ASSESSMENT OF REAL TIME PRODUCTS IN OSCAR SURFACE CURRENTS

OSTST 2010: Operational applications

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Abstract:

The Ocean Surface Current Analyses Real-time product (OSCAR, podaac.jpl.nasa.gov, www.oscar.noaa.gov) is a global dataset of surface currents calculated directly from satellite SSH, winds, and SST using geostrophy, Ekman dynamics, and thermal wind. OSCAR archived data is provided on a 5-day timebase with a 10-day temporal smoothing and uses the AVISO SSALTO/DUACS Delayed-Time and Near Real-Time MADT for SSH.

OSCAR is being developed to include fast timescales. At present, an operational version of OSCAR is calculated as a daily product for the latest 20 days. MODAS (Navy Research Lab) SSH fields have been used for the real-time extension of OSCAR. This poster presents comparisons between OSCAR real-time (RT) currents calculated using the MODAS SSH against those using the AVISO RT MADT. The RT currents will also be compared to NRT currents, with and without temporal smoothing, and assessed against in situ data, in particular against drifting buoy velocities.

OSCAR Surface Currents

The Ocean Surface Currents Analyses-Realtime processing system (OSCAR) is a satellite-derived surface current database provided in near-real time based on a combination of quasi-steady geostrophy, Ekman currents, and a thermal wind adjustment. The geostrophic term is computed from the gradient of surface topography fields. OSCAR uses the merged AVISO/CLS gridded fields and NRL/MODAS SSH fields. Wind-driven velocity components are computed from an Ekman/ Stommel formulation with variable viscosity using SSM/I, QuikSCAT (FSU/COAPS) and NCEP data assimilation model winds. The thermal adjustment term is calculated using Reynolds OI SST data. OSCAR data is available at http://podaac.jpl.nasa.gov and http://www.oscar.noaa.gov. The methodology is described in in Bonjean and Lagerloef (2002) with updates described in http://podaac.jpl.nasa.gov/DATA_CATALOG/oscarinfo.html. OSCAR is produced with a delay of approximately a day. The resolution is 1/3 degree globally, and currents are output on a 5-day timebase with a 10-day temporal smoothing.

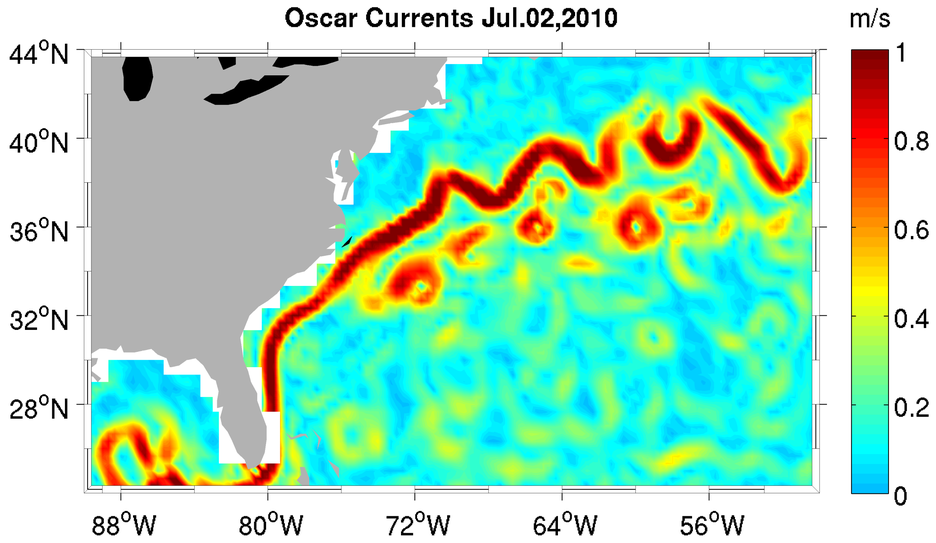
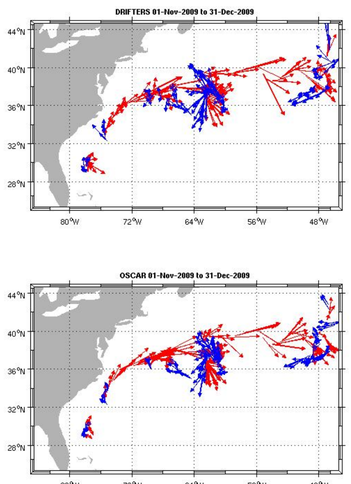


Figure. Sample OSCAR surface current field in the Gulf Stream region.

