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Modelling and Evaluation of PM10 source regions over Portugal using high resolution WRF/HYSPLIT models

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In the present study, output from the HYbrid Single-Particle Lagrangian Integrated Trajectory (HYSPLIT) Model driven by the Weather Research and Forecasting (WRF) Model is used as a tool to assess source location, transportation trends, and the extent of contribution to PM10.
The WRF model was used to simulate meteorological parameters at a resolution of 3 km and was designed to have three two-way interactive nested domains with horizontal resolutions of 27, 9 and 3 km, and the inner-most domain covered the Portugal region of interest. The vertical resolution included 41 levels, with 33 levels confined to below 500 hPa to simulate boundary layer flow characteristics. The model was integrated for 72 hours starting from 00, 06, 12 and 18UTC 17 August 2009. The event was chosen as during this day the PM10 concentrations 40 ug/m3 observed over Evora station and of the pollution aerosol optical depth (AOD) is about 0.25 which is very high comparatively very clear days AOD i.e. 0.05. The initial and boundary conditions were adopted from National Centers for Environmental Prediction Final Analyses (NCEP FNL) data available at one degree horizontal resolution. The model derived meteorological fields were validated with in-situ observations.
The HYSPLIT model was integrated with WRF model-derived meteorological fields to identify the source location using backward trajectory analysis. The backward trajectories were plotted for every one hour with different heights in the mixed layer. Trajectories were plotted for a 24-hr period starting from observations, and a cluster analysis method was used to estimate the probable contribution from each source. As a second step, forward trajectories were plotted with different identified source locations using mean data from observation at elevated point sources. Concentration levels were calculated and compared with in-situ observation to examine and assess possible relative contributions from different sources.