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IMPACT OF ASIAN POLLUTION ON THE ASIAN SUMMER MONSOON AND CLIMATE

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The Asian summer monsoon involves complex transport patterns with large scale redistribution of pollutants (gases and aerosol particulate, both) in the troposphere and lower stratosphere. Redistribution of linearly increasing emissions of pollutants generates climatic effects since Asia (10S-50N, 65-155E) is one of major contributor of these pollutants. Enhanced pollution is attributed to increase in population, industrialization and biomass burning activates. We performed a number of experiments using the global chemistry climate model ECHAM5-HAMMOZ to understand transport of aerosols and greenhouse gases e.g. black carbon (BC), organic carbon (OC), dust, sulphate, nitric oxides (NOX), ozone (O_3) and methane (CH_4) and its impact on climate. The model simulations are evaluated with balloon borne, aircraft and satellite measurements. Our model simulations showed that the Asian pollutants are lifted up in the upper troposphere and lower stratosphere by the monsoon convection. They are transported to the remote location affecting the climate of that region. A part of these pollutants get trapped in the upper level anticyclone and slowly enter the stratosphere. They produce a feedback on the monsoon rainfall. Radiative heating by ozone, methane and back carbon aerosols enhances temperature over the Tibetan Plateau, increases land-ocean contrast, low level moisture supply over India and thereby enhances rainfall. However, sulphate aerosols produce a strong negative feedback linked to anonymous production of Asian sulphate aerosols. They form a lid over Asia due to confinement in the upper level anticyclone. This lid inhibits the solar radiations reaching the lower troposphere and cools the surface, lower level moisture supply and reduces the monsoon rainfall over India. We quantify changes in radiative forcing, heating rates, temperature, clouds and ice in the troposphere and stratosphere. Our analysis also revealed that radiatively active species produces a strong impact on stratospheric ozone layer and related climate change.

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