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Supplement of

Observed high-altitude warming and snow cover retreat over Tibet and the Himalayas enhanced by black carbon aerosols

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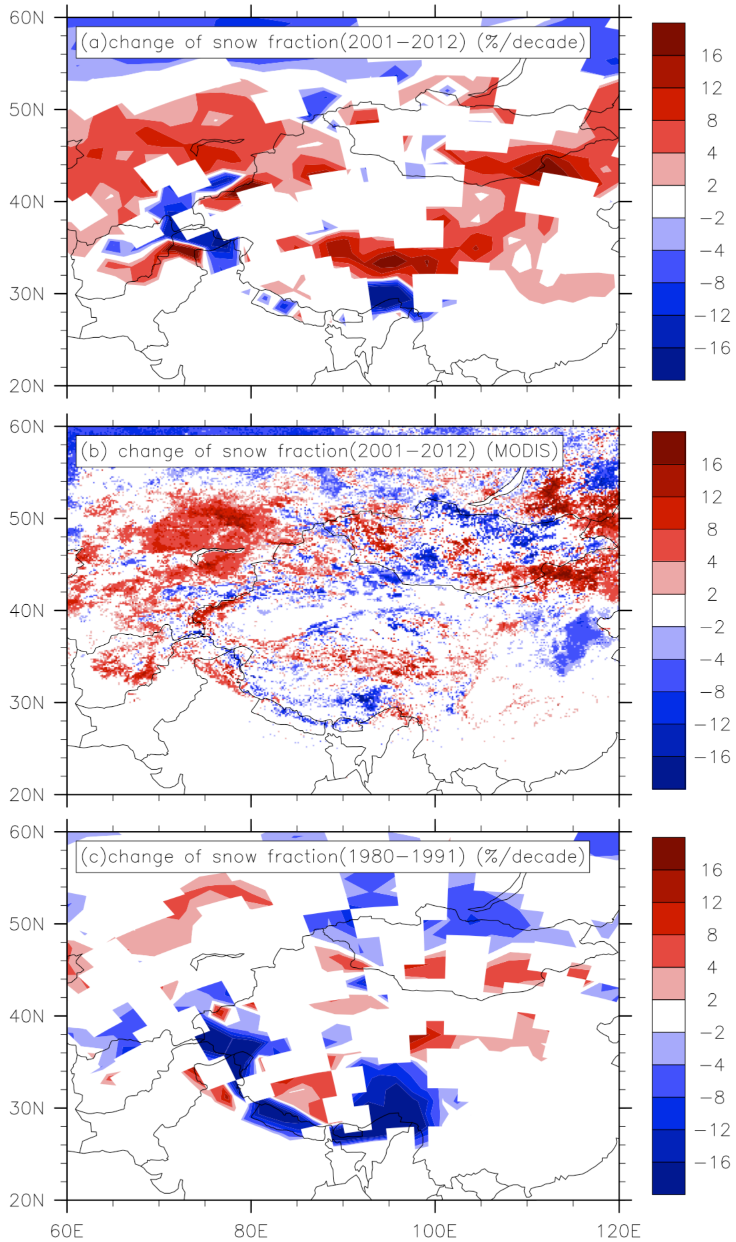

Fig. S1. (a) Snow fraction same as Fig. 1 but for 2001-2012. (b) Snow fraction same as (a) but from MODIS. (c) Snow fraction same as (a) but for 1980-1991.

