Geophysical Research Abstracts
Vol. 17, EGU2015-4751, 2015
EGU General Assembly 2015

The effect of aerosols and sea surface temperature on China's climate over the late twentieth century

Doris Folini and Martin Wild
ETH Zurich, Institute for Atmospheric and Climate Science, Zurich, Switzerland (doris.folini@env.ethz.ch)

Focusing on China in the second half of the twentieth century, we examine the relative role of aerosols and prescribed, observation based sea surface temperatures (SSTs) for the evolution of surface solar radiation (SSR), surface air temperature (SAT), and precipitation in ensembles of transient (1870 - 2005) sensitivity experiments with the global climate model ECHAM5-HAM. Observations and simulations with transient SSTs and aerosol emissions agree reasonably well in eastern China in terms of SSR dimming (-6 +/- 2 W/m2/decade, 1960 - 2000), statistically non-significant JJA SAT trend (1950 - 2000), and drying in JJA from 1950 to 1990 (-2.5% to -3.5% per decade, essentially via reduction of convective precipitation). Other major observed features are not reproduce by the model, e.g. precipitation increase in the 1990s in the Yangtze valley, the strong warming in winter in northern parts of China and Mongolia, or SSR dimming in western China. For the model results, SO_2 emissions are more relevant than emissions of black and organic carbon. Aerosol effects are less pronounced at higher model resolution. Transient SSTs are found to be crucial for decadal scale SAT variability over land, especially the strong warming in the 1990s, and, via SST forced reduction of cloud cover, for the ceasing of SSR dimming around the year 2000. Unforced cloud variability leads to relevant scatter (up to +/- 2 W/m2/decade) of modeled SSR trends at individual observation sites.