Oceanic Data Assimilation & Impacts of Ocean Observations on Hurricane Prediction

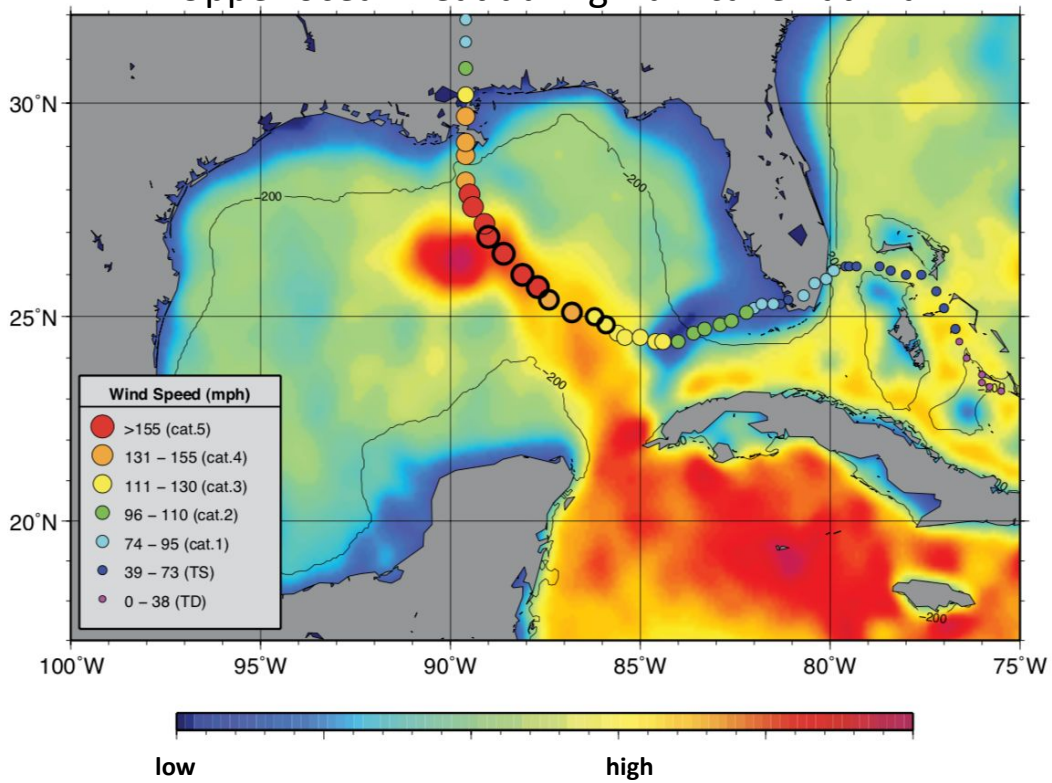
Matthieu Le Hénaff (PhOD)

Contributors: Lew Gramer (HRD/CIMAS)

Atlantic Oceanographic & Meteorological Laboratory
National Oceanic and Atmospheric Administration
U.S. Department of Commerce

