The new daily global mesoscale Blended Ocean Surface Currents (BOSC)

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Summary

We describe the new 1/6° (mesoscale) resolution daily global Blended Ocean Surface Currents (BOSC) quasi-realtime data-informed product. With a growing fraction of the world's population depending on the nearshore environment the need for timely information about surface currents is growing, with potential applications ranging from climate and weather analysis and forecasting to fisheries, marine debris, and coastal engineering. BOSC is intended as a new product of NOAA's Coastwatch/Oceanwatch program.

Methods

A *background* estimate of nearsurface velocity, ($u_f = u_g+u_e+u_s$) is formed by combining gradient currents

$$f\hat{k} \times \vec{u}_g + ug.\nabla u_g = -\nabla\eta$$

with Stokes/Ekman drift

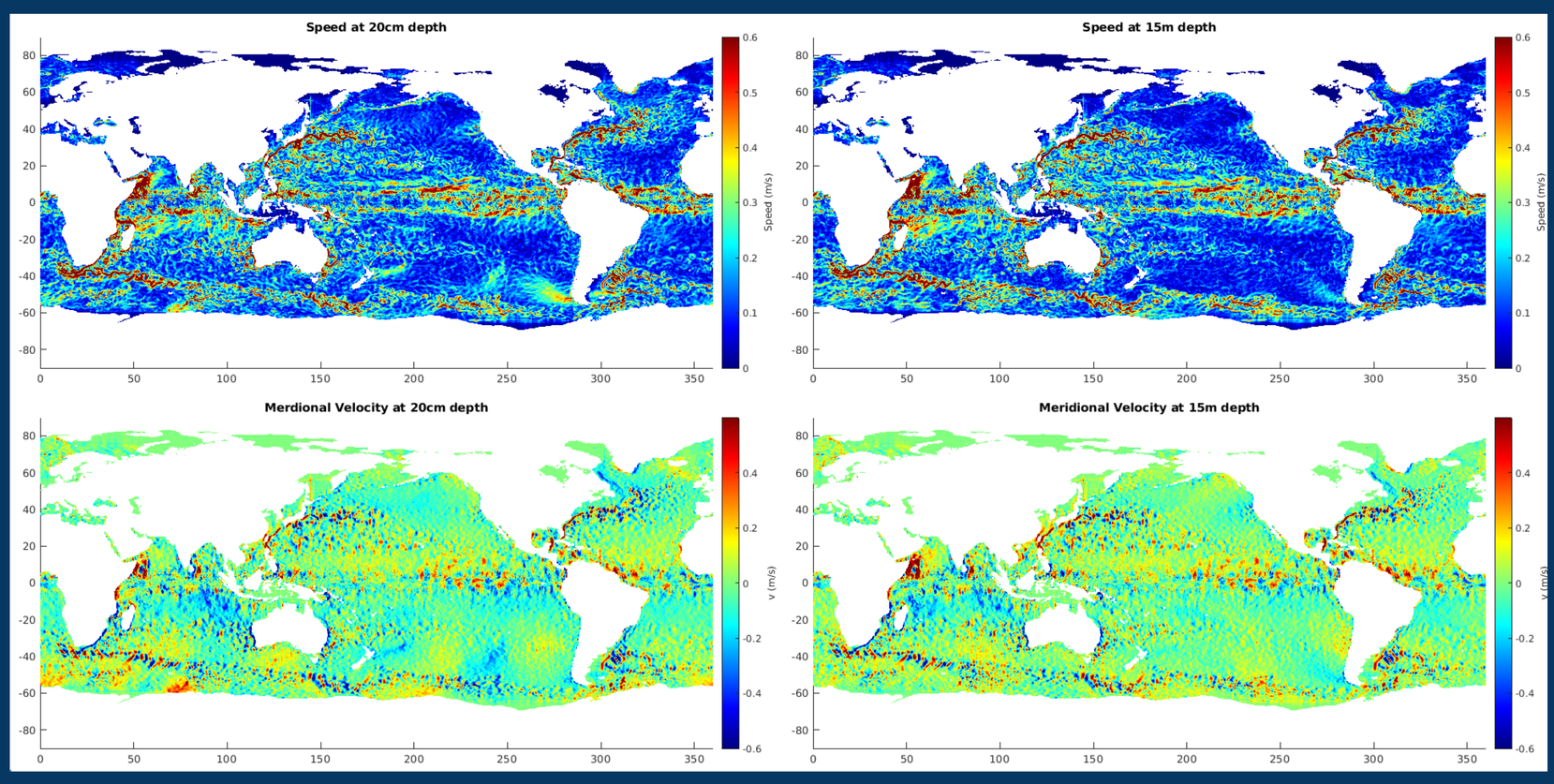
$$f\hat{k} \times (\overrightarrow{u_s + u_e}) = +k_z \frac{\partial^2 \vec{\tau}}{\partial z^2}$$

Here gridded sea level η is obtained from the ¼° daily NOAA CoastWatch/ OceanWatch near-real time multi-mission SLA product, while gridded wind stress and stokes drift are obtained from NOAA global operational wind and wave products. The resulting currents, estimated at two depths: 20cm and 15m, are referenced to the climatological surface drifter analysis of *Laurindo et al.* (2017) to reduce mean bias.

