**Figure S1.** Vertical profile of MERRA-2 PM2.5 dust mixing ratio on 2006-07-08.
Figure S2. 24-hour accumulated precipitation ($r_{24h}$) (LT 2006-07-08) observations from IMERG observation.
Figure S3. 24-hour accumulated precipitation (LT 2006-07-08) simulations from (b) Morr2-ec-Clean and (b) Morr2-ec-Dusty.
Figure S4. Hourly rainfall rates from IMERG observation (black line) and six numerical runs (colored lines) (LT 00:00–20:00, 2006-07-08), averaged among rainfall grids (> 0 mm hr⁻¹) in the High-Pcp area.