Air Resources Laboratory
Atmospheric Transport and Dispersion Research and Development

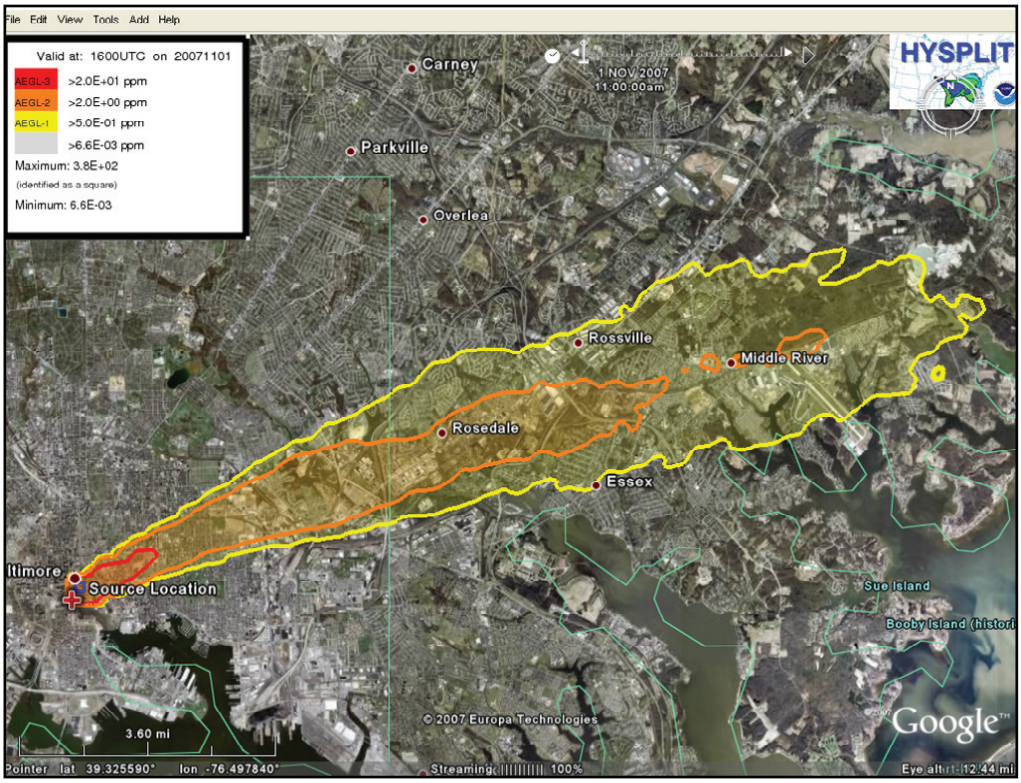
What We Do

The Air Resources Laboratory (ARL) provides essential tools and information for decision-makers and the research community to improve prediction of the atmospheric transport of toxic chemicals and other hazardous materials. ARL develops, improves, and tests dispersion models and other tools for air quality and emergency response applications, including volcanic eruptions, forest fires, nuclear accidents, and homeland security incidents. ARL also develops instrumentation, designs and evaluates high resolution observing networks, and conducts tracer field studies to improve the accuracy of atmospheric transport and dispersion predictions.

Modeling

HYbrid Single-Particle Lagrangian Integrated Trajectory (HYSPLIT) Model

ARL's HYSPLIT model is a complete system for simulating the transport of select airborne chemicals and materials. The model can perform both simple and complex computations of transport and run on a wide variety of computers. Applications of HYSPLIT at the National Weather Service (NWS) and other organizations include forecasting the path of airborne chemicals, volcanic ash, forest fire smoke, and radiological materials. Examples of on-going research include estimating errors, identifying sources of atmospheric mercury depositing on sensitive ecosystems, and forecasting the path of Saharan dust.



