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

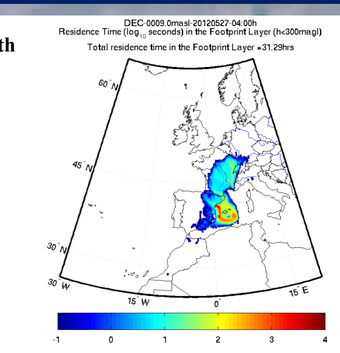
C. Grossi[a,1], R. Curcoll[a], J.A. Morguí[a,c], A. Àgueda[a], M. Ealo[a], P. Occhipinti[a], M. Nofuentes[a], L. Sánchez-García[a], O. Batet[a], A. Vargas[b], A. T. Vermeulen[d], X. Rodó[a,e].

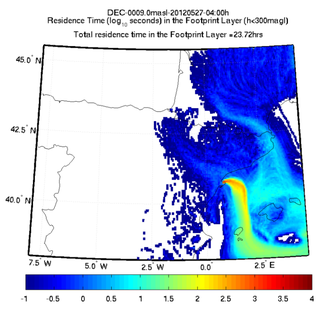
a Institut Català de Ciències del Clima (IC3), Barcelona, Spain
b Institut de Tècniques Energètiques (INTE), Universitat Politècnica de Catalunya (UPC), Barcelona, Spain
c Ecology Department, Universitat de Barcelona (UB), Barcelona, Spain
d Energy Research Centre of the Netherlands, Air Quality & Climate Change, Petten, The Netherlands
e Institució Catalana de Recerca i Estudis Avançat (ICREA)

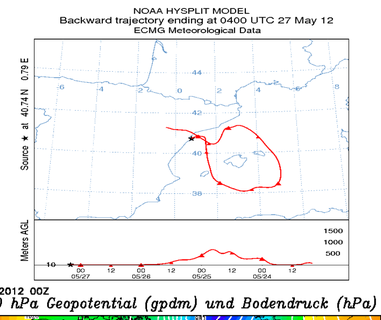
The Ebre Delta atmospheric station (DEC3) was installed in Eastern Spain within the framework of the ClimaDat project (www.climadat.es) of the Institut Català de Ciències del Clima (IC3). This station offers continuous concentration measurements of greenhouse gases (CO_2, CH_4, CO, N_2O and SF_6), along with atmospheric concentrations of the natural radioactive tracer ^{222}Rn. 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 northwestern Europe or from the Mediterranean Sea, influence observed gases concentrations. In order to understand the behaviour of measured ^{222}Rn, CO_2 and CH_4 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 main atmospheric conditions present during these episodes.

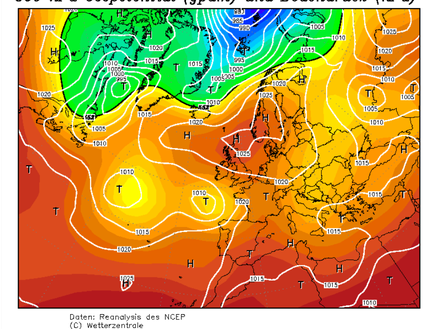
Back-trajectories and Atmospheric gases concentrations results at DEC3 station

