



Lagrangian Observations of the Tropical Atlantic Ocean

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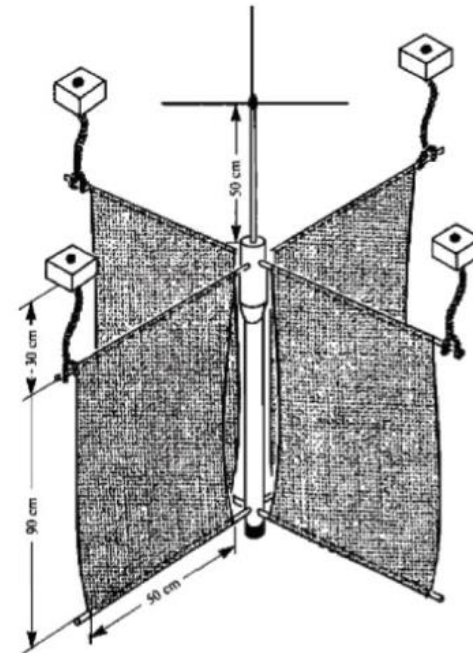


Tropical Atlantic Observing System workshop

Portland, Oregon

8-9 February 2018

1. Surface drifters

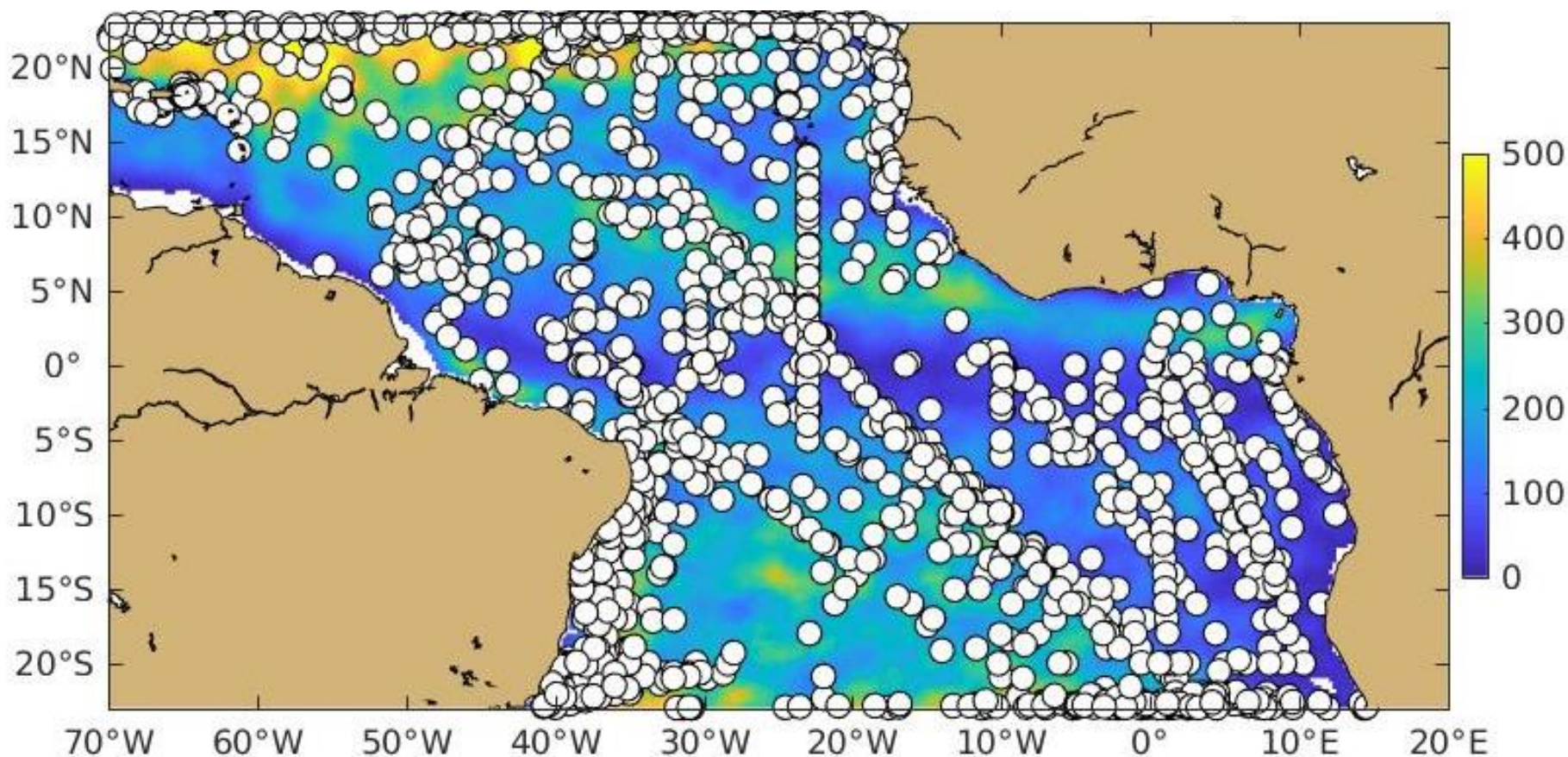


Global Drifter Program (GDP)

GDP deployments in the Tropical Atlantic:

- Ship of Opportunity (SOOP) lines AX7, AX8.
- PIRATA research cruises (US, French, Brazilian).
- Brazilian navy cruises (western TA).
- GO-SHIP cruises, esp. A05, A06, A10, A13, A16.
- UK MetOffice: both North and Tropical Atlantic.
- Collaboration with two Senegalese research inst. and Italy's National Inst. of Oceanography.
- Misc.: ex in 2018, 5 drifters will be deployed in Gulf of Guinea in collaboration with GEOMAR and the Wildlife Conservation Society.

