How does the interplay between atmospheric rivers and circulation weather types affect precipitation in Galicia?

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Introduction

In Galicia, Spain's north western most state, certain weather types (WTs) have long been known to augment the probability of rain in the warm season, or even extreme precipitation events in the cold season. However, the so called “Atmospheric Rivers” (ARs), i.e. channels of strong water vapour transport, might play an equally important role. Along the European Atlantic seaboard, Galicia is one of the wettest regions, receiving annual precipitation amounts >2000 mm on average. Thus, this region is an ideal testbed for an assessment on how local precipitation is modified by the interplay between weather types and the occurrence (or absence) of ARs.

Data and Methods

To this aim, the Lamb circulation/weather type classification is used in combination with the AR archive developed in Guan & Waliser (2015), the gridded precipitation dataset Spain011 (Herrera et al. 2015), and additional in-situ precipitation records. The study period is 1979-2010.

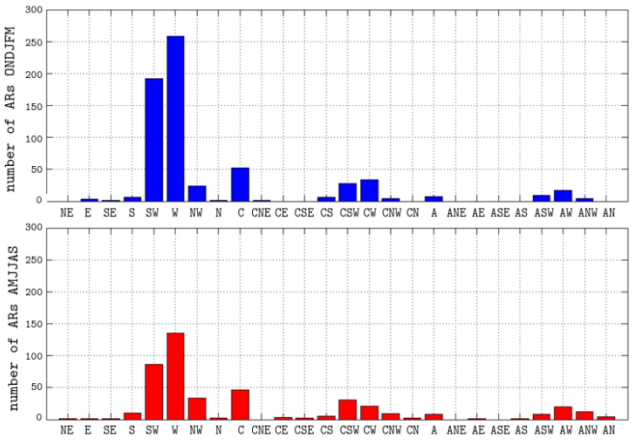

Figure 1: WT frequencies for the winter and summer half-year.

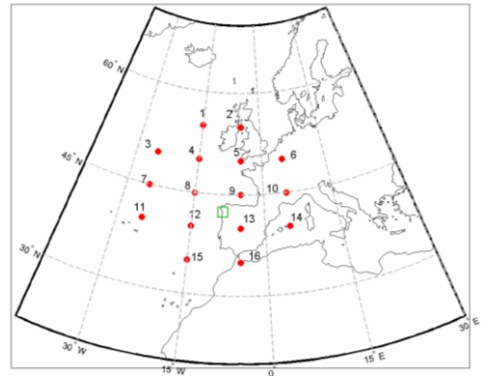

Figure 2: Sea-level pressure grid used to define the Lamb types.

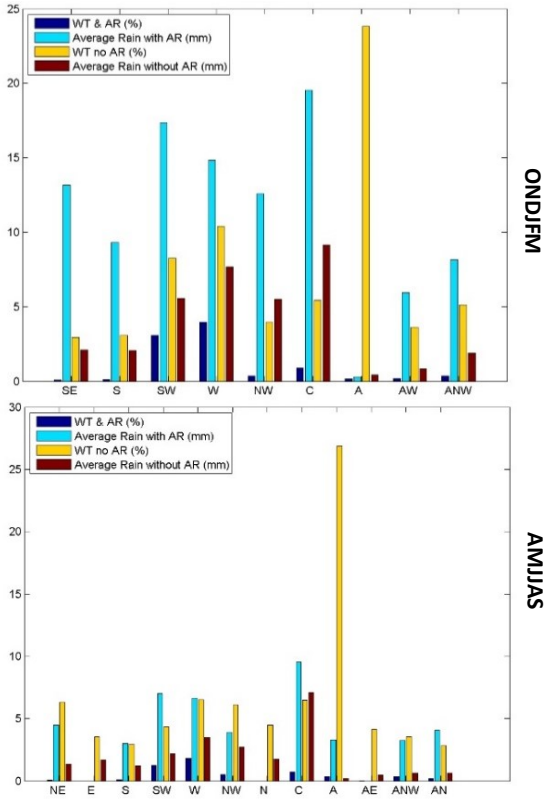

Figure 3: WT-specific mean precipitation and distribution of AR-”yes” and AR-”no” days on WTs.

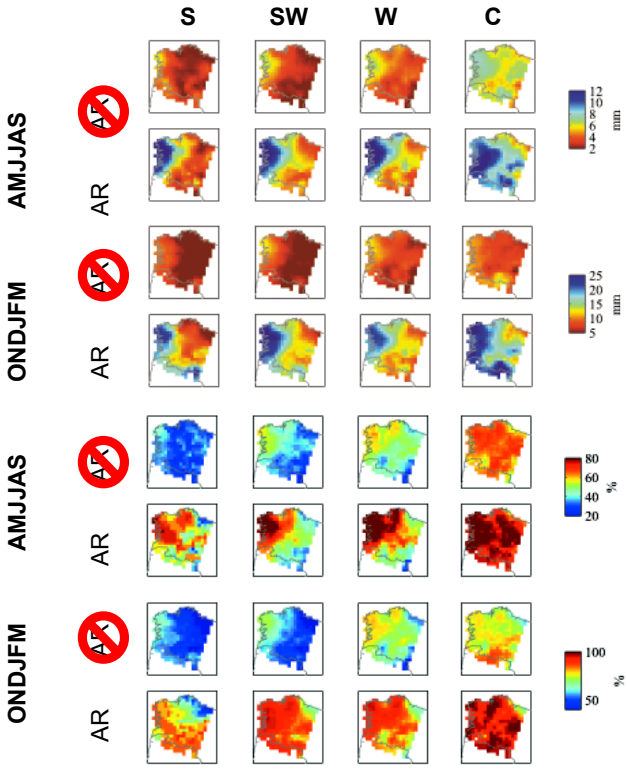

Figure 4: Mean precipitation amount (rows 1-4) and % of moderate extreme precipitation days (>90th percentile of wet-days, rows 5-8) conditioned on three purely directional WTs (South, South-West and West) and the purely cyclonic type, for both the presence and absence of ARs.

Conclusions

In Galicia, atmospheric-river landfalls can cause large amounts of accumulated precipitation. In this region, ARs are mainly associated with C, SW, W and S weather types. On average, these types occur in 1 out of 2 days in winter and in 1 out of 3 in summer. For some types, AR occurrence leads to an increase in average precipitation by a factor of two and, more importantly, augments the likelihood of moderate extreme precipitation events to near 100%.

References

- Guan B and Waliser DE: Detection of atmospheric rivers: Evaluation and application of an algorithm for global studies. JGR Atmospheres, doi: 10.1002/2015JD024257Vi.
- Herrera S et al. (2015) Update of the Spain02 gridded observational dataset for EURO-CORDEX evaluation: Assessing the effect of the interpolation method. Int. J. Climatol., doi: 10.1002/joc.4391.