27th May 2012

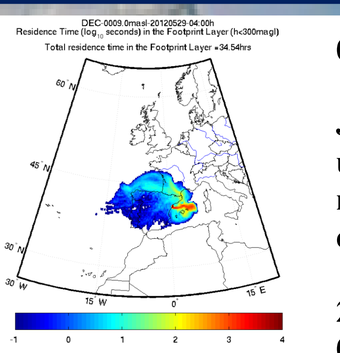


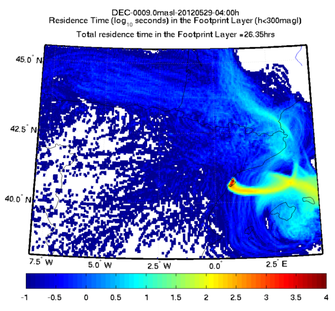


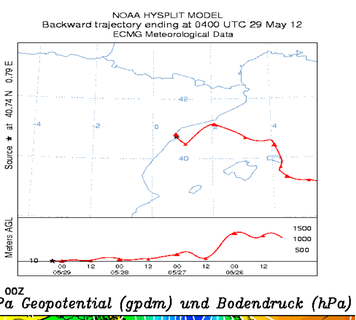


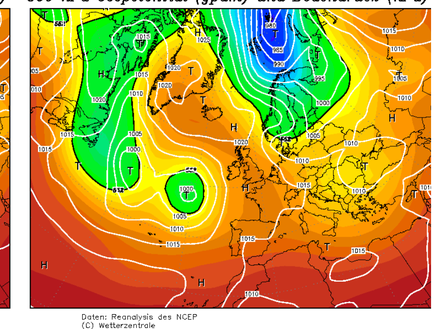


29th May 2012

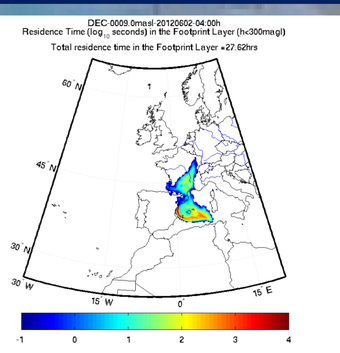


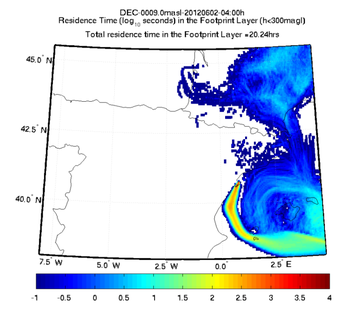


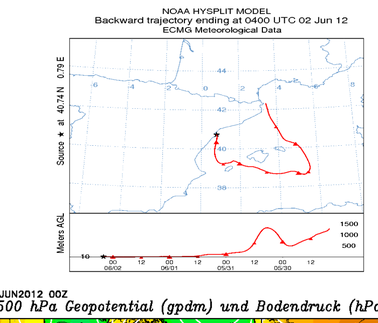


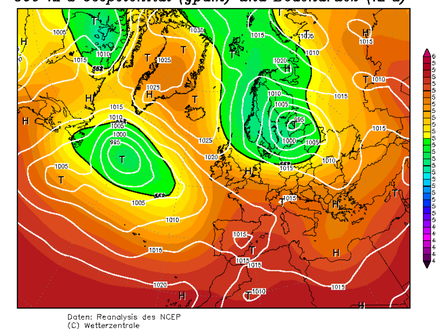


02nd June 2012



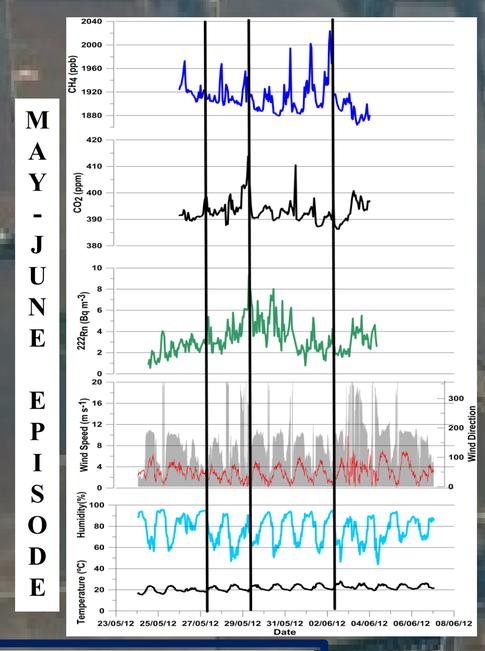


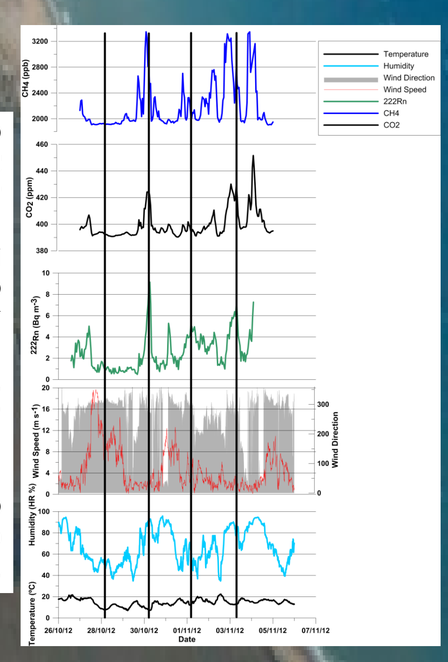




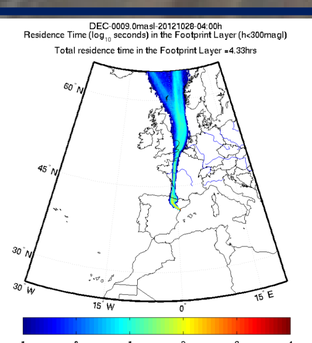
During the May-June episode environmental parameters showed a well-defined breeze behaviour. Accordingly, this lead to a decrease and an increase of the gases concentrations in a daily basis.

