# Anomalous moisture transport related to landfalling extratropical cyclones over the Iberian Peninsula



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## Background

The Iberian Peninsula (IP) is often affected by extreme extratropical cyclone (EC)-related hydrometeorological events.

### Objectives

The anomalous moisture uptake (AMU) related to landfalling ECs over the IP between 1985-2014 is analyzed through a Lagrangian approach. We performed our analysis in terms of hydrological years.

### Data and Models



### EC Detection and Tracking

MSLP minima/ 1 000 km radius for paring centres in continuous 6h time steps.

#### Lagrangian moisture tracking

IP air parcels during EC events are tracked back up to 10 days.

Total surface freshwater flux is computed:

$$e - p = m\frac{dq}{dt} \tag{1}$$

$$E - P = \frac{\sum_{n=0}^{n} e - p}{A}$$
 (2)

Moisture source => (E - P) > 0.

AMU is determined by subtracting the integrated moisture sources on days with ECs at each grid point from the climatological value at that point.

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## Landfalling ECs over the IP. Hydrological year analysis

The landfall was assumed when any point within the radius of the EC matched with an IP land mask grid.

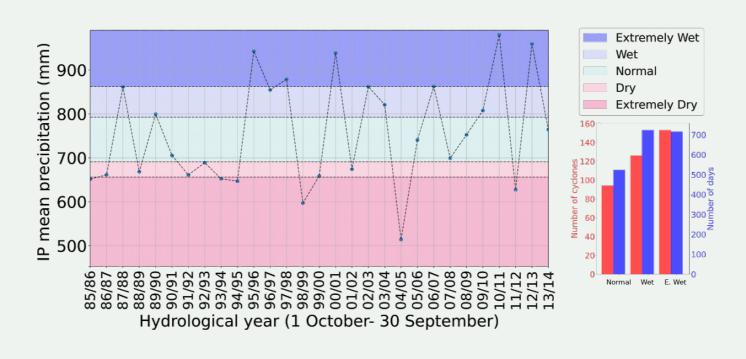


Figure 1. Hydrological year IP mean precipitation from 1985 to 2014. In dotted black Q1=656.2 mm (20%), Q2=690.9 mm (40%), Q3=792.50 mm (60%), Q4=862.29 mm (80%) precipitation quantiles.

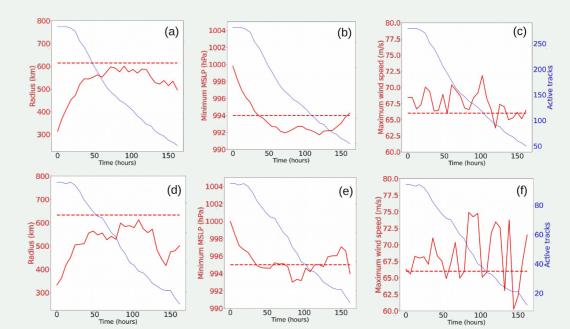
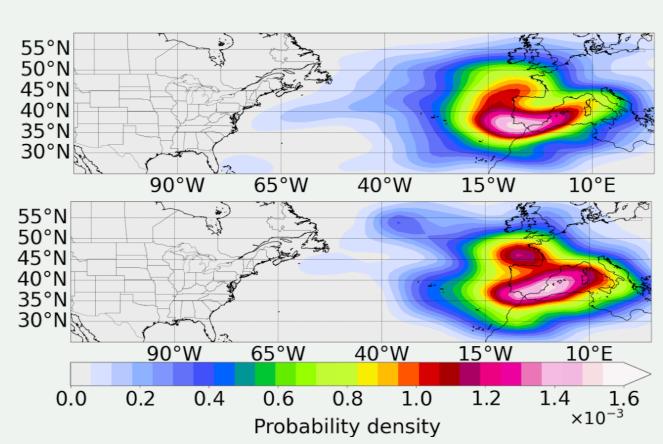


Figure 2. Features for landfall events in wet (a,b,c) and normal (d,e,f). The dashed red line represents the average feature value during over-land time steps.

## EC-related positive anomalous moisture uptake



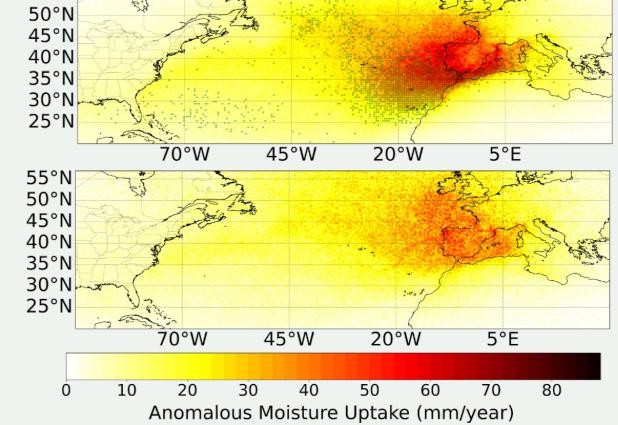


Figure 3. Probability density trajectories of landfalling ECs for wet (upper) and normal (bottom) hydrological years.

Figure 4. Annual EC-related positive AMU (mm/year) for wet (upper) and normal (bottom) hydrological years.\*

\*In dotted green, level of significance at 95% using the Wilcoxon signed-rank test.

### Conclusions

During wet and normal periods, annual EC-related positive AMU shows higher values near the landfall region, indicating local convergence of water vapour along the pathways. The extensive evaporative pattern over the North Atlantic, extending to the western coast, highlights the significance of these moisture sources for EC-related precipitation. Specifically, the annual wet period is characterized by a shift of the AMU towards the inner lower central North Atlantic, Western Mediterranean, and Cantabrian Sea.

#### Acknowledgments



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