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How do Ocean Conditions Influence Potential Oil Spills in the Faroe-Shetland Channel?

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Oil and gas exploration is well established in the Faroe-Shetland Channel (FSC, north of Scotland) and gradually pushing into deeper waters. The FSC is a complex physical system, host to strong currents, internal waves, and a unique stratification structure. Previous oil spill literature is either not regionally applicable, or unable to quantify the sensitivity of a spill to these processes. This regional numerical modelling study highlights the response of a large spill to ocean hydrodynamics, and investigates how changes in forcing parameters impact its trajectory and fate.

Six oil spill simulations are performed using Oil Spill Contingency and Response (OSCAR), with hydrodynamic forcing from Met Office operational shelf models. 258,000 cubic metres of oil are released alongside natural gas below the surface for nine days. OSCAR is run for a further three weeks to investigate how the pollutant is dispersed. A control run simulates oil and gas released in the centre of the FSC during February 2017 using a 1.5 km resolution shelf model (FOAM AMM15 NWS). Five additional simulations are carried out with different release locations, seasonal stratifications, and forcing model resolution.

Oil that has surfaced is typically transported north-eastward towards the Nordic Seas. Surface slicks pose an enhanced risk to the southern Norwegian coastline if transported onto the shelf. Below the surface, oil tends to travel westward through the Faroe-Bank Channel (FBC) and further into the North Atlantic. Sedimentation occurs within the FBC, and on both the West Shetland and Faroe Slopes. Comparison with a simulation forced with a coarser 7 km resolution shelf model (FOAM AMM7 NWS) shows that surface slick dispersion is enhanced by mesoscale eddies.

This study highlights the sensitivity of spills to ocean conditions in this highly dynamic environment. By reducing uncertainty in response simulations, industry can save significant environmental and financial costs in the event of an emergency.