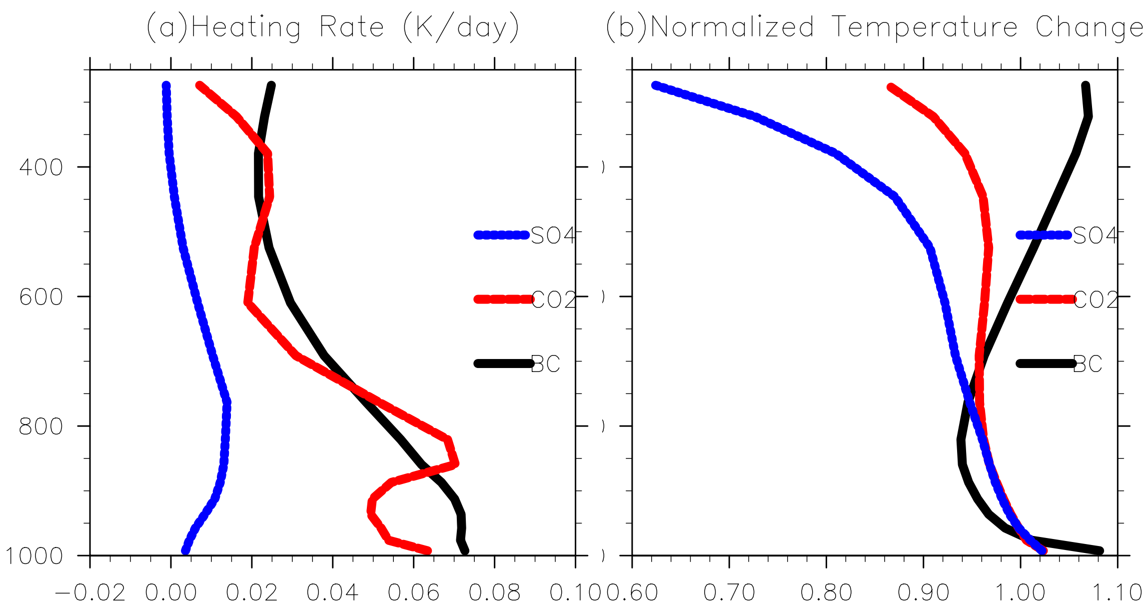

Fig. S2. Similar to Fig. 3 but showing the vertical profile averaged over the Tibet region. (a) Radiative heating rate (ºC/day). Shortwave fluxes for BC and SO_4, and longwave flux for CO_2. (b) Normalized temperature change relative to the average below 900 hPa. Note that the changes are tropospheric atmospheric temperature change, not surface temperature. The domains of the Tibet (as in Table 1) are 30 to 40ºN and 80 to 100ºE.

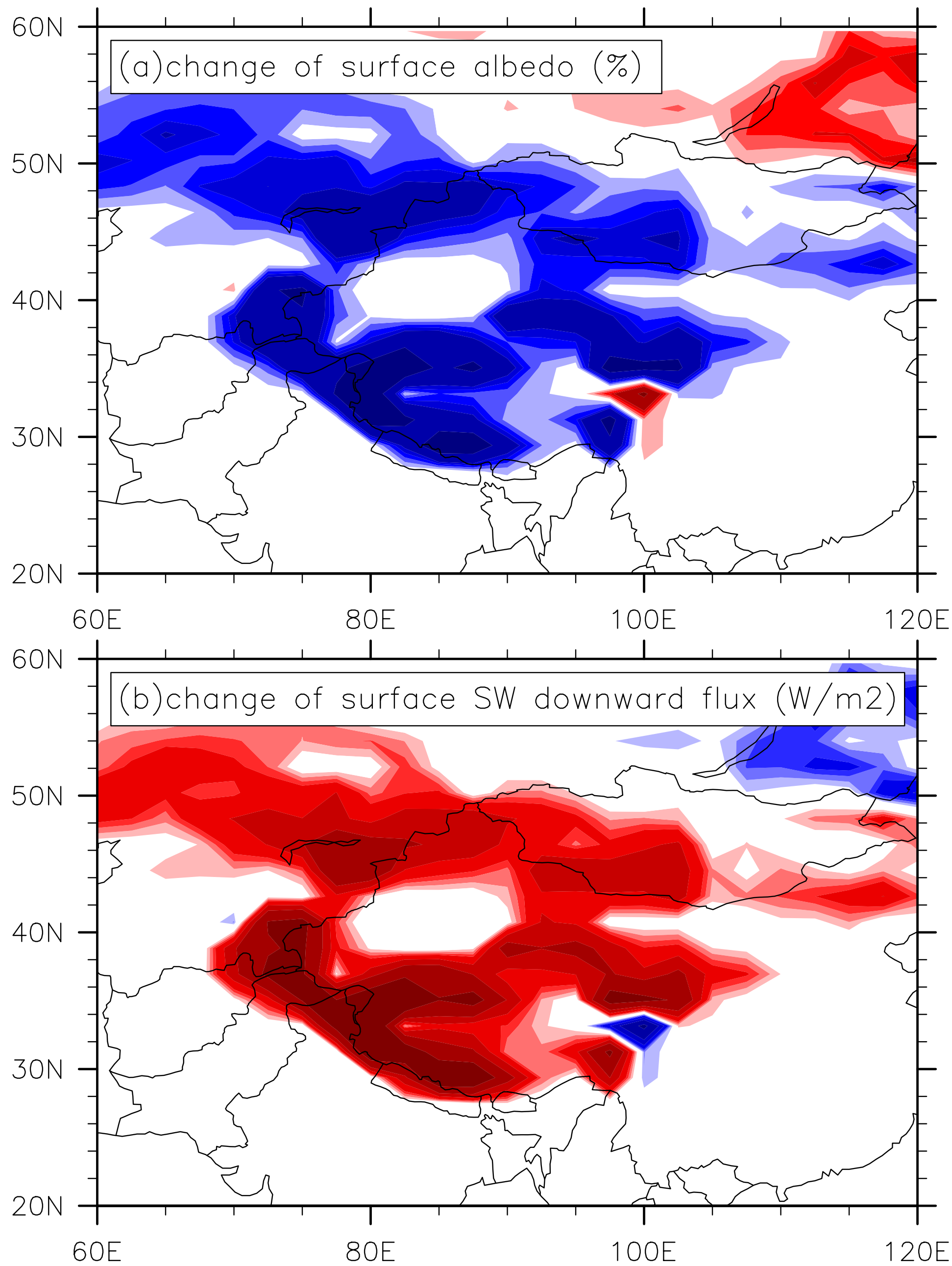

Fig. S3. (a) Change of surface albedo due to BC deposition on snow; (b) Change of net shortwave radiation (downward as positive, W/m^2). Over Tibet, the surface albedo is reduced by 2.2%, causing an increase in shortwave radiation reaching the surface by 4.1 W/m^2 (heating). Globally, the radiative forcing at the surface is about 0.1 W/m^2. The change of surface albedo is calculated by using the first five years of atmospheric-only simulation in which BC emission is increased; therefore, the change largely represents the albedo decrease due to BC deposition, although we cannot completely rule out the associated melting during this period.