Aura

20+ Years of Air Quality and Ozone Monitoring

National Aeronautics and Space Administration

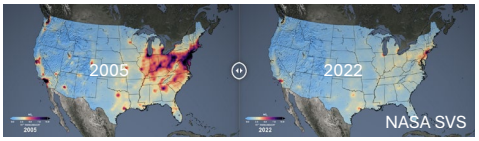
Mission Overview

Aura was conceived as a scientific discovery mission, hosting a suite of instruments that constitutes an integrated observatory of atmospheric constituents. Nevertheless, its long stable data record supports multiple applied sciences communities and operational users:

- **Human health and air quality (AQ):** providing long stable pollution records for exposure studies, assessing the effectiveness of pollution control strategies, constraining pollutant emissions, etc.

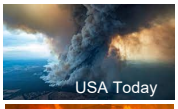
  Key data products: Ozone Monitoring Instrument (OMI): columns of key air pollutants [nitrogen dioxide (NO_2), sulfur dioxide (SO_2), formaldehyde (HCHO), and ozone (O_3)]; dust and smoke aerosols; and surface ultraviolet (UV) index.

Nitrogen Dioxide (NO_2)



- **Stratospheric O_3 monitoring and policy support:** meeting commitments under the 1987 Montreal Protocol (arguably the most successful international environmental agreement ever enacted) and assessing the impact on stratospheric O_3 of plumes from volcanic eruptions and severe wildfires that penetrate the stratosphere.

Australian New Years Fires



  Key data products: Microwave Limb Sounder (MLS): O_3 profiles and column; profiles of temperature, water vapor, and trace gases related to chemical O_3 loss and atmospheric dynamics.

Undersea Hunga Volcanic Eruption

- **Weather and atmospheric composition forecasting:** improving forecast accuracy.

  Key data products: most listed above.

Operational Users and Applications for Societal and Economic Benefit

Aura data continue to be of unique value to applied science stakeholders, including for situational awareness of short- and long-term events that informs national preparedness and resilience.

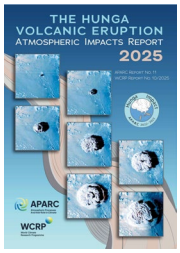
Human health and AQ

The long stable OMI records are valuable for health and AQ applications (e.g., EPA Air Trends Report, surface net O_3 production, and human health studies) as shown in numerous recent OMI publications, including to evaluate products from newer satellites (e.g., TROPOMI and TEMPO).

Stratospheric O_3 monitoring & policy support

A reduction of stratospheric O_3 increases surface UV radiation, negatively affecting human health and crop yields. The suite of MLS products, some unique, is used to support NASA's Congressional mandate under the Clean Air Act to assess the health of the stratospheric O_3 layer (e.g., 2026 World Meteorological Organization (WMO) Ozone Assessment, in preparation). Unique MLS data are essential for monitoring and understanding the impacts of the 2022 eruption of the undersea Hunga volcano on stratospheric composition (e.g., 2025 WCRP report). See MLS publications for details.

WMO



Weather and atmospheric composition forecasting

- The European Centre for Medium-range Weather Forecasts (ECMWF) uses MLS and OMI O_3 data to provide the backbone for their five-day atmospheric composition forecasts, US users of which include the EPA, The Weather Channel, and CNN. ECMWF also assimilates these data in their meteorological and atmospheric composition reanalysis.
- NASA Global Modeling and Assimilation Office (GMAO) uses MLS and/or OMI O_3 data in all their official assimilated products, including MERRA-2, M2-SCREAM, GEOS-IT, and GEOS-FP. MERRA-2 also assimilates MLS temperature profiles in the upper stratosphere and mesosphere. GEOS-CR, under development, will assimilate OMI O_3 and NO_2, as well as MLS O_3 and several other trace gas products. GMAO assimilates near-real-time (NRT) MLS and OMI O_3 data to produce initial conditions for their five-day GEOS-CF forecasts, greatly improving forecast accuracy.
- Naval Research Laboratory (NRL) relies on MLS in multiple regards, from data assimilation for numerical weather prediction (NWP) to monitoring of stratospheric clouds. NRL is the lead for NASA's INSPYRE airborne campaign, which will study the effects of pyroconvection in the lower stratosphere in 2026 and 2027. MLS NRT data will be used for flight planning. MLS products provide invaluable spatial and temporal context for campaign data.

ECMWF GMAO U.S. NAVAL RESEARCH LABORATORY

For additional examples of applied uses of Aura data, please visit the Aura and Air Quality: Observations from Space websites.