Hurricanes: The Ocean Matters

Upper ocean heat during Hurricane Katrina

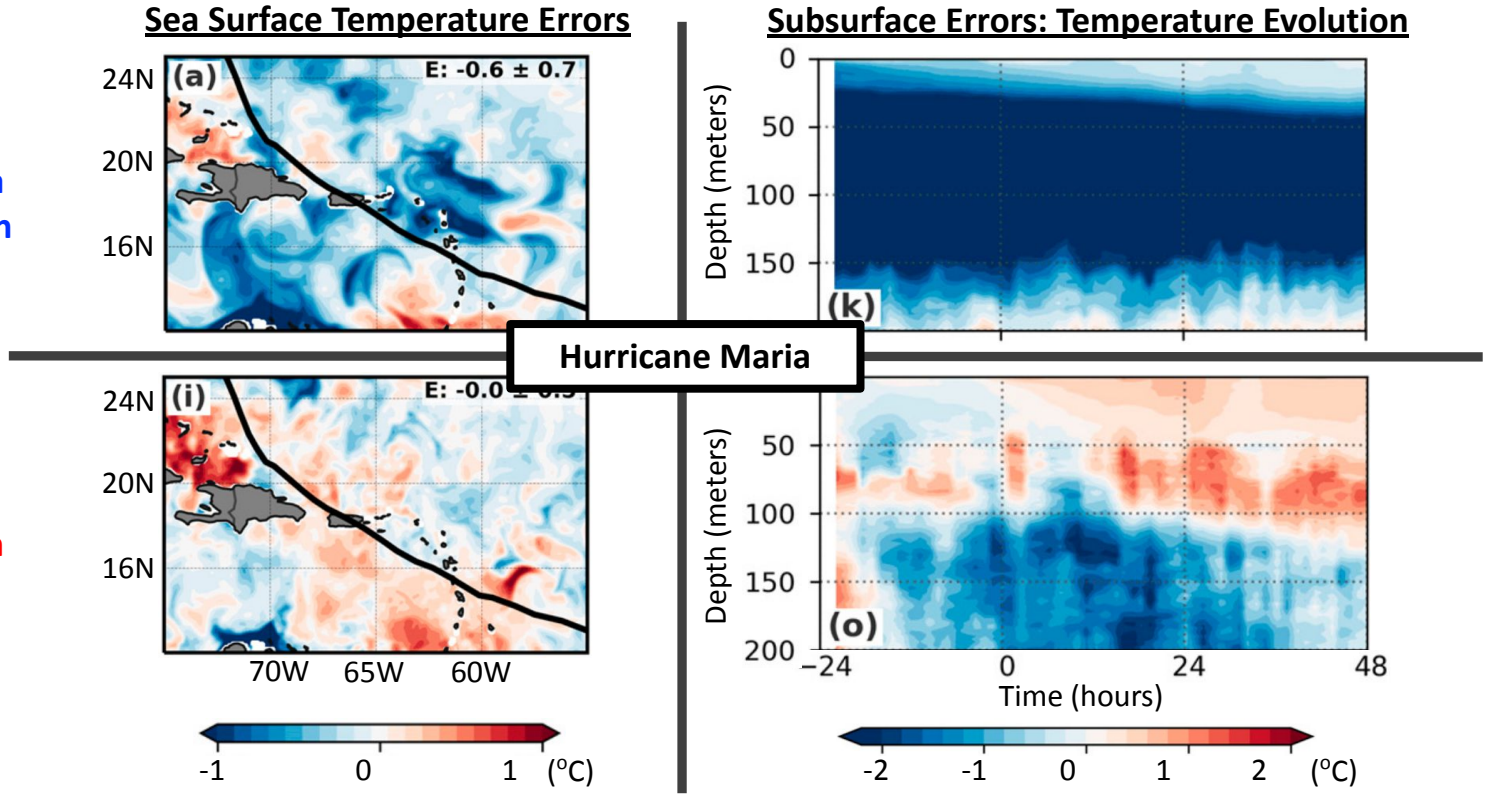


- **Ocean** features **impact hurricane intensity**
- **Sea Surface Temperature** + ocean **vertical structure** are important
- Hurricane models should account for **correct representation** of the ocean

