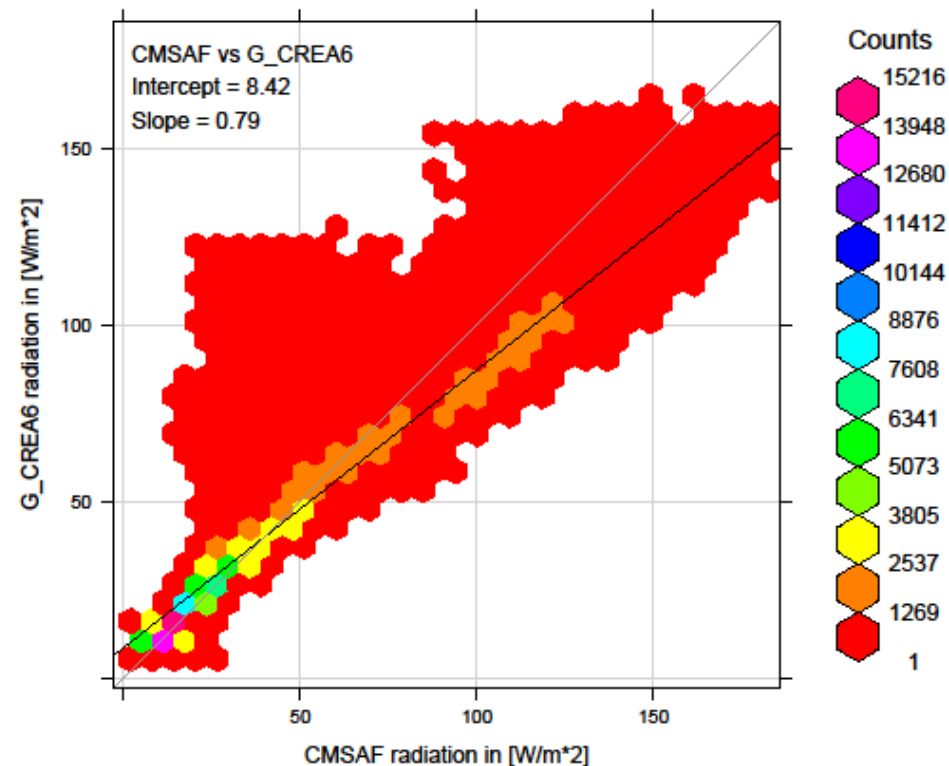


Monthly relative difference and distribution - Jan

Relative difference in Radiation of G_CREA6 and CM SAF in January

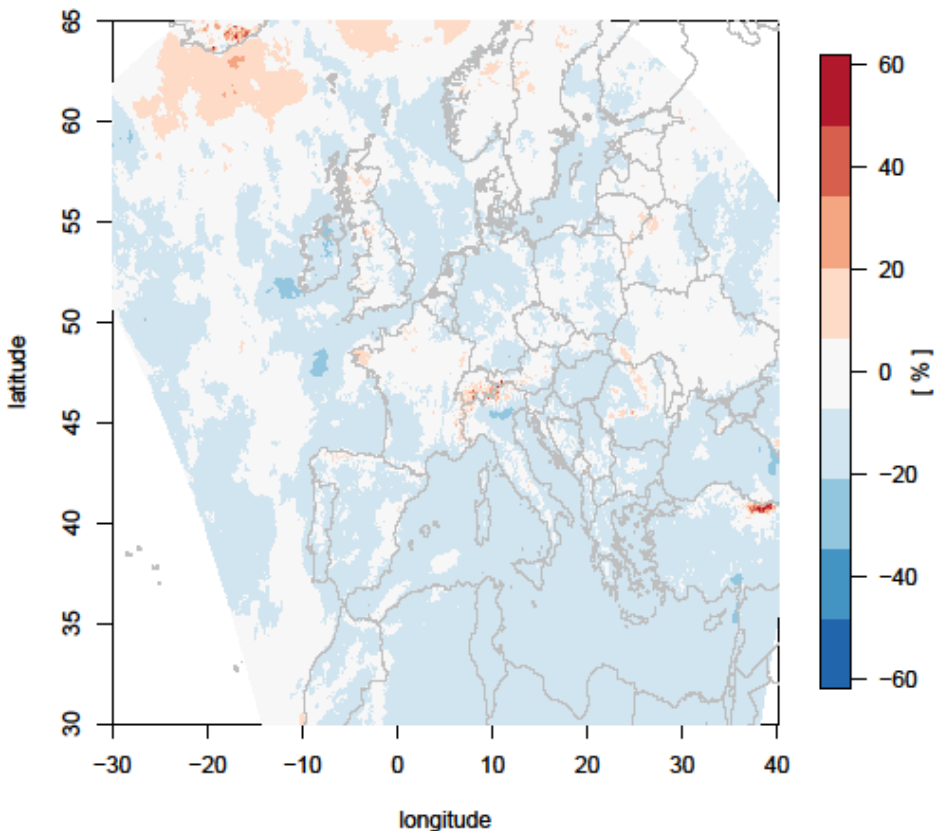


CMSAF vs G_CREA6 in January for complete domain

