The contribution of rain gauges in the calibration of the GPM-IMERG Product:

Results from the First Validation over Spain

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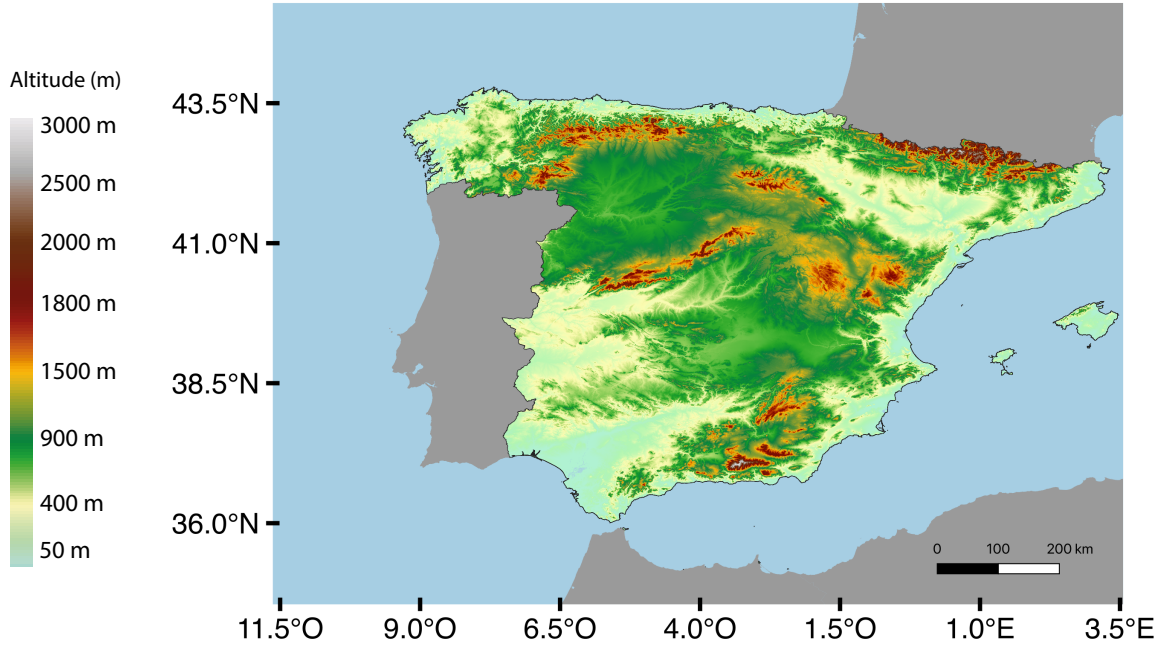
The Geography of Spain

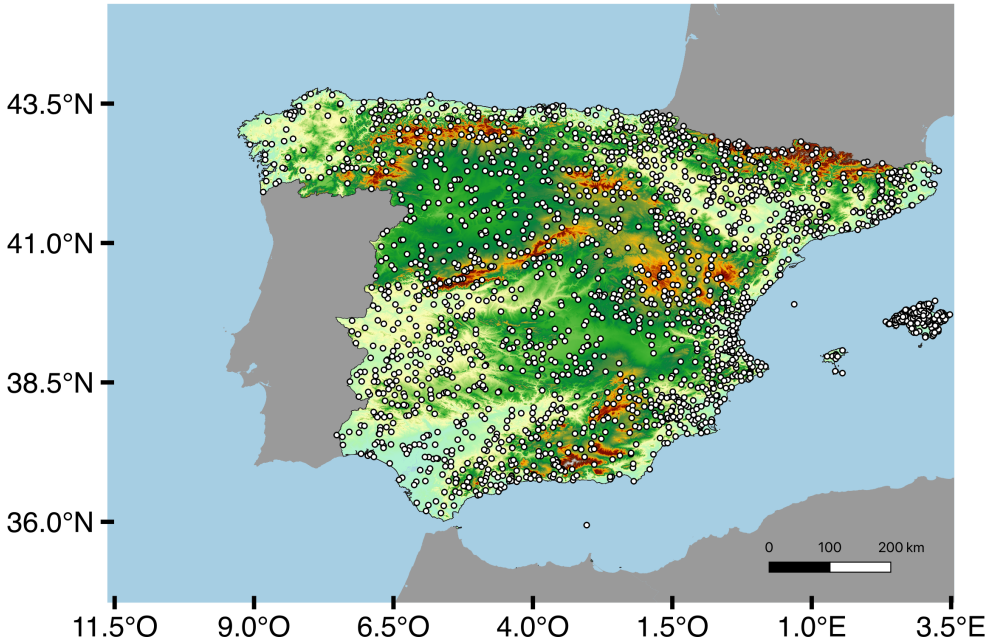
- Mountain ranges limit moist air from ocean
- The plains: *la Meseta*
- Lowlands: Ebro and Guadalquivir



