

Oceanographic Models and Emergency Management

How to Make Your Model's Products Useful to NOAA HAZMAT and USCG Search and Rescue Operations



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United States Coast Guard – Search and Rescue (SAR)

- Responsible for conducting marine search and rescue.
- Time to first product – in time for flight crew running for aircraft.
- Average 100 cases/day – each day 10 people saved, 3 lost.
- 50 operational centers around the U.S.
- Central repository of environmental data archive.



Rescue litter coming down. Rescue Swimmer and survivor going up.

NOAA Office of Response and Restoration Hazardous Materials Response Division (HAZMAT)

Mandated role of Scientific Support Coordinator (SSC) to the USCG under the National Contingency Plan.

- Time to first products – 30 minutes for weather forecast (NWS), verbal spill trajectory with oil weathering information and identification of resources at risk; 2 hours for trajectory model results.
- Average 125 calls / year for support of waterborn oil spills, chemical spills, and other disasters.
- SSCs collocated with USCG district offices; Scientific Support Team located in Seattle, WA.
- Data access on time-of-incident basis.



In November 2005 the Tank Barge DBL-152 had initial damage from hitting hurricane debris, then started to take on water and capsized. Total volume spilled estimated at 2 million gallons.

NOAA HAZMAT and USCG SAR have these needs/requirements in common:

- Area of responsibility is the entire U.S. coastline and territories, and internationally.
- Final operational decision is the optimal deployment of a limited set of assets on scene.
- Have operational (24/7) decision support tools that include drift and fate models.
- Operational tools require operational or near operational level inputs.
- Require environmental data (e.g., observations of surface current, surface wind, SST) with error estimates.
- Require Short Term Predictions (24-48 hours) of surface current and winds with uncertainty estimates at a variety of length and time scales.
- The majority of incidents occur within 100 km of shore.



During the TB DBL-152 response V-SOSs were initially used to find submerged oil, however, their results when oiled were not quantifiable enough to initiate diver recovery operations. Since the oil from the TB DBL-152 was denser than seawater, Remotely Operated Vehicles were key to finding areas with recoverable amounts of oil.

Where we differ:

- SAR requires products within minutes to hours to aid responders, the corresponding time scales for NOAA are hours for oil or chemical spills in water, minutes for chemical releases in air.
- SAR requires predictions out 24 hours; HAZMAT requires predictions out 48 hours.
- HAZMAT uses local NWS marine forecaster for incident specific spot forecast for weather situational awareness and trajectory model.
- HAZMAT requires more environmental parameters, but SAR is catching up.
- SAR requires access to previous 2 weeks of nowcasts or analysis fields.
- HAZMAT requires 3D currents predicted out to 48 hours at appropriate scale, SAR only surface.



Search and Rescue continues no matter the weather.

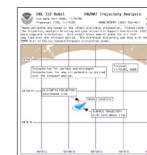


Time is a critical commodity in emergency response

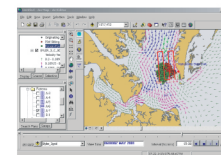
- Operations are 24/7.
- Response times range from minutes (SAR, chemical incidents in air) to a few hours (oil spills, chemical spills in water).
- Need to work with the on-scene responders "Operational Planning Period" (while some people are working, another group is planning the next operational period and needs updated forecast information).

What USCG and NOAA need from IOOS/Regional Associations

- Access to data and model products from 30 days in the past through 72 hours into the future. The key time period is the next 24 hours from "now". USCG archives data while HAZMAT contacts potential data sources on time-of-incident basis.
- Error estimates are key to estimating the outer limits of the search and oil impact areas. Resources to search and to protect environmental resources are always limited and must be optimally deployed.
- Operational products require additional levels of quality control compared to academic/research products.
- Notification of access or format changes for products. Follow IOOS/DMAC recommended metadata standards, e.g., netCDF COARDS CF. This will greatly facilitate data transfer to USCG and NOAA.
- All data presented for public access will be assumed 100% accurate by others (media, etc.) unless otherwise stated by the data providers.



NOAA HAZMAT trajectory using General NOAA Oil Modeling Environment (GNOME) with NOAA Gulf of Mexico nowcast/forecast model



Sample search pattern from USCG Search and Rescue Optimal Planning System (SAROPS)

What USCG and NOAA need from the Research Community

- Forecast model error estimates and information on model validation. We look to the research community to develop consensus on how to best implement uncertainty consistently among many models. Time is critical during an incident and at this time we have no ability to use ensemble forecasts.
- Operational determination of best search area is a function of horizontal mixing and its associated uncertainty. Need new methods for estimating this operationally.
- New peer reviewed predictive tools. This is particularly true for emerging operational technologies such as HF radar.
- Work with the operational community by including emergency response personnel on your team when your work is intended for eventual operational use.



The TB DBL-152 spilled oil more dense than the local seawater. Diver teams working from the recovery barge for 24 hours could recover up to about 21,000 gallons in areas of high oil concentration at a cost of approx. \$400,000/day.

Tips for Working with the Response Community

- Support the procedures and designated personnel in place, e.g., USCG and the Federal On-Scene Coordinator (usually Captain of the Port); the NOAA SSC.
- Consensus building is a key skill in response.
- Establish contacts prior to an incident.
- Understand ICS and agency/community roles through participation in Contingency Planning process or targeted training.



Fire boats responding to gasoline tanker explosion, spill and subsequent fire off Staten Island, NY.



A red dye diesel collecting on a marsh from a spill in Northern NJ in 2005.

