Characteristics of aerosol and meteorological parameters during the dust event of 15 April 2015 over Beijing, China

*sheng zheng[1], Ramesh P. Singh[2]

1. Department of Land Management, Zhejiang University, 2. School of Life and Environmental Sciences, Schmid College of Science and Technology, Chapman University

Dust season is prevalent every year during spring season (March-May) affecting the northeastern parts of China. On 15 April 2015, the capital of China, Beijing was hit by the worst dust storm event in decade. The China Meteorological Administration issued a yellow sandstorm alert, the third-most serious danger level, where visibility was reduced below 1,000 meters and air pollution increased. The concentration of PM_{10} in some areas of Beijing exceeded more than 1,000 $\mu g/m^3$, which is considered hazardous for people's health. Multi-satellite sensors are capable of monitoring transport and providing optical information about the dust and changes in atmospheric parameters associated with the transport of dust. The back trajectory clearly shows the source and dust track, 48 h before reaching Beijing. The source of air mass over Beijing is originated from Inner Mongolia and the border of China and Mongolia regions. The track of the dust storm reaching Beijing is from northwest. The detailed aerosol properties including aerosol size distribution (ASD) and single scattering albedo (SSA) from AERONET, and meteorological parameters including CO volume mixing ratio (COVMR), H_2O mass mixing ratio (H_2OMMR), relative humidity (RH), and O_3 volume mixing ratio (O_3VMR) from Atmospheric Infrared Sounder (AIRS) are analyzed in detail.
The ASD in coarse mode shows dominance over fine mode, indicating presence of mineral dust particles during dust storm events. The SSA increases with higher wavelength on the dusty days, and is found to be higher compared to the days prior to and after the dust events, indicating the presence of scattering and larger size particles.
During the dusty days, COVMR decreased from the surface upto mid altitude compared with the non-dusty days. An increase in the H_2OMMR is observed during the dusty days at the higher altitudes equivalent to the pressure levels 500 and 700 hPa. The mid altitude RH is also observed to decrease at the pressure levels 700 and 925 hPa during dusty days. With the onset of the dust storm event, the RH is obviously lower at the surface level. Airborne dust particles could cause significant radiative heating at shorter wavelengths and cooling at longer wavelengths, which in turns influence the temperature profile in the atmosphere. The change of temperature will cause the pronounced changes in RH at the mid altitude. In addition, dust may contain more hygroscopic chemical component, as a result RH is reduced due to the absorption of water by dust aerosols. O_3VMR concentrations enhanced at the increasing altitudes (at the low pressure levels) and decreased near the surface at the pressure levels 500-925 hPa due to dust storms. The detailed characteristics of atmospheric parameters along the track of dust events from the source will be presented. A comparative study of aerosol parameters associated with the dust events at other parts with different environmental settings will be also discussed.

Keywords: Dust storm, AERONET, AIRS, Beijing