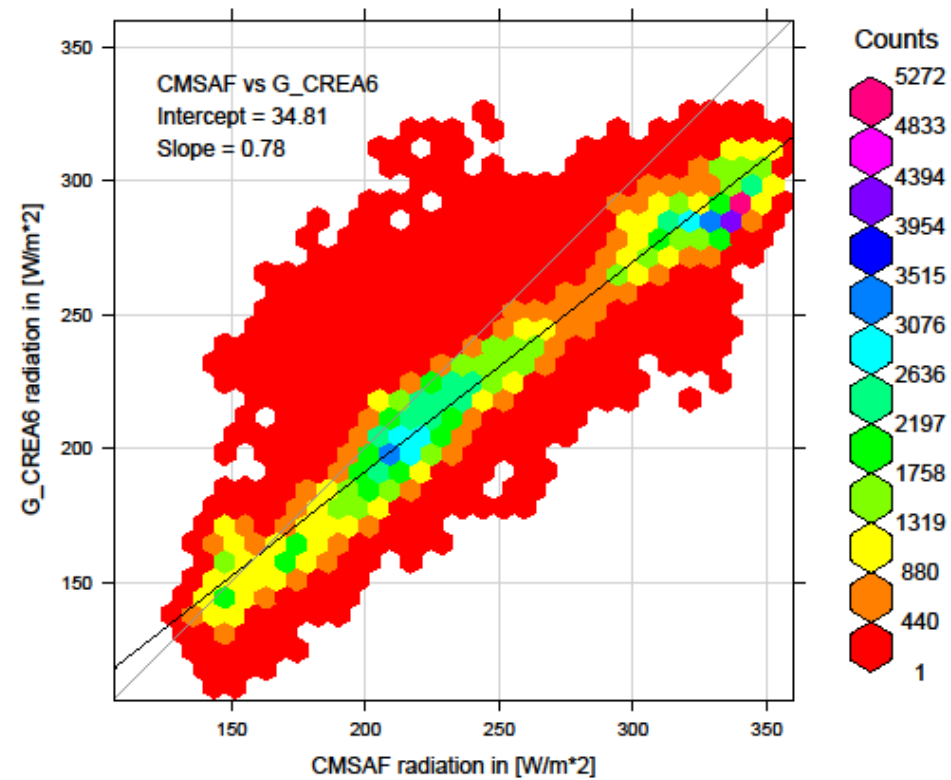


Monthly relative difference and distribution - July

Relative difference in Radiation of G_CREA6 and CM SAF in July

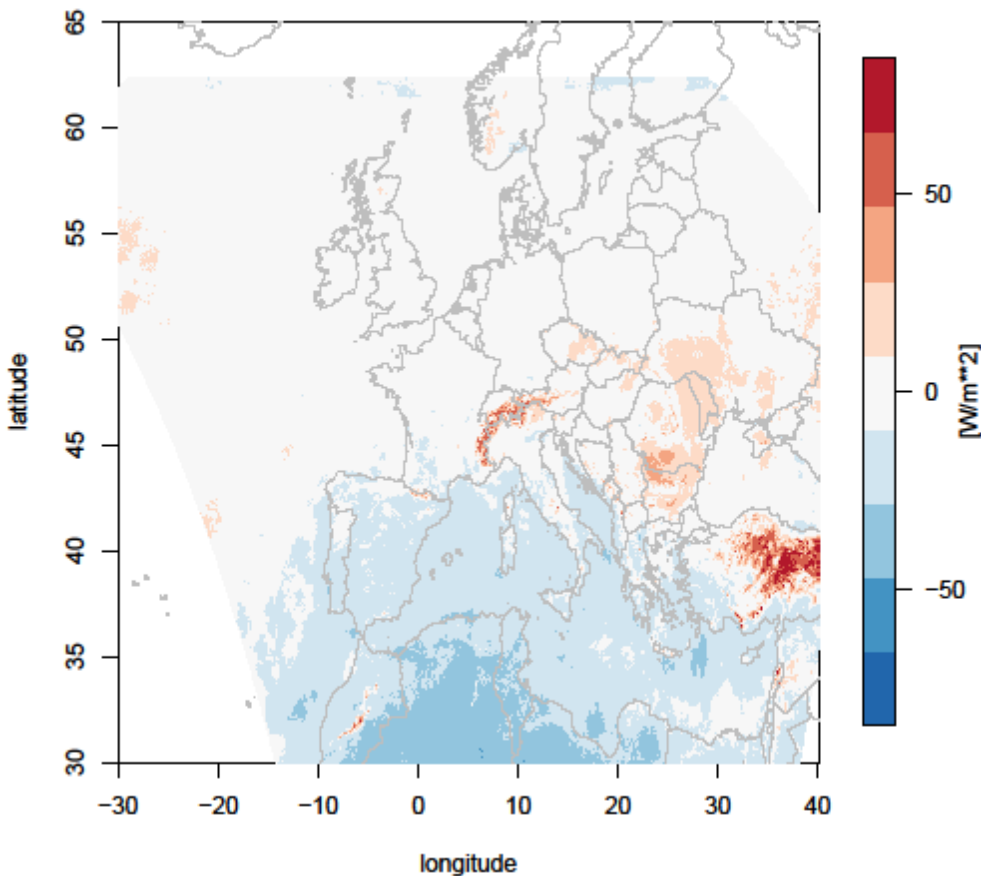


CMSAF vs G_CREA6 in July for complete domain

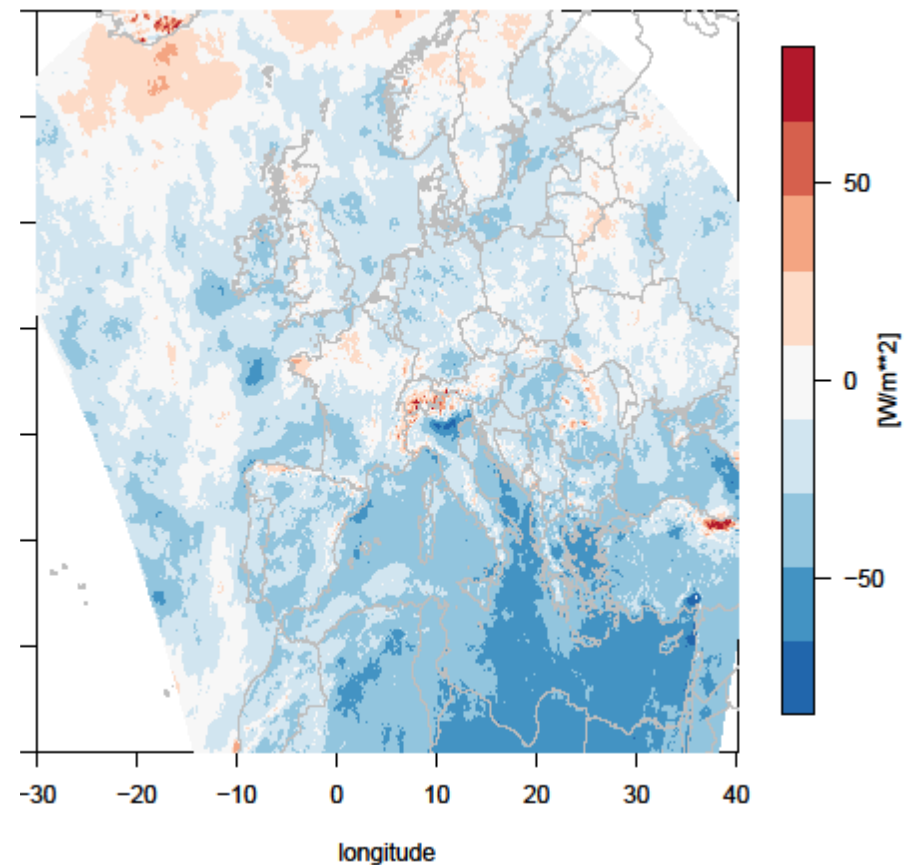