GDP drifter deployments and data density

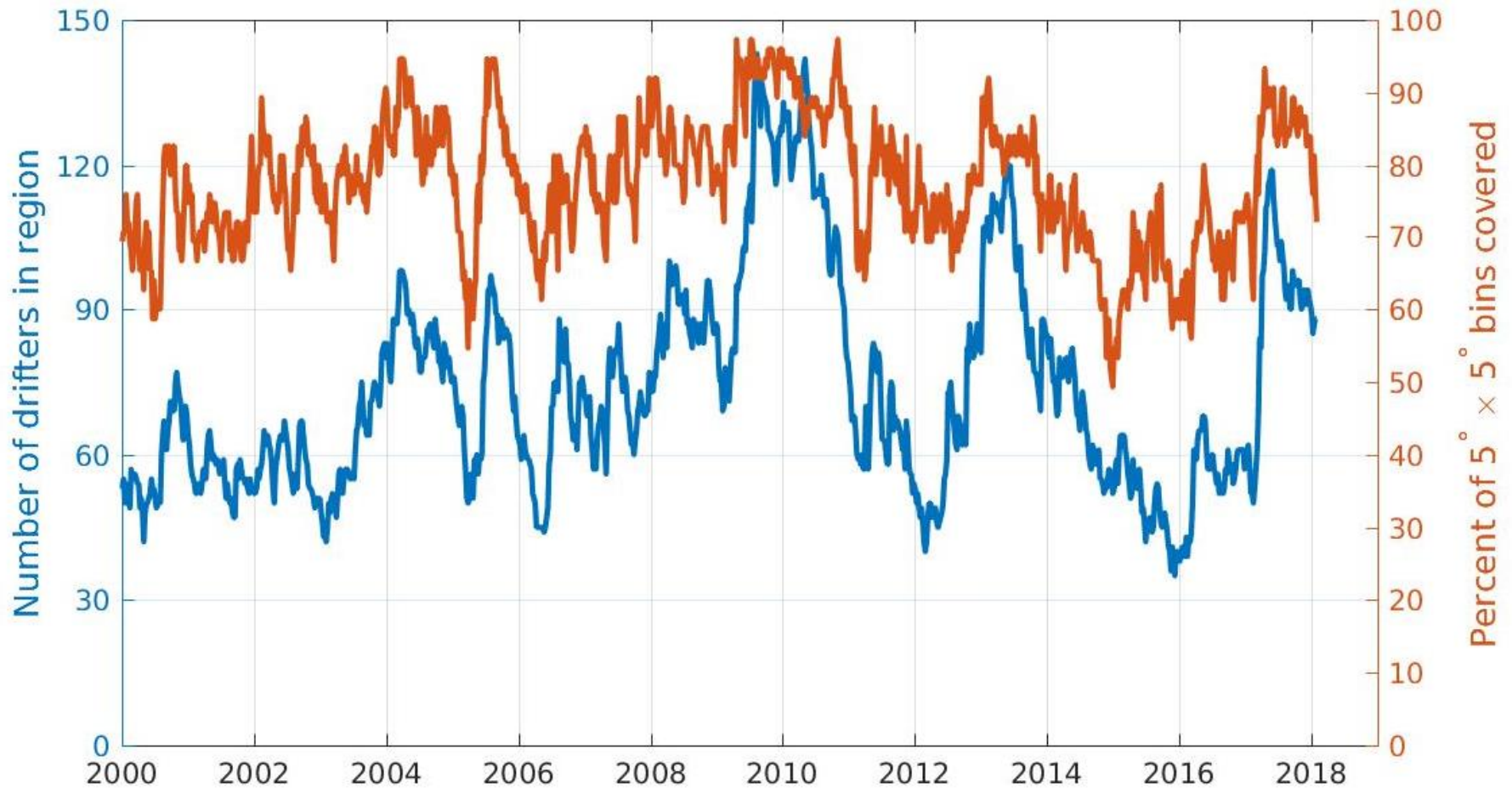


Shading: historical density of data, drifter days per square deg.

“Deployments” include drifters entering region.

Average number of new drifters: 5.1 per month since 2006.

Time series of data coverage in TA



Other types of GDP drifters

Thermistor chain drifter: T every 15m to 150m. May not diverge from equator, but will move differently than standard GDP drifter. So far deployed almost exclusively in paths of hurricanes and typhoons.

Salinity drifter: measures salinity at base of surface float. Many deployed during SPURS.

Wave drifter: new experimental design – gives wave directional spectrum using GPS observations. In future, all GDP drifters could become wave drifters after drogue is lost.

Major gaps:

Equatorial TA: strong surface divergence means short residence times. Solution: rely on other Lagrangian platforms, and emphasize value of equatorial drifter deployments.

Gulf of Guinea: hard to find sustained opportunities east of AX8.