Material and Methods

Gridded precipitation data

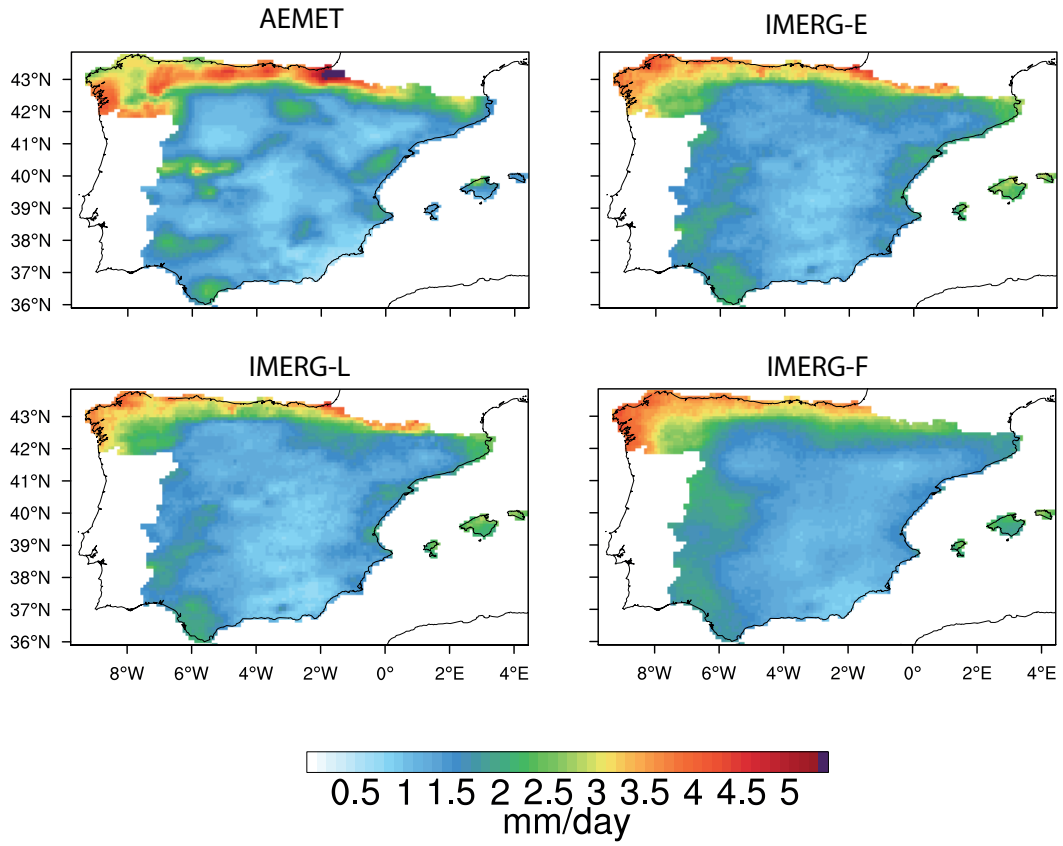
- Spanish Meteorological Agency (**AEMET**)
- **IMERG** v05B Level 3 product
  - IMERG *early*
  - IMERG *late*
  - IMERG *final*



