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# Mid-long term probabilistic forecast of oil spill trajectories based on a logistic regression model

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During an oil spill crisis, numerical trajectory modelling represents an invaluable mean for decision makers. The time horizon of trajectory simulations is generally limited by the temporal extent (typically 3 to 14 days) of the met-ocean predictions used as environmental forcings in the oil spill model. However, unfortunately, some recent major oil spill accidents (e.g. the Deepwater Horizon and the Prestige cases) demonstrated that the oil drift through the sea may persist up to several weeks or months. In order to face the limitations that the traditional met-ocean forcing predictions may represent for the oil spill modelling in such situations, we present here a novel statistical methodology for probabilistic predictions of oil spill trajectories in the mid-long term (1-6 months).
The proposed methodology is based on a combination of clustering techniques and logistic regression, a statistical technique that allows to model the value of a categorical variable for varying values of some relevant predictor variables. The method encompasses the following steps:
1) Characteristic pattern extraction from historical databases of wind and currents (the main oil slick drivers in the open ocean).
2) Fitting of a logistic regression model for the simulation of the extracted met-ocean patterns considering relevant predictors (such as sea level pressure conditions and seasonality).
3) In case of an oil spill event, future wind and current conditions can be simulated using the fitted logistic regression model during the next months (1-6 months).
4) These predicted met-ocean conditions are finally used to force an oil spill Lagrangian trajectory model during the selected forecasting period. In order to consider the probabilistic nature of the logistic regression results, several oil spill trajectory model runs are required.
5) As a final result a probabilistic map of oil spill trajectories is generated.

To test the capabilities of the proposed methodology, we apply it to one of the major oil spill disasters of the recent history, the Prestige accident (Eastern North Atlantic, 2002). Favorable comparison between the obtained results and observational oil slick data shows the capabilities of the proposed methodology.