Application of Atmospheric Transport Models at the new atmospheric Ebre Delta station (ClimaDat network) in Eastern Spain

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The Ebre Delta atmospheric station (DEC3) was installed in Eastern Spain within the framework of the Climadat project (www.climadat.org) of the Institute of Energetics of Catalonia (IC3). This station offers continuous concentration measurements of greenhouse gases (CO₂, CH₄, CO, N₂O and SF₆), along with atmospheric concentrations of the natural radioactive tracer ²²²Rn. Meteorological parameters, such as humidity, temperature, wind speed and wind direction are also measured at DEC3 site. This study aims to use the FLEXPART and the HYSPLIT models, together with meteorological input of ECMWF and a spatial resolution of 0.2 degrees to perform back trajectories at DEC3 station and qualitatively analyze how different air masses, coming from northeastern Europe or from the Mediterranean Sea, influence observed gases concentrations. In order to understand the behaviour of measured ²²²Rn, CO₂ and CH₄ concentrations at the DEC3 station, two specific episodes have been selected for this study. Back trajectories of 72 h have been run at 04:00 am for selected days with high/low gases concentrations. Both models results and pressure maps from the Wetter Zentrale (www.wetterzentrale.de) have allowed for a qualitative understanding of the tran-atmospheric conditions present during these episodes.

Back-trajectories and Atmospheric gases concentrations results at DEC3 station

Back trajectories results together with the observation of measured time-series show that DEC3 station is influenced by coastal areas phenomena (e.g. land-sea breeze during the May-June episode) and by channalization through the Ebre valley of air masses coming from the North of Europe (e.g. 28th Nov 2012). Air masses coming from the Atlantic ocean also reach DEC3 site passing over the Iberian peninsula (e.g. 1st Nov 2012).

During the May-June episode environmental parameters showed a well-defined breeze behaviour. Accordingly, this lead to a decrease and an increase of the gases concentrations in a daily basis. During the October-November episode several high concentration peaks were clearly visible for CH₄, CO₂ and ²²²Rn under low wind speed conditions (e.g. 30th October 2012). On the contrary gases concentrations were much lower when strong winds were coming from the Ebre Delta valley (e.g. 28th October 2012).

Conclusion and future work

Back Trajectories of 72 h have been run with FLEXPART and HYSPLIT models at DEC3 station. The results obtained have been compared with measured gases concentrations of CH₄, CO₂ and ²²²Rn, and with meteorological variables measured at 10 m a.g.l. at this station. The HYSPLIT model allows to rapidly perform back trajectories and visualize the result because it is quite user friendly. The FLEXPART model is less straightforward but gives 2D plume results. Both models together with the use of pressure maps give an exhaustive idea of the atmospheric conditions going on during selected scenarios and allow us to understand if the low/high concentrations observed for these gases were due to local source or remote contribution. Measurements of GHGs and ²²²Rn in the same site can be extremely useful understand the natural radiation episodes which will be continued in the future together with back-trajectories simulations.

References


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