Monthly absolute difference

Absolute difference in Radiation of G_CREA6 and CM SAF in January



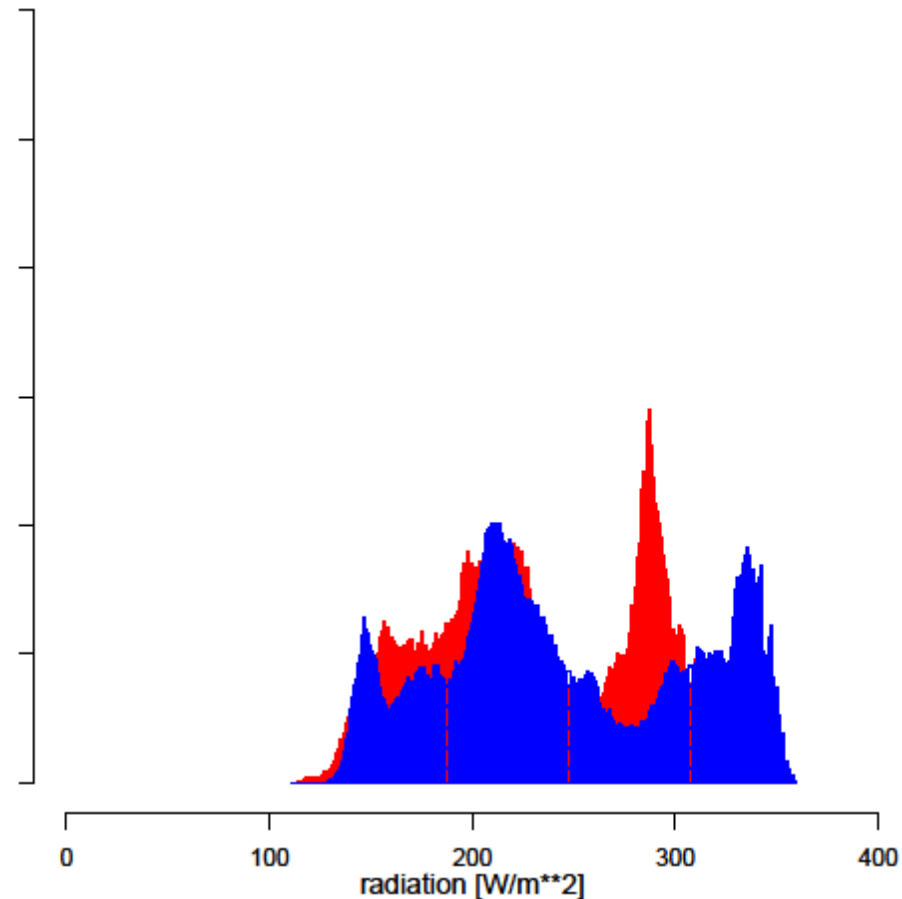
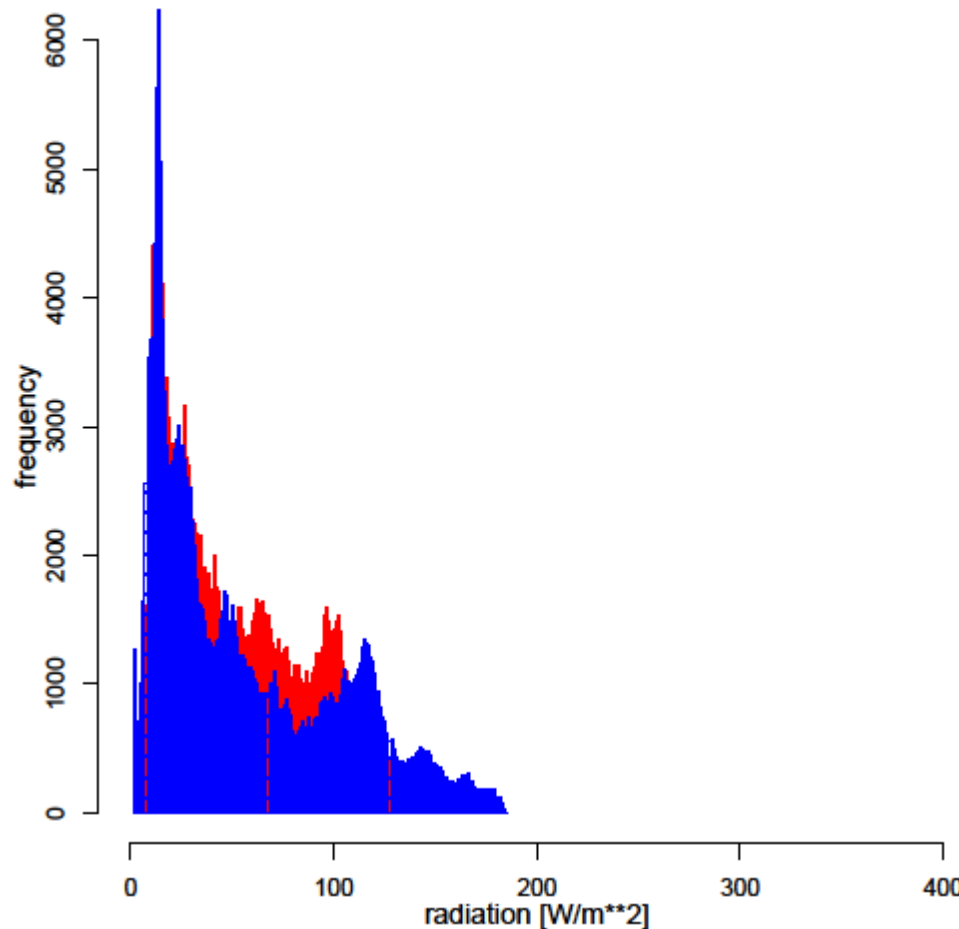
Absolute difference in Radiation of G_CREA6 and CM SAF in July



