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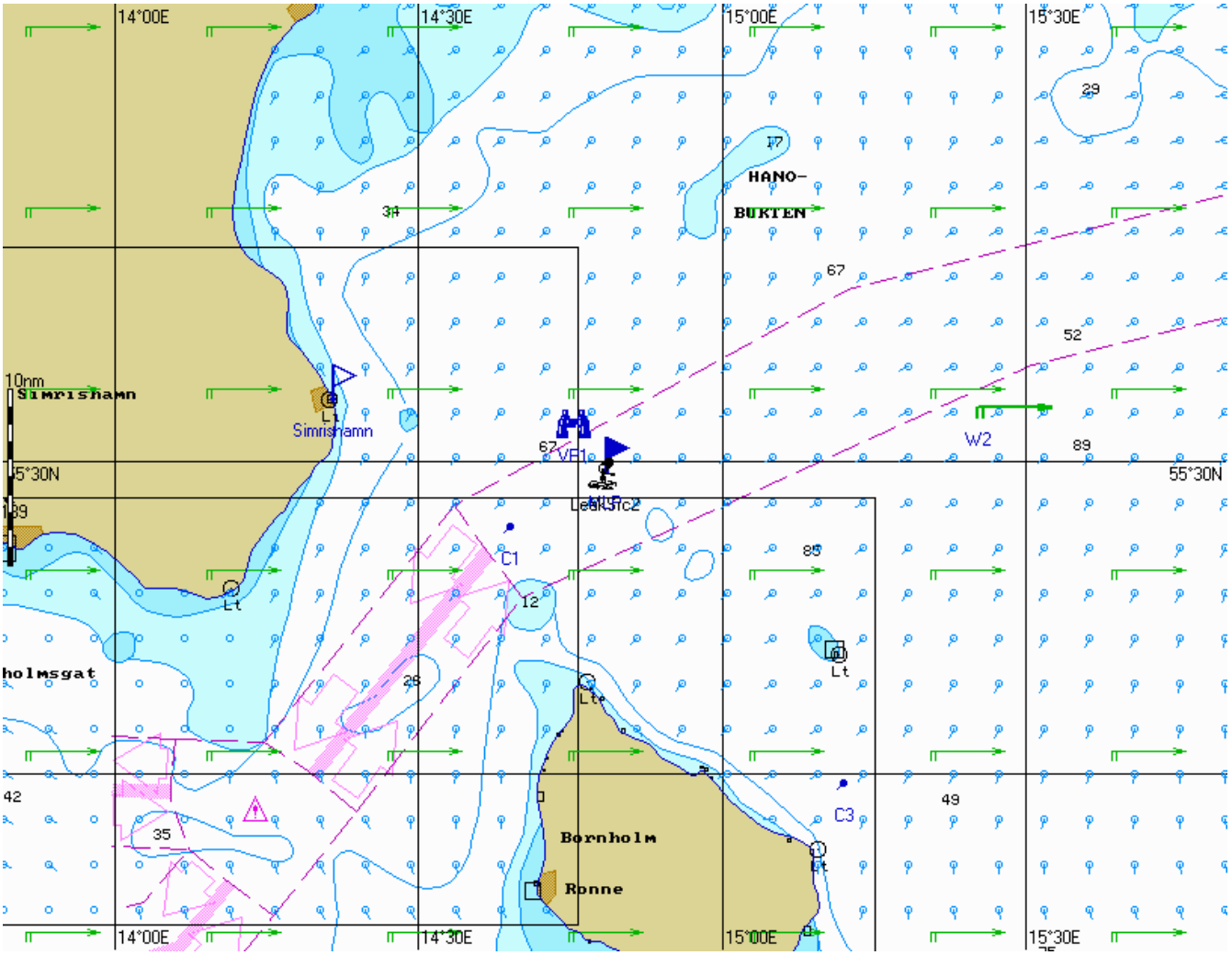

Simulations to prevent pollution from maritime transport

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THE BALTIC SEA IS UNDER PRESSURE

The Baltic Sea is one of the most heavily trafficked seas in the world. Ships traffic account for 15% of the world's cargo transportation. Both the number and the size of ships have grown in recent years and this trend is expected to continue.

The main environmental effects of shipping and other activities at sea include air pollution, illegal deliberate and accidental discharges of oil, hazardous substances and other wastes, and the unintentional introduction of invasive alien organisms via ships' ballast water or hulls.

MAIN SCOPES OF SIMULATORS USED FOR ANTI-POLLUTION ACTION AND IMPROVED EFFECTIVENESS

The main fields of applying simulators in anti-pollution research are:

- Real time accidents simulations to anticipate their possible effects and improve anti-pollution actions (it is necessary to know the current weather conditions for this type of simulations).
- Oil spill forecast for predicted accident positions (medium/ extreme seasonal weather conditions should be used for these type of simulations), recorded data can be used to optimize costs and response resource allocation.
- Backtracking - to determine which vessel that caused an oil spill based on AIS-data and recorded pollution and reconstruction of oil pollution spreading.
- Staff training to improve the coordination of rescue operations in order to optimize local contingency planning.

