Clarification: By flow I meant buoyancy flux

ira leifer to: Bill Lehr 05/25/2010 09:05 AM

Cc: Marcia K McNutt, Poojitha Yapa, pete, Lori Caramanian, Paul Bommer, Peter Cornillon, "savas@newton.berkeley.edu", "Pedro I. Espina", Franklin Shaffer, "Steven Wereley T.", Alberto Aliseda, James J Riley, Juan Lasheras, ira leifer

Dear Colleagues,

Thinking about what I wrote, I would like to clarify slightly what I meant by "flow" in the context of this complex three phase flow. To be precise, the plume expansion rate (entrainment rate) is related to the buoyancy flux. Other proxies could be used, such as the growth rate of turbulence structures, but would require more intensive analysis and introduce additional parallax uncertainty.

To first order, the effect of oil on the buoyancy flux is the same as entrained water, thus the oil's impact on plume dynamics to first order can be considered the same as for a non-oily plume (i.e., virtually all of the literature).

To second order, oil affects the bubble's boundary conditions, affecting momentum transfer from the bubbles to the surrounding flow. Given the variability in the system, I think that comparatively, this is a small effect. And of course, because of oil's surface activity, it does not detrain from the plume as water would.

Hydrate formation clearly adds an additional time-dependent reduction on the buoyancy flux; however, published field studies with Gregor Rehder and MBARI a number of years ago suggest that for bubbles in the millimeter size (ours appear smaller), hydrate formation occurs primarily as a thin skin on the bubbles, and has negligible effect on the hydrodynamics, although it does decrease the mass exchange rate dramatically.

Sorry not to be sufficiently precise in the previous email.

Warmest regards,
Ira

On May 25, 2010, at 5:02 AM, ira leifer wrote:

> Dear Colleagues,
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> To my view, having the entire hard drive of data at NOAA provides an
> important level of independence, particularly to ensure that
> sections for analysis are selected either randomly or scientifically.
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> Given the time constraints and data volume, one approach to
> evaluating the significant temporal variability is to "calibrate"
> the plume expansion rate (i.e., entrainment during the acceleration
> phase) to flow from DPIV for a range of conditions, and then use the

> plume dimensions as a proxy for quantifying variability. This could
> significantly decrease the computational overload.
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> Ira
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> On May 25, 2010, at 4:48 AM, Franklin Shaffer wrote:
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>> Martha and Team,
>> I agree with the process Bill has chosen -- having the entire hard
>> drives sent to him overnight. I just wanted to make two points.
>> First that handling and editing this kind of video is not something
>> new. We're not pushing the state-of-the-art. It's done all the
>> time in the video industry. So it's just a matter of getting the
>> right off-the-shelf equipment and expertise. I have been involved
>> with some of the fastest high speed cameras that produce huge
>> amounts of data, so I have an idea of what is available for data
>> transfer and editing. The second point is that we need to have
>> video samples long enough to account for flow rate variation. I'm
>> new to the team, so perhaps this has been discussed already.
>> But again, I agree that Bill is doing the right thing -- getting
>> all of the video into our hands.
>> Thanks,
>> Frank