Moisture sources associated with extratropical cyclones that reach the Western Mediterranean: study case

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Introduction and objetive

- Regional weather and climate in midlatitudes are largely influenced by **extratropical cyclones (ECs).**
- The Mediterranean basin hosts several of these hydrometeorological phenomena.
- A large number of Ecs originating from other basins, such as the North Atlantic, arrive in this area.

Objective: To describe the moisture sources associated with an EC case study that affected the Western Mediterranean, originating in the North Atlantic.

Detection and tracking EC: MSLP MINIMA/1000 KM radius for paring centres in continuous 6h time steps.

Methodology

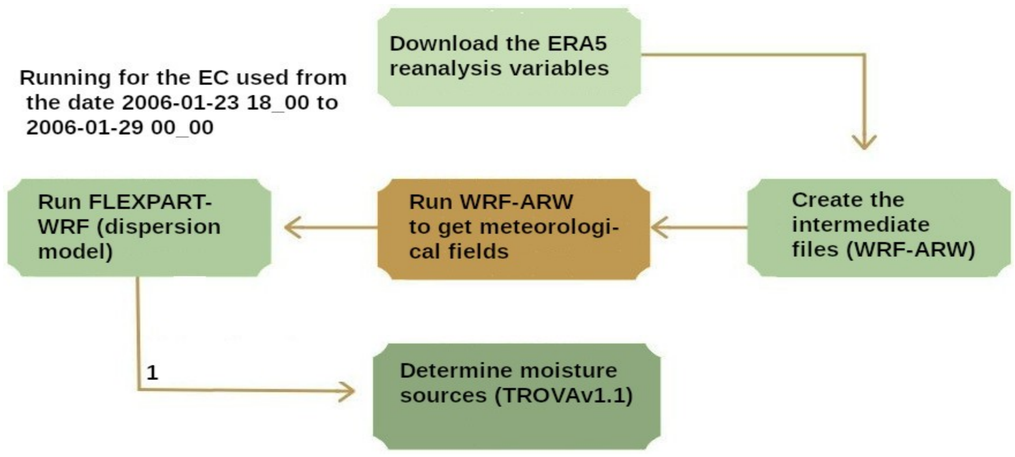

Figure 1: Flowchart implemented.

Dynamic downscaling methodology

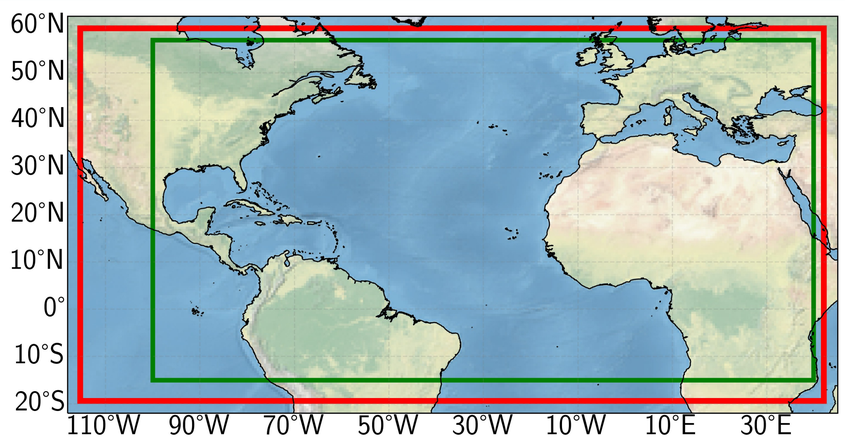

Figure 2: Configuration domain of WRF-ARW (red) and FLEXPART-WRF (green).

ERA5: initial and boundary conditions for the projections (0.25^0).

Results processing: Python and TROVAv1.1 software.