Lagrangian Submesoscale Experiment (LASER) drifter



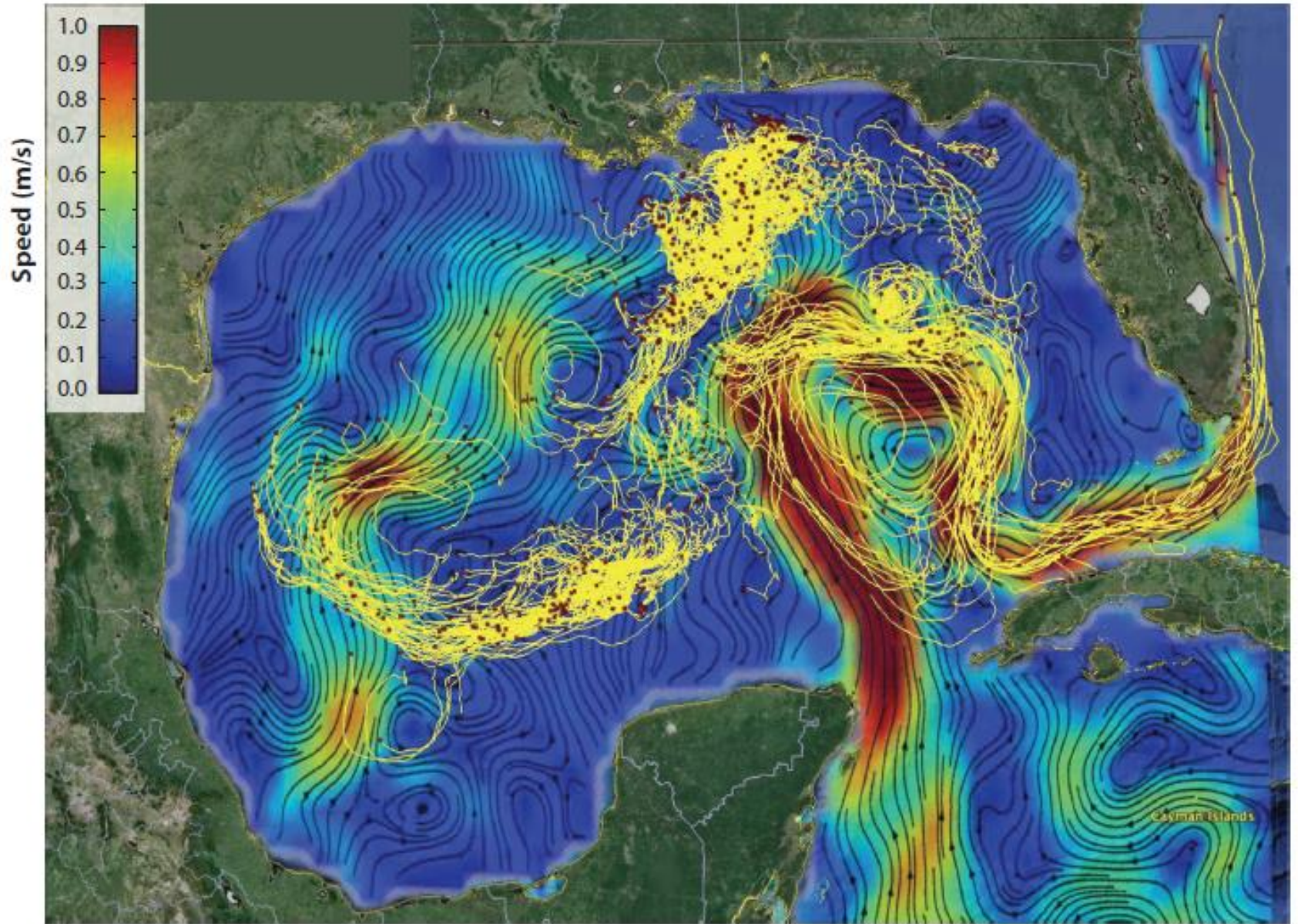
(a) the LASER drifter.

(b) LASER drifter testing in the University of Miami wave tank.

(c) A LASER drifter being used during an oil spill exercise.

For more, see <http://carthe.org>.

