Modeling local and remote impacts of Amazonian biomass burning aerosols

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Every year, biomass burning in Amazonia releases large amounts of aerosols into the atmosphere. The consequent change from low to very high atmospheric concentration of aerosols therefore affects the radiative, cloud physical and chemical properties of the atmosphere over Amazonia. This represents a dramatic perturbation to the local and regional climate, ecology, water and nutrients cycles, and human life. Given the magnitude of biomass burning in Amazonia and the efficiency of the process of atmospheric transport of fire emissions, there perturbations are very likely to affect the climate system even on a global scale. Here, we examine the smoke aerosols simulated by CCATT-BRAMS model (an aerosol and chemistry transport model coupled on-line to a non-hydrostatic and compressible mesoscale model) over South America, aiming to use the model results to assess the local and remote impacts. We will present the current model status, summarizing the efforts made in terms of numerical model development, in order to better represent within the model the atmospheric processes that are the main drivers of the fate of fire emissions and that lead to smoke impacts. Based on a 13-year numerical simulation, we will draw the general pattern of smoke long-range transport over the South American continent and explore local and remote impacts. We will discuss the smoke radiative impacts on the hydrological cycle, surface processes as well as on the troposheric chemistry over the affected areas. Finally, the human dimension of the problem will be visualized throughout correlations between the hospitalization rate of children and elderly people and the level of smoke exposition.

Geochemistry of xenoliths from the Gibeon Kimberlite Province, Namibia

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Mantle xenoliths from the off-craton Gibeon Kimberlite Province (southern Namibia) include garnet peridotites with coarse equant (CE) to mosaic porphyroclastic (MP) textures. The Gibeon mantle is characterized by a perturbed geotherm, with displacement of the most deformed MP-samples to ca. 200°C higher T [1, 2]. We have analysed by LA-ICP-MS the trace element compositions of garnets (Grt) and clinopyroxenes (Cpx) in ten Grt-peridotites from the Gibeon Townsland 1 pipe. The samples included Cpx-bearing and Cpx-free xenoliths showing CE to MP textures and varying estimated equilibrium T. One Grt shows a sinusoidal REE_{CI} profile, with peak at Eu and HREE between 2 and 5xCI, typical of depleted peridotites affected by fluid-metasomatism [3]. The other Grts are richer in HREE (≈10xCI) and show normal or sloped REE_{CI} profiles. The coexisting Cpxs show LREE-enriched profiles with variable La_{CI}/Sm_{CI} ratios (0.6-5.1). Zr vs. HREE (Y) relations are typical of more fertile peridotites affected by variable degrees of melt-metasomatism, possibly involving both PIC- and MARID-type agents [4]. No relationship has been observed between geochemical compositions and xenolith texture or PT conditions. This suggests that the recorded thermal perturbation postdated the above peridotite metasomatism and refertilisation.

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