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NCAR Team Tags "Imported" Pollutants over the Pacific Northwest

BOULDER -- From 50% to 60% of sulfate-aerosol pollution over the Pacific Northwest is coming from industrialized Asia, according to a model developed by a team of researchers at the National Center for Atmospheric Research (NCAR). While the total column of air contains "imported" sulfate aerosols, near the surface most of the aerosols come from North American sources. In contrast, sulfates in Europe are coming primarily from European sources, both at the surface and higher in the atmosphere.

Jeffrey Kiehl, head of NCAR's Climate Modeling Section, will present the group's findings December 7 at the American Geophysical Union conference in San Francisco. Research funds came from the National Aeronautics and Space Administration and the National Science Foundation. NSF is NCAR's primary sponsor.

"It's widely recognized that sulfate aerosols are playing a major role in the climate system," says Kiehl. The ability of these aerosols (tiny particles of liquids and solids) to reflect the sun's radiation may be one reason that increasing greenhouse gases have not warmed the earth as much as some climate models have predicted. Sulfates also contribute to local pollution and acid rain.

"One important way that sulfur moves in the atmosphere is through transport by the earth's winds," Kiehl explains. But winds are not the whole story. For the past three years, Kiehl and colleagues Mary Barth, Philip Rasch, and Timothy Schneider have been developing an integrated model of climate and sulfur chemistry. The model includes the emission of natural and industrial sulfur into the earth's atmosphere. To model how the sulfur gas changes into sulfate aerosol particles, they included chemical processes and the chemical and physical effects of clouds, including clouds' ability to remove sulfates from the atmosphere. They also included the effect of the sulfate aerosols on the reflection of sunlight to address the key question of sulfates' role in the climate system. The researchers compared their model simulations of sulfur and sulfate aerosols with real-world observations near the surface. More comparisons with observations yet to be made far above the surface are needed to confirm the model findings.

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Fully integrating sulfur chemistry into the climate model allowed the team to account for the effects of interacting winds, precipitation, and clouds on that chemistry. This integrated modeling allowed them to calculate the amount of sulfate aerosols formed or removed in any given region. By tagging the sulfates in the climate simulations by source region, the team could calculate the percent of sulfates transported from one region to another. The source regions considered are North America, Asia, and Europe, with the rest of the world grouped as the fourth region.

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-The End-

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