Observational evidence of EHP effects on the melting of snowpack over the Tibetan Plateau

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Observational evidences are presented showing that the Indo-Gangetic Plain (IGP) regions, bounded by the high altitude Himalayan mountains, are subject to heavy loading of absorbing aerosols, i.e., black carbon and dust, which can lead to widespread enhancement warming over the Tibetan Plateau and accelerated snowmelt in the western Tibetan Plateau (WTP) and Himalayas. The two pre-monsoon seasons of 2004 and 2005 were strikingly contrasting in terms of the aerosol loading over IGP. The warming of the TP in 2004 relative to 2005 was widespread, covering most of the WTP and Himalayas. This warming is closely linked to patterns of the snow melt. Consistent with the Elevated Heat Pump hypothesis, we find that increased loading of absorbing aerosols over IGP in the pre-monsoon season is associated with increased heating of the upper troposphere by dynamical feedback induced by aerosol heating, and enhances the rate of snowmelt over Himalayas and the WTP in April-May. Composite analysis with more contrasting years also shows that the heating of the troposphere by elevated dust and black carbon aerosols in the boreal sping can lead to widespread enhanced land-atmosphere warming, and accelated snow melt in the Himalayas and Tibetan Plateau.