
The Ocean Surface Current Analyses – Real Time (OSCAR) System

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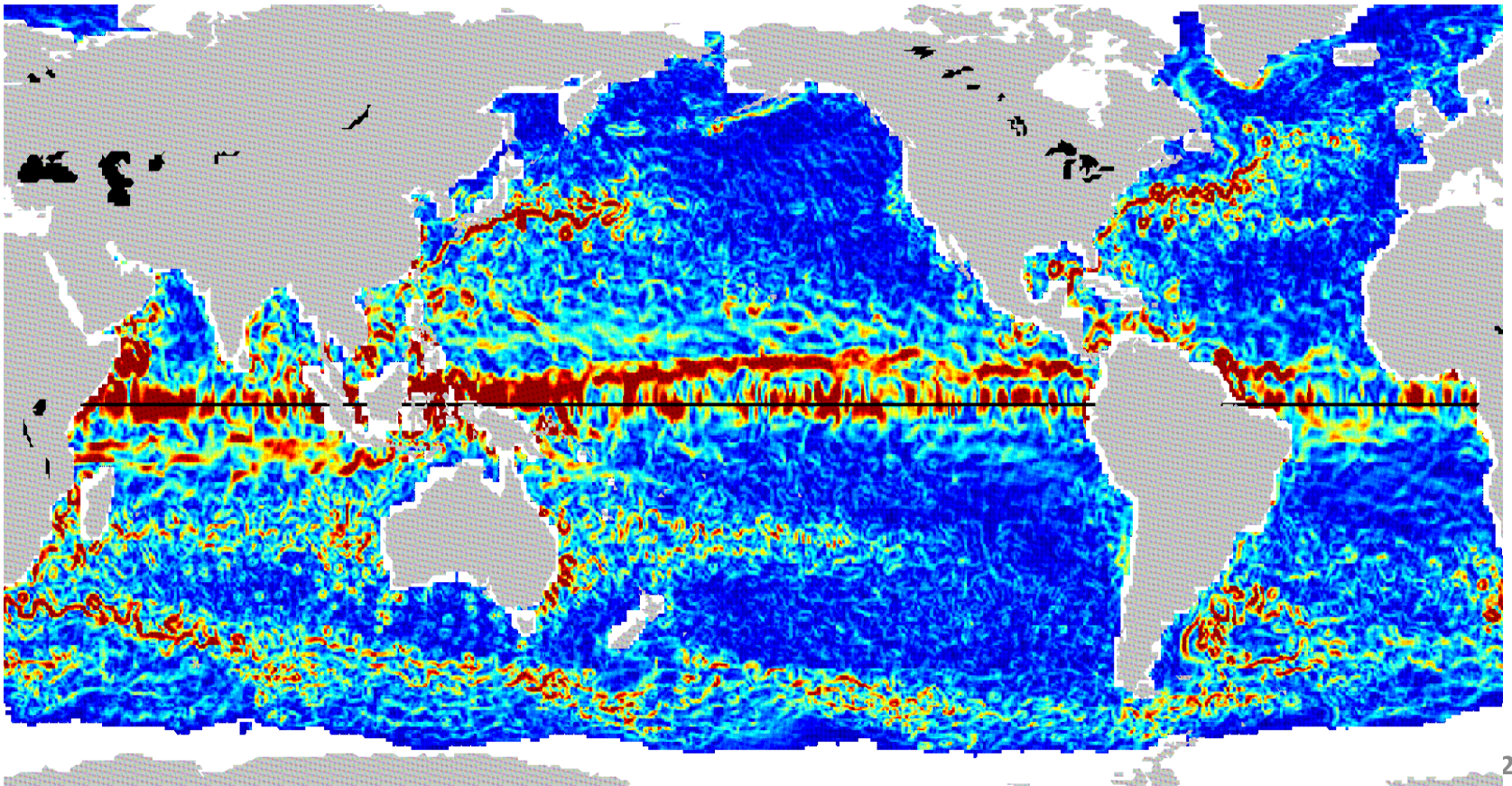
NOAA/AOML
Miami, FL

OSCAR Surface currents from satellite fields

- Ocean Surface Currents Analyses-Realtime processing system (OSCAR) is a satellite-derived global surface current database provided in near-real time based on a simplified dynamical upper ocean model, assuming quasi-steady dynamics
- OSCAR is in constant development, but the basic model is as in Bonjean and Lagerloef, 2002 (paper in prep for the improvements to the model)
- Surface currents are calculated from SSH, surface vector winds, SST, and soon to include salinity from Aquarius
 - **SSH**: geostrophic term is computed from the gradient of ocean surface topography fields (merged gridded AVISO/CLS: Jason-1,-2, T/P, Envisat, GFO, ERS-1,-2)
 - **WIND**: wind-driven velocity is computed from an Ekman/Stommel formulation with variable eddy viscosity using QuikSCAT vector winds (FSU/COAPS) and NCEP winds (very soon replaced by ERA-I winds – currently investigating Atlas and ASCAT winds)
 - **SST**: thermal wind term using Reynolds OI SST data (looking at higher resolution products to capture fronts).

OSCAR Surface currents from satellite fields

- Global coverage on $1/3^\circ$ grid spacing
- Quasi-steady model: 10-day smoothing of input fields, output on 5 day spacing
- Near real-time: updated daily
 - Soon to provide daily product
- Captures larger eddies (e.g. Gulf Stream rings)
- Limited coverage near coast (within approx 50-100km of coastline)



OSCAR Surface currents from satellite fields

- Data is provided through the NASA physical oceanography data centre and through a NOAA site dedicated to OSCAR
<http://podaac.jpl.nasa.gov> and <http://www.oscar.noaa.gov>.