Monthly frequency distribution

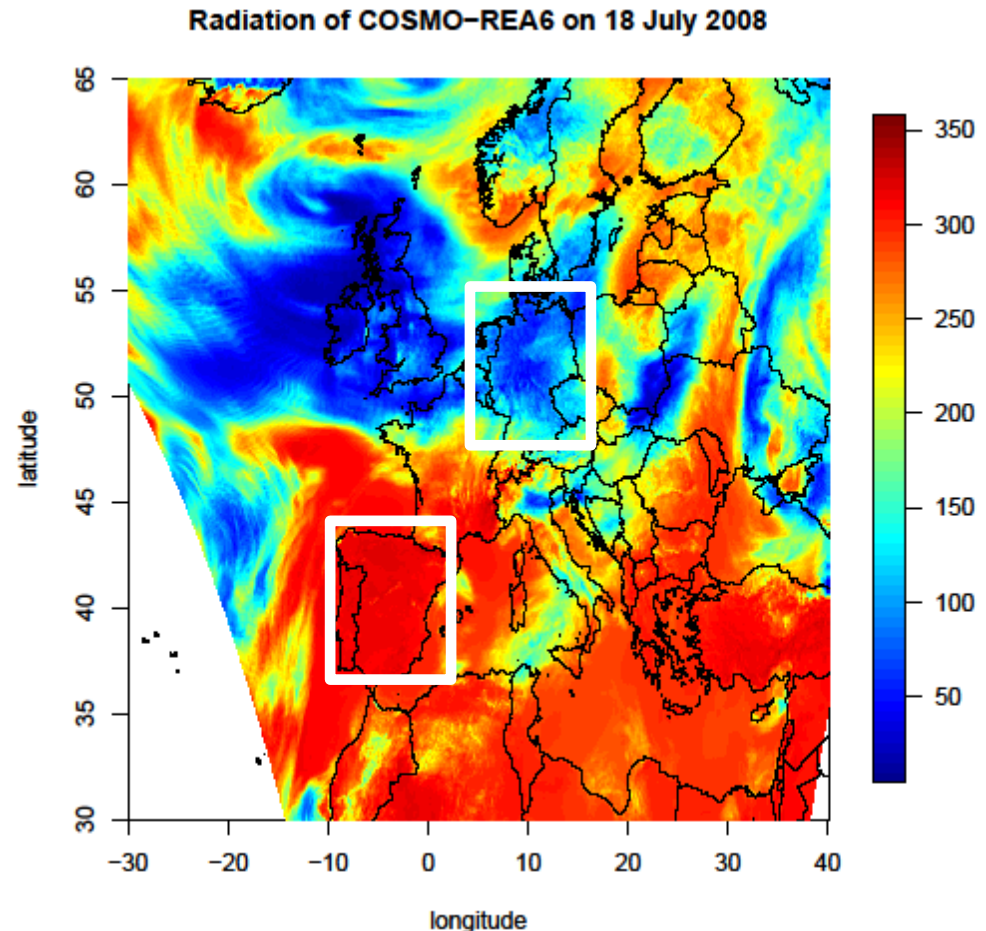
Frequency distribution of COSMO-REA6 and CM SAF in January 2008

Frequency distribution of COSMO-REA6 and CM SAF in July 2008



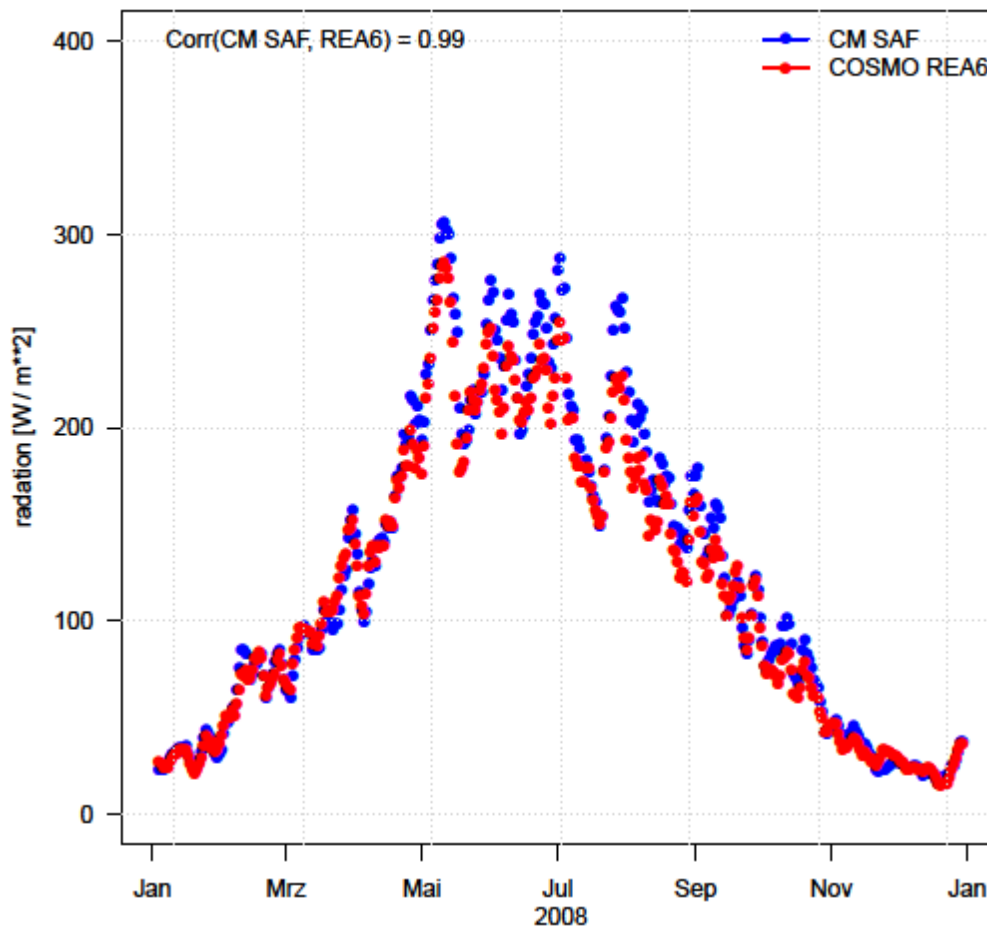
Annual cycle of six-hourly means

- ➔ Fair comparison with other RRAs in mind: use six-hourly means
- ➔ For radiation: 06UTC to 12UTC (morning) and 12UTC to 18UTC (afternoon)
- ➔ Area mean over Germany and Iberian Peninsula