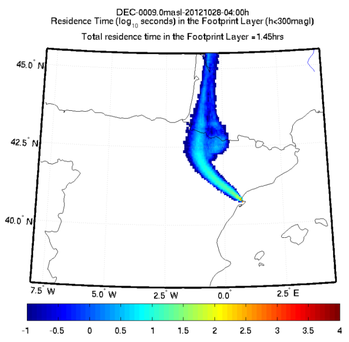
During the October-November episode several high concentration peaks were clearly visible for CH_4, CO_2 and ^{222}Rn under low wind speed conditions (e.g. 30th October 2012). On the contrary, gases concentrations were much lower when strong winds were coming from the Ebre Delta valley (e.g. 28th October 2012).

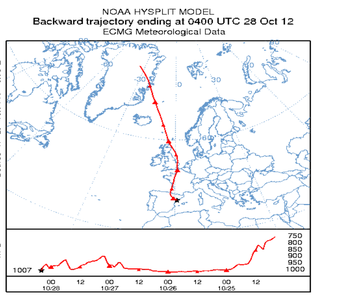


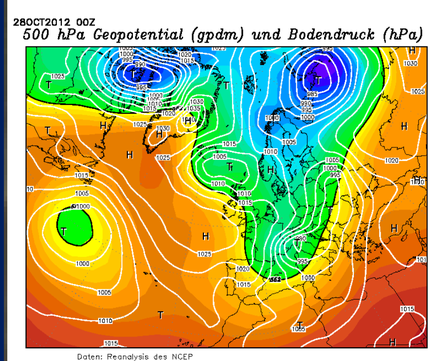


28th October 2012

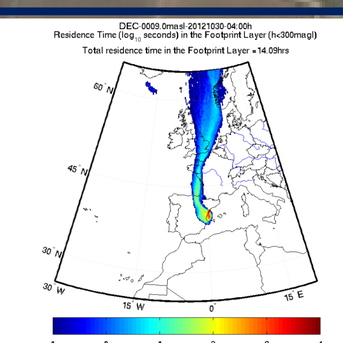


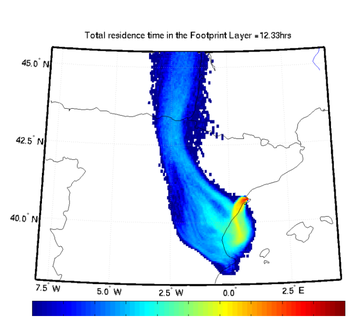


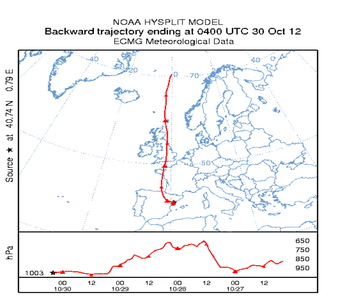


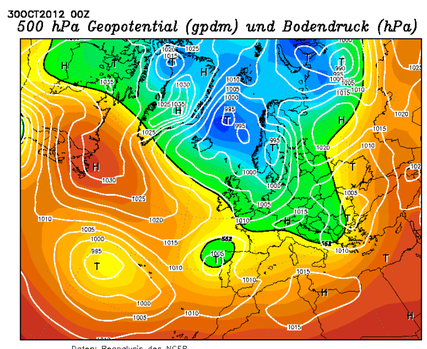


30th October 2012

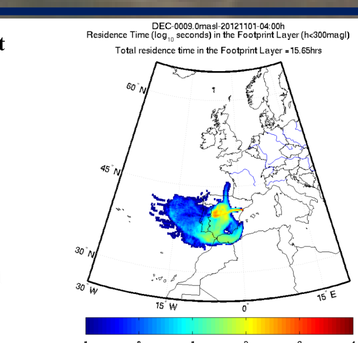


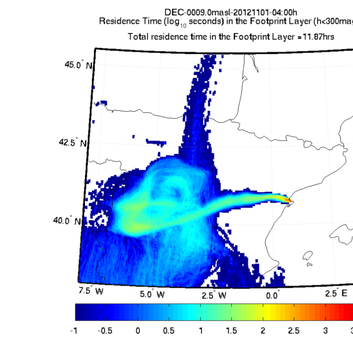


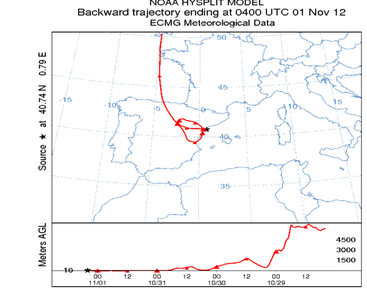


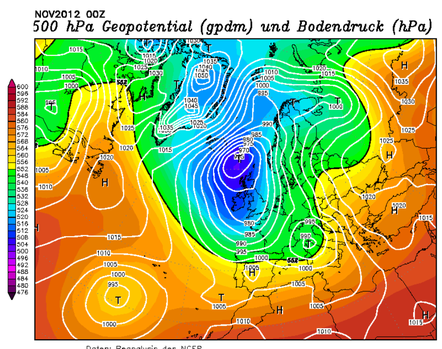


1st November 2012

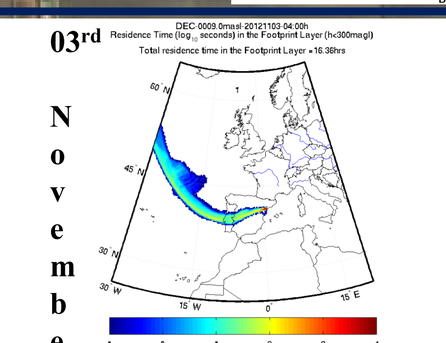