Observation Impact: Ocean Analysis

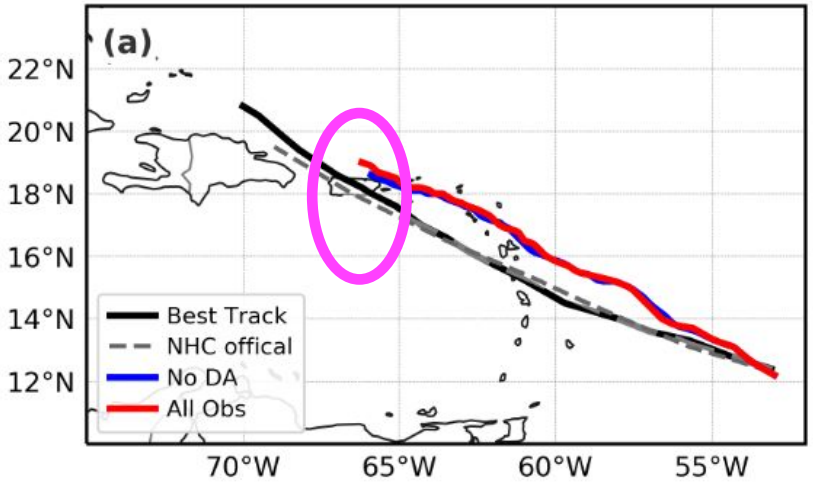
Without ocean data assimilation

With ocean data assimilation



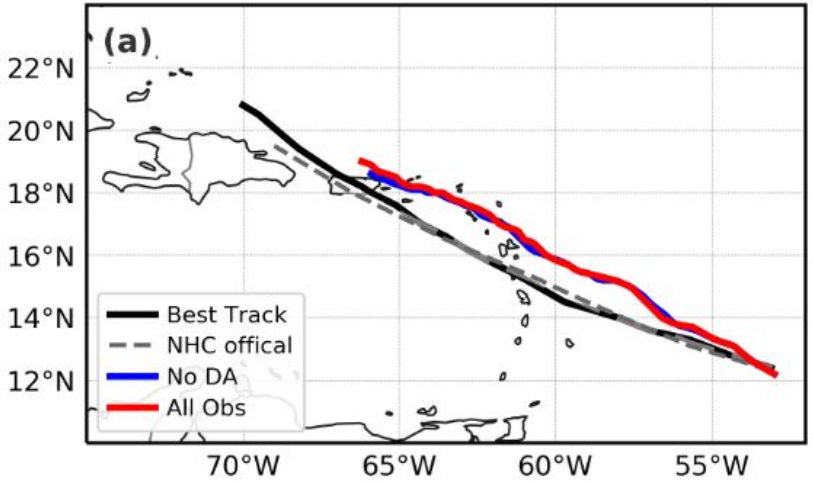
Observation Impact: Hurricane Maria

Track Comparisons

