Short-term Variability of Aerosol Optical Properties at NOAA's Federated Aerosol Network

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One of the major contributions to uncertainty in aerosol climate forcing calculations is the spatial and temporal variability of aerosols. Aerosol measurements range from surface sites making continuous, long-term, high-frequency *in situ* measurements at a single point, to aircraft studies with coverage that is enhanced spatially but (typically) not long term, to satellites with global coverage but lowered temporal and spatial sensitivity. A consistent approach is needed in order to integrate aerosol measurements over their different time and spatial scales for comparison across various measurement platforms and with model output. Anderson et al. (2003) suggest that lag autocorrelation analysis can be used to identify temporal and spatial scales of aerosol variability, which, in turn, can be used to constrain comparisons of measurements made on different time and/or space scales. Additionally, this type of analysis may provide insights into the processes affecting atmospheric aerosol loading. Here we calculate the lag-autocorrelation statistics (r(k)) for aerosol measurements from NOAA's federated network of surface sites. The goals of this study are to: (1) Relate the observed r(k) to atmospheric processes and site characteristics, and (2) Discuss similarities and differences among observations from the NOAA federated network and other platforms where lag autocorrelation analysis has been applied. The end goal is to identify relevant scales of comparison for the aerosol properties measured at NOAA's federated surface network with mobile platform measurements, remote sensing retrievals and model output.

Figure 1 shows r(k) values for aerosol number concentration (CN) at different locations. There are variations within each site category, but the variations among site categories are also striking and may indicate differences in atmospheric sources, transport and/or processes. For example, the oscillations in r(k) observed at the mountain and continental sites are diurnal and may indicate the effects of upslope transport, new particle formation and/or changes in boundary layer height. In addition to CN, we will also evaluate lag-autocorrelation statistics for aerosol scattering, absorption, Ångström exponent and single scattering albedo.

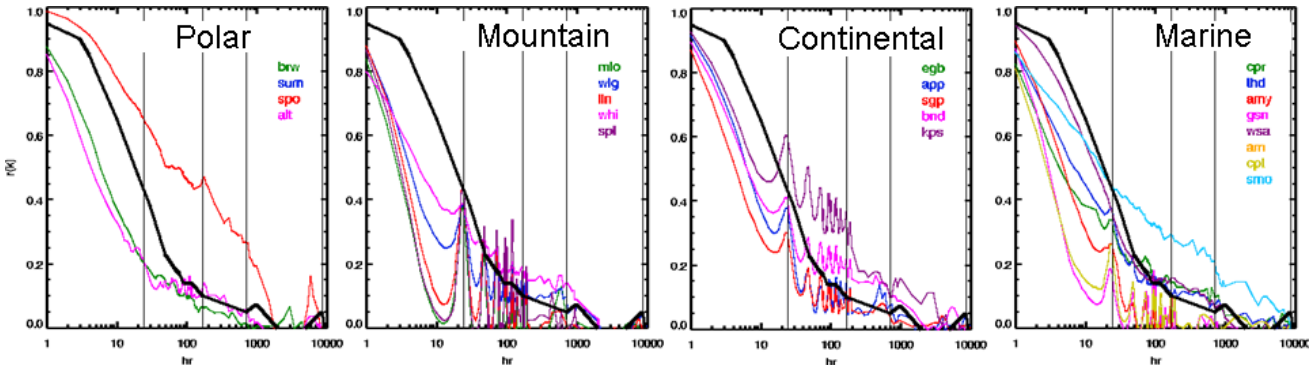

Figure 1. Lag autocorrelation statistics for CN at NOAA's federated aerosol network sites. The solid black line on all plots is provided as a point of comparison. It represents the autocorrelation statistic for aerosol scattering at Bondville (Anderson et al., 2003). Vertical lines indicate 1d, 1 week, 30 d and 1 y.