At fine mesoscales the velocities are corrected using information about the movement of temperature fronts contained in NOAA's high resolution Geopolar Blended SST

$$\vec{u}_a = \vec{u}_f - \frac{\nabla_h T}{|\nabla_h T|^2}\left[\frac{\partial T}{\partial t} + \vec{u}_f \cdot \nabla T - \left(\frac{Q}{\rho C_p} + w\frac{\partial T}{\partial z}\right)\right]$$

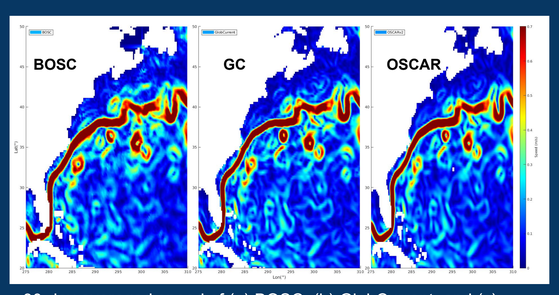
Snapshot of BOSC currents for a single day



BOSC surface currents for 18 July, 2020, showing the speed at 20cm depth (top left) and 15m depth (top right), as well as meridional velocity at 20cm depth (bottom left) and 15m depth (bottom right).

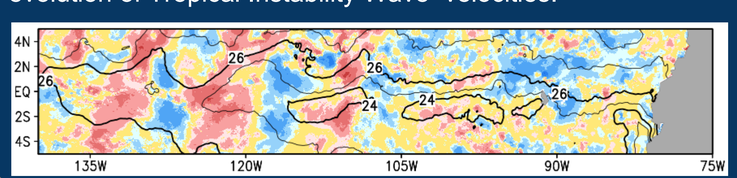
Comparisons to Globcurrent and OSCARv2

Two global current products are currently available that rely on geostrophy and Ekman dynamics : the ESA GlobCurrent of Rio et al. (2014) and the ESR OSCARv2 of Dohan (2022). The three products are similar on larger scales when the velocities are weak and the Coriolis term is large.



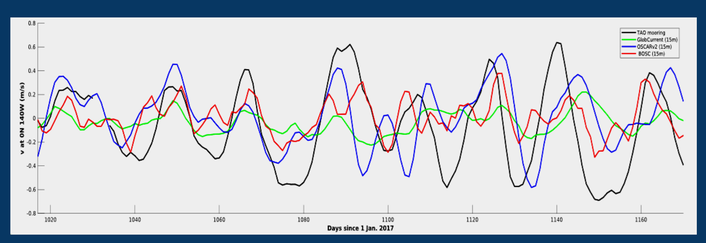
30-day averaged speed of (a) BOSC, (b) GlobCurrent, and (c) OSCARv2 in the western North Atlantic during July, 2020.

In the Eastern tropical Pacific strong temperature gradients allow BOSC to track the evolution of Tropical Instability Wave velocities.



Colors show BOSC meridional velocity. Contours show SST for January, 2020.

A comparison of meridional velocity at the TAO mooring at 0N, 140W shows that BOSC (red) is better able to track the amplitude and phase of the observed (black) TIW fluctuations than Globcurrent (green) or OSCARv2 (blue).



Time series of meridional velocity at 0N, 140W. (black) observed, (red) BOSC, (green) Globcurrent, and (blue) OSCARv2.

Status and Future

We are currently evaluating a beta version of BOSC spanning three years 2018-2020 in comparison to Globcurrent and OSCARv2 as well as independent velocity estimates such as moored currents, HF RADAR, and Lagrangian surface drifter trajectories. Results suggest that the BOSC has a global mean absolute difference from observations of 4.5 cm/s with improved performance in the tropics and other regions of strong temperature fronts such as coastal margins. Additrional data such as 25 km daily NSIDC sea ice motion is being included as constraints.

Release and Availability

A full beta release of BOSC spanning the five-year period 2017-2021 is expected late this year or in early 2023.

References

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