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Effects of biomass burning aerosols on CO_2 fluxes on Amazon Region

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During the dry season in Central Brazil and Southern Amazon, there is an usually high concentration of aerosol particles associated with intense human activities, with extensive biomass burning. It has been observed through remote sensing that the smoke clouds in these areas often cover an area of about 4 to 5 million km2. Thus, the average aerosol optical depth of these regions at 500 ηm, is usually below 0.1 during the rainy season and can exceed 0.9 in the fire season. Aerosol particles act as condensation nuclei and also increase scattering and absorption of the incident radiation. Therefore, the layer of the aerosol alters the precipitation rate; reduces the amount of solar energy that reaches the surface, producing a cooling; and causes an increase of diffuse radiation. These factors directly and indirectly affect the CO_2 fluxes at the surface. In this work, the chemical-atmospheric model CCATT-BRAMS (Coupled Chemistry-Aerosol-Tracer Transport model to the Brazilian developments on the Regional Atmospheric Modeling System) coupled to the surface model JULES (Joint UK Land Environment Simulator) was used to simulate the effects of biomass burning aerosols in CO_2 fluxes in the Amazon region. Both the total effect of the aerosols and the contribution related only to the increase of the diffuse fraction caused by the their presence were analyzed. The results show that the effect of the scattered fraction is dominant over all other effects. It was also noted that the presence of aerosols from fires can substantially change biophysiological processes of the carbon cycle. In some situations, it can lead to a sign change in the net ecosystem exchange (NEE), turning it from a source of CO_2 to the atmosphere, when the aerosol is not considered in the simulations, to a sink, when it is considered. Thus, this work demonstrates the importance of considering the presence of aerosols in numerical simulations of weather and climate, since carbon dioxide is a major greenhouse gas.