Composition of Aerosols over the Arabian Peninsula as Seen by a Global Climate – Aerosol Model

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The science of atmospheric aerosols has long received attention from researchers living in the Arabian Peninsula because of the high frequency of haze or dust events. DU is widely studied in the region, but there is a lack of information and research on measurements or modeling of other types of aerosols. This research, for the first time, provides insights into the temporospatial distribution of BC, particulate organic matter (POM), sulfate (SU), sea salt (SS), and DU, as well as the size distribution of aerosols over the Arabian Peninsula. Aerosols over the Arabian Peninsula were analyzed over a 7-year period (2005–2011) by using the global aerosol-climate model ECHAM5-HAM with the inventory of the Greenhouse Gas-Air Pollution Interactions and Synergies (GAINS) representing anthropogenic emissions. Deep Blue satellite data was used to validate the model, which underestimated the concentration of aerosols. AOD values extracted from the ECHAM5-HAM correlated favorably with AOD values observed by satellite (0.66). DU and SU were found to constitute more than 86% of the total mass of aerosols over the Arabian Peninsula. The mean mass percentages of DU, SU, POM, SS, and BC were 43.7%, 42.5%, 7.7%, 4.5%, and 1.7% respectively. Seasonality varied for each aerosol and for each region. The longest season was observed for DU, which lasted for 7 months starting from March, and SU had a season of 4 months starting from June. Most of the aerosols were in the accumulation modes (53%), soluble coarse mode (33%), and insoluble coarse mode (12%). DU and SU aerosols have similar mass significance. Assessing the climatology of various types of aerosols over the Arabian Peninsula will contribute essential information to this field. This will lead to improving the accuracy of models over arid regions and enrich scientific understanding of an internationally recognized topic.

Keywords: ECHAM5-HAM, aerosols, Dust, Black Carbon, Sulfate