Comparisons

Annual mean

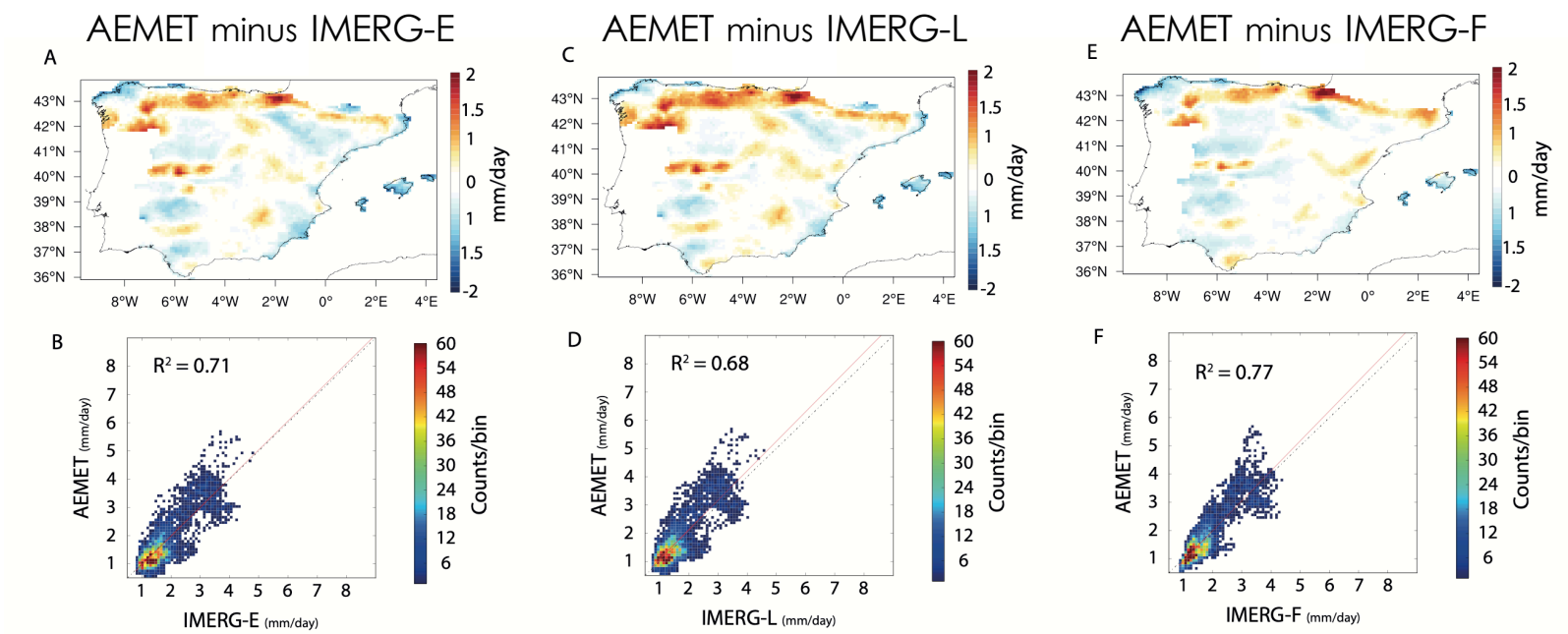
- All IMERG products capture the general pattern of precipitation
- IMERG-F is slightly better over W IP



