Great air quality for the Great Lakes

July 12 2022, by Lia Poteet

On July 1, 2020, the Moderate Resolution Imaging Spectroradiometer (MODIS) on board NASA's Terra satellite acquired this true-color image of the Great Lakes. Credit: NASA/MODIS Land Rapid Response Team/Goddard Space Flight Center

Air quality planning agencies in the U.S. Great Lakes region now include high-resolution NASA satellite data and near real-time Earth observations in their ozone pollution assessments. Creating models that accurately predict the complex lake and land breezes along Lake Michigan's shoreline is very difficult, but it's also vital to understanding how ozone pollution circulates in the region.

The unique weather of the Lake Michigan shoreline can create pockets of high levels of ground-level ozone. This air pollutant is created by emissions from cars, trucks, fossil-fuel power plants, and other sources. It is also monitored by local and federal regulators, which require states to "attain," or meet, federal air quality standards.

"Our member states are facing several non-attainment areas in this region that are violating federal ozone standards," said Zac Adelman, the head of the Lake Michigan Air Directors Consortium (LADCO). "This system is operational and we're using it from a policy standpoint now—we're actively deploying the modeling systems developed through this project to simulate mitigation efforts and inform the states' attainment strategies."

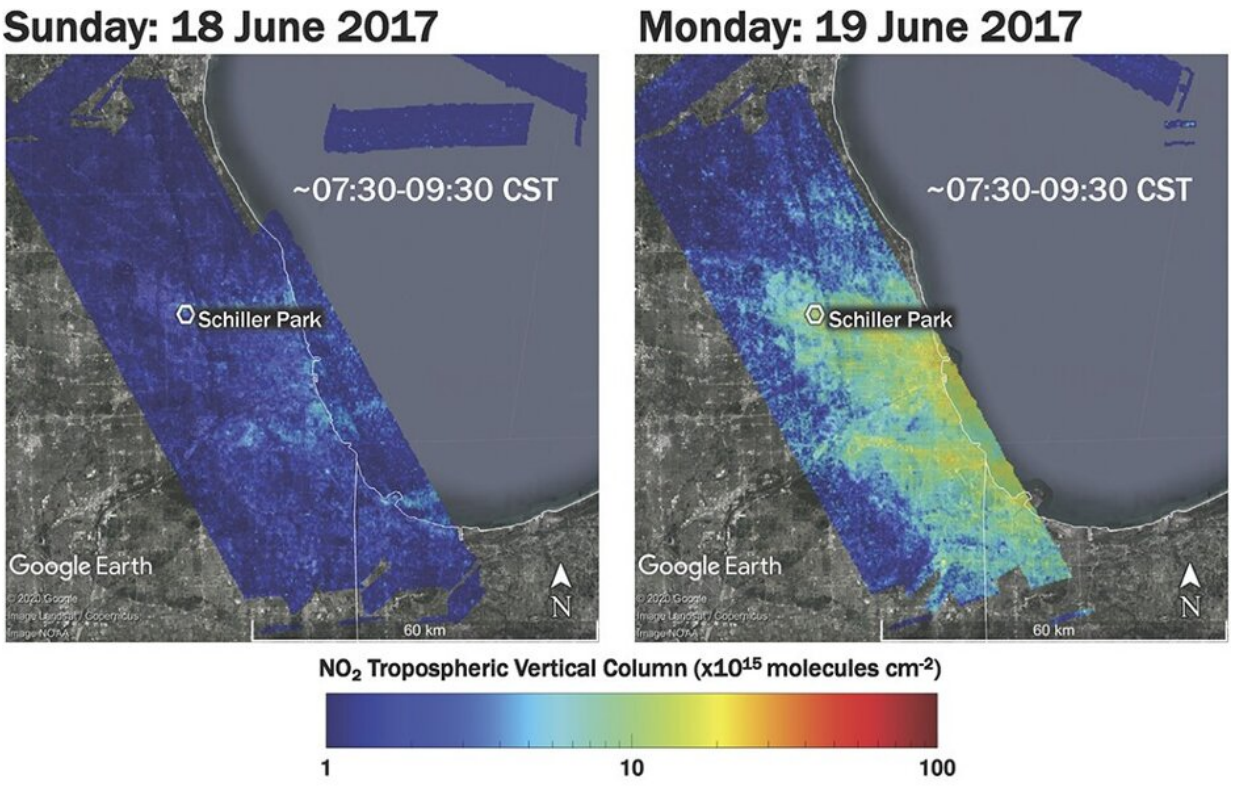
To make sure the right data was getting into the right hands and in the right format, this NASA-funded project worked with LADCO and the Wisconsin Department of Natural Resources (WDNR) to create a modeling tool that incorporates satellite data into ozone monitoring efforts. Adelman said this is important to improve confidence in policy decisions for lowering ozone pollution. Data comes from sources such as NASA and the National Oceanic and Atmospheric Administration (NOAA).

