Himalayan extreme rainfall events using WRF-Chem: Response to atmospheric chemistry

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Changes in hydrological cycle over the Himalayan river basins have become a serious concern in recent decades not only from rising number of extreme rainfall events, but also from the growing concern of aerosol impacts. In this study, we assess the aerosol influences, through the use of Weather Research and Forecasting model coupled with aerosol and gas chemistry (WRF-Chem), on two infamous extreme flood-inducing rainfall events observed over the northern Indian states of Uttarakhand and Kashmir during June 2013 and September 2014, respectively.

The simulation with embedded chemistry is able to capture the spatial distribution and magnitude of observed rainfall reasonably well, i.e., the accuracy of cumulative rainfall over the aforesaid northern Indian states is considerably improved when chemical processes are included in the simulation. Simulations also indicate abundance of absorbing (e.g., dust and black carbon) aerosols tend to warm the atmosphere over this region, while the chemical species SO_4 and NO_3 tend to cool upper levels by scattering processes and also by nucleating the clouds. This study highlights the role of aerosol and gas chemistry and recognizes the importance of atmospheric chemistry in the model simulations towards better forecasting/understanding of such extreme weather events.