Advances in Drifters Used to Study Ocean Currents and Pollutant Transport

Guillaume Novelli
University of Miami

OIL SPILL SCIENCE SEMINARS
Technology used to study oil spills, Part 2

August 2018 | Ocean Springs, MS
Consortium for Advanced Research on the Transport of Hydrocarbons in the Environment
Where does the oil come from?
Where will it go?
How fast does it spread?

Monitoring
Prediction
Model evaluation and enhancement
How to measure ocean surface currents, at high frequency, accurately, and over large domain?

Surface Drifting Buoys aka Drifters

CODE/Davis drifter

SVP drifter

Lumpkin et al.
Advances in the application of surface drifters
2017
Annual Review of Marine Science
What about oil drifters?

Goodman et al.
Tracking buoys for oil spills
1995
International Oil Spill Conference

Reed et al.
The role of wind and emulsification in modeling oil spill and surface drifter trajectories
1994
Spill Science & Technology Bulletin
More oil drifters used recently during oil spills

IESM-PTR

©le cedre

Air-deployed Far Horizon Drifters

Sharma et al. 2010

Garcia-Ladona et al. 2016

SVP/CODE hybrid
Specifications for massive scale deployment (> 1000 units)

1. Biodegradable in the ocean/on the coast
2. Easy operation (assembly, handling)
3. Small form factor (for storage)
4. Industrial production technique
5. Reliable, accurate, calibrated instrument
100% Biodegradable Shell – Non-Toxic Electronics

- Bio-based PHA resin
- Same physical properties than petroleum-based resins
  - Injection molding grade
  - No water absorption
- Biodegrade in aerobic and anaerobic seawater conditions
- Estimated 3-5 years to fully degrade in the ocean.

Diam. X Draft
0.40 m x 0.60 m

Diam.
X
DraP
0.40
t
0.60	m
Few Parts, Easy to Store and Assemble
100 drifters tested before deployment
Laboratory tests show minimal influence of waves and wind on the drifter motion.

![Graph showing the influence of waves and wind on drifter motion](image)

The graphs illustrate the comparison of different types of drifters: Rigid neck drifter, Floater, and CARTHE drifter, under varying conditions of wind speed $U_{10}$ (m/s). The $U/U_0$ ratio is plotted against $ka$, where $U$ is the drift velocity, $U_0$ is the wind speed, and $ka$ is the wave number. The $U_{slip}$ (cm s$^{-1}$) is also shown against $U_{10}$ (m s$^{-1}$).
Trajectories in the ocean nearly identical to that of the CODE drifter for > 1000 miles
Air-deployment tests during development of biodegradable parachute and release system
1000 deployed in the GoM in 2016, 500 in 2017

Novelli et al. 2017
Evidences of Oil Tracking Capability (in prep.)

OHMSETT tank

Same landing locations DWH oil and drifters
SUMMARY: TECHNOLOGICAL ADVANCES

- CARTHE drifter was developed to measure near-surface currents on a massive scale
- Biodegradable
- Calibrated
- Used all around the world (available commercially) for oceanographic and pollution studies
- Used to evaluate models and remote-sensing instruments

© greenwave instruments
ACKNOWLEDGMENTS

• GOMRI and CARTHE for generous support over the years

• Multidisciplinary team effort:
  Tamay Ozgokmen, Cedric Guigand, Ed Ryan,
  Charles Cousin, Brian Haus, Nathan Laxague,
  Bjoern Lund... and many others