National Aeronautics and Space Administration

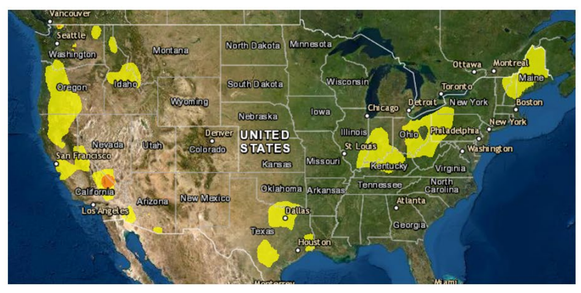
FY23 Strategic Initiatives Research and Technology Development (SRTD)

Air Quality Architecture to Meet US National Needs for Forecasting, Management, and Assessment of Health Impacts

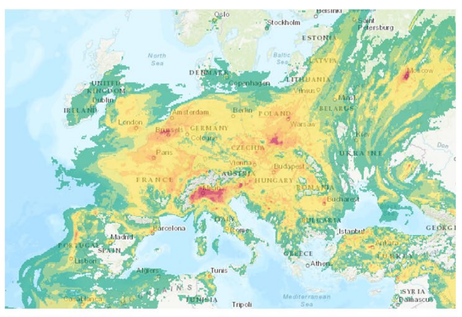
Principal Investigator: Jessica Neu (320)**; Co-Investigators:** Kevin Bowman (329), Kazuyuki Miyazaki (329), David Diner (329), Sina Hasheminassab (398), Stanley Sander (320), Carl Percival (329), Stacey Boland (312)

Strategic Focus Area: Earth System Science and Application Architecture Development | **Strategic Initiative Leader:** Jessica L Neu

Objective: To bring together a diverse set of stakeholders in the areas of air quality forecasting, research, and health studies to define potential architectures for the US air quality modeling and assimilation system of the future.



US: 1-day forecast of AQ Index based on local regression models and NOAA regional forecast model



Europe: 5-day forecast of 5 AQ species based on global model with assimilation of satellite data and full-physics regional models

Figure 1. Comparison of forecast capabilities in Europe, which has a coordinated set of air quality forecasting and attribution models (Figure 3) and those in the US, which rely heavily on local regression models.

Background:
There is a need for improved information on air quality in the US that cannot be met with the existing air quality measurement and information systems [1]. This task seeks to address the shortcomings of the current system (Figure 1) by engaging stakeholders from what have traditionally been three separate air quality disciplines - forecasting, attribution, and health impact studies - and mapping out a single national air quality architecture that can meet the needs of all three.

Approach and Results:
The keystone of our approach is a Community Workshop – held in February 2023 – that brought together stakeholder agencies from all three air quality disciplines to discuss their Needs, Goals, and Objectives with respect to a national system of observations, modeling, and assimilation (Figure 2). In preparation for the workshop, we gathered information through both review of existing strategic documents for various air quality agencies and a series of conversations with representatives from these agencies. Following the workshop, we have focused on translating the Needs, Goals, and Objectives identified there into a modified Science and Applications Traceability Matrix (SATM) and identifying architecture requirements based on those parameters. A follow-up workshop will be held in early 2024 to finalize requirements in concert with the greater air quality community.

One of the key results of the workshop and subsequent analysis is that the requirements leveraged by health-related applications are substantially more difficult to achieve than those associated with forecasting and attribution. For example, while 4 km spatial resolution is sufficient for most forecasting and attribution needs, 1 km spatial resolution is required for health applications. Health applications also uniquely require knowledge of the concentrations of air toxics, which can be very difficult to measure. These differences in requirements have driven us to modify our Y3 activities to focus on the health aspects of air quality somewhat separately from forecasting and attribution. We will undertake a study of the needs for health applications using JPL's rooftop air quality monitoring station, which is operated under the auspices of Co-Is Diner and Hasheminessab. For forecasting and attribution, we will continue to work with the Joint Effort for Data assimilation Integration (JEDI) to develop an integrated data assimilation and multi-scale modeling system that can meet the requirements developed with input from the air quality community.

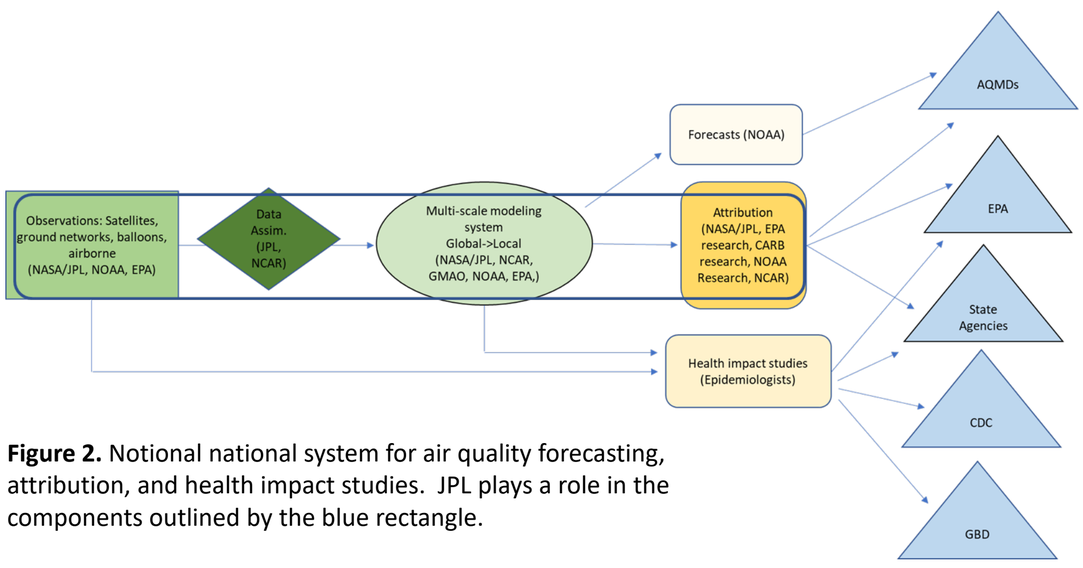


Figure 2. Notional national system for air quality forecasting, attribution, and health impact studies. JPL plays a role in the components outlined by the blue rectangle.

Significance/Benefits to JPL and NASA:
The February 2023 workshop marks the first time that the invited air quality agencies have met with the stated goal of developing a centralized air quality system for the nation. The final deliverable of the SRTD is a white paper to the next Earth Science Decadal Survey (ESDS) describing this system. If successful, JPL and NASA will be seen as contributing our system engineering skills to a problem of vital national importance and will become a well-known player in the world of air quality applications. We will also be in a position to propose new observations in support of the system and to integrate our state-of-the-art data assimilation capabilities into the architecture.

National Aeronautics and Space Administration

Jet Propulsion Laboratory
California Institute of Technology
Pasadena, California

www.nasa.gov

Clearance Number: CL#**24-5270**
Poster Number: RPC#

References:
[1] Thriving on Our Changing Planet A Decadal Strategy for Earth Observation from Space, National Academies Press, 2017**.**

PI/Task Mgr. Contact Information:
Jessica Neu: jessica.l.neu@jpl.nasa.gov (818)354-0773