Advection and Turbulent Transport: Influences on Terms of Budgets of Energy and Trace Compounds

R. Dlugi (1), M. Berger (1), M. Zelger(1), S. Rube (1), F.X. Meixner (2), M. Kortner (2), G. Kramm (3), R. Koppmann (4)

(1) AAP, Gernotstr. 11, D-80804 Muenchen, Germany. (2) Max Planck Institute for Chemistry, Biogeochemistry Department, J. v. Becherweg 27, D-55128 Mainz, Germany, (3) Geophysical Institut, University of Alaska Fairbanks, 903 Koyukuk Drive, P.O.Box 757320, Fairbanks, AK 99775 - 7320, USA, (4) Research Center Juelich, ICG II: Troposphere, D-52425 Juelich, Germany (rdlugi@gmx.de)

The terms of the budget equations for sensible heat, moisture and trace compounds (e.g. CO_2, monoterpenes) from experiments in Europe at Mediteranean sites (BEMA experiments: mixed oak / pine forest; Orange plantation) and a mixed beech/oak forest at the research center Juelich / Germany (ECHO experiment) are detemined from measurents resolved in space and time. The different terms are compared to each other. Especially the influence of horizontal and vertical advection and turbulent transport is discussed. During BEMA, a combination of sea-land breeze circulation with termal circualation on a scale of about 1-3 km between the forest and an agricultural area caused intensive sensible heat advection for dry soil conditions. The budget of monoterpenes is significantly modified under these conditions by the divergence of the wind field (3D) and also the enhanced source strength in the canopy. For the ECHO site the advection of heat and matter during daytime is also controled by differential heating of the heterogenous terrain. The observed circualation of air in the canopy is different from the situations during BEMA. Warm-dry and cool-wet air is advected inside the forest and started to oscillate and rotate in the horizontal plane during daytime. As a result, the flow at top of the canopy decouples from the flow in the trunk space for about 500-800s and then, for a short period of about 30-80s, couples to the lower flow regime. Thermodynamical and dynamical conditions for these flow conditions will be described. It is shown that the conditions for in-canopy chemical removal of reactive compounds are strongly dependent on the energetic and hydrological conditions.