Geophysical Research Abstracts, Vol. 8, 03962, 2006
SRef-ID: 1607-7962/gra/EGU06-A-03962
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Impact of previous day plumes and residual layers to produce pollution peaks

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Dynamical conditions are well known to be one of the most important drivers in the determination of plumes and peaks of pollution. It is particularly right in regions characterized by highly complex topography associated to local circulations (sea and slope breezes).So, day after day; different synoptic conditions can lead to similar dynamical flows but to different chemical concentrations in the atmospheric boundary layer, over a whole region. Chemical reactivity and ozone production are non-linear processes, depending on chemical regimes and then, some ratios like NO_x/COV, like shown by Silmann et al. (1998). Why, in same regional meteorological conditions, can the atmospheric pollutants evolve toward different patterns of plumes and levels of concentration? What is the role of residual layers in the appearance of new pollution peaks?

Within the framework of ESCOMPTE, we examine the case of the Intense Observation Period: IOP3 (2-4 July 2001). The three days of this IOP show very similar meso-scale dynamical flows, but regional concentrations of atmospheric pollutants, especially secondary species such as ozone, peroxide, radicals ... are totally different. We associate meso-scale simulations done with the RAMS-Chemistry model, and local observations (more than 40 in-situ ground measurements plus ozone lidar profiles, radiosoundings and aircraft flights) in order to understand the evolution of chemical species. A combined analysis between wind fields, ozone, NO_y, HNO3, peroxides concentrations, and O_3/NO_z, O_x/NO_z,O_3/HNO_3ratios, used as indicator of the age of the air mass, allow us to explain how the previous day plume over sea during the night coming back on land during the day leads to different pollutant concentrations with the same meteorological conditions than the previous day.