"We tested many different surface data sets from NASA and NOAA to figure out how we can combine them to produce the most accurate estimate of meteorological conditions that influence these ozone

concentrations," said Jason Otkin, principal investigator for the project and an associate scientist at the Space Science and Engineering Center at the University of Wisconsin-Madison.

"It's really exciting to see how LADCO has run with these resources, and how they've been so engaged throughout the process," Otkin said.

LADCO's Adelman agreed. "This project really helped us add value to the meteorological and air quality models we use to support the decisions in the states, making it easier for us to help our member states assess ozone levels and meet federal pollution standards," Adelman said.



These two images show how a pocket of increased nitrogen dioxide (NO2) concentration, shown in yellow, appeared within 24 hours in the Schiller Park area along Lake Michigan's shoreline in June 2017 resulting from the transition

from the weekend (Sunday) to Monday. This data was acquired via ground observations and NASA's Geostationary Trace gas and Aerosol Sensor Optimization (GeoTASO) aircraft instrument. Credit: NASA/National Science Foundation

In addition to wind and weather, NASA provides other Earth observations that affect the complex environment around the Great Lakes. Those include high-resolution data on soil moisture and temperature from NASA's Land Information System and Short-term Prediction Research and Transition Center (SPoRT), which incorporates data from NASA's Soil Moisture Active Passive (SMAP) mission and NOAA sources such as the GOES series of satellites. The team also incorporates lake surface temperature and vegetation data from Visible Infrared Imaging Radiometer Suite (VIIRS) instrument on board the joint NASA-NOAA Suomi National Polar-orbiting Partnership (Suomi NPP), and the Moderate Resolution Imaging Spectroradiometer (MODIS) aboard NASA's Terra and Aqua satellites.

To evaluate the effectiveness of these complex computer models of the Great Lakes regions, NASA's Health and Air Quality project team built on previous work in the area, including a 2017 study focused on local ozone air quality near Lake Michigan, and a recent campaign to map ozone hotspots around the Great Lakes.

Using this view from above, the project team also worked with local air quality partners at LADCO to run their model to improve the accuracy of simulations—therefore allowing more precise action measurements.

"Previously, LADCO was doing air quality simulations with the Environmental Protection Agency at 12-kilometer-resolution," said Brad Pierce, a member of the project team. "We were able to improve that

resolution, bringing it up to 1.3 kilometers and increasing the accuracy of the simulations by more than 30%."

By working directly with the end users, the team has been able to actively refine the modeling process as LADCO tries out these maps in real time. Otkin and his team have monthly technical calls with LADCO and quarterly calls with WDNR to make further adjustments to the system now that it's in operation.

"The most effective partnerships are those where you're not just throwing something over the fence," Pierce said, "but you work with the user, incorporate their feedback, and actually give them a fully operational tool that's really customized for their needs. That's what we were able to do here—LADCO has been as active of a participant as we have in terms of the research, a real partner."

The results mean LADCO's member states can more confidently plan strategies to comply with federal ozone standards for years to come, Adelman said. He added that LADCO's member states are counting on the more accurate estimates from NASA Earth observations for when their formal plans to tackle ozone and meet state-specific air quality goals are due to the Environmental Protection Agency in 2023.

Provided by NASA's Goddard Space Flight Center

Citation: Great air quality for the Great Lakes (2022, July 12) retrieved 27 June 2024 from https://phys.org/news/2022-07-great-air-quality-lakes.html