Moisture sources

Identification of moisture sources (Lagrangian methodology)

$$e - p = m\left(\frac{dq}{dt}\right) \qquad E - P = \frac{1}{A}\sum_{k=1}^{N}(e-p)_k$$

***m*:** mass of the particle

***e-p*:** increase or decrease in the water vapor ratio along the trajectory every 6 hours

***E*:** evaporation

***P*:** precipitation

***N*:** total number of particles over the area of grid A

Residence time of water vapor: ~ 10 days

***E – P > 0*:** moisture source region

Methodology: Stohl and James (2005), considering precipitating particles according to Laderach and Sodemann (2016).

Results

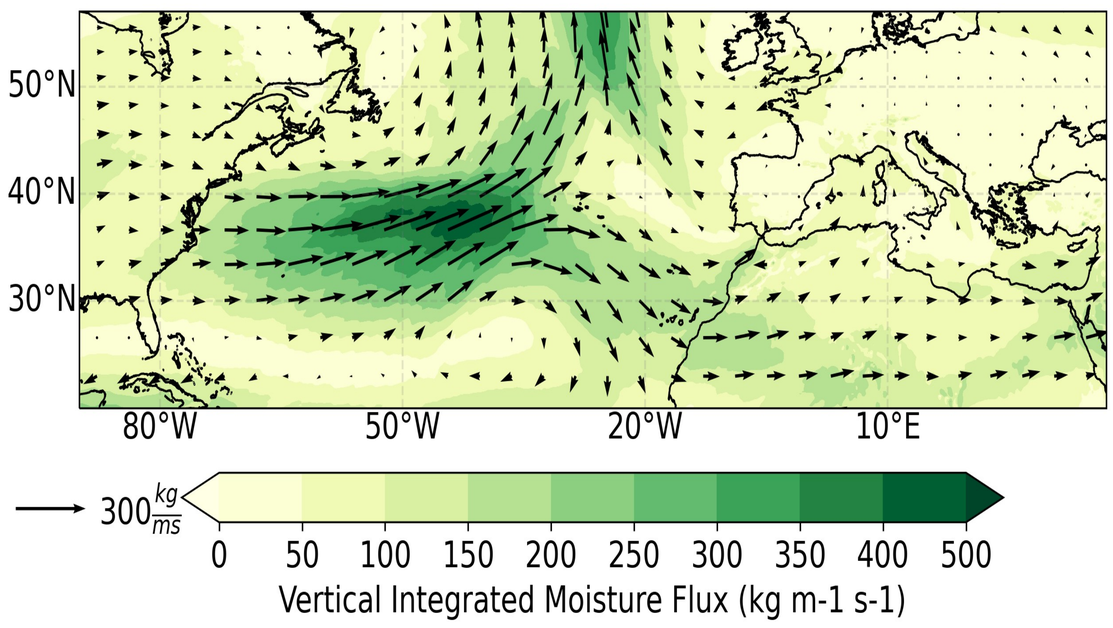

Figure 3: IVT mean field of the WRF-ERA5 model. Period 2006-01-23 to 2006-01-29.