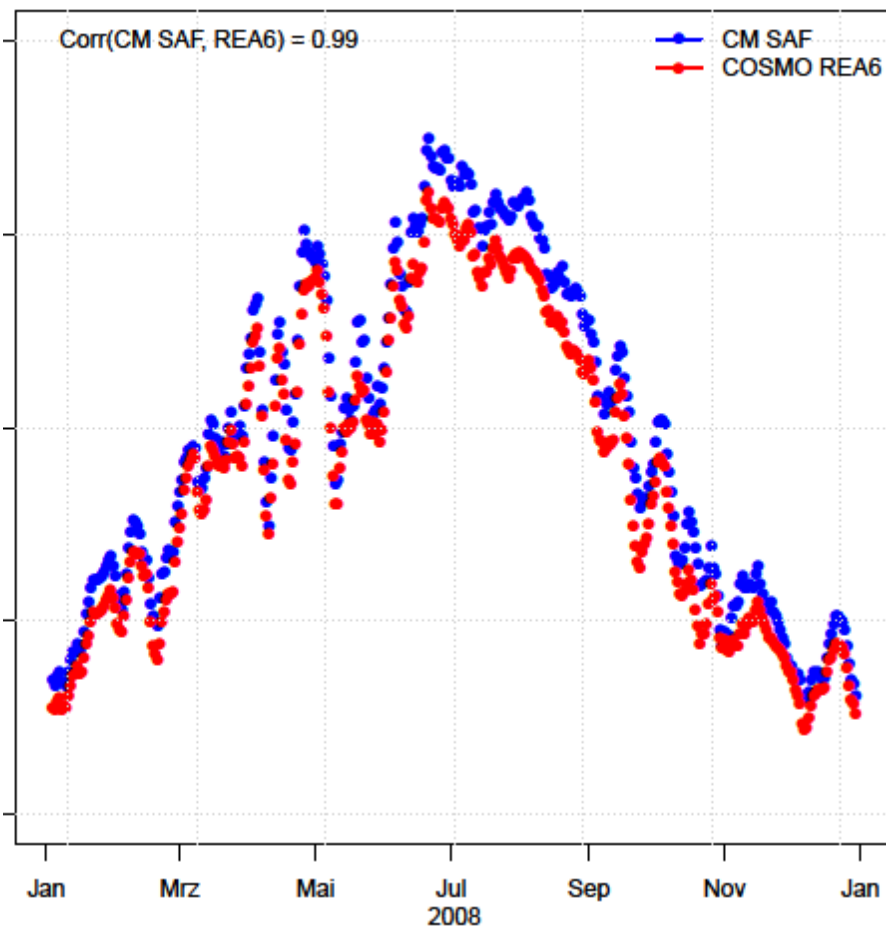


Annual cycle of daily means

Annual cycle of daily radiation over Germany for 2008

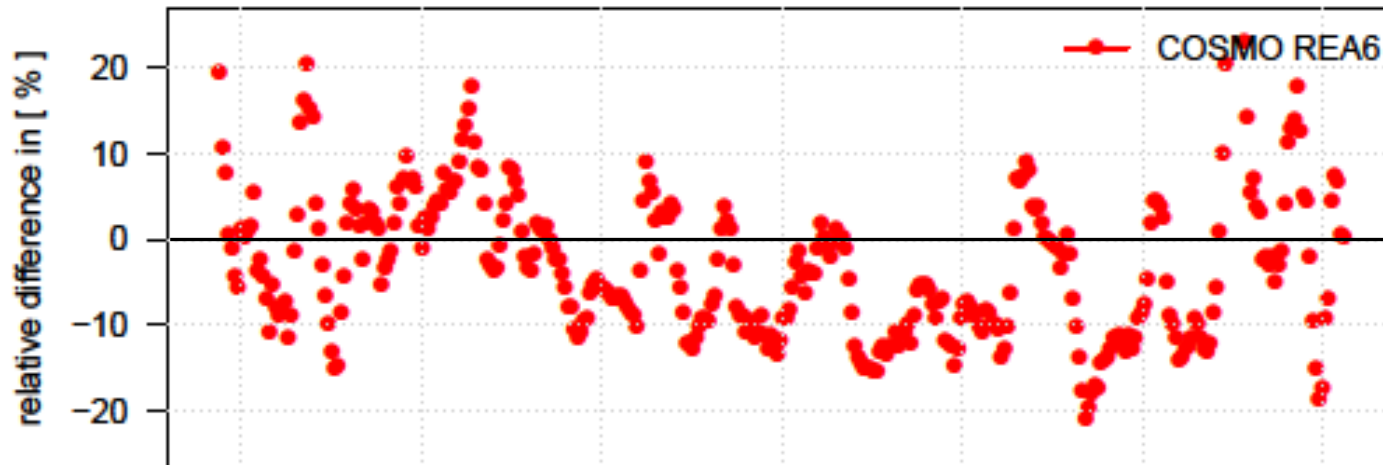


Annual cycle of daily radiation over the Iberian Peninsula for 2008

