

NCAR

Predicting the Transport of Airborne Hazardous Material In Support of Homeland Security

Support of Homeland Security at the 2002 Winter Olympics

The National Center for Atmospheric Research (NCAR) supported the Department of Defense (DoD) during the 2002 Salt Lake City Winter Olympics by developing and deploying an advanced operational computer-based weather forecast system. The forecasted weather variables were used as input to a DoD system that calculated the transport of hazardous material from potential releases. Figure 1 shows predicted low-level winds in the Salt Lake Valley (yellow lines), the concentration (green) of a gas that was released on the north side of the area, and the dosage (accumulated exposure, red). The brown-white shading indicates mountains that, together with the lakes in the area, produced complex winds with much spatial variation that required the use of a sophisticated forecast system. The forecast system was employed operationally for 100 days.

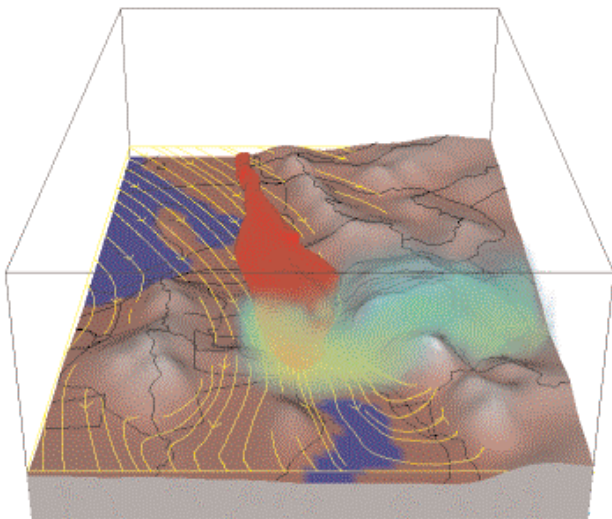


Figure 1

Predicting Plume Transport For Metropolitan Areas

NCAR has developed a sophisticated wind analysis and forecasting capability that uses operational National Weather Service (NWS) weather-radar data, in combination with other standard weather data, to predict detailed wind patterns in the lower atmosphere. Both analyses of current winds and short-term forecasts of up to 30 minutes can be produced within a couple of minutes on a dual-processor PC. Such high-resolution wind

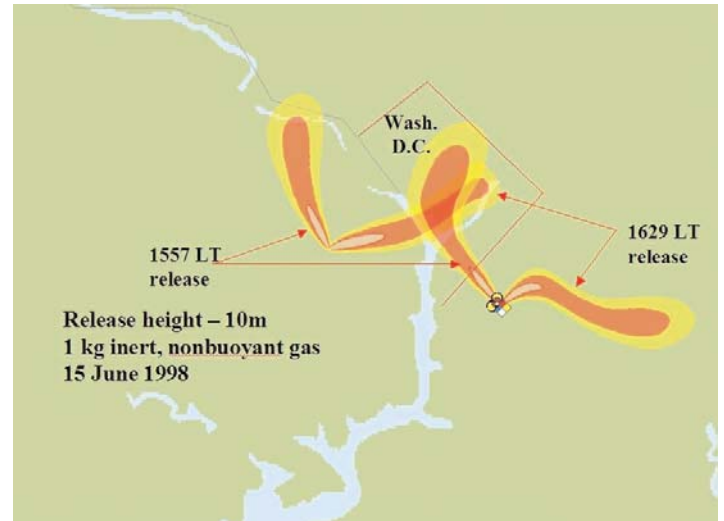


Figure 2

products are critical for computing the transport of hazardous material. Figure 2 shows plumes computed for two hypothetical hazardous-material releases, and computed plumes for releases at the same locations about one-half hour later. The large changes in the plume transport were due to rapidly changing wind patterns, which can only be detected using remote sensors like weather radar coupled with sophisticated analysis software. There is no other wind analysis and forecasting system that can utilize the readily available NWS radar data in this way. In this example, the data used were from the NWS radar at Sterling, Virginia.

Predicting Plume Transport Within Cities

The same software that utilized the radar wind data in the previous example can also be used with laser-based radars called lidars (light-detection and ranging) that can observe winds over smaller areas and with greater detail. The wind data must be obtained from a lidar that is specifically deployed for this purpose because there is no operational lidar network, as there is for weather radars. When lidar data are utilized, winds can be measured every 60 m (~200 feet). Figure 3 shows hazardous material tracked using lidar data. The lidar, in this example, was not in Manhattan, but the street map is used as background to provide a scale reference. Lidar systems are commercially produced. They have a range of about 7 km (~4 miles), so they can measure the winds over a significant fraction of a metropolitan area, or over any area where a high-profile event may cause security concerns.

