Geophysical Research Abstracts
Vol. 14, EGU2012-7365-1, 2012
EGU General Assembly 2012

The role of precipitation in aerosol-induced changes in northern hemisphere wintertime stationary waves

A. Lewinschal, A.M.L. Ekman, and H. Körnich
Stockholm University, Sweden (annica@misu.su.se)

Aerosol particles have a considerable impact on the energy budget of the atmosphere due to their ability to scatter and absorb incoming solar radiation. Persistent particle emissions in certain regions of the world have lead to quasi-permanent aerosol forcing patterns. This spatially varying forcing pattern has the potential to modify temperature gradients that in turn alter pressure gradients and the atmospheric circulation. This study focuses on the effect of aerosol direct radiative forcing on northern hemisphere wintertime stationary waves.

A global general circulation model based on the ECMWF operational forecast model is applied (EC-Earth). Aerosols are prescribed as monthly mean mixing ratios of sulphate, black carbon, organic carbon, dust and sea salt. Only the direct aerosol effect is considered. The climatic change is defined as the difference between model simulations using present-day and pre-industrial concentrations of aerosol particles. Data from 40-year long simulations using a coupled ocean-atmosphere model system are used.

In EC-Earth, the high aerosol loading over South Asia leads to a surface cooling, which appears to enhance the South Asian winter monsoon and weaken the Indian Ocean Walker circulation. The anomalous Walker circulation leads to changes in tropical convective precipitation and consequent changes in latent heat release which effectively acts to generate planetary scale waves propagating into the extra-tropics. Using a steady-state linear model we verify that the aerosol-induced anomalous convective precipitation is a crucial link between the wave changes and the direct aerosol radiative forcing.