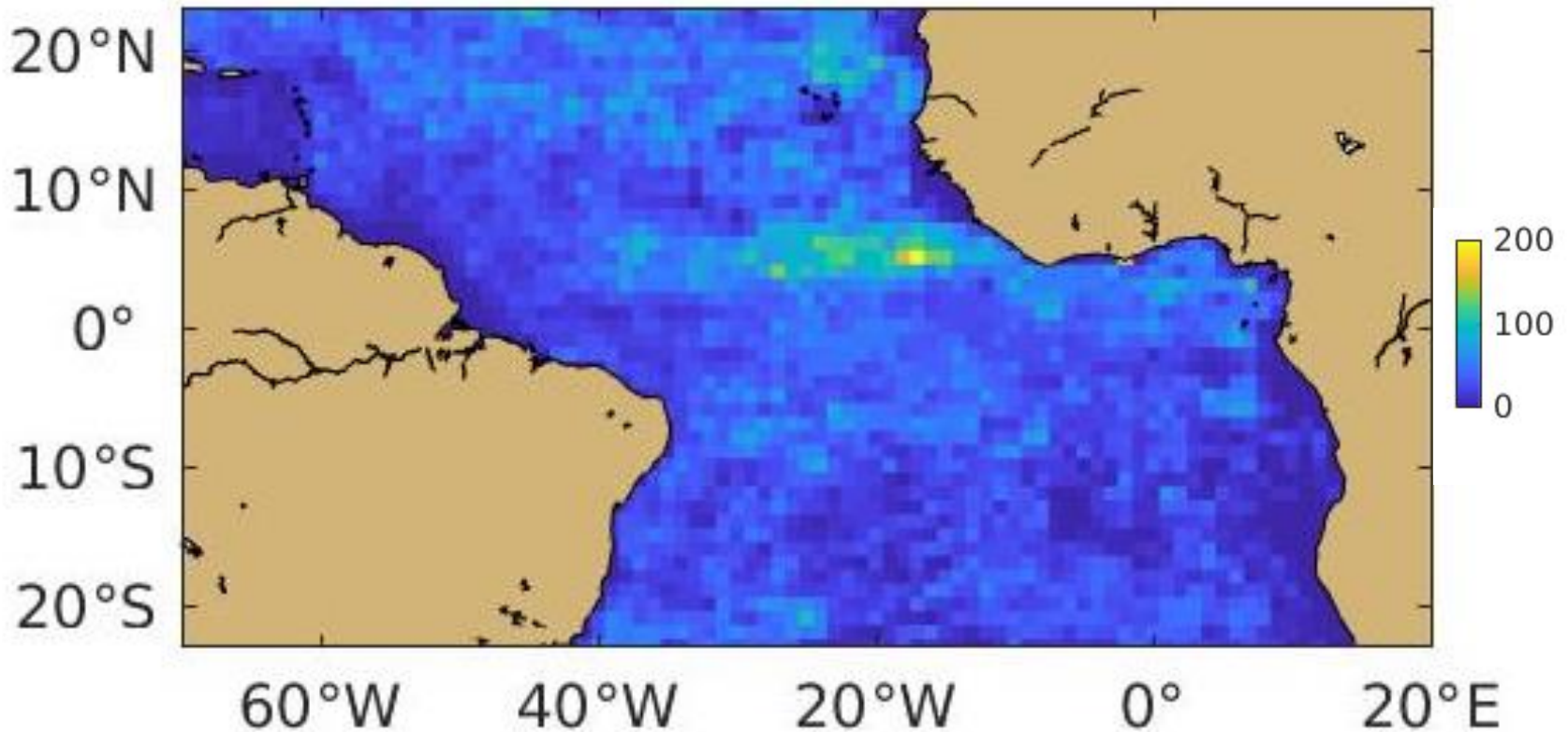
[Lumpkin et al., 2017]



LASER: ~1000 drifters deployed in Gulf of Mexico in winter 2016.

2. Argo floats: velocity observations

Data source: YoMaHa (IPRC), data through February 2017.

