P70 Simulating black carbon and dust and their radiative forcing in seasonal snow: A case study over North China with field campaign measurements

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A state-of-the-art regional model, WRF-Chem, is coupled with the SNICAR model that includes the sophisticated representation of snow metamorphism processes available for climate study. The coupled model is used to simulate the black carbon (BC) and dust concentrations and their radiative forcing in seasonal snow over North China in January-February of 2010, with extensive field measurements used to evaluate the model performance. In general, the model simulated spatial variability of BC and dust mass concentrations in the top snow layer (hereafter BCS and DSTS, respectively) are quantitatively or qualitatively consistent with observations. The model generally moderately underestimates BCS in the clean regions but significantly overestimates BCS in some polluted regions. Most model results fall into the uncertainty ranges of observations. The simulated BCS and DSTS are highest with >5000 ng g-1 and up to 5 mg g-1, respectively, over the source regions and reduce to <50 ng g-1 and <1 μg g-1, respectively, in the remote regions. BCS and DSTS introduce similar magnitude of radiative warming (~10 W m-2) in snowpack, which is comparable to the magnitude of surface radiative cooling due to BC and dust in the atmosphere. This study represents the first effort in using a regional modeling framework to simulate BC and dust and their direct radiative forcing in snow. Although a variety of observational datasets have been used to attribute model biases, some uncertainties in the results remain, which highlights the need for more observations, particularly concurrent measurements of atmospheric and snow aerosols and the deposition fluxes of aerosols, in future campaigns.