To date, four roles have been identified for agency personnel working within a responsible party's management team. They can serve as monitors, integrated resources, advisors, or managers. These roles can be defined as follows:

- *Monitors*—Personnel assigned to observe the actions undertaken by the responsible party's management team to ensure it is acting in a manner consistent with the directives of the unified command. A monitor serves as the eyes and ears of an agency on-scene coordinator (OSC) to assist the OSC in the exercise of their "direct mode" authority.
- *Integrated resources*—Personnel assigned by an agency OSC to serve as a member of a responsible party's management team. An integrated resource is managed by a superior in a responsible party's management organization.
- *Advisors*—Personnel assigned to provide advice to one or more members of the unified command and/or personnel in a responsible party's management team.
- *Managers*—Personnel assigned to assume a position on an agency or responsible party's management team and manage the actions of subordinate personnel (when there is no responsible party or when the responsible party is judged to be doing an inadequate job in one or more functional areas).

Agency personnel may be asked to assume more than one role at a time, or their roles may change during the course of response operations. The roles of agency personnel should be determined by their agency's on-scene coordinator. An agency on-scene coordinator should provide the responsible party's incident commander with clear guidance on the roles to be assumed by agency personnel.

Author

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NUMERICAL SIMULATION OF THE *AEGEAN SEA* OIL SPILL

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ABSTRACT: *A numerical study of the trajectory of the* Aegean Sea *oil slick was made, using the Météo-France oil spill model. The model, configured for operation on a workstation, predicts the drift, spread, dispersion, and shoreline interaction of the spilled oil. Its main component is a hydrodynamic ocean model, forced by the wind fields of the European Centre for Medium Range Weather Forecasts atmospheric model. Model predictions were compared with results of aircraft and beach surveys.*

On December 3, 1992, the tanker *Aegean Sea* broke up off La Coruña harbor on the Galician coast of Spain. Escaping oil formed a slick which spread along the coast. More than 200 km of shoreline was affected. The Météo-France oil spill model was tested in hindcast mode over the period December 3–6, 1992.

Ocean model

A two-dimensional depth-integrated model on a 0.25′ × 0.25′ grid was implemented with the capability of predicting wind-driven movements in the area of La Coruña. It is driven by meteorological analysis from the European Centre for Medium Range Weather Forecasts (ECMRWF) global numerical weather prediction model.

The model solves the nonlinear shallow water equations:

$$\frac{\partial q}{\partial t} + q.\nabla q + f.k\Lambda q = -g.\nabla\eta - \frac{1}{\rho}\nabla P_a + \frac{1}{\rho.H}(\tau_s - \tau_b) + A.\nabla^2 q \qquad (1)$$

$$\frac{\partial \eta}{\partial t} + \nabla(H.q) = 0$$

Where:
t = time
q = depth-integrated current
η = sea surface elevation
H = total water depth
f = Coriolis parameter
k = a unit vector in the vertical
P_a = the atmospheric surface pressure
τ_s = surface wind stress
τ_b = bottom frictional stress
ρ = density of water
g = gravitational acceleration
A = the horizontal diffusion coefficient (2000 m^2/s).

These equations, written in spherical polar coordinates, are integrated forward in time on an Arakawa C-grid using a split-explicit finite difference scheme. The surface wind and bottom stresses are computed using a quadratic relationship. A gravity wave radiation condition is used at open boundaries.

Oil spill model

The oil slick is modeled as a distribution of independent droplets that move in response to current shear, turbulence, and buoyancy.

The current shear is calculated analytically for each droplet with a bilinear eddy viscosity model that assumes the vertical eddy viscosity to increase linearly with the distance from both the water surface and the bottom boundary.[2] The governing equation is:

$$\frac{\partial w}{\partial t} + i \cdot f \cdot w = -\frac{1}{\rho} \cdot \frac{\partial P}{\partial n} + \frac{\partial}{\partial z}\left(v_t \cdot \frac{\partial w}{\partial z}\right) \qquad (2)$$

Where: $w = u + i \cdot v$ is the horizontal velocity (u and v are the x and y components of current)

V_t = an eddy viscosity

$$\frac{\partial}{\partial n} = \frac{\partial}{\partial x} + i \cdot \frac{\partial}{\partial y}$$

The model is coupled to the ocean model by:

$$q = \frac{1}{H} \cdot \int_0^H w \cdot dz \qquad (3)$$

The turbulence (diffusion) is represented by a three-dimensional random walk technique. The buoyancy force depends on the density and size of the oil droplets, so that larger, more buoyant ones tend to remain in the surface layer, whereas smaller droplets mix downward. If a droplet is moved onto land, then that droplet is considered beached and takes no further part in the simulation.

