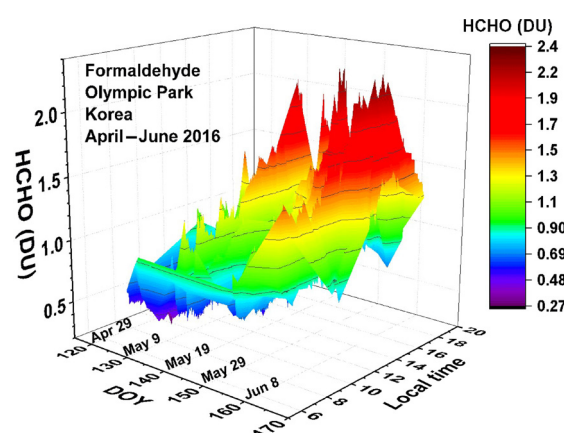


Air Quality Sensors and Forecasts

Satellite Needs Working Group - Solution Fact Sheet

Effectively predicting key air quality parameters and their impact on human health requires a combined approach leveraging models, ground-based data, and satellite observations. To meet these needs, the Satellite Needs Working Group (SNWG) enables the Air Quality Sensors and Forecasts solution. This 3-component solution will:

- **Expand air quality networks.** The Pandora Global Network (PGN) will be expanded to provide data in under-represented locations (10 in rural U.S. locations, and 20 at foreign U.S. embassies in regions with high levels of air pollution). Select embassies will also receive low-cost $\text{PM}_{2.5}$ Clarity sensors, and the AERosol RObotic NETwork (AERONET) will expand to a subset of locations.
- **Provide air quality forecast products for select locations.** NASA's Global Modeling and Assimilation Office (GMAO) will integrate Pandora observations with modeling output to obtain tailored air quality forecasts at Pandora locations.
- **Produce $\text{PM}_{2.5}$ forecasts for U.S. embassies and major cities worldwide.** The City Air quality foREcasting and analysis System (CARES) will use machine learning, ground-based observations, and NASA's Goddard Earth Observing System-forward processing (GEOS-FP) model output to provide consistent $\text{PM}_{2.5}$ forecasts at U.S. embassy locations and major global cities.



The figure (above) shows Pandora-measured formaldehyde amounts in Olympic Park, Korea from April to June 2016 at local times. Measurements of formaldehyde and other trace gases will now be available in data-sparse regions as well as existing sites.

Credit: Jay Herman et al., 2018

Scientific and Societal Benefit

- Supports air quality monitoring for 30 additional locations in the rural U.S. and around the globe that currently lack ground observations, and initiates a long term-record of data collection for historical analyses of aerosols and trace gas concentrations
- Provides localized air quality forecasts at any Pandora site to better mitigate human exposure to harmful air pollution
- Provides $\text{PM}_{2.5}$ forecasts, up to 72 hours in advance, to monitor and anticipate the amount of fine particulate matter in the human breathing zone
- Supports validation for emissions and air quality monitoring satellite platforms at additional sites through the expansion of the Pandora and AERONET network, leading to improved satellite data, and better modeling and forecasting outputs



Air Quality Sensors and Forecasts

Data Characteristics			
Solution Component	Air Quality Remote and In-Situ Sensors	GMAO Forecasts	PM _{2.5} Forecasts
Input Source	Ground-based Pandora Spectrometer System, AERONET Sun photometers, Clarity sensors	Pandora Spectrometer System and GEOS Composition Forecast (GEOS-CF) model output	GEOS-FP and available PM _{2.5} measurements
Output Variables	<ul style="list-style-type: none"> Total column ozone, nitrogen dioxide, formaldehyde (Pandora) Tropospheric profiles and near-surface concentrations of nitrogen dioxide and formaldehyde (Pandora) Spectral aerosol optical depth and particle properties (AERONET) Surface PM_{2.5} concentration (Clarity) 	<ul style="list-style-type: none"> Total column and surface ozone, nitrogen dioxide, formaldehyde U.S. EPA-defined Air Quality Index for ozone and nitrogen dioxide 	<ul style="list-style-type: none"> Surface PM_{2.5} concentration U.S. EPA-defined Air Quality Index for PM_{2.5}
Processing Level	2	4	4
Temporal Coverage	Dependent on sensor installation	January 2019 - TBD	May 2024 - present
Temporal Sampling	Hourly	Hourly forecasts up to 72 hours in advance, updated daily	3-hourly forecasts up to 72 hours in advance, updated daily
Latency	1 hour	Forecasts available NRT, historical data available with 24 hours latency	~2-4 hours (dependent on GEOS-FP latency)
Spatial Coverage	Select U.S. embassies (20) and agricultural sites (10)	Select U.S. embassies (20) and agricultural sites (10) with plans to scale to all operational Pandora Sensor locations	Select U.S. embassies (270) and world cities (10,000+)
Spatial resolution	Point locations	Point locations	Point locations
Data format	Text files, HDF5	Text files, JSON files (available via API & website)	ASCII (available via API)

How do I access this data?

Raw data from Pandora, AERONET, and Clarity sensors can be found on each network's webpage. GMAO forecasts and PM_{2.5} forecasts will be available on a central webpage that is currently under development.



PGN



AERONET
Data Explorer



Clarity
OpenMap

Where can I find more information?

More information on Air Quality Sensors and Forecasts is available on this solution's webpage.



Air Quality Sensors/
Forecasts Webpage