# Air Resources Laboratory
Web-based HYSPLIT Applications for Emergency Response

A Complete Modeling System for Simulating Dispersion of Harmful Atmospheric Material

The accidental or intentional release of chemical, biological or nuclear agents can have significant health, safety, security, economic, and ecological implications. The Air Resources Laboratory's (ARL's) HYbrid Single-Particle Lagrangian Integrated Trajectory (HYSPLIT) model is a tool that helps explain how, when, and where potentially harmful materials are atmospherically transported, dispersed, and deposited. 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 hazardous air pollutants allows air quality managers to develop targeted policies and plans to mitigate the problem.
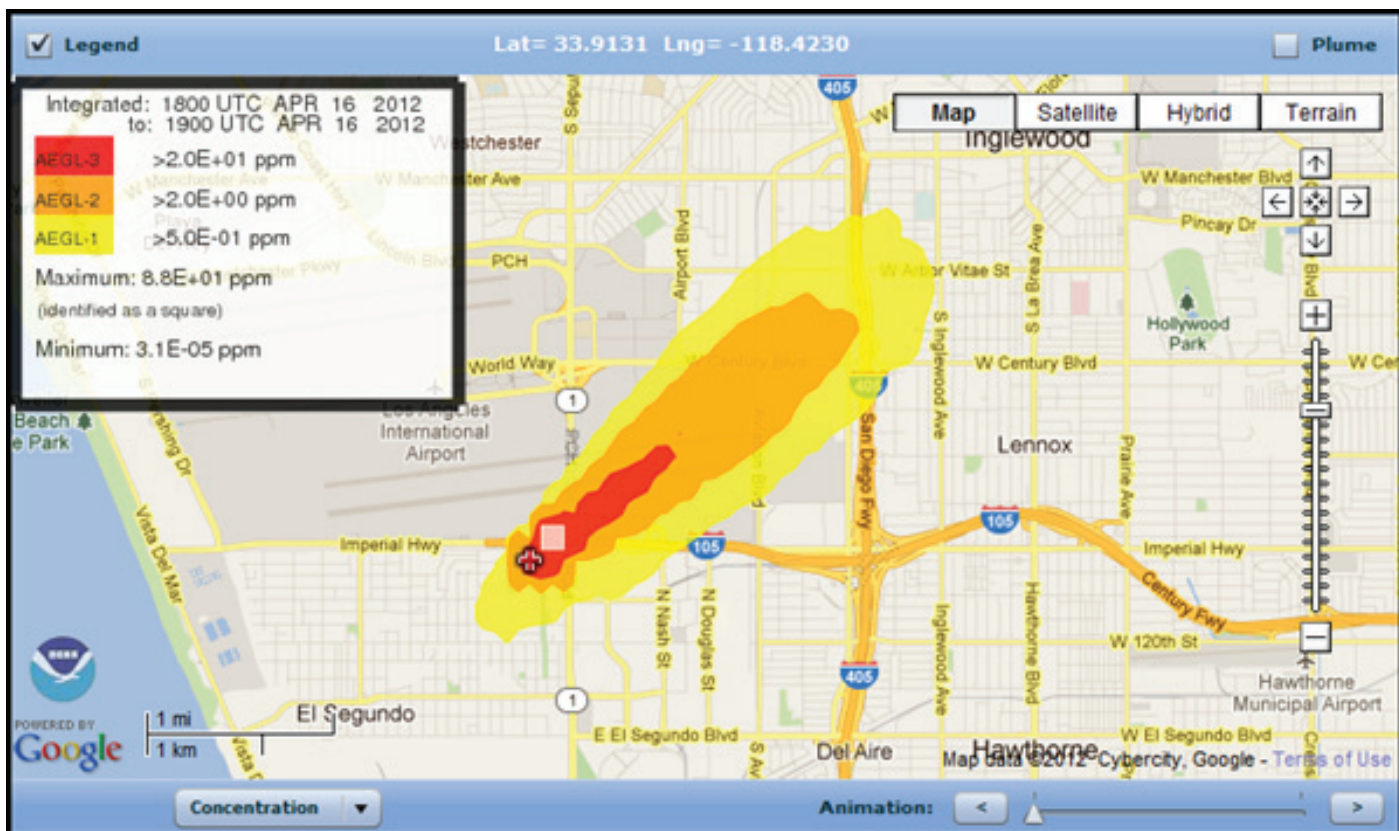
The HYSPLIT model is a complete system for computing both simple air parcel trajectories and complex dispersion and deposition simulations. The model calculation method is a hybrid between the Lagrangian approach, which uses a moving frame of reference for the advection and diffusion calculations as the air parcels move from their initial location, and the Eulerian approach, which uses a fixed three-dimensional grid as a frame of reference to compute the pollutant air concentrations.

NOAA uses HYSPLIT for both research applications and emergency response events that require modeling the transport and dispersion of harmful pollutants released to the atmosphere. The model is designed to support a wide range of simulations related to the atmospheric transport and dispersion of pollutants and hazardous materials, as well as the deposition of these materials to the Earth's surface. Some of the applications include tracking and forecasting the release of radioactive material, volcanic ash, wildfire smoke, and pollutants (such as mercury) from various stationary emission sources.

At the local/regional level, field forecasters regularly respond to requests for dispersion forecasts from state and local emergency managers. At the national level, the model is often applied to needs from the aviation industry and air quality regulators. Internationally, NOAA participates with the World Meteorological Organization (WMO) and the International Atomic Energy Agency, providing dispersion model forecasts in the event of a large scale nuclear incident.

In addition to stand-alone versions of HYSPLIT for LINUX, Mac, and Windows, HYSPLIT is also available to users in a variety of web-based venues:

Examples of HYSPLIT simulations and data.
Photo credit: The Design Pond.

- NOAA's National Centers for Environmental Prediction (NCEP) can initiate an on-demand HYSPLIT simulation on the NOAA supercomputer at the request of authorized users, such as Weather Forecast Offices (WFOs), WMO member country Delegated Authorities, and various federal agencies. The results are then posted to a secure website for access.
- WFOs can also access pre-computed dispersion forecasts for select locations as set by NCEP. WFOs can request that a point of interest be added to the list for special events, such as on-going wildfires, the Super Bowl, national political conventions, etc.
- All NOAA users, but particularly WFOs, have access to a special operational web-based version of HYSPLIT designed for short-term emergency response applications. This version resides on a web server in Boulder, CO, with a backup server in Largo, MD. It is operationally-maintained by the NOAA Web Operations Center (WOC) in Silver Spring, Maryland. Gridded meteorological forecast data are sent directly from the NCEP on a real-time basis to the WOC server for use in HYSPLIT calculations. Current meteorological datasets include output from the North American Mesoscale model, the Rapid Refresh model, and the Global Forecast System model. Users can run simulations of smoke, chemical, and radiological releases. An application currently in development will allow users to model the release of chemicals to the atmosphere from chemical accidents using the source term model of the NOAA/EPA CAMEO/ALOHA modeling system to feed the time-varying release rate to HYSPLIT.
- A public, web-based version of HYSPLIT has been successfully running in a non-operational environment at ARL since the late 1990s. Although a dispersion forecast is still restricted to registered users affiliated with atmospheric science, trajectories and dispersion runs using archived meteorological data are available to anyone. This system, referred to as READY (Real-time Environmental Applications and Display sYstem), continues today, and is the basis for the current operational system deployed at the WOC.

HYSPLIT Model
> www.arl.noaa.gov/HYSPLIT_info.php

READY
> http://ready.arl.noaa.gov

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

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