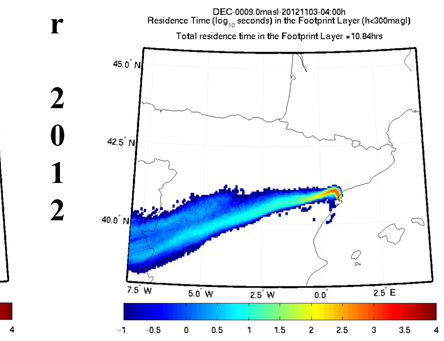


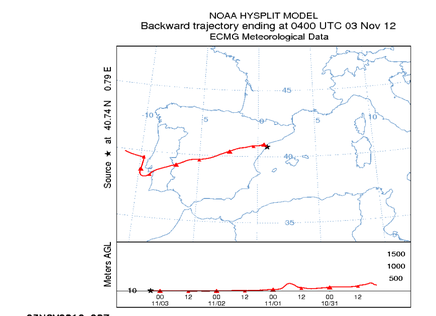


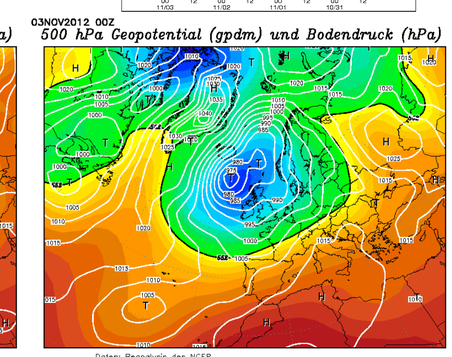


3rd November 2012









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 CH_4, CO_2 and ^{222}Rn, 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 ^{222}Rn at the same site can be extremely useful to study remote contributions episodes and will be continued in the future together with back-trajectories simulations.

References

• Draxler, R.R., and G.D. Hess, 1998. An overview of the HYSPLIT_4 modeling system of trajectories, dispersion, and deposition. Aust. Meteor. Mag. 47, 295-308.
• Stohl, A., M. Hittenberger, and G. Wotawa, 1998. Validation of the Lagrangian particle dispersion model FLEXPART against large scale tracer experiments. Atmos. Environ. 32, 4245-4264.

[1] Corresponding author: Claudia Grossi; e-mail: claudia.grossi@ic3.cat