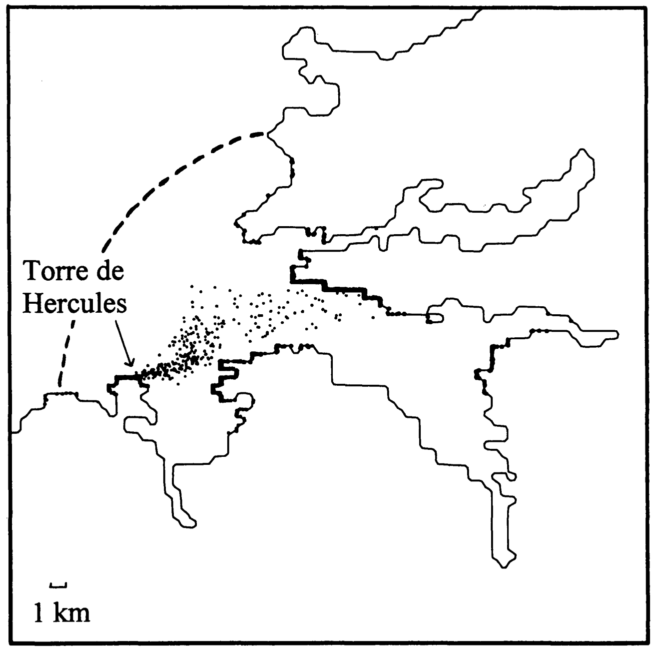

Figure 2. Model-simulated slick at 6 utc on December 6, 1992

Aegean Sea oil spill

The simulation begins on December 1 and ends on December 6. The oil spill is represented by the uniform release of 5,760 droplets over the period December 3–6. One droplet is released per minute. The behavior of the tracked droplets is considered to be representative of the entire spill. Model simulations are compared with the results of aircraft and beach surveys. ERS-1 synthetic aperture radar (SAR) pictures are rather sparse on this area, and no picture was available over the simulation period.

For the simulation period, the winds were predominantly from the west or southwest and, the oil moved to the east-northeast. Figures 1 and 2 show, respectively, the simulated positions of the slick on December 4 and December 6. The dashed line indicates the edge of the observed position of the slick. The slick position agrees well with the observed position. In particular, on December 6, the simulated beached oil areas fit the beach survey results.

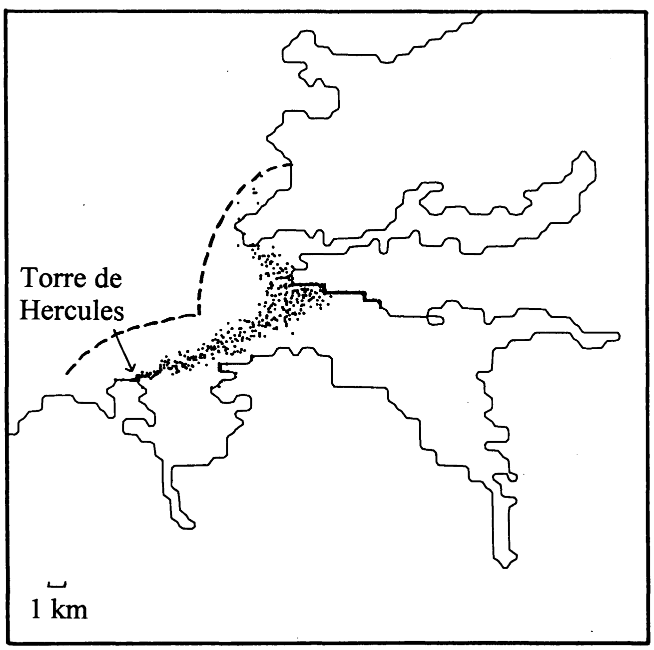

Figure 1. Model-simulated slick at 6 utc on December 4, 1992

Conclusion

Comparison of the model-predicted oil slick with results of aerial and beach surveys shows broad agreement. The improvement of the model will go on, with the inclusion of tides and physical processes such as evaporation of the oil.

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