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Comprehensive analysis on characteristics and mechanisms of transboundary air pollution in a persistent heavy PM2.5 pollution episode in central east China

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Previous researches have shown the significant transboundary air pollution (TAP) in China. The characteristics and mechanisms of transboundary air pollution have yet to be fully understood. Based on various kinds of measurements along with the atmospheric modeling approach, we analyzed the driving meteorological conditions to the formation and evolution of a persistent severe PM2.5 pollution episode in Central-East China (CEC, 112°E -118°E, 30°N -34°N) from Dec. 3 to 5, 2017, which was a typical persistent regional severe haze with characteristics of transport and explosive increase in PM2.5 concentration. Results show that PM2.5 concentrations in most cities in CEC region experienced two major increases: the first increase occurred on Dec. 3 by the convergence of surface wind, accompanied with low-level north wind transported pollutants from North China to CEC in free troposphere; the second increase occurred from the night of Dec. 3 to early Dec. 4, in which various meteorological factors, including different cold advection at the surface and 925 hPa, large-scale subsidence, and radiative cooling, jointly resulted in a deep (reaching around 800 m) and strong temperature inversion with a significant reduction in mixing layer thickness, causing an increase (the explosive increase) of PM2.5 concentration in CEC region. The model results indicate TAP accounted for about 65 – 94% of total PM2.5 concentration in the region during the event, in which the southerly moving surface transport was the major driving factor. Our findings demonstrate the synergetic effect of transboundary air pollution and large-scale subsidence, providing a critical reference for air pollution forecast and assessment in the eastern China.