Satellite Data Reveal Immense Pollution Pool Over Bihar, India

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Scientists studying satellite data have discovered an immense wintertime pool of pollution over the northern Indian state of Bihar. Blanketing around 100 million people, primarily in the Ganges Valley, the pollution levels are about five times larger than those typically found over Los Angeles.

The discovery was made by researchers analyzing four years of data collected by the Multi-angle Imaging Spectro-Radiometer (MISR) onboard the Terra satellite. Lofted into orbit on Dec. 18, 1999, Terra is the flagship of NASA's Earth Observing System Program.

"This study is the most comprehensive and detailed examination of industrial, smoke and other air pollution particles over the Indian subcontinent to date, and reveals how topography, meteorology and human activity help determine where these particles are concentrated," said Larry Di Girolamo, a professor of atmospheric sciences at the University of Illinois at Urbana-Champaign and a co-investigator on the MISR mission.

"MISR is the first instrument to make high-resolution, multi-angle radiometric measurements of Earth from space," Di Girolamo said. "By measuring reflected sunlight at nine angles, we can accurately determine the amount of particulate matter, including that generated from man-made pollution, in the atmosphere."

While high pollution levels were found over much of India, a concentrated pool of particles was discovered over Bihar, a largely rural area with a high population density. A large source contributing to the Bihar pollution pool is the inefficient burning of a variety of biofuels during cooking and other domestic use. Particles in the smoke remain close to the ground, trapped by valley walls, and unable to mix upward because of a high-pressure system that dominates the region during winter.

"The result is a pollution episode that can affect both human health and local climate," Di Girolamo said. "The airborne particles can damage delicate lung tissue, and by altering the radiative heating profile of the atmosphere, the particles may change temperature and precipitation patterns."

Prior to the MISR study, atmospheric models had predicted a tongue of pollution extending across the middle of India. The MISR observations, however, show the pollution lies much farther north.

"These models are very important to us, as they are used to forecast pollution episodes and climate change," Di Girolamo said. "The fact that model results don't match the MISR observations suggests there are problems in the models or the model inputs that need to be fixed." The role of airborne particles remains one of the largest uncertainties in atmospheric modeling. In addition to modifying local climate, the particles can interact with clouds and change the cloud properties. This is particularly important, since clouds have the greatest radiative forcing on the climate system.

"The Bihar pollution pool must be having a tremendous impact on the local climate and the health of the approximately 100 million people that reside within this pool." Di Girolamo said. "Our long-term goal is to better predict the occurrence of these pollution episodes and their impact on public health and local climate."

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Contact:

James E. Kloeppel, Physical Sciences Editor
University of Illinois at Urbana-Champaign
217-244-1073
kloeppel@uiuc.edu

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