***AEMET** -> Spanish Meterological Agency

Comparisons

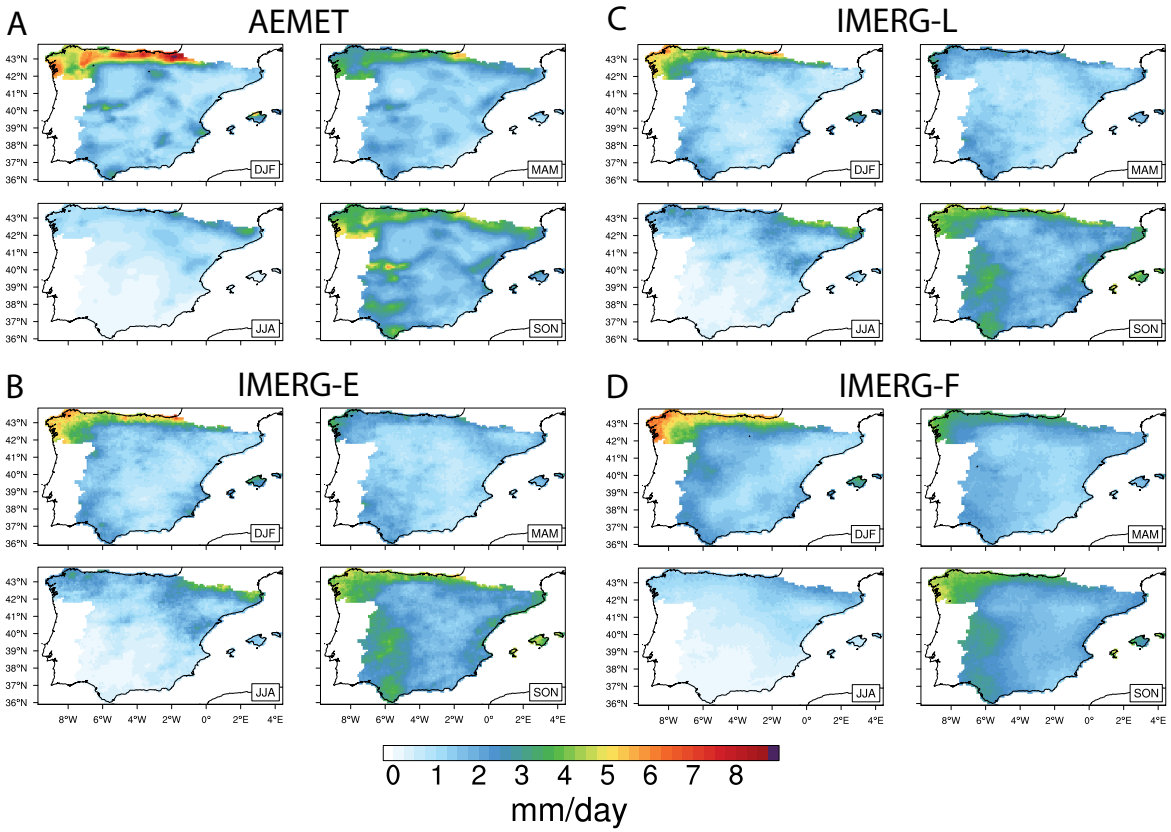
Annual mean



All versions underestimate precipitation over mountains

Comparisons

Seasonal mean

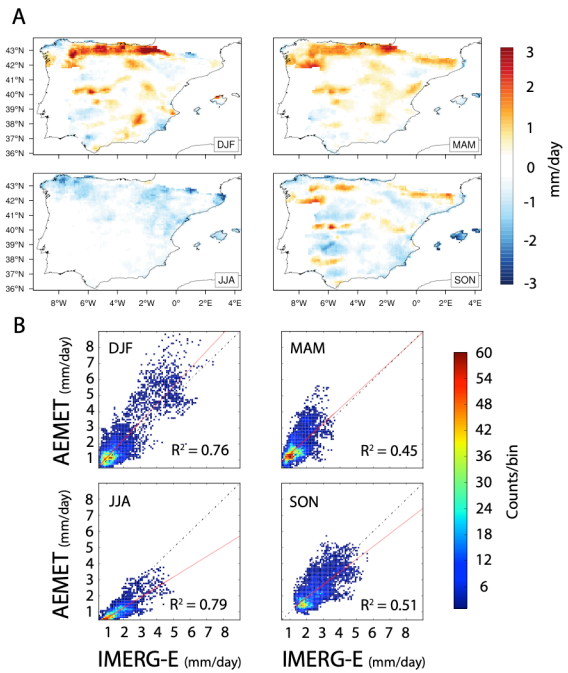


- All IMERG products capture seasonal pattern of precipitation
- IMERG-F is slightly better in winter

