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Analysis of temporal variability in land-atmosphere interactions, boundary layer dynamics and chemistry during the 2012 PEGASOS field campaigns

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Surface and airborne measurements collected during the 2012 PEGASOS intensive field campaign over the Netherlands and the Po valley, Italy, offer an optimal source of information to further improve our knowledge on the role boundary layer exchange processes in atmospheric chemistry. The use of a zeppelin, sampling close to the surface ($\sim$50m) up to $\sim$600m altitude and measuring in the early morning, provided detailed measurements of vertical gradients as well as the temporal evolution in chemical composition and relevant meteorological parameters. This allows more detailed analysis of the role of the morning transition and entrainment of residual air masses previously being identified to be essential to daytime chemical processing in the boundary layer. Analysis of these measurements is supported by the use of a number of modelling systems including a selection of 1-D model approaches. In addition, these 1-D models are applied to directly link the observations to the representation of these processes in the 3-D atmospheric chemistry models used to address the overall PEGASOS research goals.
In this presentation, results of simulations with an 1-D chemistry-climate model system covering the full measurement period will be presented. Assimilation of meteorological and chemical composition re-analysis data as well as a detailed representation of atmosphere-biosphere and boundary layer exchange processes in this 1-D system allow to assess the role of local scale land-atmosphere interactions versus long-range transport during the PESOSAS field campaigns. In this presentation we will focus on an assessment to what extent daytime boundary layer dynamics and chemistry depends on the short- and more long-term history of the system, e.g., residual layer processing and the role of changes in soil moisture status on land-atmosphere interactions.