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Mixing processes and spatial relationships between sites along the 42ºN parallel in the Iberian Peninsula using atmospheric dispersion particle patterns

A. Font (1), R. Curcoll (1), J-A. Morguí (1) and X. Rodó (1)

(1) Climate Research Laboratory, Science Park in Barcelona, University of Barcelona

Baldiri i Reixach 4-6, Torre D, 08028 Barcelona, Catalonia, Spain

The atmospheric dispersion particle pattern of nine sites in the NE of the Iberian Peninsula, all of them situated along the 42ºN parallel, is presented. Six of the nine stations are continental whereas one is situated in the NE Mediterranean coastline and two of them are strictly located in the Mediterranean Sea. The study is based on a weekly basis climatology set-up of 51 simulations for 2006 (4-days-backward) computed with the Lagrangian Dispersion Model FLEXPART, centred at 600 meters above the sea level (masl). The dispersion pattern of each site was characterized by the slope of the power-law fit of cumulated area versus time (γ). The study is focused in the dispersion pattern in the surface layer (defined as the layer 0-300 meters above the ground level, magl) and in the entrainment layer (900-1500 magl).

First of all, it has been focused the correlation coefficient of γ between sites. Regarding the surface layer dispersion pattern, the correlation matrices of γ show high correlation coefficients when continental sites are compared ($R>0.80$) and low correlation ones for the maritime-continental intercomparison ($R<0.45$). When the maritime and the coastal sites are compared, the correlation coefficient is $R\sim0.7$. A similar trend is also observed in the entrainment zone dispersion pattern but the correlation coefficients are smaller ($R>0.76$, $R<0.2$ and $R\sim0.5$, respectively).

The seasonality of the dispersion pattern is analyzed through Principal Component Analysis (PCA) of the 51 simulations (variables) computed of the 9 stations available

(observations). The distribution of the simulation days in the new axis defined by the PCA differentiate synoptic situations characterized by different dispersion patterns in both the continental and maritime sites.

Finally, this PCA dispersion pattern is contextualized using the Lyapunov exponents from the lower troposphere (0-4000 masl). It is shown that mixing processes are enhanced during summer at low altitudes.