Geophysical Research Abstracts
Vol. 13, EGU2011-12397, 2011
EGU General Assembly 2011

Radiative effects of biomass burning aerosols in the Mediterranean region during ITOP 2004

Christoforos Tsamalis (1,*), François Ravetta (1), Jurgen Fischer (2), Alexandros Papayannis (3), and Georgios Tsaknakis (3)

(1) LATMOS, UPMC Univ. Paris 06, Université Versailles St-Quentin, CNRS/IPSL, Paris, France, (2) Institute for Space Sciences, Freie Universitat Berlin, Berlin, Germany, (3) Laser Remote Sensing Laboratory, Physics Department, National Technical University of Athens, Athens, Greece, (*) Now at Laboratoire de Météorologie Dynamique, CNRS/IPSL, Ecole Polytechnique, Palaiseau, France (christoforos.tsamalis@lmd.polytechnique.fr)

The Mediterranean region is affected by biomass burning (BB) aerosols either transported from other regions like North America and North-eastern Europe or produced locally due to warm and dry summers characterising the Mediterranean climate, which favour the ignition and the expansion of fires. These aerosols affect the regional climate, as the BB plumes influence both the chemical composition of the atmosphere by deteriorating the air quality and the radiative equilibrium of the atmosphere, which finally modifies the mesoscale dynamics by changing the heating rate. It has to be noticed that the Mediterranean region is very vulnerable to climatic change in comparison with other regions of the Earth, but due to relatively minor importance of Mediterranean fires to the earth climate, the studies of biomass burning aerosols are limited in this area.

For this reason, some cases of biomass burning plumes, arrived in southern France at the Observatoire de Haute Provence from North America during the campaign ITOP 2004 and then stayed in the Mediterranean region and further re-detected above Athens, are examined. The Intercontinental Transport of Ozone and Precursors (ITOP) project was conducted in summer 2004 as part of ICARTT field study, with aim to perform observations of chemical processing occurring in air masses transported from the United States to Europe at both high and low levels in the troposphere in a quasi Lagrangian manner and to quantify its impact on ozone and aerosol budget in Europe.

Before the estimation of the biomass burning radiative impacts, some sensitivity tests are realised using the radiative code MOMO in the solar spectrum, developed at Free University of Berlin, and the aerosol modelling package OPAC. By using the aerosol models continental average and urban from OPAC for two cases of relative humidity (0% and 50%) the sensitivity studies have shown that the most determinant parameter is the surface albedo accompanied by the optical depth, when it is large enough (over 1) and then follows the vertical position of the layer, of which the effect can be omitted to the first approximation. On the contrary, the shape and the vertical extension of the layer do not seem to influence significantly the radiative properties of the aerosols.

Then, we examined the impact of BB aerosols for three profiles, which were the most important registered during the ITOP campaign. Two profiles with optical depth around 0.12 at 316 nm were chosen (24 July morning and 26 July), and a third one with optical depth around 0.26 (24 July noon). At the top of the atmosphere (TOA) the radiative forcing depends on the model. For the continental average model is always negative (cooling) with values between -11 and -0.2 Wm^{-2}, on the contrary for the urban model depends on the solar zenith angle (SZA) (for small SZA there is warming, while for large SZA there is cooling), while it is between -6 and 6 Wm^{-2}. At the bottom of the atmosphere (BOA), the radiative forcing is always negative (cooling), with values down to -30 Wm^{-2} for the continental average model and -47 Wm^{-2} for the urban model (the maximum radiative forcing is always 0 Wm^{-2} for SZA around 0^o). The heating rate may reach 5.5 K/day for the continental average model and up to 8 K/day for the urban one.