OIL SPILL TRAJECTORY MODELLING OF THE STRAITS OF MALACCA

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ABSTRACT

Heavy vessel traffic in the navigation route of the Straits of Malacca has posted great potential of marine catastrophy to this narrow water channel. The high frequent oil spill incidents from various sources has been recognized as one of the most severe source of sea-based pollution that degrades the invaluable coastal and marine resources of the Straits. The need of an effective oil spill contingency plan for the sustainable management of the Straits is clear and the availability of an accurate oil spill trajectory model is undoubtedly a helpful tool in this matter. The framework of an oil spill trajectory model OILTRAJ for the Straits of Malacca has been described and its accuracy verified for both short and long-term prediction.

OILTRAJ model has taken into account the effects of the wind induced current, background surface current and tidal current. Wind data can be obtained from measured/ forecast wind velocities or retrieved from the database of synoptic wind for the Straits. Effects of land-sea breezes are also taken into considerations for the near shore area. Data as compiled in the earlier reports on the background surface current have been used.

Tidal current has been considered as one of the important drift components in the Straits due to its rapidly changing magnitude and direction. The semi-diurnal type tidal effects are significant especially during short-term drift (less than 12 hours) of the oil spill. A more reliable and simple 1 dimensional tidal model has been used to replace the 2 dimensional tidal model to simulate the tidal current for the Straits of Malacca. The comparison of results between the tidal model and tide stations has shown good agreement in both magnitudes and phases and have indicated the reliability of the 1-D

tidal model for the Straits of Malacca. Verification studies of two field tests have justified the methods adopted in the OILTRAJ model. It has also been shown that each component of wind, surface current and tidal current is important for the short-term simulation of oil slick trajectory. Clearly satisfactory predicted results from an oil spill incident has also shown the validity of OILTRAJ model for long-term prediction of oil trajectory for the Straits of Malacca. Surface current has played the primary role in this long-term drifting and the availability of more accurate data will definitely increase the reliability of the OILTRAJ model.

ABSTRAK

Frekuensi yang tinggi untuk kes tumpahan minyak daripada asal usur yang berlainan telah pun dikenalpasti sebagai salah satu punca utama dalam pencemaran laut di Selat Melaka. Pelbagai sumber pantai dan laut yang tak ternilai semakin dimusnahkan. Maka, keperluan satu rancangan kontingensi yang berkesan untuk pengawalan tumpahan minyak adalah jelas dan model pergerakan tumpahan minyak pula pasti akan membantu dalam masalah ini. Idea dan struktur model pergerakan tumpahan minyak untuk Selat Melaka, OILTRAJ telah pun dibentangkan dan menpertingkatkan kejituan model untuk kegunaan jangka masa pendek dan panjang.

Model OILTRAJ telah mengambilkira kesan pergerakan arus yang disebabkan oleh angin, aliran arus permukaan dan juga pergerakan arus akibat kesan pasang surut air laut. Data untuk angin boleh diperolehi dengan cara pengukuran/ ramalan atau pun dari data angin sinoptik yang tersimpan dalam database. Kesan payu darat-laut juga diambilkira jika tumpahan minyak berada berdekatan dengan kawasan pantai. Data yang telah dikumpulkan untuk arus permukaan dalam laporan terdahulu telah juga digunakan.

Arus pasang surut air laut telah diambilkira dalam model OILTRAJ. Ini disebabkan arus tersebut bersifat semi-diurnal dan bertukar arah serta magnitud dengan pantas. Kesannya adalah jelas semasa ramalan jangka pendek (kurang daripda 12 jam). Satu model 2-dimensi telah pun digantikan dengan sebuah model 1-dimensi yang lebih jitu untuk menjangka arus akibat pasang surut air laut. Model untuk meramal pasang surut air laut telah mempamerkan keputusan yang baik dalam kedua-dua magnitud dan fasa apabila dibandingkan dengan data dari jadual yang berkenaan. Ini telah membayangkan

kejituan model 1-dimensi tersebut. Data eksperimen yang dilaksanakan di laut telah pun digunakan untuk menguji kesesuaian model OILTRAJ. Penyelidikan yang dijalankan telah menunjukkan kepentingan setiap komponen arus semasa ramalan jangka masa pendek. Output yang memuaskan juga telah ditunjukkan oleh model OILTRAJ dalam simulasi satu kemalangan laut yang melibatkan tumpahan minyak di Selat Melaka. Kejituan model ini telah dibuktikan. Arus permukaan telah memainkan peranan yang utama dalam ramalan jangka masa panjang tersebut dan data yang lebih jitu pasti akan meningkatkan lagi mutu simulasi model OILTRAJ.

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