Ocean Surface Velocity Impact on Ocean Prediction

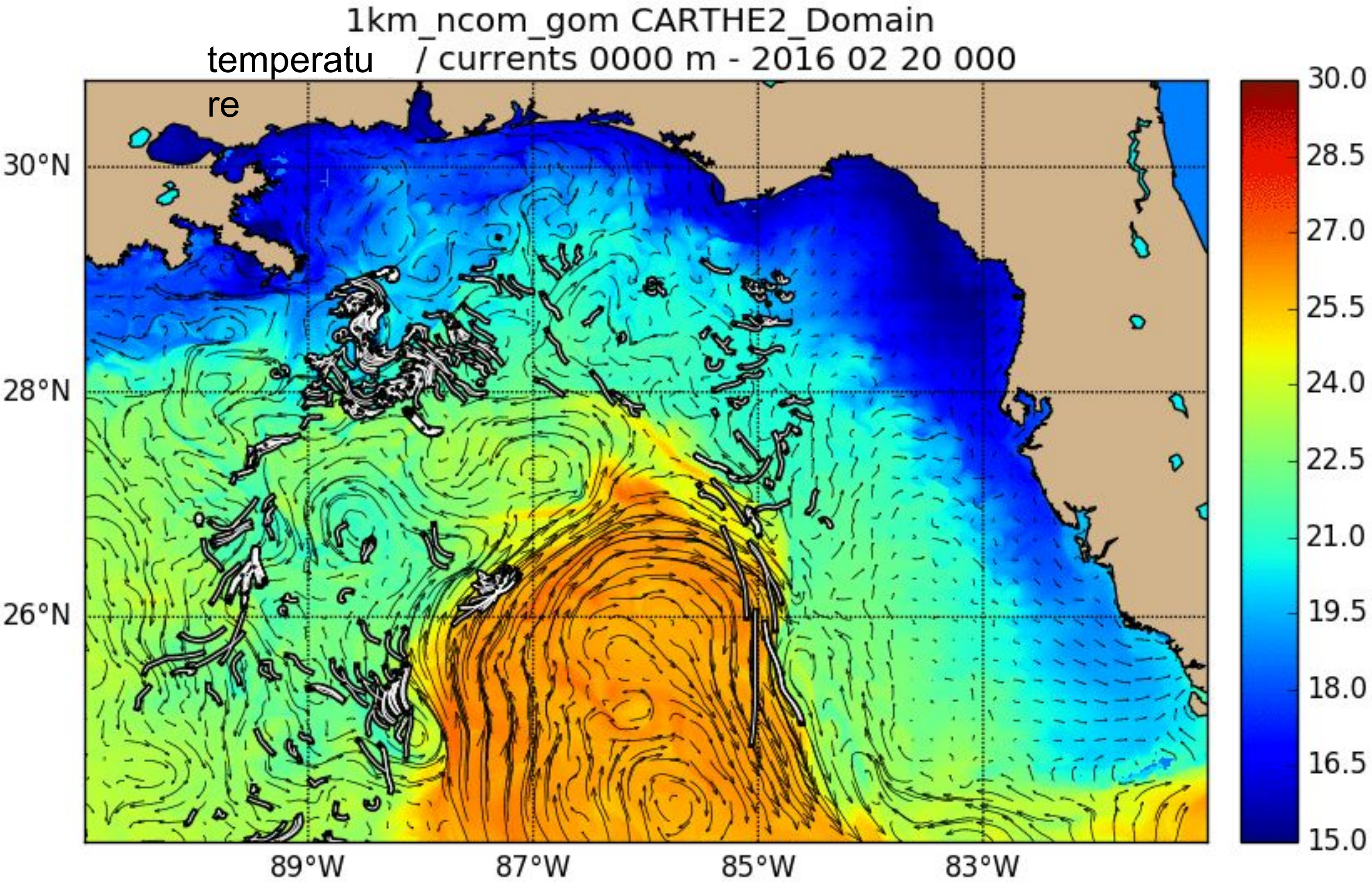
- Observation density limits ocean prediction skill
- Surface velocity observations have substantial impact throughout the water column including temperature and salinity

Jacobs, Gregg, Joseph M. D'Addezio, Hans Ngodock, and Innocent Souopgui. "Observation and model resolution implications to ocean prediction." Ocean Modelling 159 (2021): 101760.