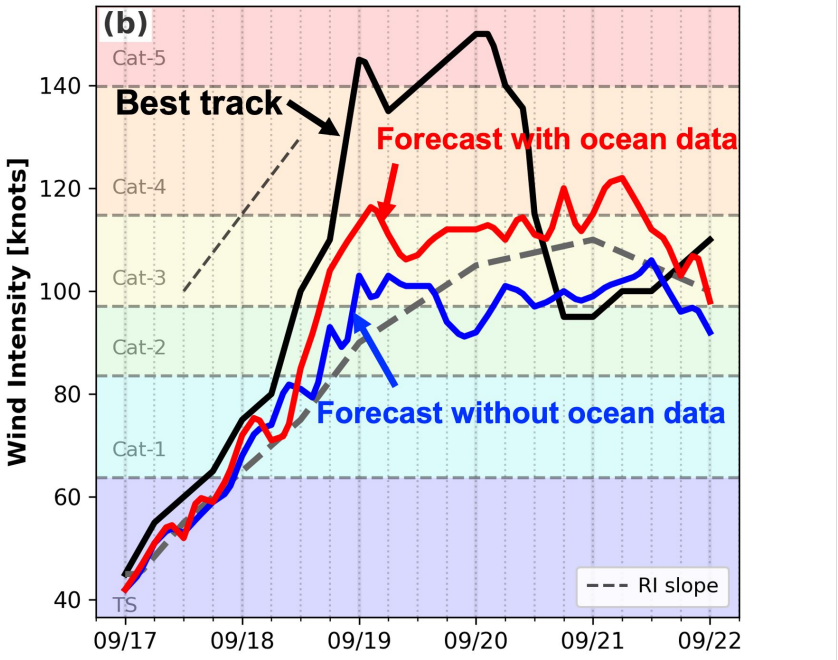


Observation Impact: Hurricane Maria

Track Comparisons



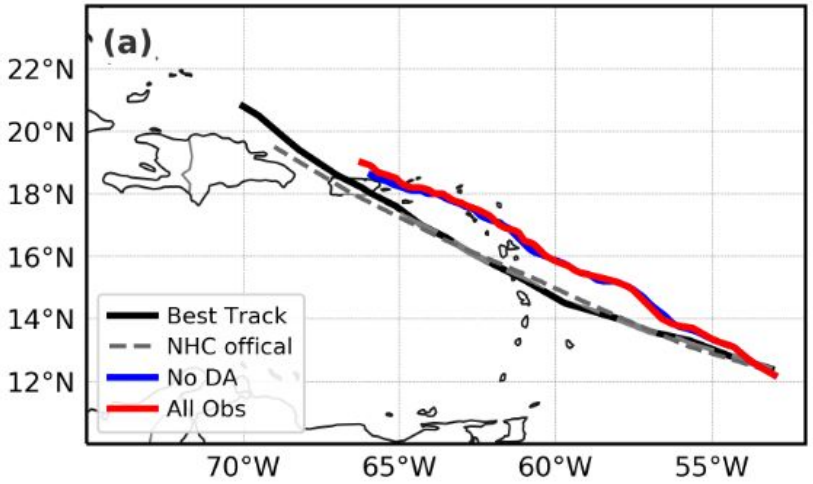
Intensity Forecast



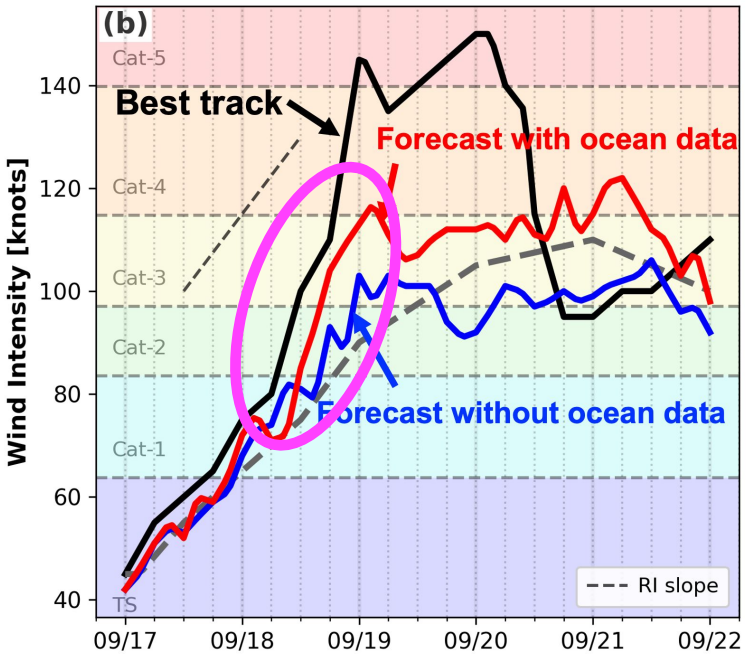
Ocean data assimilation reduces intensity forecast errors

