Chemical Transport Modeling of Nitrogen Deposition in the Western U.S.: A National Park Perspective

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Millions of visitors from around the world enjoy western national parks each year, and often regard these places as a natural refuge from more polluted environs. However, monitoring and modeling studies show that even remote parks are being influenced by air pollution. One example of this trend is nitrogen deposition, which can foster ecosystem change once a critical threshold is reached. Recent wet- and dry-deposition estimates for total nitrogen (defined as nitrogen contributed from nitric acid, ammonium and nitrate) in the western U.S. range between 0.8 kg ha^{-1} yr^{-1} in western Washington to 4.2 kg ha^{-1} yr^{-1} in California's Central Valley. At Rocky Mountain National Park, located in northern Colorado and the site of extensive research on the effects of nitrogen deposition to sensitive alpine ecosystems, the measured total wet deposited nitrogen between 2005 and 2009 ranged between 1.9 kg ha^{-1} yr^{-1} to 2.5 kg ha^{-1} yr^{-1}, which is greater than the projected 'critical load' of 1.5 kg ha^{-1} yr^{-1}. It is notable that current monitoring efforts do not consider reduced gaseous nitrogen (namely ammonia), even though significant ammonia sources exist throughout the western U.S. that could potentially have large impacts at downwind national parks. These sources are primarily composed of agricultural operations such as fertilizer application and animal feedlots, and include California's Central Valley, Idaho's Snake River Valley, and northeastern Colorado, and all are examples of ammonia sources near national parks that contain sensitive high-alpine ecosystems. This presentation will discuss results from recent CAMx air quality model simulations for nitrogen deposition at western national parks, with the aim of identifying "hotspots" in sensitive regions that are not currently monitored, and to examine the emission sources that are affecting these areas. In particular, attention will be given to nitrogen species that are not currently monitored, including ammonia, nitrogen oxides, and organic nitrates.

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