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# Using a global ocean circulation model to conduct a preliminary risk assessment of oil spills in the Atlantic

Zoe Jacobs (1,2), Katya Popova (2), Joel Hirschi (2), Andrew Coward (2), Andrew Yool (2), Simon van Gennip (2), Babtunde Anifowose (3), and Liam Harrington-Missin (3)

(1) University of Southampton, United Kingdom (zlj1e13@soton.ac.uk), (2) National Oceanography Centre Southampton, United Kingdom, (3) Coventry University, United Kingdom, (4) Oil Spill Response Ltd, Southampton, United Kingdom

Although oil blowouts from deep-water drilling happen very rarely, they can cause catastrophic damage to the environment. Despite such potentially high impacts, relatively little research effort has gone into understanding subsurface oil plumes in the deep ocean. In this study, we demonstrate the significance of this problem and offer potential solutions using a novel approach based on a leading-edge, high-resolution global ocean circulation model. We present examples demonstrating: (a) the importance of ocean circulation in the propagation of oil spills; and (b) likely circulation footprints for oil spills at four key locations in the Atlantic Ocean that exist in different circulation regimes – the shelves of Brazil, the Gulf of Guinea, the Gulf of Mexico and the Faroe-Shetland Channel. In order to quantify the variability at each site on seasonal timescales, interannual timescales and at different depths, we utilize the Modified Hausdorff Distance (MHD), which is a shape-distance metric that measures the similarity between two shapes. The scale of the footprints across the four focus locations varies considerably and is determined by the main circulation features in their vicinity. For example, the hypothetical oil plume can be affected by variations in the speed and location of a particular current (e.g. Brazil Current at the Brazilian shelf site) or be influenced by different currents entirely depending on the release depth, month and year (e.g. Angola Current or Southern Equatorial Current at the Gulf of Guinea site). Overall, our results demonstrate the need to use state of the art global, or basin-scale, ocean circulation models when assessing the environmental impacts of proposed oil drilling activities.