THE CHARACTERISTIC OF OIL SPILL SIMULATORS OF MARITIME UNIVERSITY OF SZCZECIN

Maritime University of Szczecin has got two sophisticated oil spill simulators: PISCES II and ASA OILMAP. Their main abilities are described below.

PISCES II:

- Allows integration of information from diverse sources
- Enables response planning, decision-making and overall operational control
- Is fully compliant with the requirements of the Oil Pollution Act of 1990 (OPA 90)
- Has got networked configuration for interactive operation of multiple workstations
- Is based on the PISCES solutions originally developed as a simulation tool for the Preparedness for Response Exercise Program (PREP) of the US Coast Guard.
- Is able to create databases for resources, at-risk facilities and sensitive areas, weather, tide and current conditions, and event logging and exercise scripting.
- Includes a dynamic simulation module for emergency response drills and training exercises
- owns the graphic display of deployed response resources and incident situation using the world collection of Transas TX-97 vector electronic charts and other map formats.
- Uses mathematical models to predict trajectory, weathering, and shoreline impact of oil or chemical spills in waterways; forecast downwind location and threat level of airborne toxic substances resulting from chemical spills based on the NOAA developed ALOHA model.
- Enables interface position reporting (GPS) or AIS system.
- Enables real-time/fast-time simulation.

ASA OILMAP

is an oil spill model system designed for oil spill response and contingency planning. It includes simple graphical procedures for entering spill information and connects to on-line weather forecast servers for accurate wind and current data. OILMAP uses a variety of electronic chart systems, including global nautical CMAP charts from Jeppesen Marine and is also compatible with ESRI GIS software. The power of OILMAP is to rapidly provide oil spill trajectory predictions anywhere in the world and makes oil spill modeling accessible to the oil and gas industry, shipping companies and government agencies.
A variety of graphically based tools are included and they allow the user to:

- Specify spill scenarios.
- Display spill trajectories.
- Select oil types from a database.
- Use the Response Calculator to model response activities.
- Connect to on-line forecasting services.

OIL SPILL SIMULATION	input data:		
Accident coordinates	φ=55°29,435'N	Sea state	1 m
	λ=014°48,462'E	Water density	1,006
Current direction	90°	Pressure	1012 hPa
Current speed	0,25 kts	Cloudiness	5
Wind direction	270°	Amount of oil	6000 t
Wind speed	8 kts	Ratio	6000 t/h
Air temperature	20 °C	Type of oil	IFO 180
Water temperature	8 °C		

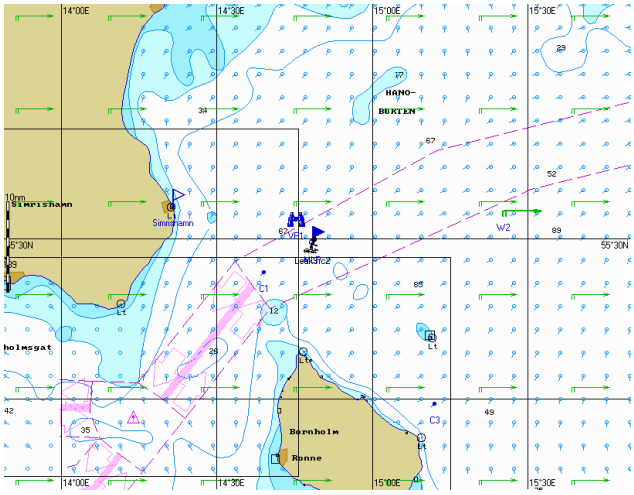

FIGURE 1. PISCES II - THE BEGINNING OF SIMULATION
The threatened area near Bornholm. The position of the two ships collision. The collision results in an oil spill.

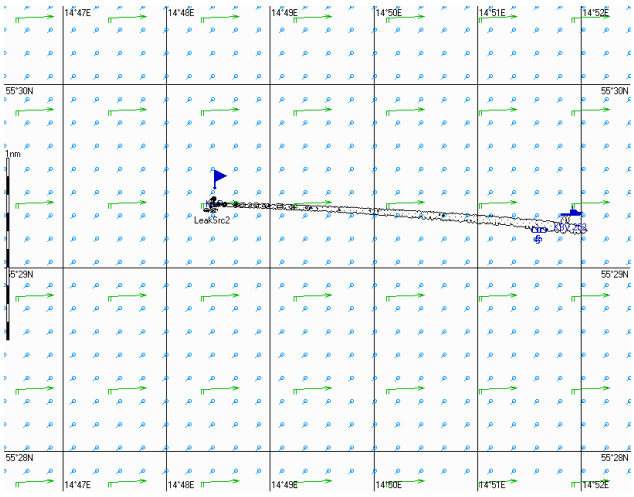

FIGURE 2. PISCES II ANTI-POLLUTION ACTION
To remove the oil slick KBV-type vessels were ordered from the two nearest Swedish ports.

