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Configuration of the jetstream and rainfall seasonal anomalies in the Mediterranean

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The Mediterranean climate variability constitutes an issue of particular concern, since the number of cyclones has declined, the total rainfall reduced, while the temperature has increased. These factors can lead to a desertification of the region. In this region the precipitation is abundant in the cold season, when the perturbations originate in the Atlantic. Specifically, the rainfall is abundant in the west Mediterranean basin in fall and spring, while in winter the east basin is wetter than the western basin. In this context, we analyze the Mediterranean rainfall anomalies in fall, winter, and spring in relation to the configuration of the jetstream in the region including north Atlantic, Europe and North Africa.

In the Euro-Atlantic region the westerly jetstream splits into the Atlantic jet and the African jet. Applying SVD analysis to NCEP Reanalysis and to rainfall data from CMAP, seasonally and monthly averaged, we show that the Atlantic jet acts as a waveguide for the Atlantic storms, carrying the rainfall to the Euro-Mediterranean region, and that the relative position and intensity of the Atlantic and the African jet is related to the wet and dry anomalies in the Mediterranean region, via the ageostrophic circulation transverse to the jets.

Dynamical features are explored using composite analysis. Specifically, we find that in fall, when the two jets are still relatively weak, the Atlantic jet points towards Iberia and the African jet originates over the Libya. With this configuration the ageostrophic flow is frontogenetic in the west basin, and a subsiding north westerly flow inhibits the rain over the east basin. In winter when the two jets are strong, the Atlantic jet runs deeply into north Europe and the African jet originates to the west of the Atlantic coast of Africa. In this configuration, the rainfall is abundant in the east basin, and the ageostrophic flow is frontogenetic because of a rising south easterly flow in the lower levels. In spring, the jetstream configuration is similar to the fall configuration, therefore the rain returns to the west basin.