Mesoscale Modeling of the Canadian wildfire smoke transported within the Planetary Boundary Layer in Maryland

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Improvement of operational forecast of air quality (and in particular ozone (O_3) and particulate matter (PM)), especially for extreme events, depends on accurate integration of observations and models. We will present our work on a case study of a fire event that impacted the mid-Atlantic region. We use the Weather Research and Forecasting model coupled with Chemistry (WRF-Chem), and various measurements from both existing ground-based and space-born observations including, the Environmental Protection Agency (EPA) Airnow data, the National Aeronautics and Space Administration (NASA) operated Troposphere Ozone profile Lidar network (TOLNET), Micro-Pulse Lidar Network (MPLnet), Moderate Resolution Imaging Spectroradiometer (MODIS), Cloud-Aerosol Lidar with Orthogonal Polarization (CALIOP). The overall objective of this study is the investigation of what improvements can be achieved by comparing model and integrated profile data sources with respect to the modeling of the Planetary Boundary Layer (PBL) and role of the especially difficult ozone forecast issues that we face today operationally. We will show preliminary work on how these methods may be combined and the advantage that can be gained in forecasting air pollution using an important case where long-range transported fire smoke from a Canadian wildfire on June 7-13, 2005 that influenced the northeastern US. Overall, the model captured the O_3 diurnal variation and PM spatial distribution in comparison with EPA Airnow data and MODIS/CALIOP observations, respectively. Wildfire smoke was transported from central Canada through the Great Lakes, and down to the Baltimore-Washington D.C. metropolitan region. The nighttime O_3 mixing ratios reached around 30 ppbv, while the daytime O_3 mixing ratios approached about more than 100 ppbv near EPA stations in Maryland, due to the mixing of the transported Canadian smoke into the PBL. In terms of the vertical distribution, we utilized O_3 vertical profiles observed from the Beltsville, MD station of the TOLNET O_3 lidar network, the NASA GSFC TROPospheric OZone DIAL lidar. The transported Canadian smoke was identified at altitudes above 2.5 km, but later mixed down into the PBL and surface. Model

performance as well as ceilometer and ozone lidar measurements revealing this "mixing-down" will be presented and discussed.