Observation Impact: Hurricane Maria

Track Comparisons

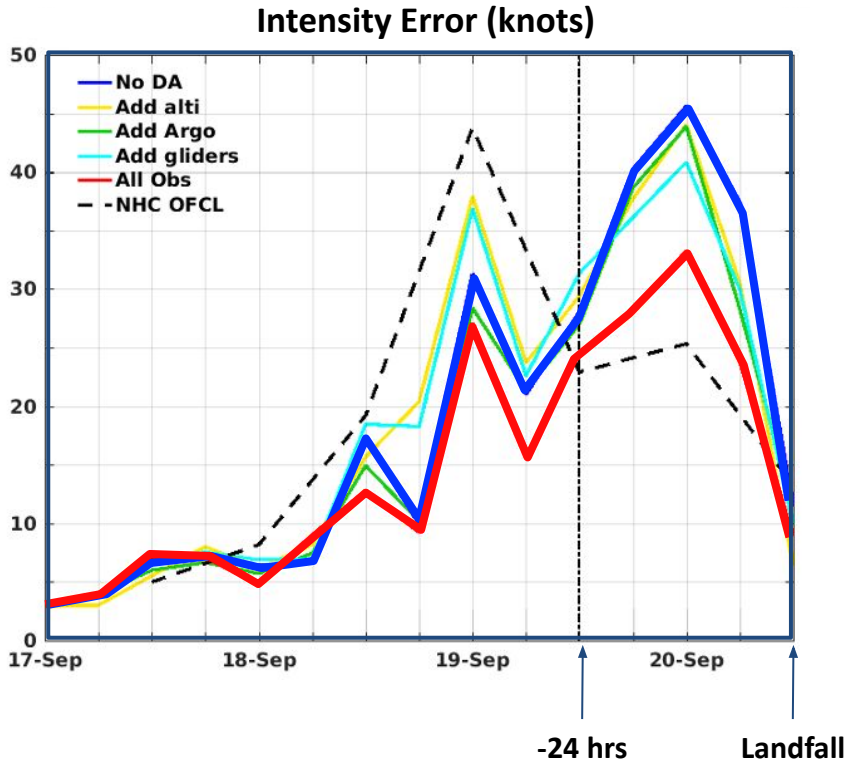


Intensity Forecast



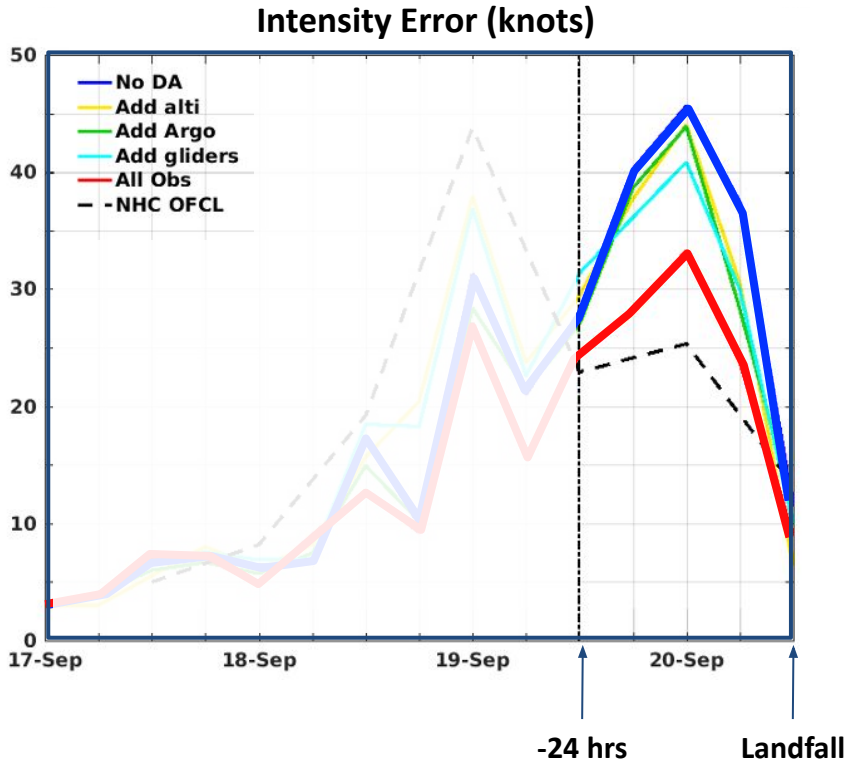
Ocean data assimilation reduces intensity forecast errors

