Wintertime high PM events in the Western United States

H. A. HOLMES[1]*, C. IVEY[2], Y. HU[2], A. G. RUSSELL[2], J. K. SRIRAMASAMUDRAM[3] AND E. R. PARDYJAK[3]

[1]Department of Physics, University of Nevada, Reno, Reno, NV 89557 (*correspondence: hholmes@unr.edu)
[2]School of Civil and Environmental Engineering, Georgia Institute of Technology, Atlanta, GA 30332
[3]Deparmtnet of Mechanical Engineering, University of Utah, Salt Lake City, UT 84112

Stable atmospheric boundary layers are associated with a decrease in boundary layer height and inhibited mixing which causes an increase in pollutant concentrations. This phenomena is prevalent throughout the intermountain west where persistent cold air pools (CAPs) often last for days or weeks. During the CAP events, particulate matter (PM) concentrations in the atmosphere accumulate and reach levels that are harmful to human health.

Atmospheric models have a difficult time capturing the strength and evolution of the CAP therefore having an impact on both meteorological forecasting and predictions for pollutant transport and accumulation. The atmospheric chemistry and physics during these events are complex and make it difficult to determine the meteorological and source impacts in the region. Investigations of the physical processes leading to increased PM concentrations during CAP events have shown that it is difficult to quantify the transport behavior.[2] Receptor modeling in Salt Lake City, UT indicates that secondary aerosols are a large contributor to elevated wintertime PM concentrations but the sources attributed to the secondary aerosol formation cannot be identified.[1]

This paper will present observational data to quantify the turbulent mixing during CAPs in Salt Lake City and estimate the source impacts using a hybrid source oriented and receptor modeling approach.[3] The benefit to this approach for source impact estimates is that the secondary species impacting the PM concentrations can be investigated by source type and the numerical results are adjusted to match the observed species concentrations. Using this method, source impact estimates for a one month CAP period in the Salt Lake Valley indicate that on-road gasoline vehicles, coal combustion, livestock, and wood stoves contribute to increased $PM_{2.5}$ concentrations.

[1] Kelly *et al* (2013), *JA&WMA*, 575-590. [2] Silcox *et al* (2012), *Atmospheric Environment*, 17-24. [3] Ivey *et al* (2013), in ITM on Air Pollution Modeling, Miami, FL 26-30 August.