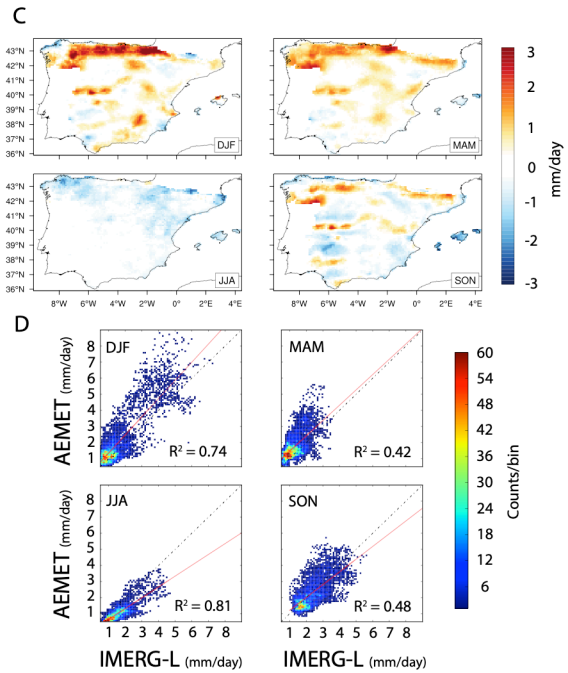
Comparisons

Seasonal differences

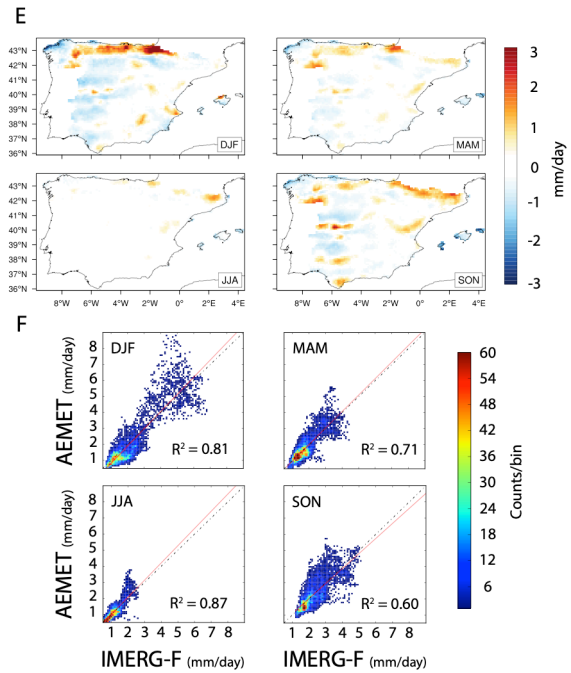
AEMET minus IMERG-E



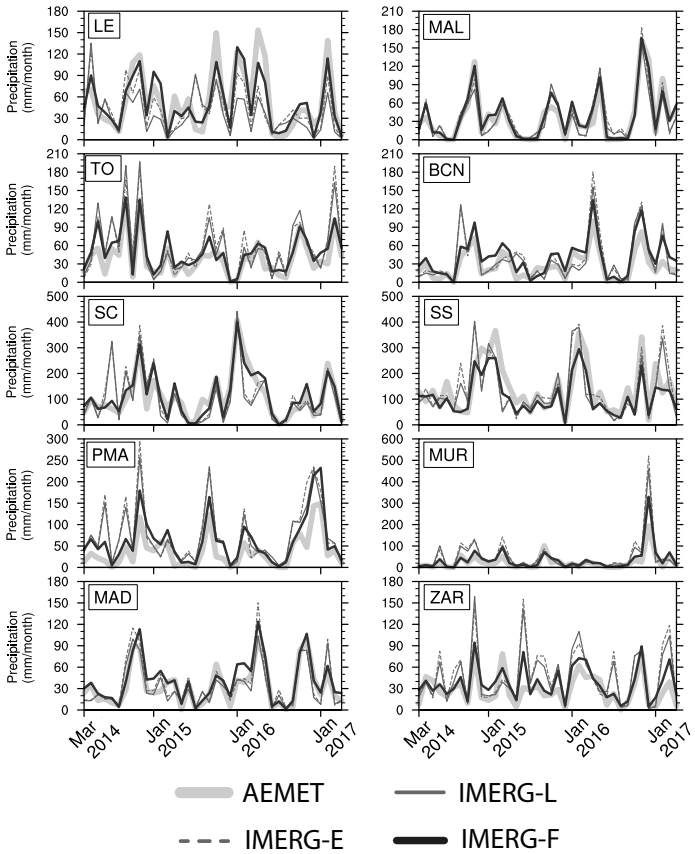
AEMET minus IMERG-L

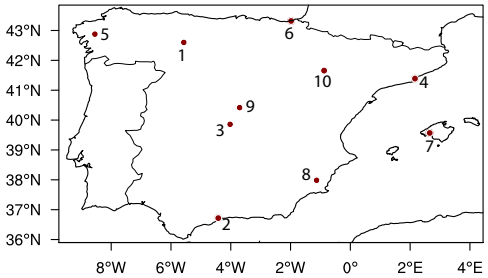


AEMET minus IMERG-F



Time series Monthly mean



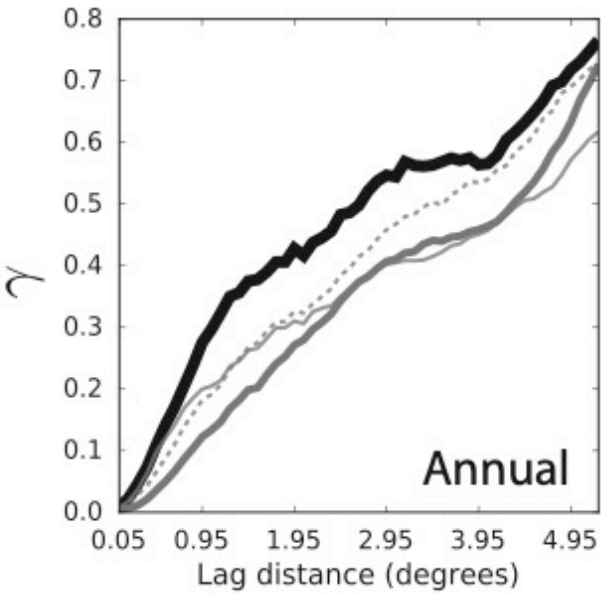