Validation Method

Assessment of the accuracy of surface current calculations in OSCAR is done by comparison with in situ velocity measurements. Here we present comparisons of OSCAR against drifting buoy velocities. However, drifters are a Lagrangian measurement, capturing both fast motions and small-scale motions. Comparison with 1/3 degree resolution gridded satellite measurements that have been temporally smoothed requires some smoothing of the drifter data, although the type of smoothing is somewhat sensitive to the dynamics at the location. In the energetic but dominantly geostrophic region of the Gulf Stream, shown below, a 1-day binning of drifter velocities and locations provides enough averaging for a realistic comparison with OSCAR currents, while still maintaining most of the variability in the region. In less energetic regions, a more reliable comparison is made if the drifters are treated using the same 10-day smoothing and 5-day timebase of OSCAR. The drifter data distributed by NOAA/AOML\\ www.aoml.noaa.gov/phod/dac/gdp.html



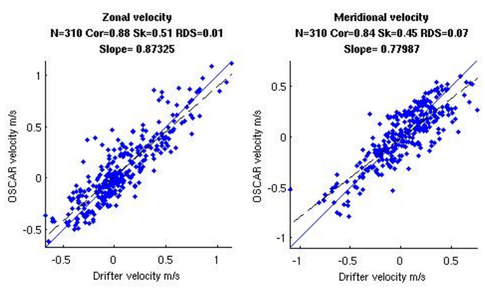


Figure. Left: Daily vectors are plotted for times between 05-Nov-2009 and 31-Dec-2009, constrained to the Gulf Stream current, for drifting buoy velocities along drifter tracks, and for OSCAR velocities using **AVISO RT** SSH fields. Right: Scatter plots of OSCAR vs Drifter velocities for both zonal (left) and meridional (right) components. Solid lines are the 1-1 lines, dashed the best-fit through the data.

Dynamical Regions Sample Results

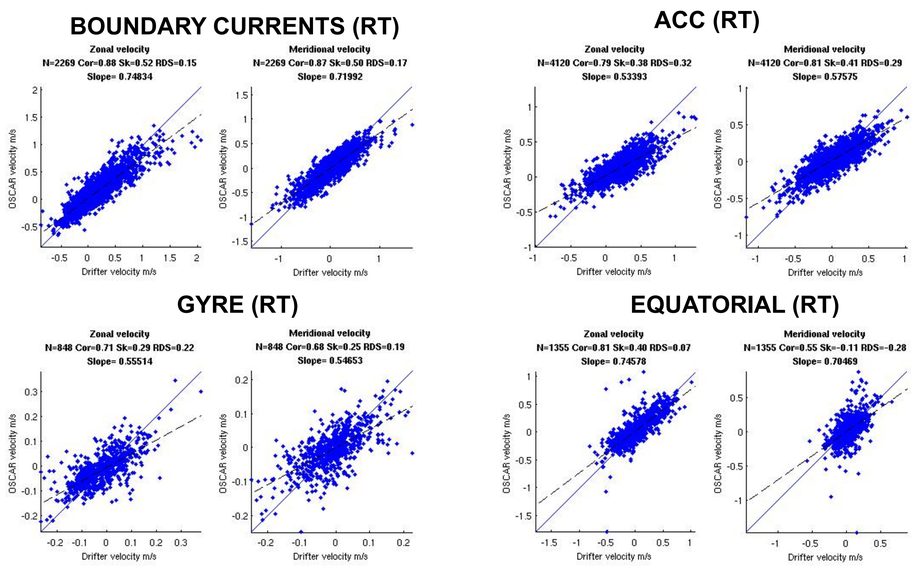


Figure. Sample scatter plots as above comparing OSCAR (with AVISO RT for SSH) currents against drifter velocities in the dynamical regions described above. The sample period is Nov-Dec 2009, for which RT fields were made available, and QuikSCAT was still operating for half of November. Other analyses over longer periods have been performed with similar results.

