

Modeling Gas Separation From a Bent Deepwater Oil and Gas Jet/Plume By Fanghui Chen and Poojitha D. Yapa *

Department of Civil and Environmental Engineering
Clarkson University, Potsdam, NY 13699, USA.
e-mail: pdy@clarkson.edu

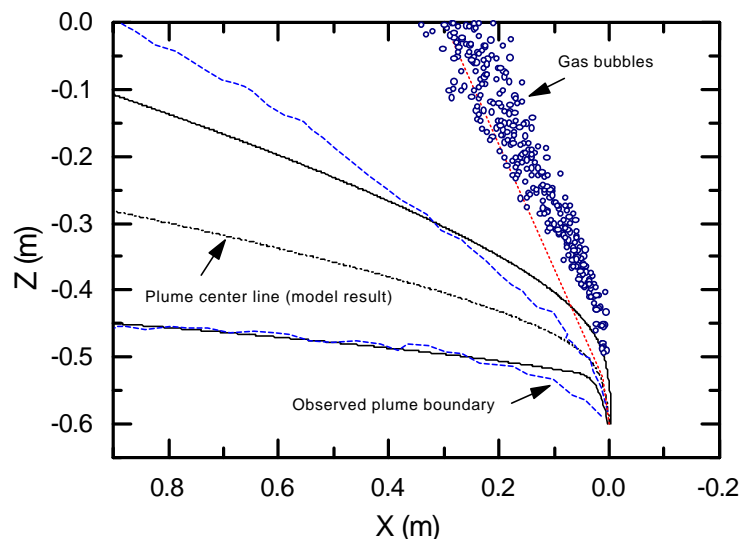
Abstract

Socolofsky et al. (1999) and Hugi (1993) observed that gas could separate from the main jet/plume of an oil and gas mix under certain ambient cross flow conditions. There are locations in deepwater where cross currents are significant (e.g. Gulf of Mexico). Out of the few models available for oil and gas behavior simulation under deepwater conditions only one (Johansen, 2000) can take into effect the separation of gases from the main jet/plume.

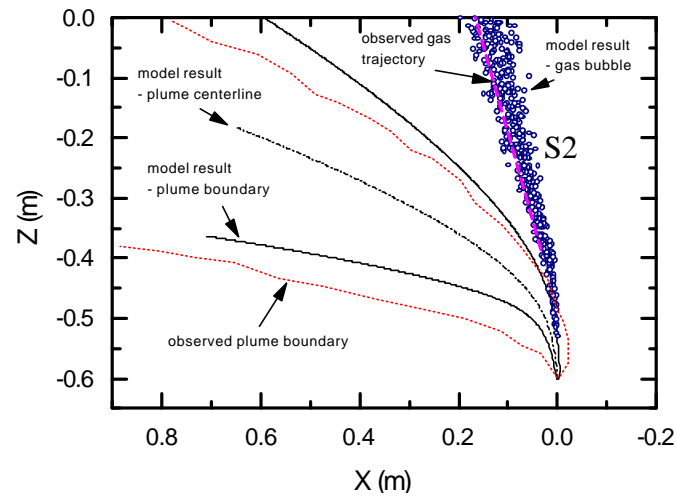
A strong ambient current causes a jet/plume to bend. Because gas rises faster than oil, it can separate from the bent plume. This gas separation can lower the neutral buoyancy level of plume. Consequently, the overall trajectory of the oil droplets underwater and slicks at the water surface may vary significantly because the location of transition of the jet/plume mixing to the far-field turbulent mixing has drastically changed.

In this paper, the turbulent, multi-phase (oil and gas) jet/plume in a cross-flow is modeled by using the integral Lagrangian control volume method. A comparison of the model results with the experimental data shows good agreement. A scenario for a deepwater blowout simulation shows that taking gas separation into account is very important in a bent plume.

Keywords: Gas separation; Multi-phase plumes; Jets in crossflow; Oil and gas jet/plumes



Multi-phase plume in cross flow for case S1: numerical simulation – present model; experimental data from Socolofsky et al., (1999).



Comparisons of multi-phase plumes in crossflow simulations with observations for cases S2 through S10 (experimental data from Socolofsky et al. 1999).

