NWS HYSPLIT atmospheric transport and dispersion modeling

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Understanding and predicting atmospheric transport and dispersion is essential for protecting the health and welfare of the public and emergency response personnel when harmful substances are released into the air in significant quantities. The Federal National Response Framework, approved by the President in January 2008, assigns to NOAA the responsibility for atmospheric transport and dispersion (ATD) prediction of smoke and radioactive and hazardous materials, maintenance and development of HYSPLIT, and coordination with the World Meteorological Organization on international incidents. The NOAA Air Resources Laboratory (ARL) develops many of NOAA's capabilities for these services in conjunction with NCEP.

Currently, the HYSPLIT system is used to provide the following operational atmospheric dispersion products:

- 48-hour wild-fire smoke forecasts from the daily 06 UTC cycle for CONUS, Alaska, and Hawaii, driven by the 12 km North American Model (NAM).
- 48-hour dust forecasts from the 06 and 12 UTC model cycles for CONUS.
- 48-hour volcanic ash forecasts whenever requested by the International Civil Aviation Organization (ICAO)-designated U.S Volcanic Ash Advisory Centers (in Washington, DC and Anchorage, AK). This is typically driven by the NWS Global Forecast System (GFS), although other model output can be used.
- 72-hour radiological emergency response plume forecasts when requested per the World Meteorological Organization (WMO)-designated Regional Specialize Meteorological Center (RSMC) arrangements. This forecast is typically driven by the GFS.
- 16-hour dispersion forecasts for HAZMAT-type (chemical spill, explosion, etc.) incidents upon the request of an NWS Weather Forecast Office (WFO), almost always driven by 12-km NAM, though other model output can be used.
- Back-tracking products when requested per the WMO/RSMC or Comprehensive Test Ban Treaty Organization (CTBTO) agreements. This forecast is typically driven by the GFS, although the NAM can be used.

For all applications, dispersion is simulated using either the multi- or single-processor version of the same code. The smoke and dust forecast guidance is sent in gridded form to the NOAA National Display and Graphics System (NDGD) for distribution to forecasters and emergency managers at the individual state level.

The RSMC predictions are initiated by the NCEP SDM (Senior Duty Meteorologist) and distributed to National Forecast Centers via fax. Digital and graphical products are also shared between other country RSMCs through a protected ARL (non-operational) web page. Monthly exercises are performed by the SDM with other RSMCs.

The volcanic ash predictions are initiated by NCEP, NESDIS/SAB (Synoptic Analysis Branch), or NWS AAWU (Alaska Aviation Weather Unit).

The HAZMAT-type output is made available on a secure NCEP server (https://hysplit.ncep.noaa.gov/).

Recently, HYSPLIT volcanic ash products were improved to provide trajectories, and meet NOAA requirements for back-tracking support to the Comprehensive Test Ban Treaty Organization (CTBTO). Improvements soon be implemented are the use of higher resolution global meteorological FV3GFS gridded predictions and the use of the High Resolution Rapid Refresh (HRRR) model to drive HYSPLIT.