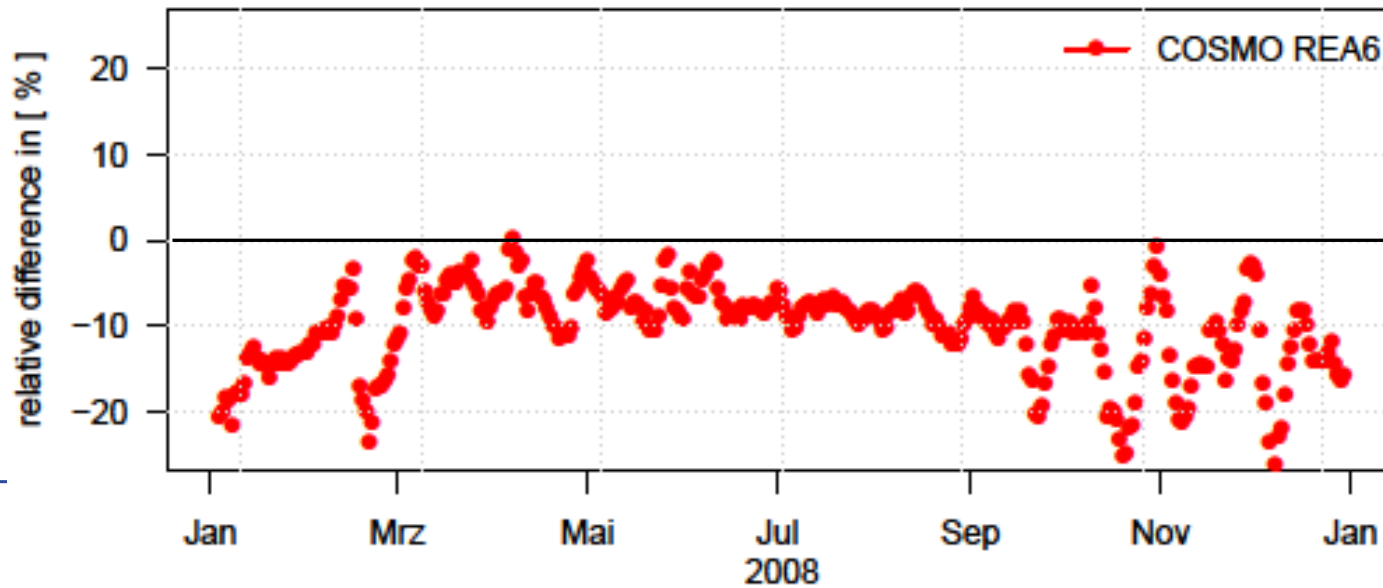


Relative difference of daily means

Annual relative anomaly of daily radiation over Germany for 2008

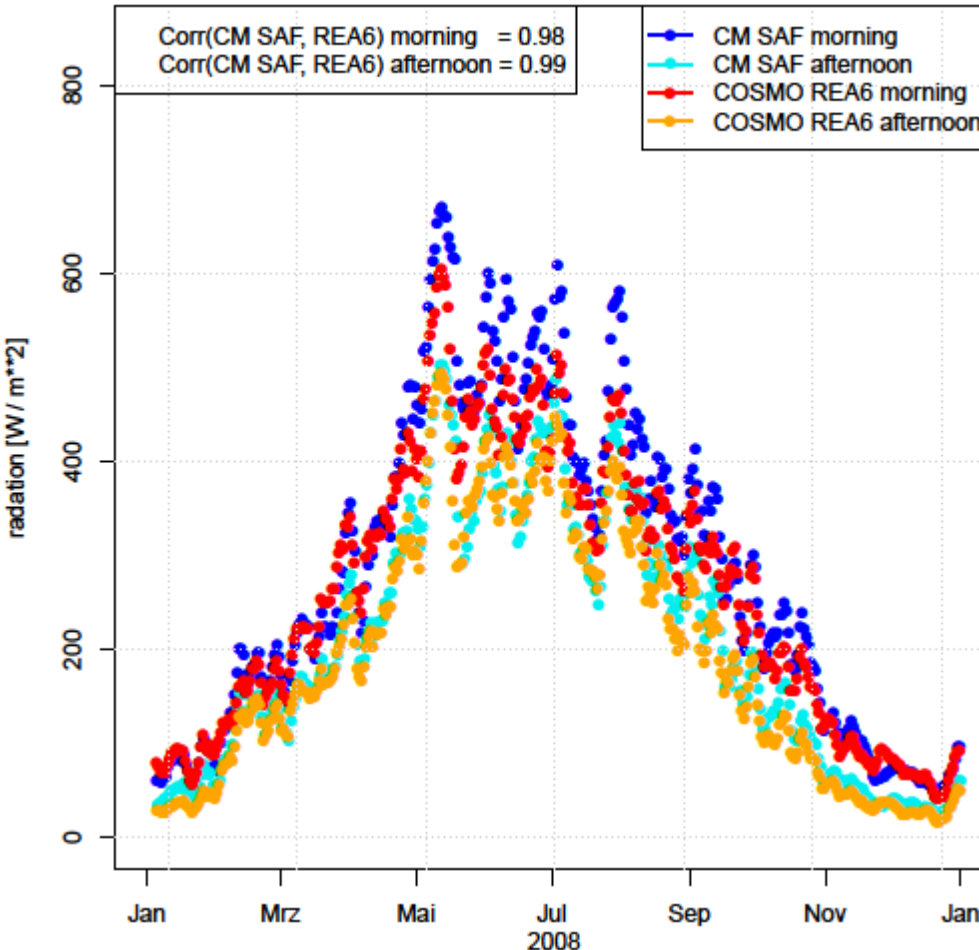


Annual cycle of daily radiation over the Iberian Peninsula for 2008