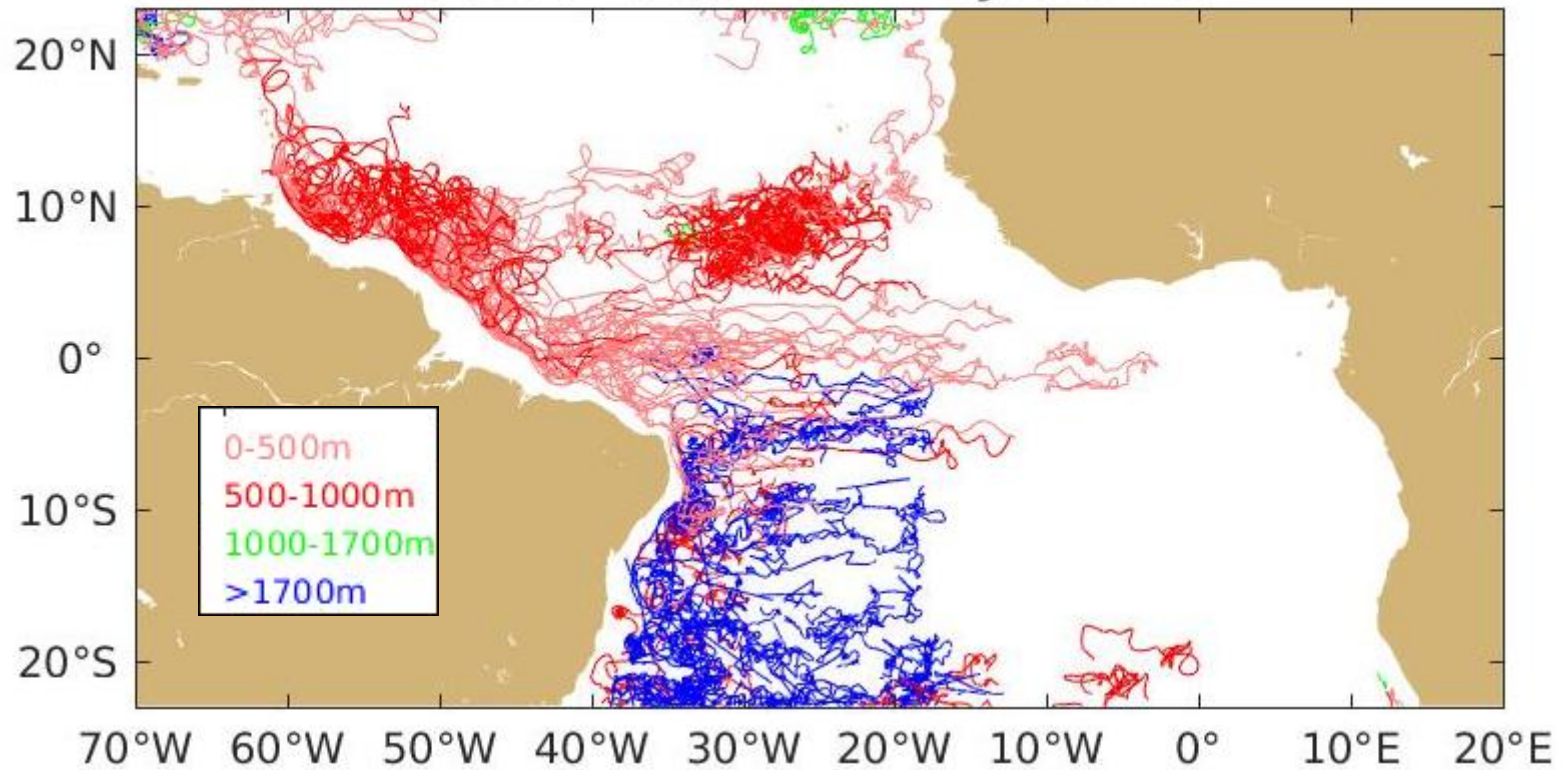


Shading: float-derived velocity observations per square degree at the surface (parking depth velocities have very similar distribution).

3. Acoustically-tracked floats

Data source: WOCE Subsurface float DAC.

Subsurface float trajectories



Summary: what we have now

The Global Drifter Program collects Lagrangian observations over much of the Tropical Atlantic thanks to collaborations with SOOP, PIRATA, GO-SHIP, and various agencies. Observations are relatively sparse on the equator and in the Gulf of Guinea.

Argo float displacements are far more sparse than drifter velocities, but do not exhibit significant equatorial divergence.

Field campaigns such as the Deep Basin Experiment have collected acoustically-tracked trajectories at depth in some limited parts of the Tropical Atlantic.

Summary: future needs

Other types of drifters could be used for targeted observations. For example, thermistor chain drifters might not diverge significantly from the equator, and would provide many more near-surface observations than Argo floats.

Deployment partners and opportunities are needed to sustain drifter deployments in the Gulf of Guinea.

Much of the Tropical Atlantic remains unsampled by acoustically-tracked floats. Future efforts will reveal much about deep transport pathways, particularly east of the Mid-Atlantic Ridge.