Back Trajectory Analysis of Reactive Nitrogen Measured Continuously at Rocky Mountain National Park, Colorado

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Increases in the wet and dry deposition of reactive nitrogen in ecologically sensitive areas of the Rocky Mountains have led to recent efforts to determine the source types and source regions that contribute to this problem. Analysis of data collected during a 2006 field study at Rocky Mountain National Park, Colorado, indicated that during April and July, approximately half of the deposited nitrogen was from sources within the state of Colorado. Potential contributing sources include agricultural activities, mobile sources, oil and gas extraction, fossil fuel combustion, and wildfires. During November 2008 through November 2009 a follow up study designed to examine data collected during a full year was conducted. Several methods were utilized to obtain continuous measurements of both oxidized and reduced nitrogen. These high time resolution data collected over a year provide a unique opportunity to examine source-receptor relationships both seasonally and by hour of day. As a first step, air mass back trajectories are examined to determine where they resided prior to arriving at RMNP under a variety of conditions including periods of high and low deposition, concentrations, and precipitation by month and by hour of day. Back trajectories were generated on a 4 km grid resolution using output from the Weather Research and Forecasting (wrf) mesoscale meteorological model with observational data assimilation including data from a nearby radar wind profiler installed for the study. Additionally, a receptor model, Trajectory Mass Balance, was used to estimate the relative attributions of several source areas to the measured concentrations.

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