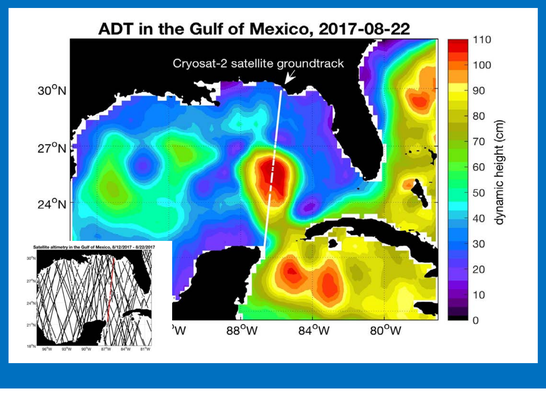
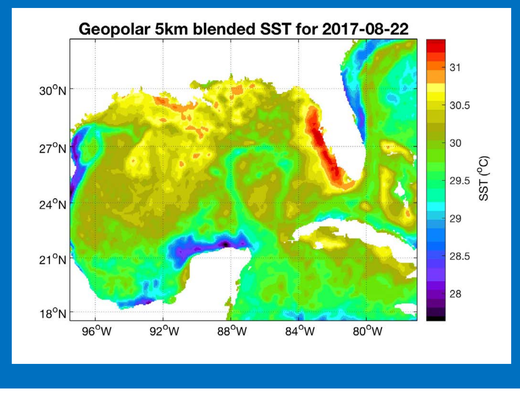
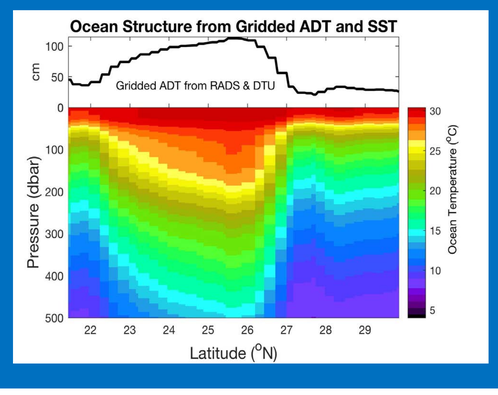
An Empirical Dynamic Topography can provide a **high-resolution** depiction of **ocean structure from altimetry.**

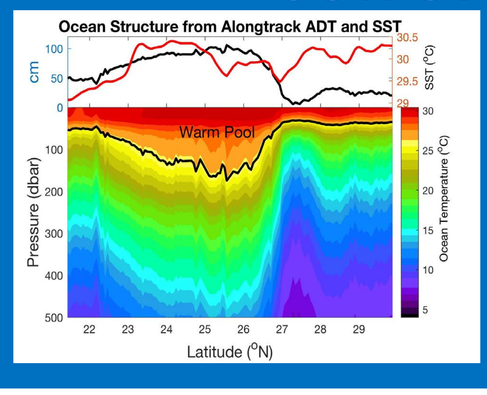
INPUT





OUTPUT





OSTST 2019

New developments for NOAA's operational upper Ocean Heat Content product suite

Deirdre A. Byrne, NOAA/STAR/LSA
Jessica Burns, NOAA/STAR/LSA
Eileen M. Maturi, NOAA/STAR/MEB
Eric W. Leuliette, NOAA/STAR/LSA

INTRODUCTION

- NOAA's operational Ocean Heat Content (OHC) Product Suite is fed into the Statistical Hurricane Intensity Prediction System (SHIPS) to help forecast the probability of tropical cyclone intensification. The OHC suite is based on a 2.5-layer model and a ¼° x ¼° climatology.

DATA SOURCES

- The World Ocean Database (WOD) for profiles (*T(z),S(z)*). The Radar Altimeter Database System (RADS) sea level anomaly and the RADS OI gridded NRT product. The Technical University of Denmark (DTU) mean dynamic topography. NOAA's (5 km) Geo-Polar Blended Global Sea Surface Temperature Analysis Level 4.

METHODS

- *T(z)* and *S(z)* are parameterized in a 3-step process. First, at every depth as a function of dynamic height (φ). Next, the residuals of those fields are parameterized with respect to Julian Day, and finally the "double prime" residuals are parameterized as a function of Sea Surface Temperature (SST).

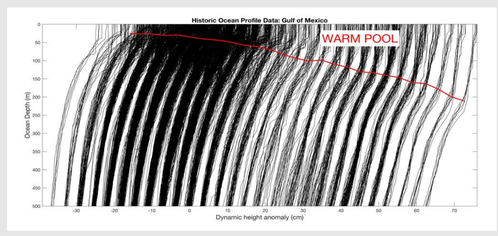
RESULTS

- By a number of measures, the empirical dynamic topography showed improvement over the operational product. In particular, extreme events were more likely to be captured at closer to their observed intensity.

