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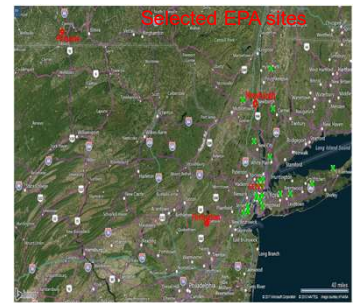
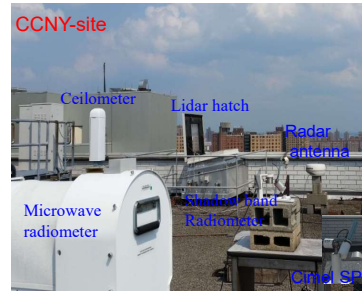
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Abstract

This study presents a synergistic observation of aloft aerosol plume, long-range transport and potential impacts on the local air quality by the ground-based and satellite sensors in New York City. Two episodes of smoke plumes transported from the NW US and Canada are investigated on June 22-23 and Sep.5, 2017. The time-height distribution of the plumes and their dispersion, subsidence and mixing process into the PBL are characterized from a combined ceilometer and lidar. The PM_{2.5} concentrations indicate coincident increase from 5- to 20-30 μg/m³ and good correlation (R=0.8) in the NYC urban and upwind rural area which implies the regional transport. At the upwind rural Pinnacle site, the PM_{2.5} and CO indicate consistent enhancement and strong correlation (R=0.85-0.93) which mean to the smoke-associated transport. The wildfires sources and smoke transport path are demonstrated from the satellite and HYSPLIT product

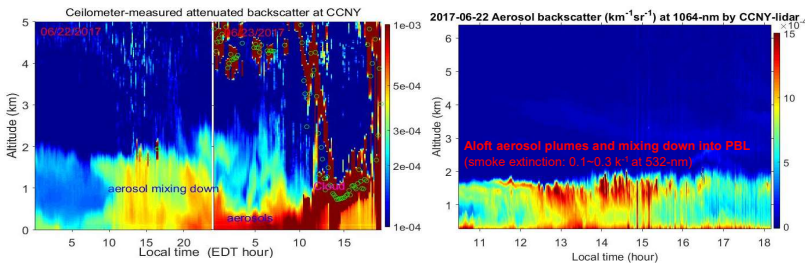
CCNY-lidar and co-located ground-based instruments

- 1. A three-wavelength Elastic-Raman Lidar:** 2-3 day/week, daytime (10~17:00 LT)
 - ✦ 1064-, 532-, 355-, 387- and 407-nm (3-elastic & 2-Raman ch. from N₂ & H₂O);
 - ✦ Profiling aerosol extinction, backscatter and Angstrom exp., lidar-ratio; PBLH & H₂O(night)
- 2. A Ceilometer (Vaisala-51 & 31):** 24-hr/7-day automatic run.
 - ✦ PBLH, near surface aerosols and cloud height up to 7.5 km altitude.
- 3. A CIMEL sunphotometer (SP) (AERONET-CCNY and LISCO sites)**
 - ✦ AOD at 340~1020 nm, Angstrom exponent, water vapor content;
 - ✦ Inversion data (volume size distribution, refractive index, SSA).
- 4: Air quality monitoring station (NYSDEC):** surface PM_{2.5}, O₃, CO.
- 5. Microwave radiometer (MWR-3000a , T, RH, liquid water)

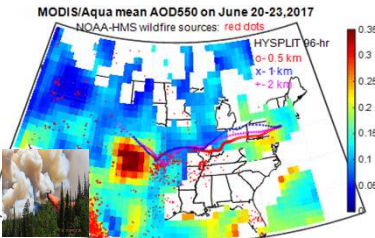


Smoke plumes transport and impacts on air quality

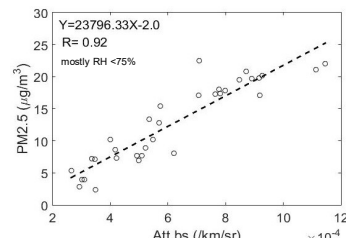
Episode-1: Aerosol plumes mixing down into PBL and transport from the west US



