SYSTEM FOR DETECTION OF OIL SPILLS

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Introduction

Malaysian coastal and marine environment contains many species, habitats and other resources that could be severally affected by oil pollution (Marine Department, 1997). Operational remote sensing and Geographic Information System (GIS) are important tools for oil spill research and development activities. Microwave and optical satellite data were used to detect and map spill area and pattern. Other parameters required to detect, monitor and clean-up the spill were also extracted from remotely sensed data. This include ship track, ship speed, wave spectra, current speed. Oil spill data, access and protection information is then placed in GIS environment for rapid access, retrieval and queries. For contingency planning, it is necessary to identify vulnerable coastal locations before a spill happens, and promptly perform removal actions when an oil spill occurs, so that protection priorities can be established and clean-up strategies recognised. The steps were: (a) Environmental Sensitivity Index (ESI) map; (b) Prediction oil spill trajectory by winds; and (c) Resource requirement for protecting spills area.

Materials and Methods

1. Detection and monitoring: Data from various sensors (TOPSAR, Radarsat, ERS, Landsat, SPOT, AVHRR) were analysed. Oil spill spot were detected, quantified and classified. Information such as the location, quantity and the distribution were exported to GIS system for trajectory modelling and prediction. Algorithm and models to extract other significant parameters such as ship track, ship speed, wave spectra, current speed were also established.

2. Assessment and spatial information system: Spatial and attribute data related to risk assessment were integrated with spill data acquired from remotely sensed data. Multi-criteria analysis was carried out utilising oil spill incidents and environmentally sensitive areas and other related information. The GIS-based system can now be used to establish the appropriate response, assessment and multiple resource planning (Shattri and Tee, 1998).

3. Contingency planning: The derived information from remotely sensed data were used to identify and classify types of coastal topography and sensitive land features for later sensitivity analyses and assessment of the need for protection.

Results and Discussion

Techniques to detect, monitor oil spill from remotely sensed data were developed. These parameters include oil spill spot, width, thickness and distribution. Other related parameters include ship track, ship speed, wave spectra and current speed. The main limitation is the access to real time data. This is due to the fact that most satellite ground station operators do not offer real time data through Internet. The extracted information can then be integrated to the oil spill risk management system for decision process. The system has three components, i.e. detection, information and modelling (Shattri and Tee, 1998). The systems would be able to detect, monitor, provide assistant and information and risk assessment. Risk criteria is based from the oil slick movement prediction. The engine of the system is based from PCI's EASI/PACE V6.2 and SPANS V7.0. Simple linear trajectory model was adopted for trajectory modelling. As for contigency planning, Environmental Sensitivity Index (ESI) maps was produced for the study area (Straits Of Malacca). These maps serve as quick references for oil and chemical spill responders and coastal zone managers. Oil spill trajectory simulations are assumed, using mean seasonal surface currents and surface drift produced by winds. Hypothetical spill trajectories will be simulated for each of the potential launch areas across the entrance SOM. These simulations assumed more than hundred spills occuring in each of the four seasons of the year from each launch area. The results presented as probabilities (expressed as a percent chance) that an oil spill occuring in a particular launch area will contact a certain environmental resource or a land segment within 3, 10, or 30 days. A summary of the trajectory analysis (for 10 days) for oil spills originating in each launch area across the SOM that present a potential risk to the land segments is used in conjunction with the attached oil spill, launch area maps. GIS stores any from of data including wing, hydrodynamic and other parameter data as input for the oil spill models calculations. Further data on biological resources habituating a region of interest and tactical response information can be incorporated for post spill impact.

Conclusions

System for oils oil spill risk assessment has been developed. The system composed detection and monitoring sub-system, spatial information system, and prediction. Contingency planning sub-system will later be embedded to the system. Contingency planning requires identification of the incident of concern; an impact assessment; a probability assessment; evaluation mitigation alternative; and development of procedures to implement the desired response operations. A successful combating operation to a marine oil spill is dependent on a rapid response from the time the oil spill is reported, until it has fully combated.

References

Marine Department Control of Oil Spill in Malaysian Water: Oil Spill Incidents in Malaysian, Water, Year 1975 - 1997.

Shattri, M.B. and Tee. 1998. Development of GIS-based oil spills risk management system, 4th Annual GIS Asia Pacific Conference, 13-15th October, PJ.

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