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Parametric Reconstruction of Water Vapour Accumulation Modes in the Western and the Eastern Mediterranean Basins

J.L. Palau, F. Rovira, and M. Millan

Fundacion CEAM, Pollutant Dynamics, Paterna, Spain (jlp@confluencia.biz, +34 961318190)

The Mediterranean Sea acts as a source of heat and moisture for the surrounding regions, but not only because it is a closed and warm sea. The Mediterranean Basin is located in the mid-latitudes (i.e., high solar insolation), and it is almost completely surrounded by mountains. Moreover, from a meteorological point of view, the Mediterranean Basin can be regarded as two well-differentiated sub-basins: The Western Mediterranean Basin, where the prevailing synoptic conditions are associated with the Azores High Pressure system; and the Eastern Mediterranean Basin, which is under the influence of the Middle-East monsoon low-pressure system.

The combination of all these features enables strong evapotranspiration with lower ventilation conditions (especially on the Western side) than in other geographical areas of the world (e.g., areas under the direct influence of the Atlantic Ocean). As a result, there are different water vapour "accumulation modes" on both sides of the Mediterranean Basin.

The determination of the main atmospheric accumulation modes and their seasonal variability on both sides of the Mediterranean Basin is a relevant issue for integrating some of the feedbacks driving climate change, e.g., precipitation regimes, secondary pollutant production, ventilation conditions, etc.

This study focuses on the total water vapour accumulation modes found on both sides of the Mediterranean Basin throughout the year. The data used in this study come from the most recent EOS satellite missions. Specifically, this investigation analyses the nine-year time series of water vapour data measured by the MODIS instrument (MODerate Resolution Imaging Spectroradiometer) on board the TERRA (EOS AM-1) satellite.

Annual evolution (2000-2008) and seasonality of the total precipitable water column are analysed in both the Western and the Eastern Mediterranean Basins. After carrying out the parametric reconstruction of the water vapour time series, we have obtained their statistically significant principal harmonics, related them to different atmospheric recharging periods (identified as water vapour accumulations) and calculated the seasonality of the different accumulation modes in both Mediterranean basins.

Results are in good agreement with previous short-term field campaigns and mesoscale modelling studies which used atmospheric tracers of opportunity to estimate the vertical recirculation times in the Western Mediterranean Basin.

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