



Sub-daily rainfall downscaling using EURO-CORDEX regional climatic models in Spain.

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Some precipitation events, such as those that took place on October 2018 in Mallorca with 12 deceased, suggest that frequency and intensity of extreme rainfall events may be increasing in some areas of Spain. To analyze if these changes are related to global warming the scientific community commonly use the results of Global Circulation Models (GCMs). However, these models present very important biases that are normally corrected using observation records (Cannon et al., 2015). Nevertheless, most bias correction techniques are only able to correct the first and second order moments (Maraun et al., 2017) and in addition they are usually applied at daily or supra-daily temporal aggregation, neglecting what happens below the daily scale (Scoccimarro et al., 2015).

To analyze rainfall at sub-daily time scales, we rely on a recently published work (Diez-Sierra and del Jesus, 2019) that presents a methodology to predict sub-daily rainfall statistics from hourly rainfall data and atmospheric information. Supra-daily rainfall statistics and large scale atmospheric variables from reanalysis datasets are used as predictors. The present study aims to extend this work using the results of 11 regional climatic models from EURO-CORDEX as predictors.

The results of our study show significant negative changes in the average rainfall and percentage of rainy days in most of the climates in Spain at the daily scale, which are in line with previous analysis (Serrano-Notivoli et al., 2018, Carlos Garijo and Luis Mediero 2016). However, when we analyze what happens below the daily scale, we observe significant positive changes in the variance at hourly time scales, mainly due to the increment of the surface air temperature. Therefore, we conclude that an increment in the surface air temperature will likely favor the torrentiality in many of the climates of Spain at temporal aggregations below the day. These results are compatible with the results obtained by Scoccimarro et al. 2015.

References

- Cannon, A.J., Sobie, S.R., Murdock, T.Q. Bias correction of GCM precipitation by quantile mapping: How well do methods preserve changes in quantiles and extremes? (2015) *Journal of Climate*, 28 (17), pp. 6938-6959.
- Carlos Garijo and Luis Mediero (2016). Quantification of the expected changes in annual maximum daily precipitation quantiles under climate change in the Iberian Peninsula. Conference Paper.
- Diez-Sierra, J. and del Jesus, M. (2019). Subdaily rainfall estimation through daily rainfall downscaling using random forests in Spain. (2019) *Water (Switzerland)*. (In Press)
- Maraun, D., Shepherd, T.G., Widmann, M., Zappa, G., Walton, D., Gutiérrez, J.M., Hagemann, S., Richter, I., Soares, P.M.M., Hall, A., Mearns, L.O. Towards process-informed bias correction of climate change simulations (2017) *Nature Climate Change*, 7 (11), pp. 764-773.
- Scoccimarro, E., Villarini, G., Vichi, M., Zampieri, M., Fogli, P.G., Bellucci, A., Gualdi, S. Projected changes in intense precipitation over Europe at the daily and subdaily time scales (2015) *Journal of Climate*, 28 (15), pp. 6193-6203.
- Serrano-Notivoli, R., Beguería, S., Saz, M.Á., de Luis, M.; Recent trends reveal decreasing intensity of daily precipitation in Spain (2018). *International Journal of Climatology*, 38 (11), pp. 4211-4224.