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Effects of absorbing aerosols on intraseasonal variability of the Indian Monsoon

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In this work, we use the NASA Unified Weather Research and Forecasting (Nu-WRF) model to study the effect of absorbing aerosol (dust and black carbon) on the short-term predictability (1-7 days) of the South Asian monsoon rainfall and cloud system. Two sets of 7-day forecasting experiments were conducted with and without aerosol radiative forcing. Each set consists of 34 7-day forecasts with initial conditions from daily reanalysis and GEOS-5 aerosol distribution (only for aerosol run) from June 11- July 14, 2008. Comparing the aerosol and no-aerosol runs, we find that aerosol-monsoon coupling induces a complex interaction among direct, indirect and semi-direct effects, strongly mediated by atmospheric dynamical feedbacks, resulting in substantial changes in the spatial and temporal distributions and magnitudes of the surface and atmospheric radiation balance, atmospheric stability, and moisture convergence. The net effect is a non-local response of monsoon rainfall and cloudiness, with respect to the region of maximum aerosol loading, characterized by a northward shift of the monsoon rain and cloud systems toward the Himalaya foothills, and eastern shift towards the Bay of Bengal, and reduction in rainfall over central India, consistent with the EHP hypothesis. The possible impacts of aerosol on diurnal cycle and modulating wet and dry monsoon spells will also be discussed.