Abstract

Oil released in a deepwater blowout breaks up into droplets. Hence, the time it takes for oil to reach the water surface, its location, and the size of the surface slick at a given time, are all affected by oil droplet sizes. Information on oil surfacing time, its location, and slick size are essential for emergency spill response as well as contingency planning. Despite the importance of the oil droplet size on oil fate in many oil spill problems, our ability to estimate oil droplet sizes has been poor. In this paper, methods are developed for a deepwater oil spill model to estimate the oil droplet size distribution generated due to an accidental release. Models for estimating oil droplet size distribution generated by a deepwater release are developed based on the maximum entropy formalism (MEF). The quality of results depends on the constraint equations used. The paper shows results using only the mass balance and specific surface area as constraint equations. The latter case showed markedly improved results. Model results for droplet size distribution are compared with limited experimental data.

Introduction

In the last two decades, the increase in offshore oil and gas exploration and production in deeper waters (800m or more) increased the chance for a deepwater blowout. Models have been developed to meet the challenges of minimizing the impact from an oil spill or for contingency planning, e.g. DEEPBLOW (Johansen, 2000), CDOG (Zheng et al., 2003; Yapa and Chen, 2004.), and OILMAPDEEP (ASA website – www.appsci.com). Field experiments were also carried out for model calibration and verification (Johansen et al., 2001; Johansen et al., 2003; Chen and Yapa, 2003) and to understand the underlying physics. A difficulty in these numerical models is the estimation of the oil droplet size distribution. Oil that escapes from a well blowout or pipeline rupture, breaks up into droplets. The size of these droplets influences if and when they will reach the surface or remain dispersed in the water for a long time. Therefore, the ability to estimate the oil droplet size distribution is key to getting good model results. In turn, the model results will aid contingency planning and response during an accidental spill.

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