OSCAR using AVISO NRT & RT, and NRL SSH

OSCAR employs AVISO merged SSH products, both DT and NRT. Historically, SSH fields produced by an extrapolation procedure from Navy Research Lab's MODAS SSH has been used to create a near-real-time OSCAR. Here, we assess the newly available AVISO RT SSH fields in OSCAR.

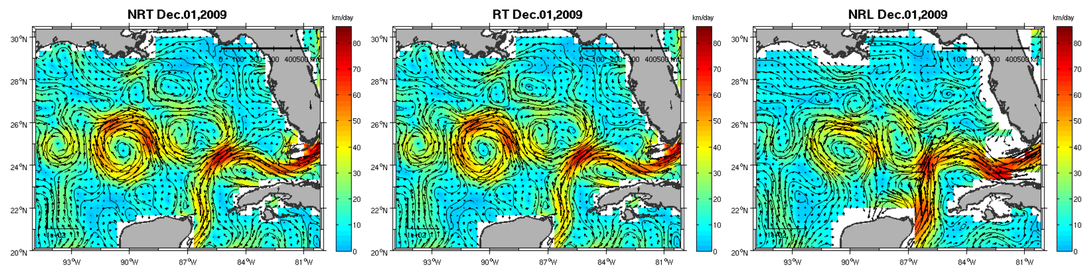


Figure. Sample OSCAR fields in the Gulf of Mexico using AVISO NRT, RT and NRL fields. A daily OSCAR version for real-time uses is in development, with preliminary results in the Gulf presented at: www.esr.org.

Study Regions

The success of OSCAR at capturing surface currents varies with dynamical region. We have divided this drifter analyses into four regions, marked by the colored boxes below.

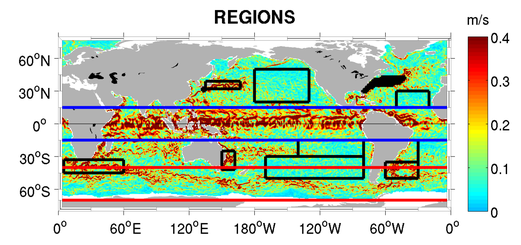
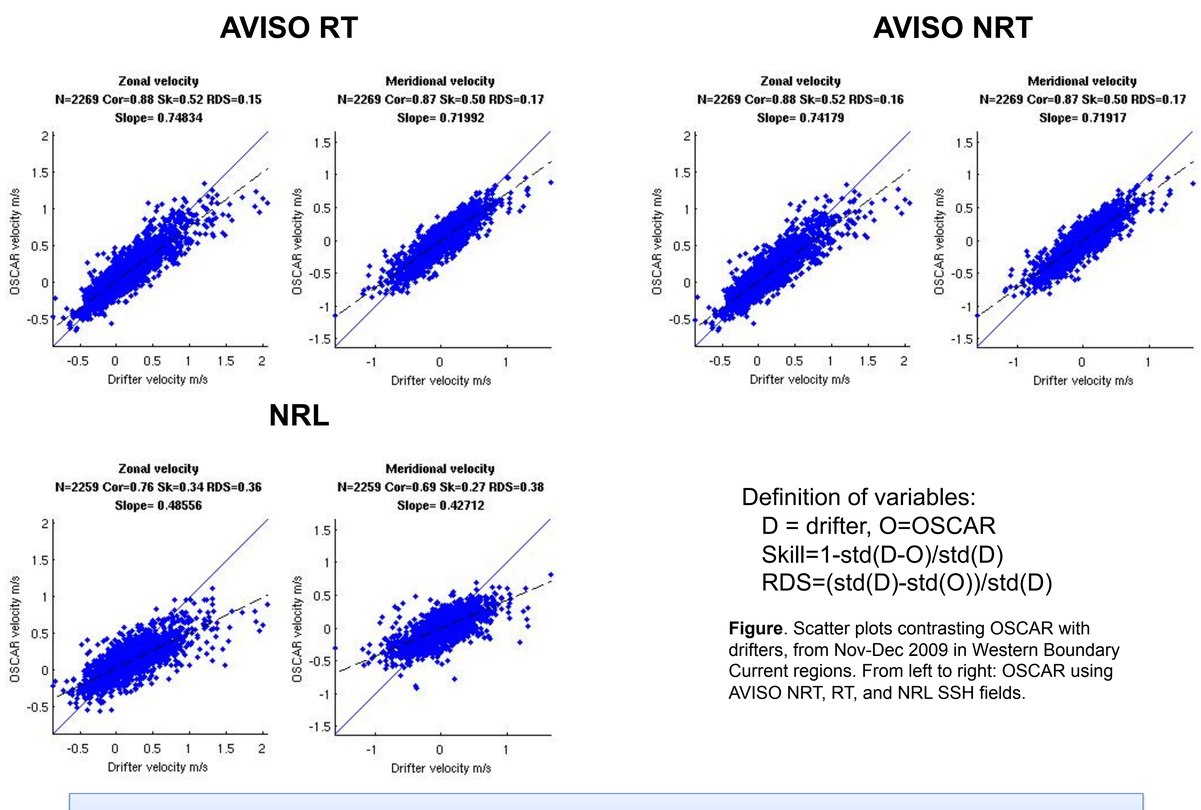