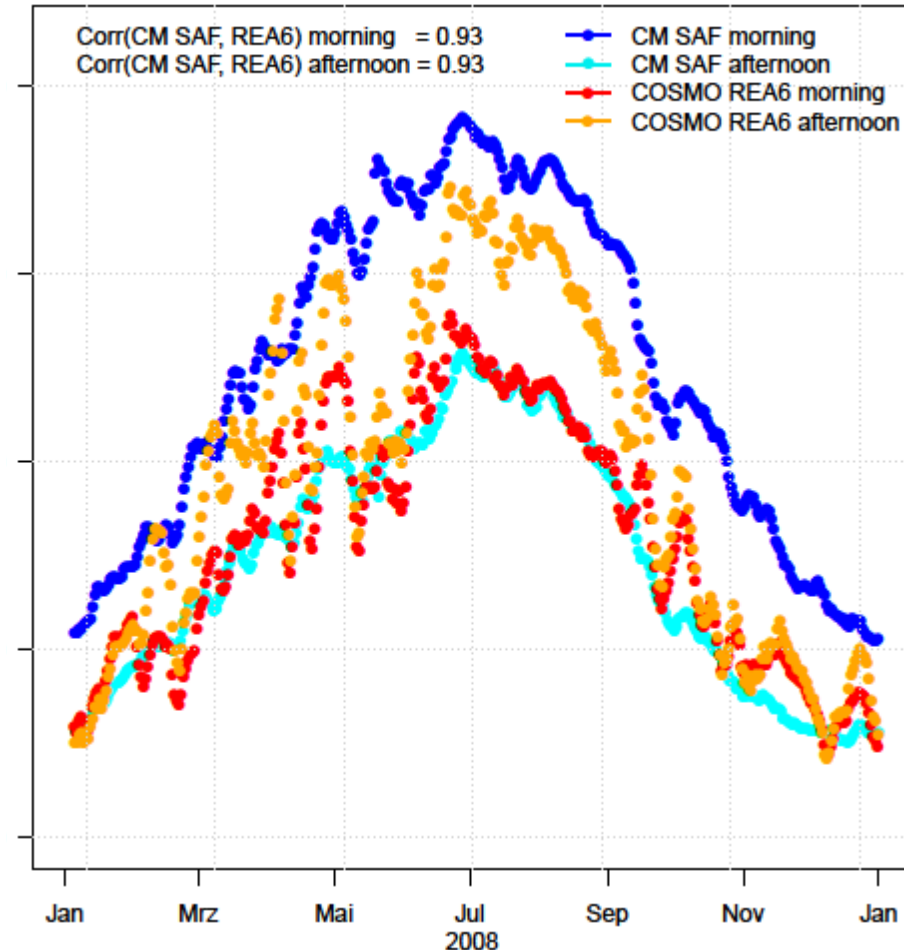


Annual cycle of six-hourly means

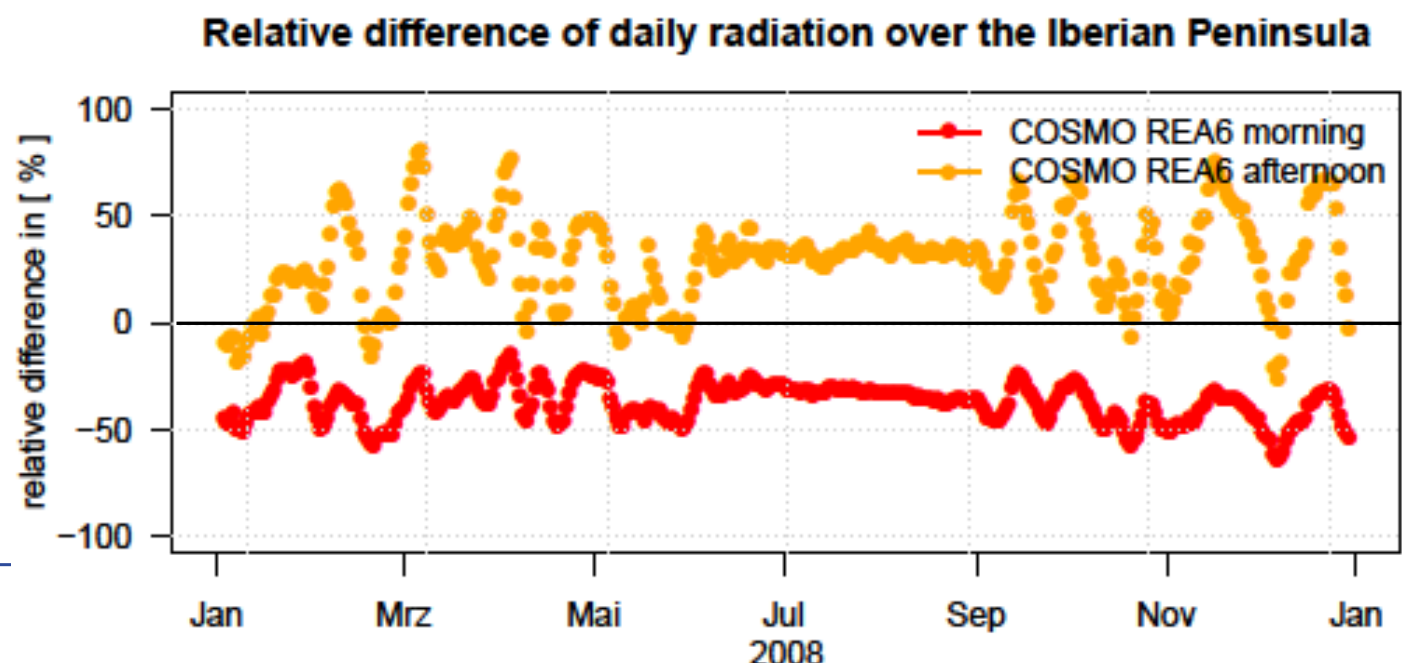
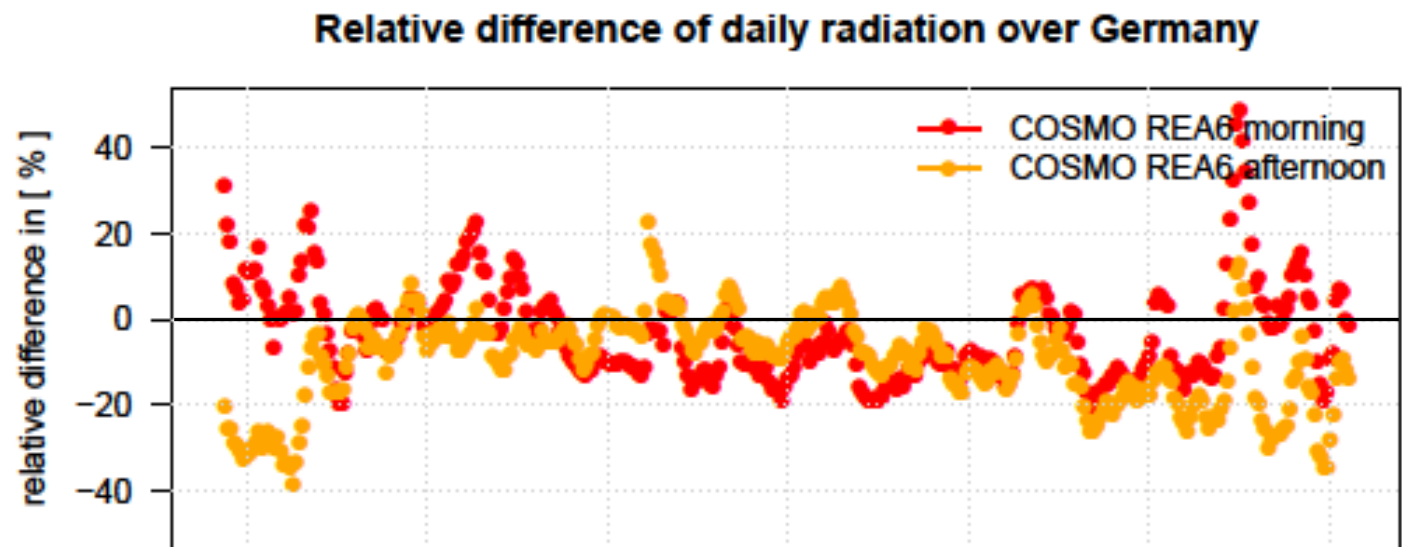
Annual cycle of radiation over Germany (5 day mean)



Annual cycle of radiation over the Iberian Peninsula (5d mean)

