Ph.D. position (4 years)
Meteorology and Air Quality Section
Wageningen University
The Netherlands
http://www.met.wau.nl/

Contact person: Jordi Vila (jordi.vila@wur.nl)

Short description

In heterogeneous landscape, the thermal forcing of the planetary boundary layer (PBL) and the sources and sinks of the atmospheric constituents are largely discontinuous. As a consequence of these surface perturbations, the distribution and evolution of atmospheric compounds such as water vapor, carbon dioxide or reactive greenhouses (ozone) can be largely modified. At the top of the PBL, the entrainment or detrainment of species can dilute or enhance the concentration of atmospheric constituents in the atmospheric boundary layer. In addition, the horizontal variation of the thermal forcing can induce mean circulation that can influence the transport and mixing of species. Furthermore, the discontinuous injection and removal of species can disrupt the chemical pathways and equilibria. The mentioned processes happen normally on spatial and temporal scales smaller than the grid size of the large atmospheric chemistry models. Therefore, they require a representation in form of a parameterization to be included in large atmospheric models.

The main objective of this doctoral research is to achieve a better understanding of the combined effects of the dynamics on the transport and on the transformation in boundary layers characterized by perturbations in the surface conditions. We will carry out sensitivity analysis on various heterogeneous landscapes and chemical mechanisms by means of fine-scale modeling (e.g. large eddy simulation) in order to solve the most relevant physical and chemical scales of the flow. Model simulations will be tested with available upper air and surface observations. Our starting hypothesis is that these turbulent flows are controlled by the scale of the surface inhomogeneities (variations in the heat and moisture fluxes), wind speed and by the chemical reaction rate. In the second and final stage, we will develop suitable process descriptions that represent reliably the reactivity of species above heterogeneous surfaces.

Requirements
- MSc diploma in Atmospheric Physics or related subject
- Good knowledge of numerical modeling and data treatment
- Good skills in numerical programming (preferably FORTRAN)

Starting date: October/November 2004

Duration of the position: 4 years