Observation Impact: Hurricane Maria



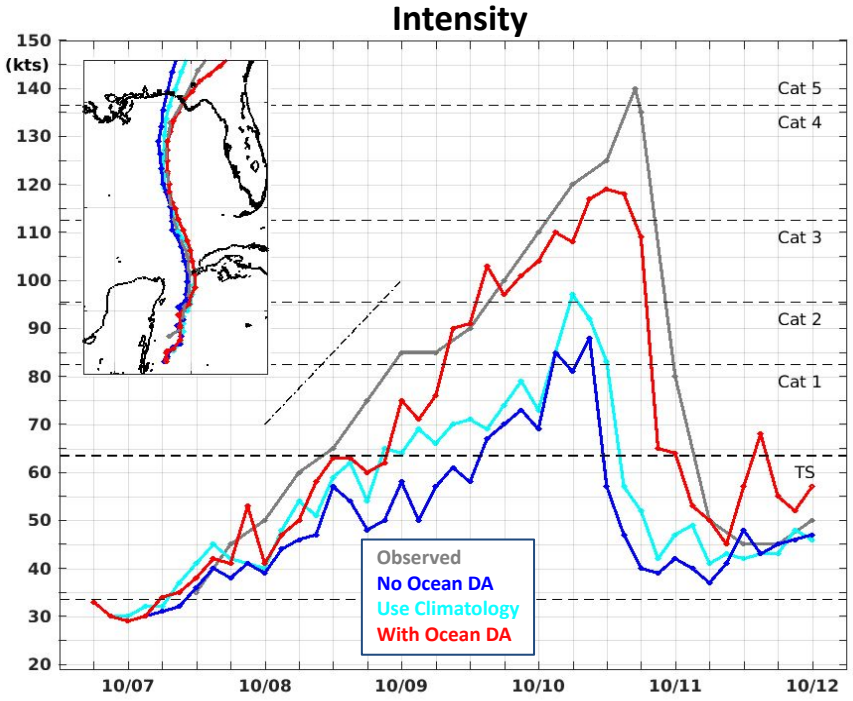
- Assimilating ocean obs leads to **30% intensity improvement**
- **All observation platforms** contributed
- **Gliders** are the main contributor to error reduction

Observation Impact: Hurricane Maria

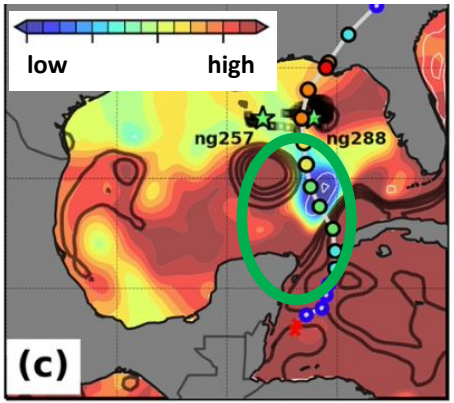


- Assimilating ocean obs leads to **30% intensity improvement**
- **All observation platforms** contributed
- **Gliders** are the main contributor to error reduction

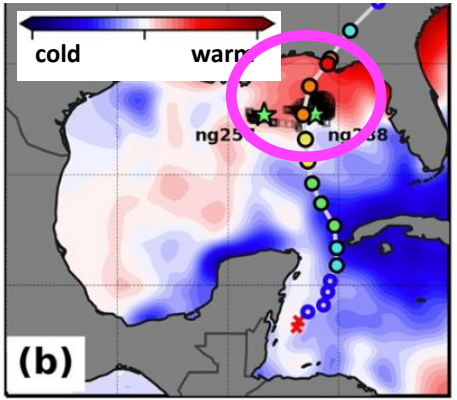
Observation Impact: Hurricane Michael



- **Forecast improvement**
- **All observations contributed**
- Modulated by **ocean features**

