Air Resources Laboratory

Advancing Atmospheric Science and Technology Through Research

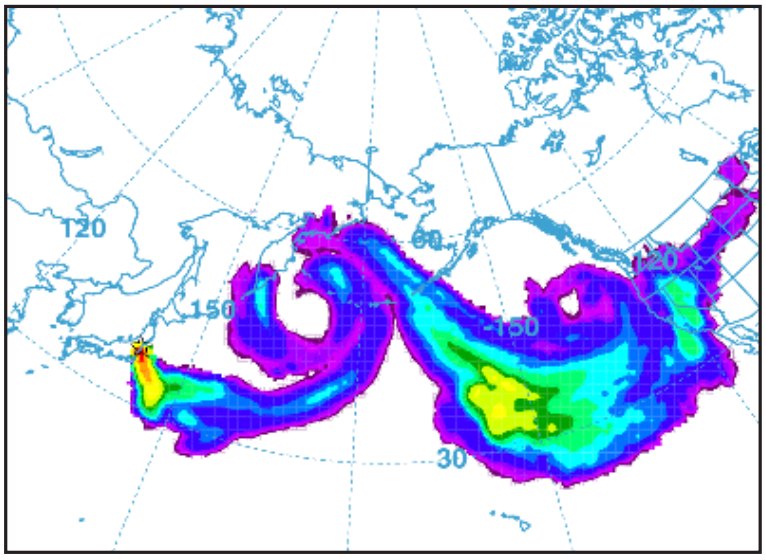
The Air Resources Laboratory (ARL) is a research laboratory within the National Oceanic and Atmospheric Administration (NOAA). ARL is headquartered at the NOAA Center for Weather and Climate Prediction in College Park, Maryland and has divisions in Idaho, Nevada, and Tennessee. Its mission is to provide atmospheric information and data to decision-makers and the science community in order to improve the Nation's ability to protect human and ecosystem health.

What We Do

ARL conducts research and development in the fields of atmospheric dispersion, air quality, climate change, and boundary layer science. Key capabilities include improving approaches for predicting atmospheric dispersion of hazardous chemicals and materials; developing, evaluating, and applying air quality models; conducting research on surface energy budgets and climate variability and trends; and advancing the understanding of (and ability to predict) the behavior of the planetary boundary layer (the mixed layer of the atmosphere closest to the ground).

Atmospheric Dispersion

The accidental or intentional release of chemical, biological or nuclear agents can have significant health, safety, security, economic, and ecological implications. ARL's dispersion research provides critical modeling and observation data to understand how, where, and when chemicals and materials are atmospherically transported. Having this understanding is essential for responding appropriately and preventing disaster. ARL developed, and continuously improves and tests, the Hybrid Single-Particle Langrangian Integrated Trajectory (HYSPLIT) model for air quality and emergency response applications. ARL's field observations involve design and evaluation of high resolution surface observing networks (e.g., stations typically 10 miles or less apart-compared to 100 miles or more apart for national weather observing networks) to capture small-scale air flows that can determine how and where materials are transported.



Example of a specialized HYSPLIT model simulation of radioactive Cesium particles from the Japanese Daiichi Nuclear Power Station, conducted for the International Atomic Energy Agency to determine the potential path of radiation from the damaged nuclear reactors. The highest air concentrations were over Japan (warm colors). By the time the particles reached the United States, air concentrations were 100 times lower, representing a radiation exposure well below the natural background levels.

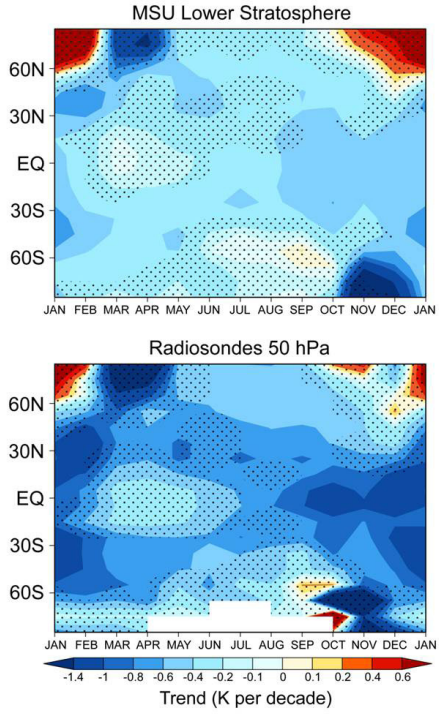
ARL technician collecting ammonia measurements over an agriculture field during a major California air quality study in 2010. Photo: NOAA

Air Quality

Poor air quality has significant health, economic, and ecological consequences. Effective air quality management and prediction depends on knowing the sources and the atmospheric transport, transformation and fate of air pollutants. To support air quality decision makers, ARL evaluates and improves sophisticated computer models used for forecasting air quality and collects data for a variety of airborne pollutants. A primary focus of ARL's air quality research is on understanding the interaction of air pollutants in the atmosphere and between the atmosphere and the underlying land and water surfaces.

Climate

Weather and climate influence every sector of society. Changes in the climate can influence economic prosperity, human and environmental health, and national security. Citizens, communities, businesses, governments, and international organizations are demanding climate information and products to cope with climate variability and to adapt to and mitigate climate change. ARL provides essential information and tools for decision-makers to understand how and why climate has changed and what changes might occur in the future. National and international climate scientists and decision-makers use ARL's information to understand climate trends and the need for mitigating and adapting to climate change.



The seasonal and latitudinal structure of lower-stratospheric temperature change (Kelvin per decade) may reveal clues to the causes of the changes. Satellite (top) and radiosonde (bottom) observations show cooling (blue) of the tropics and wintertime warming (red) of the polar regions over 1979-2010. Image Source: Seidel et al. in Wiley Interdisciplinary Reviews: Climate Change, 2011, and Free, M in Journal of Climate, 2011

ARL scientists gearing up to collect atmospheric measurements in the vicinity of wind turbines in West Texas. The data collected and analyzed by ARL will improve forecasts of winds at heights more relevant to the wind energy industry. Photo: NOAA

A recent U.S. Climate Reference Network station, installed by ARL in the Tetlin National Wildlife Refuge near Tok, AK, is powered by new fuel cell technology. The station provides high-quality, long-term climate observations of temperature and precipitation in one of the coldest regions below the Arctic Circle. On 1/21/12 temperatures dipped to -51 °F. Photo: NOAA

Boundary Layer

Underlying ARL's activities in air quality, dispersion, and climate is world-class expertise in assessing and predicting the behavior of the planetary boundary layer. This is the mixed layer of the atmosphere closest to the ground, basically where people live, work, and play. As such, it has a significant influence on a number of important issues, including dispersion of airborne hazardous materials, low-level winds and turbulence which affect wind energy production and transportation, initiation of convection which affects aviation, evolution of hurricanes, air quality, regional climate changes, the transfer of compounds between land/water and the atmosphere, and the behavior of wildland and agricultural fires and the smoke they produce. ARL's boundary layer research includes the development of instrumentation; the design, evaluation, and operation of high resolution observing networks; and tracer field studies to improve understanding of key boundary layer processes.

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Last Updated March, 2014