The relation between dynamical and humidity synoptic structures: an examination of some Mediterranean extreme weather events.

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Synoptic-scale dynamics is often described through the single field of potential vorticity. If a balance is assumed between mass and temperature fields, the distribution of potential vorticity may be inverted to give all the other dynamical fields. Aside from the dry properties of the flow, moist processes may play a significant role that is not taken into account through the potential-vorticity inversion. High-impact weather events in the Mediterranean region often have signatures in both parts of this description: dynamical (tropopause foldings, troughs, surface pressure lows) and humidity structures (quasi-saturated tropospheric air) can trigger and sustain wind storms and precipitation events. The objective of the present study is to give some insights into the characteristics of potential-vorticity and moisture fields, and to investigate the relation between them.\\

An innovative algorithm implemented by Plu et al (2006) has been applied to ERA-40 data on some Mediterranean high wind and rainfall cases. This tool is based on a bidimensional discrete orthogonal wavelet transform and allows the detection and extraction of coherent structures from meteorological fields. First, a model-to-observation approach will test the relevance and the accuracy of the ERA-40 humidity fields for this study: simulated brightness temperatures will be compared with satellite observations. Then, the application of the wavelet algorithm to a moisture field will help to prove the existence of humidity coherent structures and to document them. In this context, the use of an alternative moisture variable based on a comparison with a 42-year climatology will also be presented.

Plu, M., P. Arbogast, A. Joly, 2006. A wavelet representation of potential-vorticity coherent structures. Second Thorpex International Science Symposium, Landshut, Extended Abstract, 2 pp.