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Impact of the Aerosol Direct Radiative Forcing on the Asian summer monsoon using ICTP-Regional Climate Model (RegCM)

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The direct radiative forcing of aerosol over Asia play a significant impact on climate. Eleven types of aerosols (Anthropogenic, Biogenic and Natural sources) are implemented into Aerosol Module in ICTP-Regional Climate Model framework, these aerosols are Black Carbon (hydrophobic and hydrophilic), Organic Carbon (hydrophobic and hydrophilic), Sulfate, Sea-Salt (fine and accumulation modes), and dust (4-size bins). The results shown that during five year study 2002-2006, the surface radiative forcing is about -160 W/m2 over the western part of China and -20 W/m2 over the eastern part. This cooling of the surface radiative forcing reduced the temperature from -3.5C to -3.0C over the western part and eastern part of China, respectively. Surface cooling (1.5C) is recorded over India as well. Negative impact in Wind speed values are decreased (- 1.5 m/s) over the eastern part of China, while there is a positive impact over the Tibetan Plateau (2 m/s).
The most dominant aerosols in the pre-monsoon are dust particles, because during the pre-monsoon season of March-April, dusts from the deserts of western China, and the Middle East are transported into the northern and southern slopes of the Tibetan Plateau causing strong surface cooling in the radiative forcing. Warming effects are noticed in the TOA radiative forcing at the Tibetan Plateau, this because the effects of the 'elevated heat-bump' where the absorption of solar radiation by dust heats up the elevated surface air and then the heated air rises via dry convection creating a positive temperature anomaly in the mid-to-upper troposphere over the Tibetan Plateau relative to the region to the south. No clear event is recorded on precipitation over the continent, but there is increasing is recorded close to the India over the Indian Ocean (3.5 mm) during December-February (DJF) and March-May (MAM) seasons.