Abstract Submitted
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Large-eddy simulation study of oil/gas plumes in stratified fluid with cross current.[1] DI YANG, SHUOLIN XIAO, University of Houston, BICHENG CHEN, Pennsylvania State University, MARCELO CHAMECKI, University of California, Los Angeles, CHARLES MENEVEAU, Johns Hopkins University — Dynamics of the oil/gas plume from a subsea blowout are strongly affected by the seawater stratification and cross current. The buoyant plume entrains ambient seawater and lifts it up to higher elevations. During the rising process, the continuously increasing density difference between the entrained and ambient seawater caused by the stable stratification eventually results in a detrainment of the entrained seawater and small oil droplets at a height of maximum rise (peel height), forming a downward plume outside the rising inner plume. The presence of a cross current breaks the plume's axisymmetry and causes the outer plume to fall along the downstream side of the inner plume. The detrained seawater and oil eventually fall to a neutral buoyancy level (trap height), and disperse horizontally to form an intrusion layer. In this study, the complex plume dynamics is investigated using large-eddy simulation (LES). Various laboratory and field scale cases are simulated to explore the effect of cross current and stratification on the plume dynamics. Based on the LES data, various turbulence statistics of the plume are systematically quantified, leading to some useful insights for modeling the mean plume dynamics using integral plume models.

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