



The role of anthropogenic aerosols on the rapid warming at the end of the millennium and beyond

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The rapid temperature increase of 1°C over mainland Europe since 1980 is considerably larger than the temperature rise expected from anthropogenic greenhouse gas increases. Here we show shortwave and longwave surface forcings measured in Switzerland and Germany and relate them to humidity- and temperature increases through the radiation- and energy budget. Shortwave climate forcing from direct aerosol effects is found to be much larger than indirect aerosol cloud forcing, and the total shortwave forcing, that is related to the observed 60% aerosol decline, is two to three times larger than the longwave forcing from rising anthropogenic greenhouse gases. AOD and radiation measurements are in line with aerosol emission records in Europe and explain solar dimming and the temperature decline after 1950, as well as solar brightening and the rapid temperature rise since the 1980s. With anthropogenic aerosols now reaching low and stable values in Europe, solar forcing will subside and future temperature will only rise due to anthropogenic greenhouse gas warming.