Ozone monitoring continues to improve, researchers report

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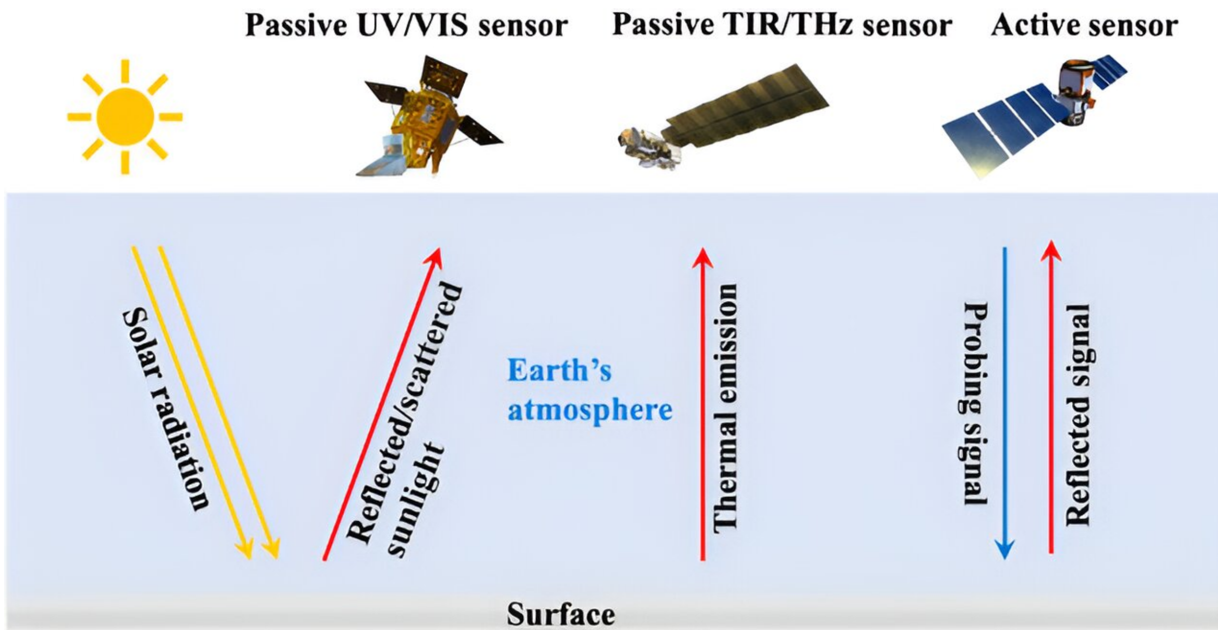

Remote sensing techniques for ozone monitoring. Credit: *Journal of Remote Sensing* (2024). DOI: 10.34133/remotesensing.0178

The troposphere comprises the lowest layer of Earth's atmosphere, stretching from the planet's surface to a little over eight miles into the sky. It also contains about 10% of the ozone in the atmosphere, but that 10% is heavily influenced by human activity and plays a critical role in the formation of smog, which is hazardous to human health, according to an international team led by researchers with the Chinese Academy of

Sciences (CAS).

The team recently assessed current abilities to monitor tropospheric ozone, summarizing progress and challenges and proposing new paths forward. They published their review on Aug. 2 in the *Journal of Remote Sensing*.

Ozone in the troposphere is primarily generated by nitrogen oxide and volatile organic compounds—both byproducts of human activities changing the climate, such as burning non-renewable fuels, the researchers said. Ozone is also associated with weather processes and can cause respiratory diseases, similar to particulate matter 2.5, another pollutant associated with climate change.

Currently, to monitor concentration levels and variations of ozone in the troposphere, researchers either directly measure ozone in specific areas on the surface of the planet or use sensors that can detect the gas at a distance. Using these sensors, typically affixed to satellites or airplanes or weather balloons, is known as remote sensing.

While direct measurements are accurate, they lack comprehensive inclusion of atmospheric properties. Similar to taking the temperature of a specific rock, the temperature might be accurate, but it doesn't provide information about the surrounding environment. After all, the rock could've been in direct sunlight on a snowy tundra.

"We reviewed the current observation techniques and retrieval algorithms, analyzed their development trend and identified areas needing improvement," said co-corresponding author Jian Xu, professor with the National Space Science Center, CAS. "Our goal was to highlight the limitations of existing methods and propose a few potential technological solutions for more accurate remote sensing of tropospheric ozone from space."

According to the researchers, remote sensing remains the best way to monitor ozone. Instruments, including various types of sensors, and data processing techniques have significantly improved and will continue to do so. Co-corresponding author Husi Letu, professor with the Aerospace Information Research Institute, CAS, noted better instrument calibration and standardizing analysis approaches would also help advance the field.

"Recent advancements in satellite observation techniques and retrieval algorithms for tropospheric ozone have significantly improved in terms of product accuracy and spatial resolution/coverage," Letu said. "These developments are essential for better air quality management and effective pollution control, highlighting the importance of continued innovation in this field."

The researchers also recommended that future approaches should implement and refine combined active and passive sensing, integrated physics and machine learning retrieval algorithms.

More information: Jian Xu et al, Remote Sensing of Tropospheric Ozone from Space: Progress and Challenges, *Journal of Remote Sensing* (2024). DOI: 10.34133/remotesensing.0178

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