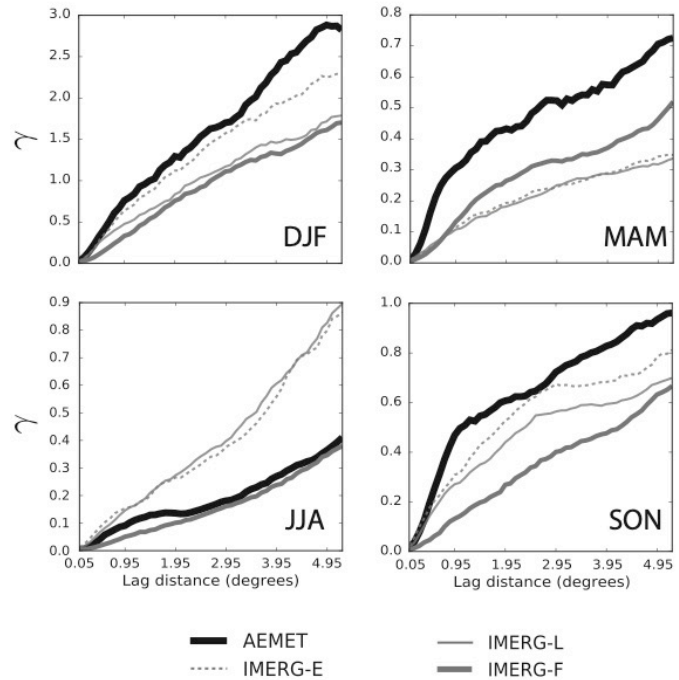
1. León (LE)
2. Málaga (MAL)
3. Toledo (TO)
4. Barcelona (BCN)
5. Santiago de Compostela (SC)
6. San Sebastián (SS)
7. Palma de Mallorca (PMA)
8. Murcia (MUR)
9. Madrid (MAD)
10. Zaragoza (ZAR)

- Good performance in MAL, SC and MAD
- Early and Late versions have problems in ZAR, PMA and SS.