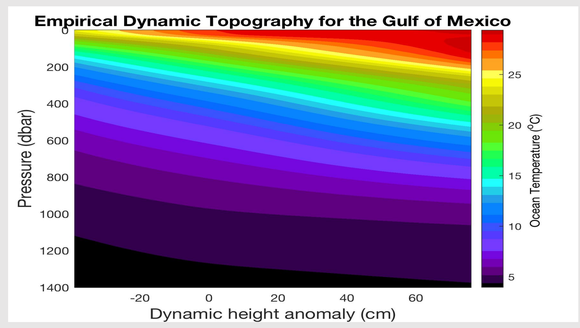
DISCUSSION

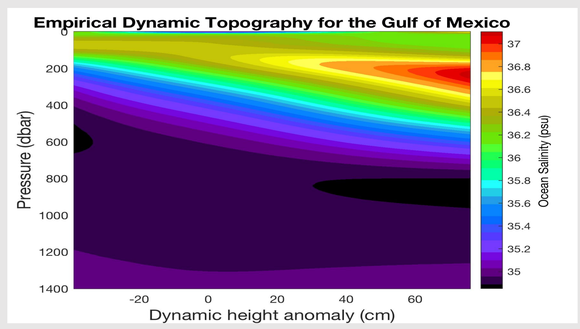
- The high resolution capability of the Empirical Dynamic Topography will become more significant as the number of altimetry missions, particularly SAR and wide-swath missions, increases. With the development of an enhanced algorithm for upper Ocean Heat Content, NOAA is taking the first step to leverage the capabilities of these missions in its operational products.
- In this region, the method shows little skill in capturing the variability in salinity in the upper 200 m of the water column. It is possible that inclusion of Sea Surface Salinity (SSS) as an additional input parameter might improve that representation.

STEP 1. *T* and *S* are sorted with respect to dynamic height. Shown: *T(z).*



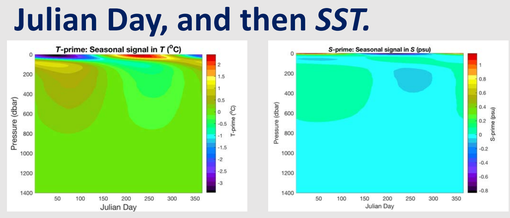
STEP 2. An empirical dynamic topography





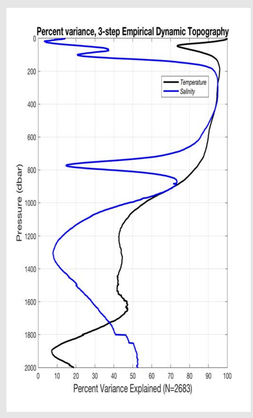
The first and most significant mode of variability.

STEP 3. The residuals (*T', S'*) are parameterized with respect to Julian Day, and then *SST.*



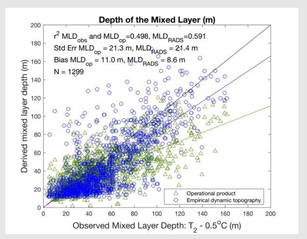
Parameterization with respect to SST (not shown) is conducted in a similar manner.

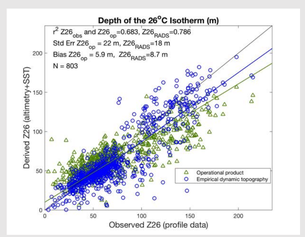
STEP 4. APPLICATION AND EVALUATION



Results show a significant amount of the regional variance in *T* and *S*, (especially in *T*), is explained by an empirical dynamic topography.

For initial evaluation, dynamic height (φ) is simply calculated from profile data.

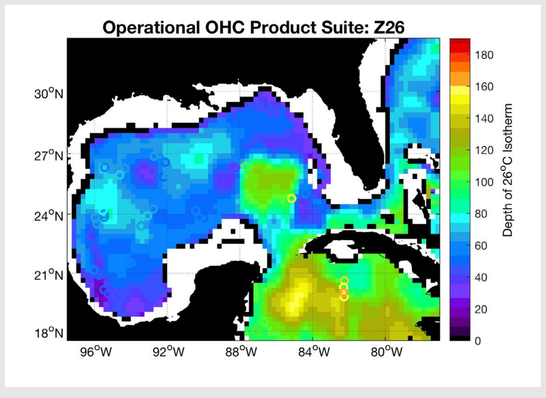


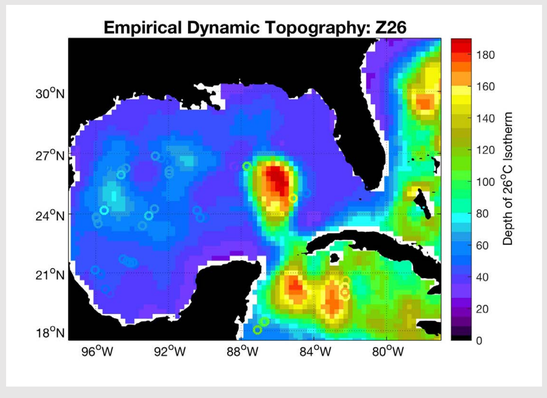


Two key measures of upper ocean heat content: mixed layer depth, and depth of the 26 °C isotherm.

The operational and empirical topography products are compared with coincident *in situ* profile data from WOD for 2017-2019.

EVALUATION (continued): The prediction of the depth of the 26 °C isotherm on 2017-08-22.





On the left, the operational OHC product, which uses Navy ALPS data as input. On the right, results using empirical dynamic topography and RADS OI gridded data. The difference in amplitude of the more intense features is noteworthy. *In situ* measurements of the depth of the 26°C isotherm (Z26) for a 30-day period centered on this date have been overplotted in small circles, using the same color scale.