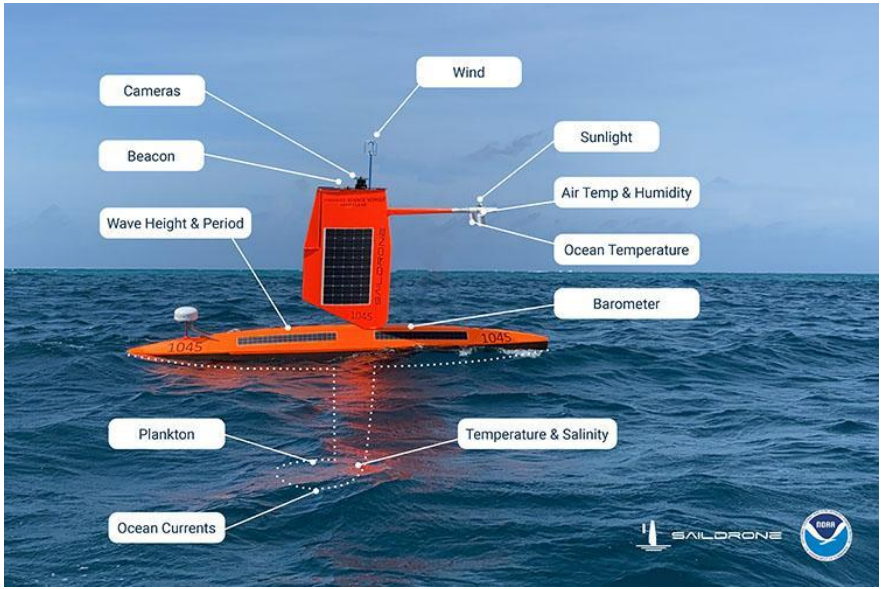


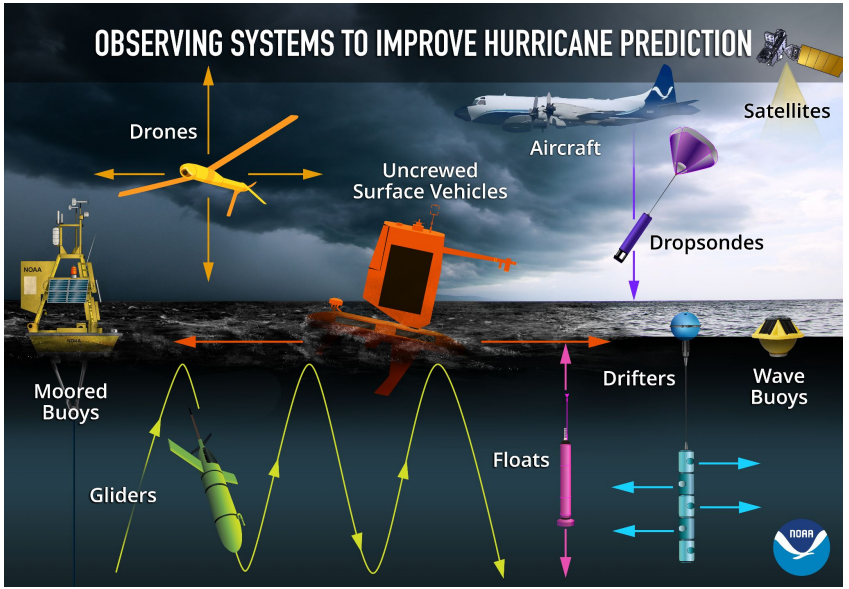
Heat Potential



Surface Temperature Anomaly

New Measurements





- **Saildrones** measure air-sea interactions
- **Co-located deployment** with gliders
- Opportunity for **coupled Data Assimilation**

Concluding Remarks

Key Takeaways:

- The **impact** of observations varies depending on **ocean conditions** and characteristics of the tropical cyclone
- The **best** ocean observing **strategy** is in **combining observation types** (satellite and *in situ*)

Future Outlook:

- Use next-generation ocean DA system for data impact studies
- Continue efforts toward coupled Data Assimilation