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Study of aerosol effect on accelerated snow melting over the Tibetan Plateau during boreal spring

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In the present study, a coupled atmosphere-ocean global climate model (CSIRO-Mk3.6) is used to investigate the role of aerosol forcing agents as drivers of snow melting trends in the Tibetan Plateau (TP) region. Anthropogenic aerosol-induced snow cover changes in a warming climate are calculated from the difference between historical run (HIST) and all forcing except anthropogenic aerosol (NoAA). Absorbing aerosols can influence snow cover by warming the atmosphere, reducing snow reflectance after deposition. The warming the rate of snow melt, exposing darker surfaces below to short-wave radiation sooner, and allowing them to heat up even faster in the Himalayas and TP.The results show a strong spring snow cover decrease over TP when absorbing anthropogenic aerosol forcing is considered, whereas snow cover fraction (SCF) trends in NoAA are weakly negative (but insignificant) during 1951–2005. The enhanced spring snow cover trends in HIST are due to overall effects of different forcing agents: When aerosol forcing (AERO) is considered, a significant reduction of SCF than average can be found over the western TP and Himalayas. The large decreasing trends in SCF over the TP, with the maximum reduction of SCF around 12—15% over the western TP and Himalayas slope. Also accelerated snow melting during spring is due to effects of aerosol on snow albedo, where aerosol deposition cause decreases snow albedo. However, the SCF change in the “NoAA” simulations was observed to be less.