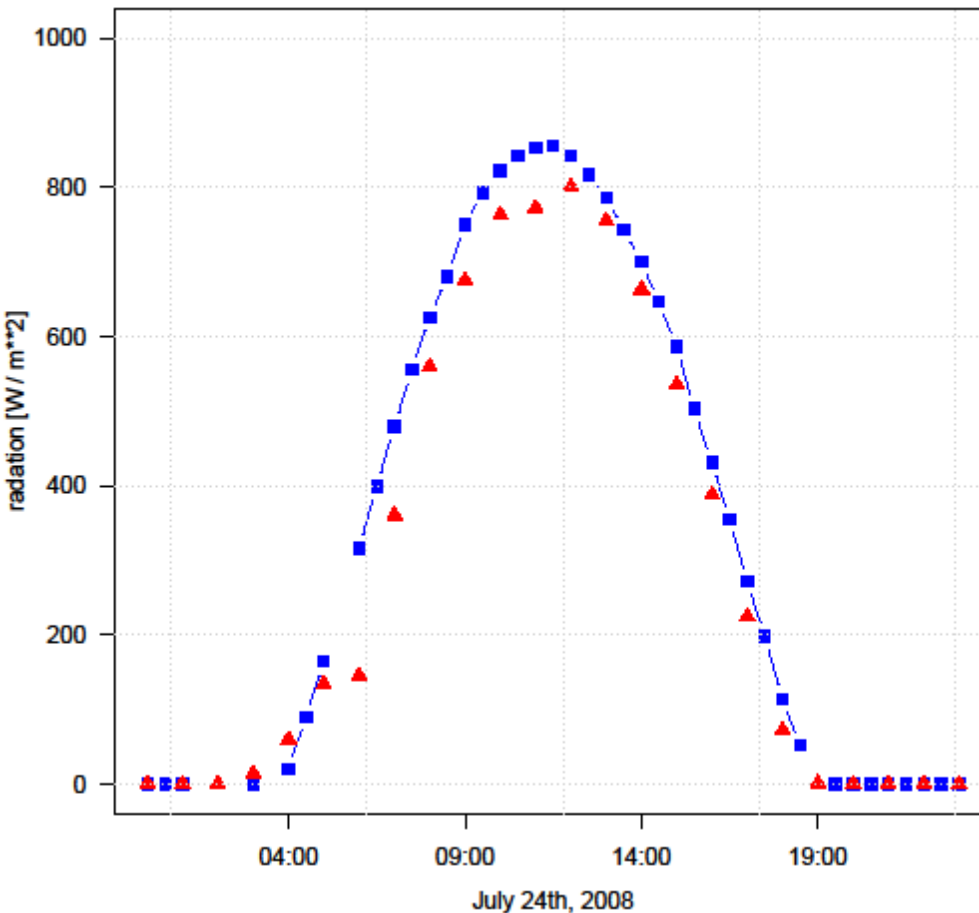


Relative difference of six-hourly

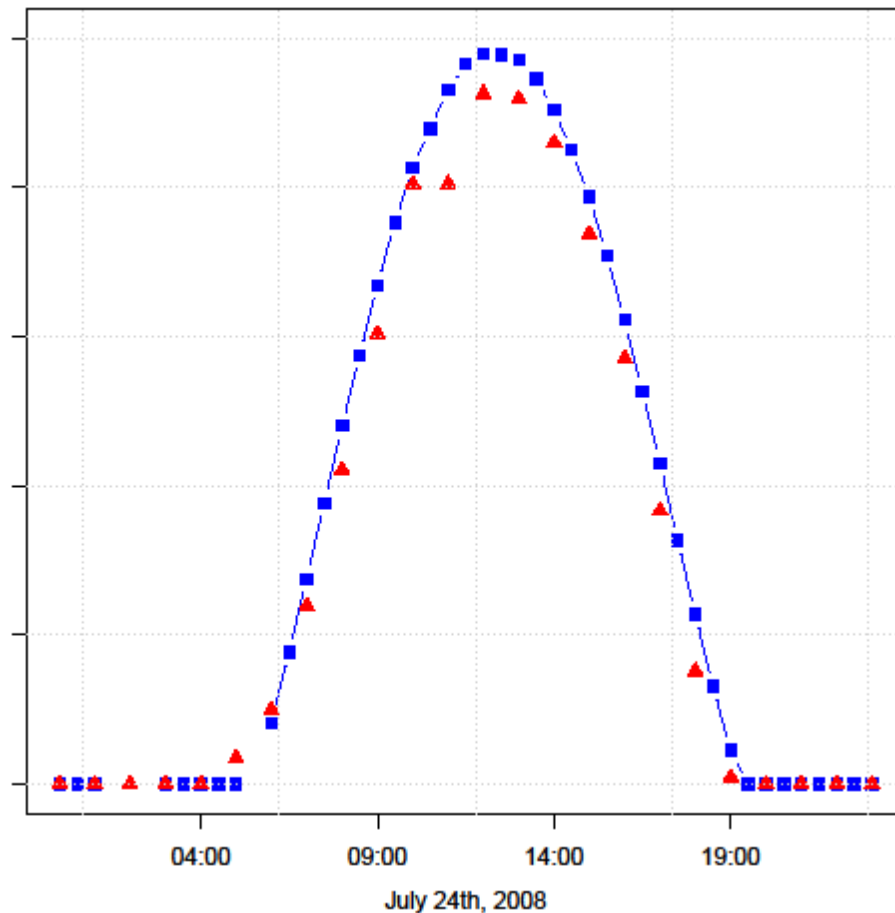


Daily cycle

Daily cycle of radiation over Germany



Daily cycle of radiation over Spain



Summary

- COSMO-REA6 has a negative bias against CM SAF SARA-H:
 - Annual spatial relative difference of around 10%
 - Annual variability in monthly spatial relative differences: larger in wintertime and smaller in summertime
- Correlation in daily and 6-hourly annual cycle is 0.99
- 6-hourly morning annual cycle too low and afternoon too high over the Iberian Peninsula
- COSMO-REA6 misses the peaks on clear sky days
- Presentation by Christopher Frank: Thursday, ASI13 @ 9:15am

Conclusions

- ➔ Radiation is slightly underestimated by COSMO-REA6 compared to CM SAF
- ➔ Model insufficiencies prevent better values
 - ➔ old aerosol climatology blocking high radiation
 - ➔ high clouds too thin
 - ➔ convection scheme and cloud representation
- ➔ Other high quality data sets available; RRAs do not stand out (as opposed to wind speed)
- ➔ Extend this study to more years and more RRAs (SMHI, MO)