The vessels are equipped with LAMOR systems.

The figure shows the direction of the spread of the oil slick and the ship moving along the slick cleaning up the oil.

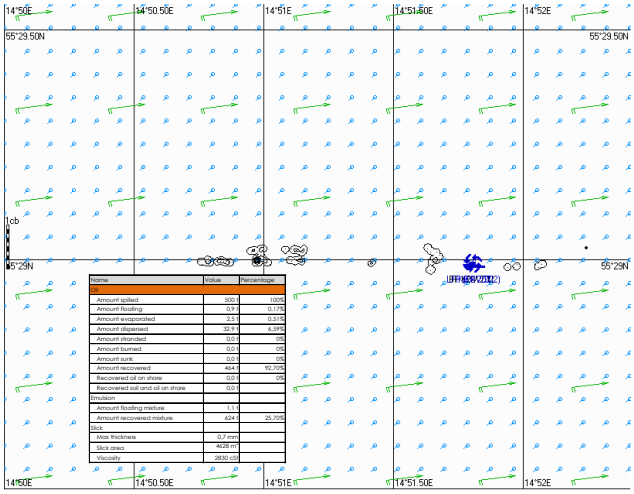

FIGURE 3. PISCES II – RESULTS OF SIMULATION
This figure shows the final phase of the collection of oil stains from the water surface and spill statistic of carrying out the rescue operation. The following data is displayed for a spill as a whole: amount of spilled, floated, evaporated, dispersed, stranded, burned, sunk and recovered oil. Also the amount of floating and recovered oil emulsion (water/oil mixture), maximum thickness, and the total area of oil slick are displayed.

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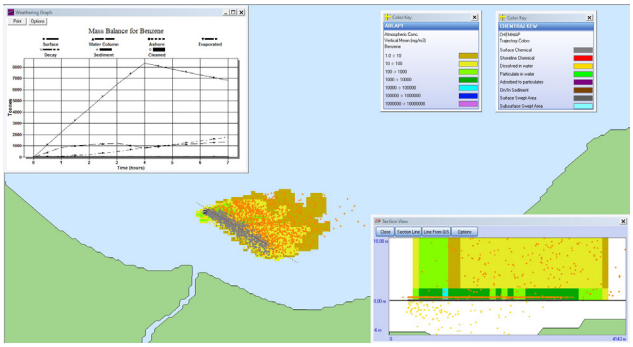

FIGURE 4. ASA CHEMMAP - GASOLINE LEAKAGE SIMULATION

CHEMMAP- the slick is caused by a gasoline leakage into the sea. The graphic portrayal shows the spreading of the slick in sea water and the evaporation of substances into the atmosphere (top left). The figure shows a three-dimensional visualization of the gasoline slick on the surface (bottom right).

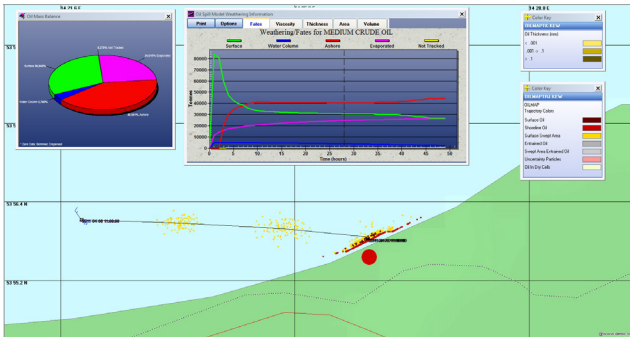

FIGURE 5. ASA OILMAP – CRUDE OIL LEAKAGE SIMULATION

OILMAP- Medium crude oil slick on sea surface. Diagrams show oil mass balance (top left) and feathering/fates (top) on surface, in water column and ashore for entire duration of simulation.

CONCLUSION

Optimization of location response resources depending on reduction of costs is very important. Full complement of planned simulations, based on predicted ships' accidents, should give an answer: whether an allocation of responses or their expansion are necessary. Protection of the Baltic Sea environment without bearing the unnecessary costs is a main purpose of research.

BalticMasterII
maritime safety across borders

Lead Partner
REGION BLEKINGE

Baltic Sea Region Programme 2007–2013
Part-financed by the European Union
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Baltic Master II is a flagship project in the EU Strategy for the Baltic Sea region that brings together countries from around the whole Baltic Rim. Its aim is to improve maritime safety by integrating local and regional perspectives with cross-border cooperation. This involves increasing the land-based capacity to respond to maritime oil spills and working to prevent pollution from maritime transport. The project runs from. January 2009 to January 2012.