NOAA is developing an operational web-based plume prediction system using ARL's HYSPLIT model. NWS Weather Forecast Offices (WFO) are testing the prototype system and providing feedback to developers. The goal is to provide the capability for WFOs to run the model online and provide results to local emergency managers. This picture is an example of the type of product that can be displayed with Google Earth.

The Real-time Environmental Applications and Display sYstem (READY)

READY is an internet based system that displays meteorological data and runs trajectory and dispersion simulations. This system brings together HYSPLIT, graphical displays, and textual forecasts into a form that is easy to use by anyone. READY is particularly useful for weather and air quality forecasters, but it also may be used by weather-sensitive industries and hobbyists (e.g., balloonists, hang gliders) and the general public.

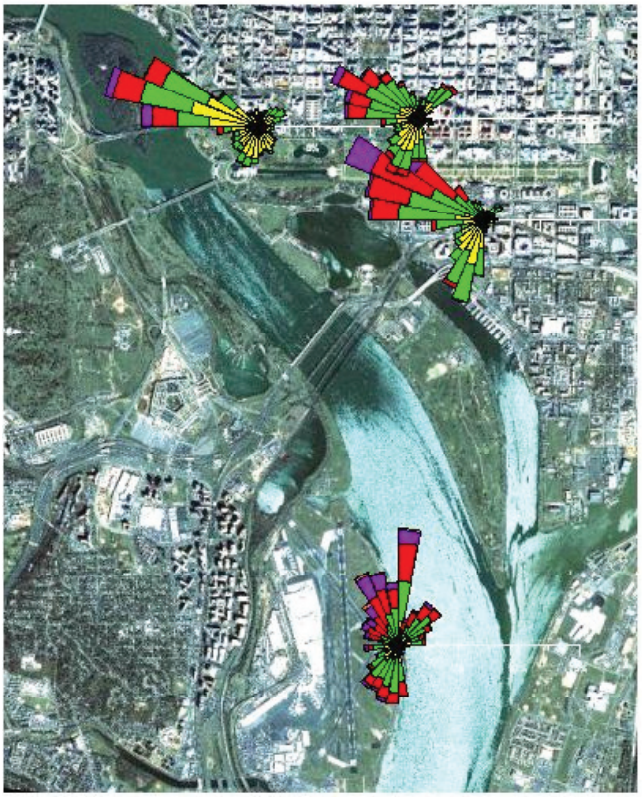
Observations

High Resolution Observing Networks

ARL designs and evaluates high resolution meteorological observing networks (e.g., stations typically 10 miles or less apart—compared to 100 miles or more apart for the national weather observing network) to capture small-scale air flows that can have a significant impact on how and where airborne chemicals and materials are transported. ARL also evaluates how this high resolution information can be incorporated into NOAA's large-scale weather models to improve their predictions of surface wind fields.

Field Studies

The flow of airborne materials in urban, coastal, and mountainous regions is very complex. Terrain, water, and man-made structures distort the wind fields that carry materials. To improve and evaluate dispersion models, it is important to gather field data on atmospheric flows in different types of situations. ARL collects such data by tracking the concentrations of tracer materials that can be readily followed back to a known source. This provides the information required to understand how airborne materials move from one location to another.



Meteorological towers deployed across Washington, D.C. collect high quality wind data and are used to drive computer models to better predict the dispersion of hazardous substances and to track severe weather over the city. (image: NOAA)

Why It Is Important

The accidental or intentional release of chemical, biological or nuclear agents can have significant health, safety, homeland and national security, economic, and ecological implications. ARL's Atmospheric 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. For instance, accurate predictions of the path of a chemical release help emergency managers evacuate the right people. Predictions of volcanic ash plume locations allow aircraft to avoid dangerous areas. Understanding the sources of mercury in fish allows air quality managers to develop targeted policies and plans to mitigate the problem.

For More Information:

READY
www.arl.noaa.gov/ready.php

HySPLIT Model
www.arl.noaa.gov/HYSPLIT_info.php

ARL Transport & Dispersion R&D
www.arl.noaa.gov/atmosDisp.php

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