Helber et al., Ocean Drifter Velocity Data Assimilation, Part 1: Formulation and Diagnostic Results, submitted to Ocean Modelling (2022)

Smith et al., Ocean Drifter Velocity Data Assimilation Part 2: Forecast Validation, submitted to Ocean Modelling (2022)

A dense independent ocean observation data set



We are limited by sparse data

- We can show errors at large scales (> 220 km) are smaller than the variance. Observations constrain features in forecasts.
- At smaller scales, errors are larger than variances. Observations leave features unconstrained.
- Satellite and in situ data density limit skill.

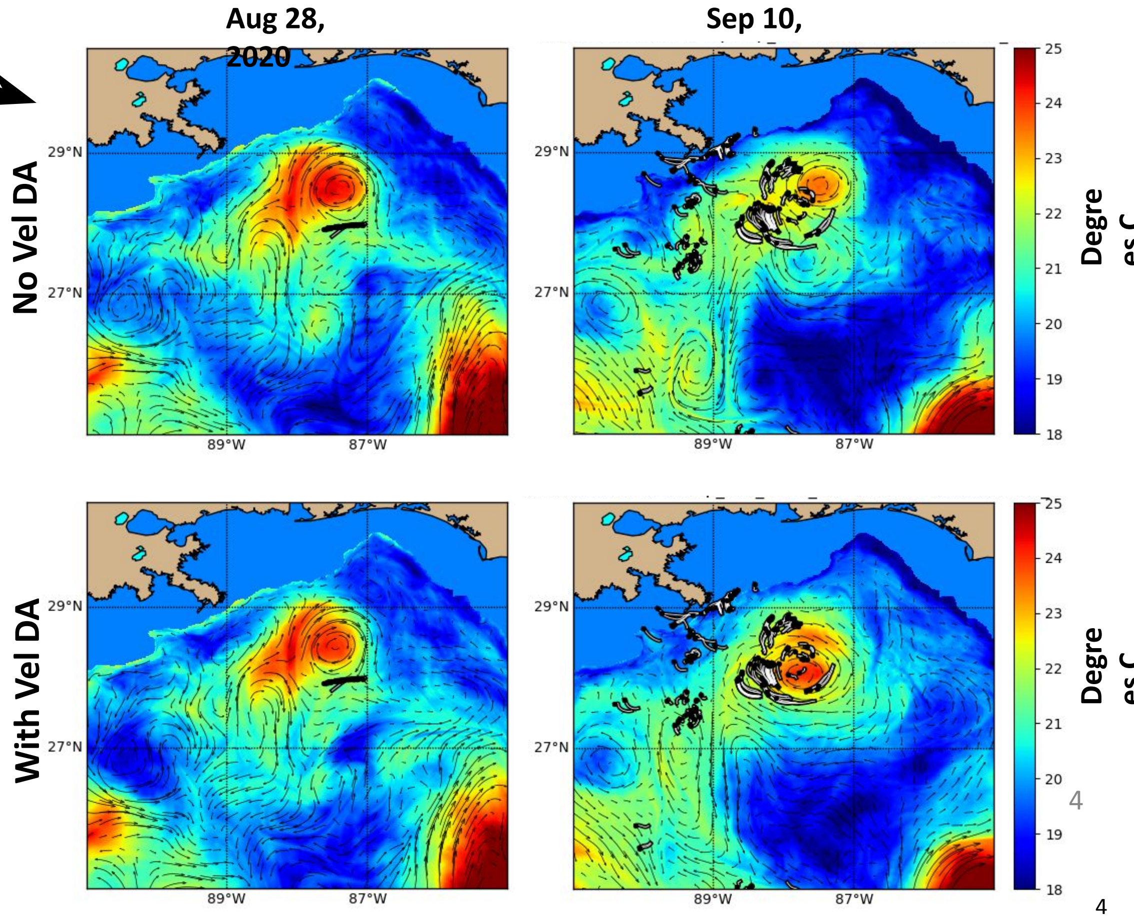
Demonstration of surface velocity impact

Temperature at 100 m Depth

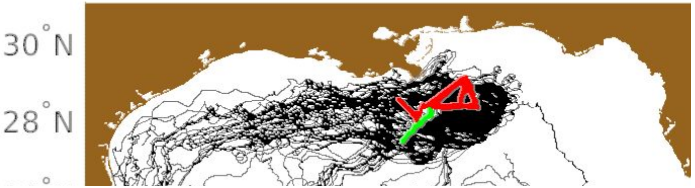
Surface drifters deployed as part of DARPA Ocean of Things

Inferred velocity corrects model daily

Velocity -> geostrophy -> geopotential -> T&S vertical covariance



Comparison to independent glider



RMS errors	T (°C)	S (PSU)	U (m/s)	V(m/s)
No Vel DA	0.865	0.222	0.128	0.198
With Vel DA	0.733	0.183	0.103	0.078