Geophysical Research Abstracts, Vol. 8, 07566, 2006
SRef-ID: 1607-7962/gra/EGU06-A-07566

Variability in atmospheric CO_2 mixing ratio reflected by tall tower measurements

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The purpose of our research was to study the physical processes affecting the temporal profile of atmospheric CO_2 mixing ratio measured at the Hungarian tall tower site (Hegyhátsál, 46°57'N, 16°39'E, 248 m ASL). For this study we used the HYSPLIT (HYbrid Single-Particle Lagrangian Integrated Trajectory) - model developed by NOAA/ARL. Instead of the coarse resolution (~2.5°x2.0°) FNL data provided by the authors of the model we used ECMWF winds at 0.5°x0.5° resolution with 3h time steps. Based on the HYSPLIT model a concentration footprint calculation and visualization software has been developed to determine the region of influence of the measured signal and to scrutinize the influence of the different atmospheric circulation patterns. For this purpose we adopted the method of *Gloor et al. (2001).* It has been found that changes in the location and size of the concentration footprint is generally associated with synoptic events. In case of frontal overpasses free tropospheric air can be transported downwards the surface. Under such conditions the mixing ratio of CO_2 changes abruptly which can be clearly detected by the measurements. The analyses of a few synoptic events are presented together with air trajectory analysis. In order to perform a coupled analysis of the measured signal and the trajectories we have adopted the methodology of *Aalto et al. (2000)* to construct a so-called CO_2 chart. This chart might be used to identify the anthropogenic signal of CO_2 in a European scale. The CO_2 charts are compared with a fossil fuel emission database (EDGAR 2000).

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Gloor, M., Bakwin, P., Hurst, D., Lock, L., Draxler, R. and Tans, P., 2001. What is the concentration footprint of a tall tower? *J. Geophys Res.*, 106, 17831-17840.