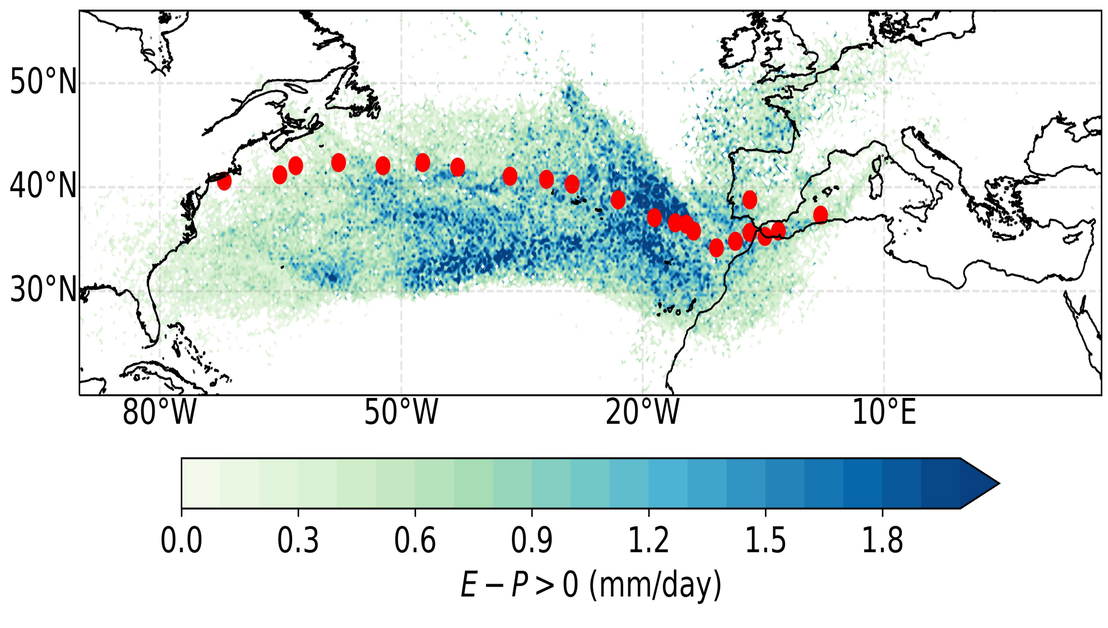

Figure 4: Moisture sources pattern for the EC. Period 2006-01-23 to 2006-01-29.

Contribution percentage

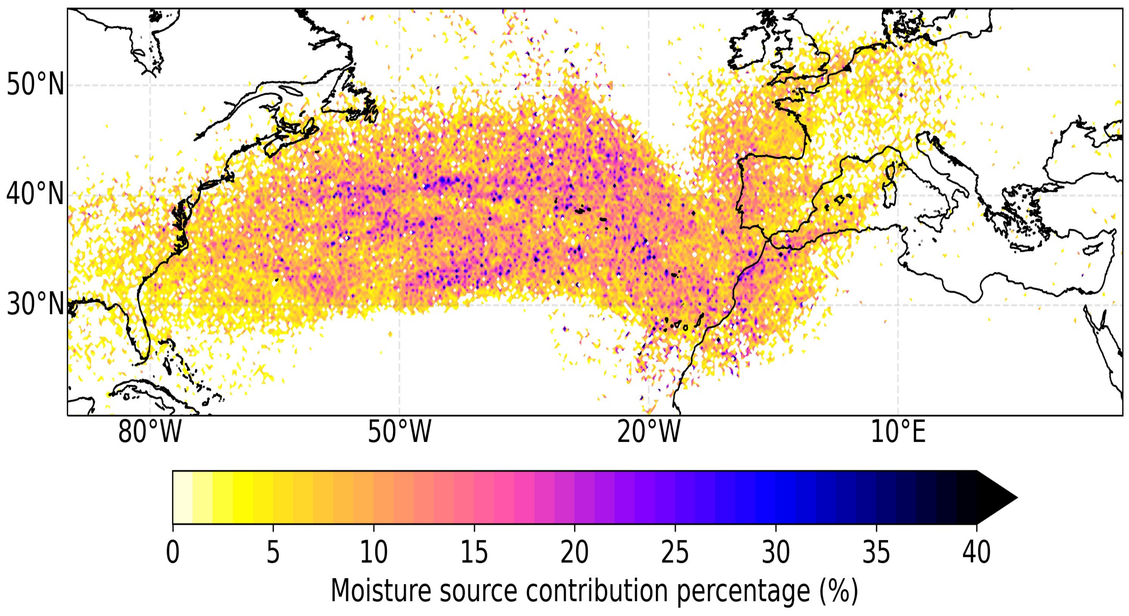

Figure 5: Moisture sources contribution percentage for the EC. Period 2006-01-23 to 2006-01-29.

Conclusions

1- The IVT mean in the analized period was located between $30\text{-}40^0$ N, in the west and center of the Atlantic Ocean, with an eastward flux.

2- The EC uptaked the most moisture near its center, in regions located over the central and eastern Atlantic from $30\text{-}45^0$ N.

3- The moisture sources contribute percentage about 15-30% of the total uptake along cyclone life.

4- A lower contribution is observed to the south of the Iberian Peninsula.

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