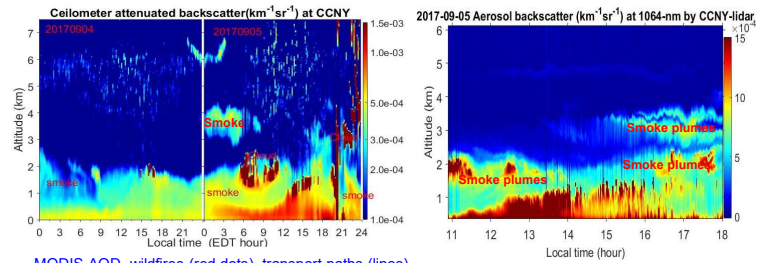
MODIS-AOD, wildfires (read dots), transport path (lines)



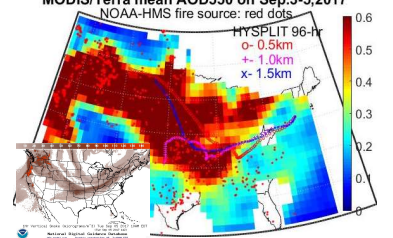
Correlation: ceilometer-attenuated backscatter and PM_{2.5}



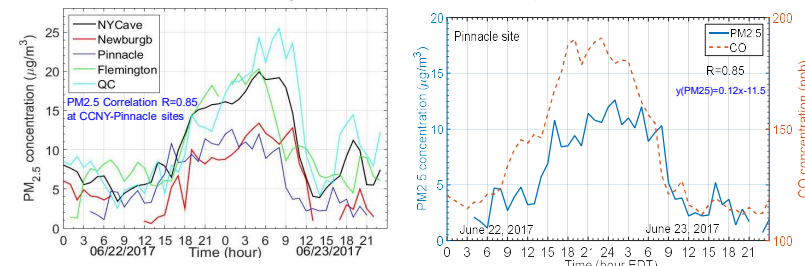
Episode-2: Dense smoke transport from the NW US to Atlantic on Sep.5, 2017



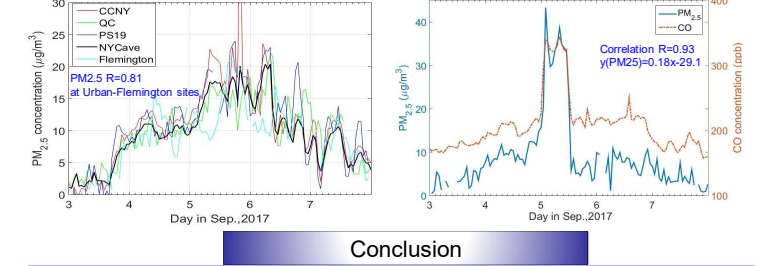
MODIS-AOD, wildfires (red dots), transport paths (lines)



Coincident increase of ground PM_{2.5} and CO in NYC and upwind rural area



Coincident increase of ground PM_{2.5} and CO in NYC and upwind area



Conclusion

- Continental-scale transport of smoke plumes and mixing down PBL are observed from the ceilometer-lidar in NYC, they are originated from the wildfires in the NW US and/or SW Canada from the satellite/HYSPLIT data.
- Ground PM_{2.5} show coincident increase in NYC (5 μg/m³ to 20-25 μg/m³) and upwind area (non-urban, Newburgh, Flemington, and Pinnacle (from 10 to 43 μg/m³)); the good correlation (R=0.81-0.85) of PM_{2.5} at CCNY and the upwind rural sites indicate the regional transport.
- Ground PM_{2.5} and CO at Pinnacle site show consistent increase with the strong correlation R=0.85-0.93, indicating the smoke-associated transport.