Geophysical Research Abstracts
Vol. 12, EGU2010-3435-1, 2010
EGU General Assembly 2010

Regional radiative impacts of mixed dust and carbonaceous aerosols over West Africa

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Africa is a major source of aerosols at global scale. Two types of aerosols dominate the regional background: biomass burning aerosols as results of combustion of the vegetation and mineral dust aerosols related to erosion of arid soils by wind. These important burdens of aerosols are known to have each one a strong impact on the regional radiative budget. Whereas recent modelling efforts show significant impacts at climatic timescale on West African Monsoon due to the radiative effects of dust aerosols (see Solmon et al 2008 in GRL and references therein), biomass burning radiative effects in this region stand still poorly documented. What about West Africa, during the dry season (december-february) when both biomass burning and dust aerosols are encountered in the atmospheric background ?

In that frame, we use ICTP Regional Climate Model versions 3 in order to estimate the radiative forcing due to the external mixing of mineral dust and carbonaceous aerosols from biomass burning, BioFuel and Fossil Fuel combustion during the dry season. Emissions of biomass burning aerosols are taken from new inventories based on SPOT vegetation burnt area products. Optical properties of carboneaceous aerosols are updated thanks to chemical sampling at Djougou during AMMA SOP-0.

This presentation focuses on the model efficiency to correctly reproduce the main features concerning aerosols observed during AMMA-SOP0/DABEX field campaigns. It refers to (i) a strong stratification of dust and smoke layers, and (ii) a marked seasonal cycle of aerosol mixture optical properties. Those features are key parameters for modelling the direct and semi direct effects of aerosols over West Africa.

Results of simulations indicate that the particular low value of single scattering albedo (SSA) for biomass burning aerosols ($\sim$0.81 at 550nm) involves important diabatic heating in the atmosphere. Values of aerosol heating rates are estimated and compared with aircraft measurement from DABEX experiment. This leads to anomalous wind circulation. During the dry season, a decrease of the northward propagation of the moonson flux is observed while the eastern part of the African easterly jet is enhanced due to aerosol diabatic heating close to emission sources of biomass burning aerosols. Preliminary results exploring the impact of biomass burning aerosols and dust aerosols on West African monsoon for a ten years simulation are also presented.