Geophysical Research Abstracts, Vol. 9, 02504, 2007
SRef-ID: 1607-7962/gra/EGU2007-A-02504
© European Geosciences Union 2007

Determination of the atmospheric boundary layer height on an Alpine pumping day at Hohenpeißenberg (Germany)

K. Staudt (1), J.-C. Mayer (2), G.-J. Steeneveld (3), F.X. Meixner (2), Th. Foken (1)

(1) University of Bayreuth, Department of Micrometeorology, Bayreuth, Germany, (2) Max Planck Institute for Chemistry, Biogeochemistry Department, Mainz, Germany, (3) Wageningen University, Meteorology and Air Quality Section, Wageningen, The Netherlands

For selected days of the field experiment SALSA 2005 at Hohenpeißenberg (southern Germany) from mid of August to end of September of 2005 the atmospheric boundary layer (ABL) height was determined using sodar and tethered balloon data. Additionally, data from groundbased turbulence measurements were used for parameterisations of the stable boundary layer (SBL) depth and for slab models for the growth of the convective boundary layer (CBL). Here, results from one day are presented.

05 September 2005 was the first of four consecutive fair weather days when the mesoscale circulation between the Alps and the foreland, called Alpine pumping, was established. Southerly wind directions during the night indicated outflow of air from the Alps. The day time period of Alpine pumping when air is sucked into the Alps started with a sudden reversal of wind direction in the morning to east north-easterly whereas the transition back to southerly wind directions in the evening hours was more continuous.

Visual inspection of sodar reflectivity profiles was applied to determine the ABL height. These profiles frequently revealed a complex ABL structure and a shallow CBL height. Tethered balloon measurements of temperature and humidity were compared to sodar data which confirmed this complex structure. The ABL structure turned out to be strongly influenced by Alpine pumping with distinct layering as well as suppressed CBL growth. Processes triggered by Alpine pumping such as cold air advection from the lower parts of the Alpine foreland as well as subsidence that replaces boundary layer air which is pumped into the Alps strongly affected the ABL structure.

Thus, methods that were developed for flat homogeneous terrain are not applicable under these conditions, like slab models that neglect these processes and largely overestimated the CBL height.