Spatial variability

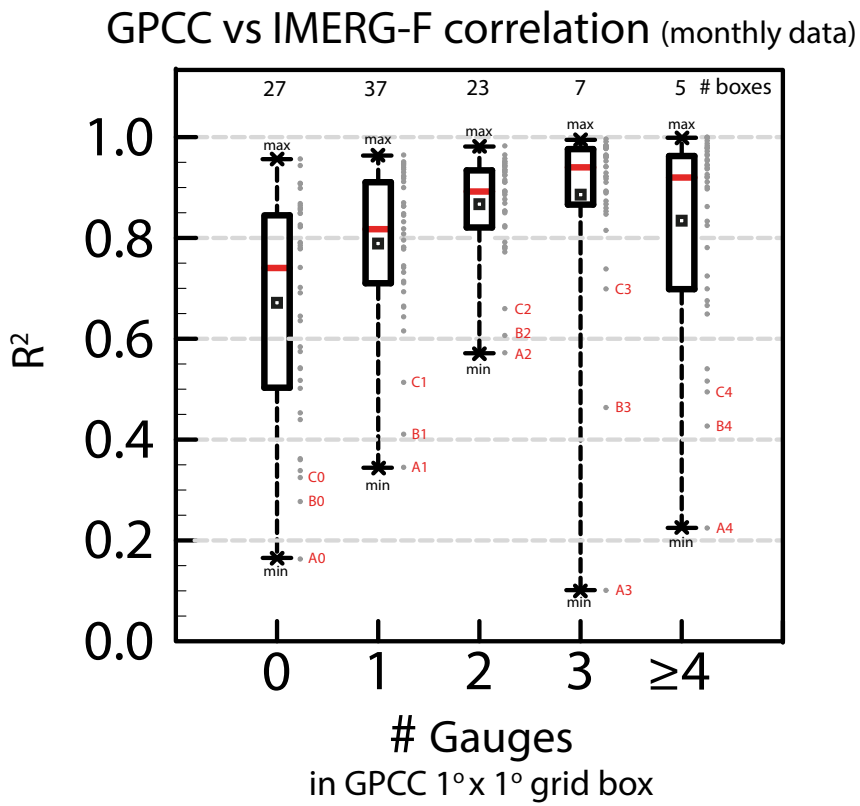
Semivarogram $\gamma(h)$





Gauge density impact

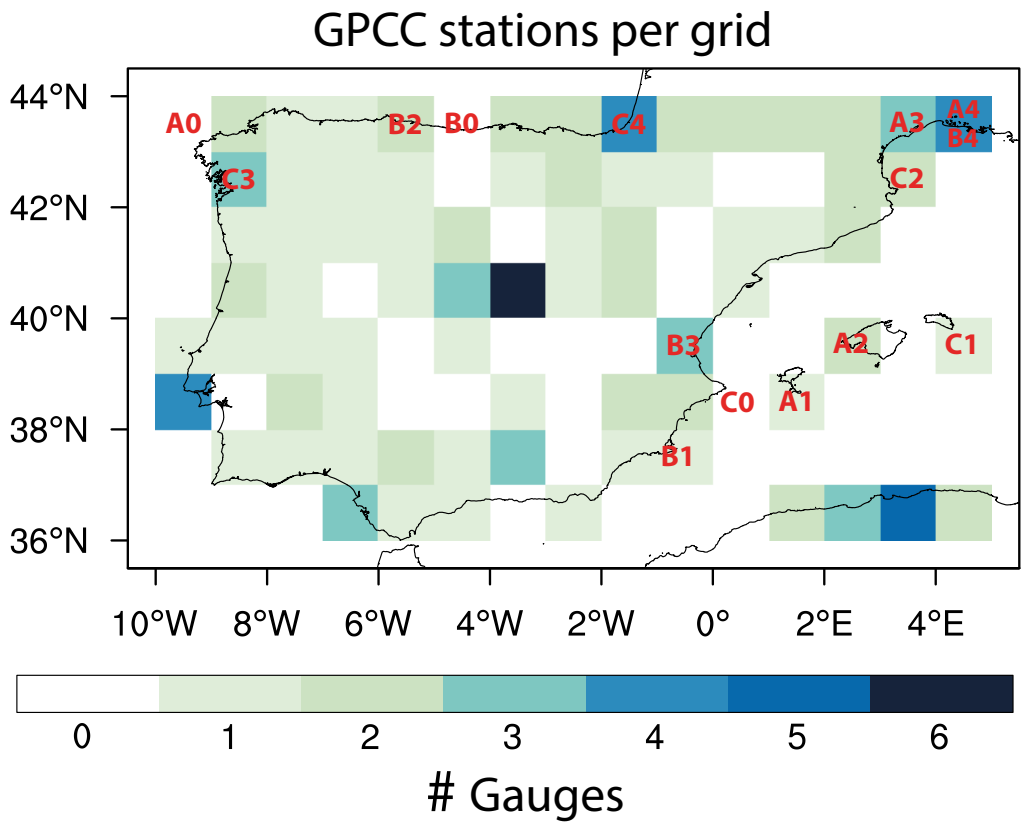
GPCC vs IMERG correlation



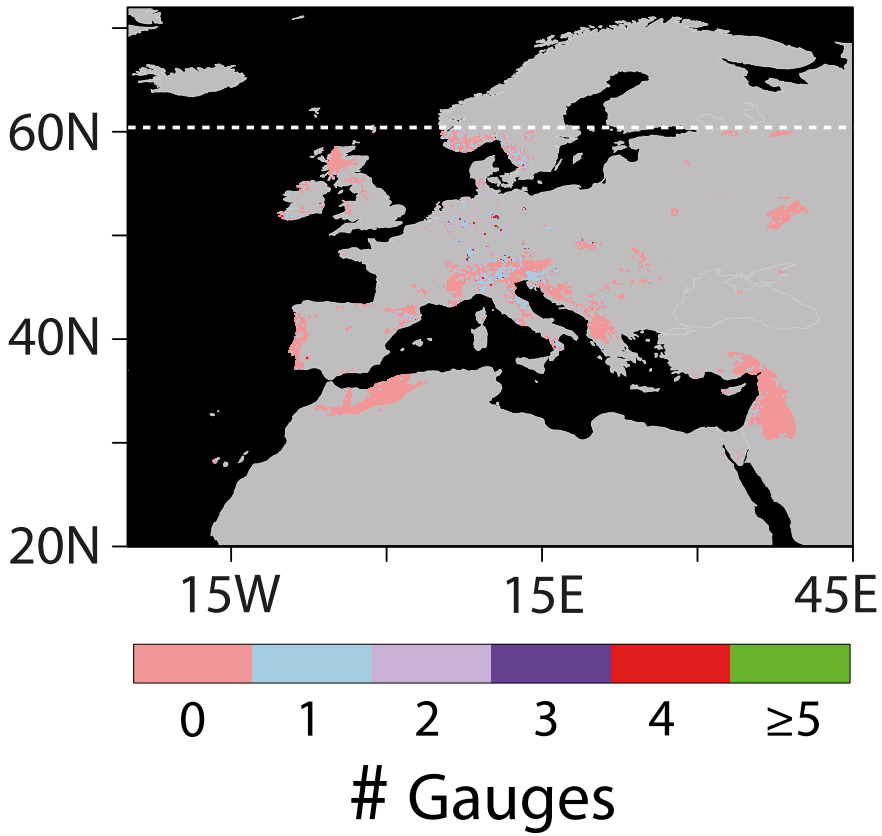
- 0.70 R^2 without gauges
- $\geqslant$ 0.80 R^2 when at least 1 gauge is available

Gauge density impact

Outlier pixels



Analysis over europe



Outlier analysis (Cook's distance)

- Areas where no gauge is available (pink pixels)
- Valleys surrounded by mountains and near coastlines (blue and light violet)
- Central Alps and the Rhine (dark violet, green and red)

Navarro, A., García-Ortega, E., Merino, A., Sánchez, L.J., Kummerow, C., Tapiador, J.F., 2019. Assessment of IMERG Precipitation Estimates over Europe. *Remote Sensing* 11.

To Conclude

- IMERG-F compares the best with independent observations
- IMERG is a reliable complement to the official rain gauge network
- Noticeable shortcoming appears to be orographic enhancement

Thank you!

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