Satellites can improve regional air quality forecasting

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Satellites planned for launch during the next several years may have an expanded role: Forecasting air-quality worldwide.

That's the view of University of Iowa researchers, who found that data gathered from geo-stationary satellites—satellites orbiting Earth at about 22,000 miles above the equator and commonly used for telecommunications and weather imaging—can greatly improve air-quality forecasting.

The UI study, published in the journal *Geophysical Research Letters*, is timely because space agencies in North America, Europe, and East Asia plan to launch geostationary satellites in the near future to continuously monitor pollutants found in Earth's atmosphere.

Co-lead authors Gregory Carmichael, professor of chemical and biochemical engineering, director of the Iowa Informatics Initiative, and co-director of the UI Center for Global and Regional Environmental Research (CGRER), and Pablo Saide, postdoctoral researcher at CGRER, say the geo-stationary satellites will provide aerosol optical depth—a measure of the amount of smoke, dust and other pollutants at different altitudes—every hour and in high resolution to give a better picture of changing air quality on the ground.

The data will be combined with what's collected currently by low Earth-orbiting satellites to produce more detailed maps that experts can use to make improved air-quality forecasts.

The researchers combined observed data and model predictions to estimate the effect of adding geo-stationary satellite data to aerosol simulations. More specifically, they combined data from the existing Geo-stationary Ocean Color Imager instrument on board the Korean Communications, Ocean and Meteorology Satellite, which observes northeast Asia, with data from low Earth-orbiting satellites. The two-week study period looked at air pollutants including desert dust, biomass burning, and various human-caused pollutants over northeast Asia.

While current models capture major pollution features, they tend to underestimate aerosol loads and surface concentrations. Adding geo-stationary satellite data improved the simulations. This was especially evident in the Korean peninsula, where predictions of surface particulate matter—when including geo-stationary data—was about five times better than using only low Earth-orbiting satellite data.

Carmichael says, "This study shows that these new data streams have the potential to really improve our prediction skill, but more work is needed to improve the modeling and retrievals in order to be better prepared to utilize the data that will come from the new geo-stationary satellites as they come online."

The study supports the planned geo-stationary missions, adds Carmichael.

More information: The paper, "Assimilation of next generation geostationary aerosol optical depth retrievals to improve air quality simulations," can be found here.

Provided by University of Iowa