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Different dispersal mechanisms of subsea dispersant injection in deepwater and shallow water blowouts

Subsea dispersant injection (SSDI) is a response option that involves injecting dispersant directly into the leaking well stream. The immediate effect is a reduction of the oil-water interfacial tension, leading to a reduced droplet size in the jet created by the well stream emerging into seawater. Especially after Deepwater Horizon, it has become general knowledge in the oil spill community that reduced droplet size from SSDI aids overall surface oil dispersal as smaller droplets surface over a larger ocean area. This mechanism alone would imply that SSDI is less effective for shallow water blowouts, where small and large droplets alike are rapidly lifted to the surface by expanding gas. However, recent work has shown that there are additional mechanisms involved for SSDI which implies that SSDI would be effective also for shallow water blowouts. These mechanisms are that residual dispersants I) enhance dispersion by waves through the reduced interfacial tension, and ii) reduce emulsion water uptake. In this study, we compare two blowouts with SSDI with identical oil and gas rates, where the main difference is that one occurs in deep water and another in shallow water. We show how the mechanisms of reduced droplet size, enhanced surface dispersion, and reduced water uptake are different between the two scenarios, and the implications this has for the fates of these two types of blowouts.