Figure. Four regions are used in the drifter comparisons here: Boundary Currents (BC), Gyres (open ocean), Equatorial Currents (EQ), and the Antarctic Circumpolar Current (ACC).

Boundary Currents Results



Definition of variables:
D = drifter, O=OSCAR
Skill=1-std(D-O)/std(D)
RDS=(std(D)-std(O))/std(D)

Figure. Scatter plots contrasting OSCAR with drifters, from Nov-Dec 2009 in Western Boundary Current regions. From left to right: OSCAR using AVISO NRT, RT, and NRL SSH fields.

Summary of Results

	Num pts	Correlation u	Correlation v	Skill u	Skill v	RDS u	RDS v	Slope u	Slope v
BC NRT	2269	0.88	0.87	0.52	0.50	0.16	0.17	0.74	0.72
RT	2269	0.88	0.87	0.52	0.50	0.15	0.17	0.75	0.72
NRL	2259	0.76	0.69	0.34	0.27	0.36	0.38	0.49	0.43
EQ NRT	1355	0.81	0.56	0.41	-0.08	0.08	-0.25	0.75	0.71
RT	1355	0.81	0.55	0.40	-0.11	0.07	-0.28	0.76	0.70
NRL	1353	0.77	0.36	0.36	-0.16	0.16	-0.05	0.64	0.38
GYRE NRT	848	0.71	0.67	0.29	0.24	0.22	0.19	0.55	0.54
RT	848	0.71	0.68	0.29	0.25	0.22	0.19	0.56	0.55
NRL	848	0.61	0.41	0.21	0.08	0.40	0.46	0.37	0.22
ACC NRT	4120	0.79	0.81	0.37	0.41	0.33	0.30	0.52	0.57
RT	4120	0.79	0.81	0.38	0.41	0.32	0.29	0.54	0.58
NRL	4120	0.64	0.63	0.22	0.21	0.49	0.53	0.33	0.30

D = drifter, O=OSCAR
Skill=1-std(D-O)/std(D)
RDS=(std(D)-std(O))/std(D)

AVISO RT works very well within OSCAR.

References:

Bonjean, F and G.S.E. Lagerloef (2002), Diagnostic Model and Analysis of the Surface Currents in the Tropical Pacific Ocean. Journal of Physical Oceanography, (32): 2938–2954.