The screenshot shows the PO.DAAC (Physical Oceanography Distributed Active Archive Center) website. At the top, it features the NASA logo and the Jet Propulsion Laboratory California Institute of Technology branding. The main navigation bar includes links for HOME, DATASET DISCOVERY, DATA ACCESS, CORE MEASUREMENTS, ANIMATIONS & IMAGES, USER COMMUNITY, and HELP. A search bar is prominently displayed. The left sidebar contains a 'BROWSE DATASETS' section with filters for Parameter, Collections, Platform, Sensor, Spatial Coverage, and Latency. The main content area is divided into several sections: 'DATA ACCESS TOOLS & SERVICES' with links for PROTOCOLS, LEVEL 2 SUBSETTING, and DATA SUBSCRIPTION; 'STATE OF THE OCEAN' with a globe visualization; 'ANIMATION & IMAGES'; 'EVENTS'; 'ANNOUNCEMENTS'; 'LEARN ABOUT'; 'PO.DAAC SERVICES & TEAM'; 'EOSDIS NASA EARTH SCIENCE DATA CENTERS'; and 'FUN FACT'. The footer includes the USA.gov logo and privacy/feedback links.

The screenshot shows the OSCAR (Ocean Surface Current Analyses - Real time) website. At the top, it features the National Oceanic and Atmospheric Administration logo and the OSCAR title. The main navigation bar includes links for Home, Project Overview, Data Display & Download, Validation, and General Interest. The main content area features a large map titled 'Near-realtime ocean surface currents derived from satellite altimeter and scatterometer data'. The map shows a 5-Day Interval Surface Current for April 27, 2011, with a color scale from blue to red representing current speed up to 1.0 meter/second. To the left of the map are two satellite images. Below the map, there are three bullet points: 'Global Dataset for Display and download', 'Peer-reviewed scientific publications using OSCAR data', and 'OSCAR data available through OPeNDAP/DODS'. At the bottom, there is a section for 'Pilot project for a NOAA/NESDIS Operational Surface Current Processing and Data Center National Ocean Partnership Program (NOPP)'.

[Home](#) | [Project Overview](#) | [Data Display & Download](#) | [Validation](#) | [General Interest](#)

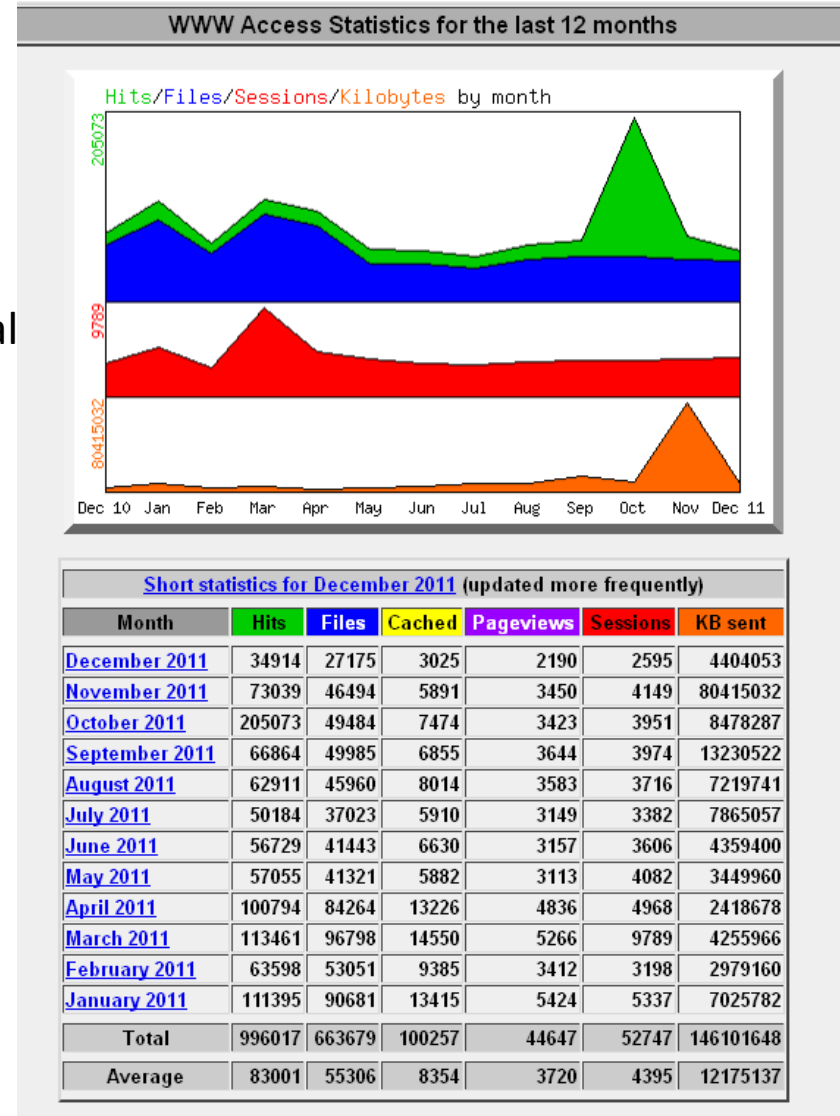
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OSCAR Surface currents from satellite fields: user base

- 17 year history of OSCAR, from a tropical study to a global third degree dataset
- Wide user base
 - From: scientific users of NRT data, climate studies using smoothed seasonal data
 - To: Recreational boaters
 - (coarse resolution, but free data)
- An established dataset, e.g. from the NOAA OSCAR website in 2011:
 - visited by 4149 unique hosts
 - in 61 countries
 - 806 websites link to OSCAR website

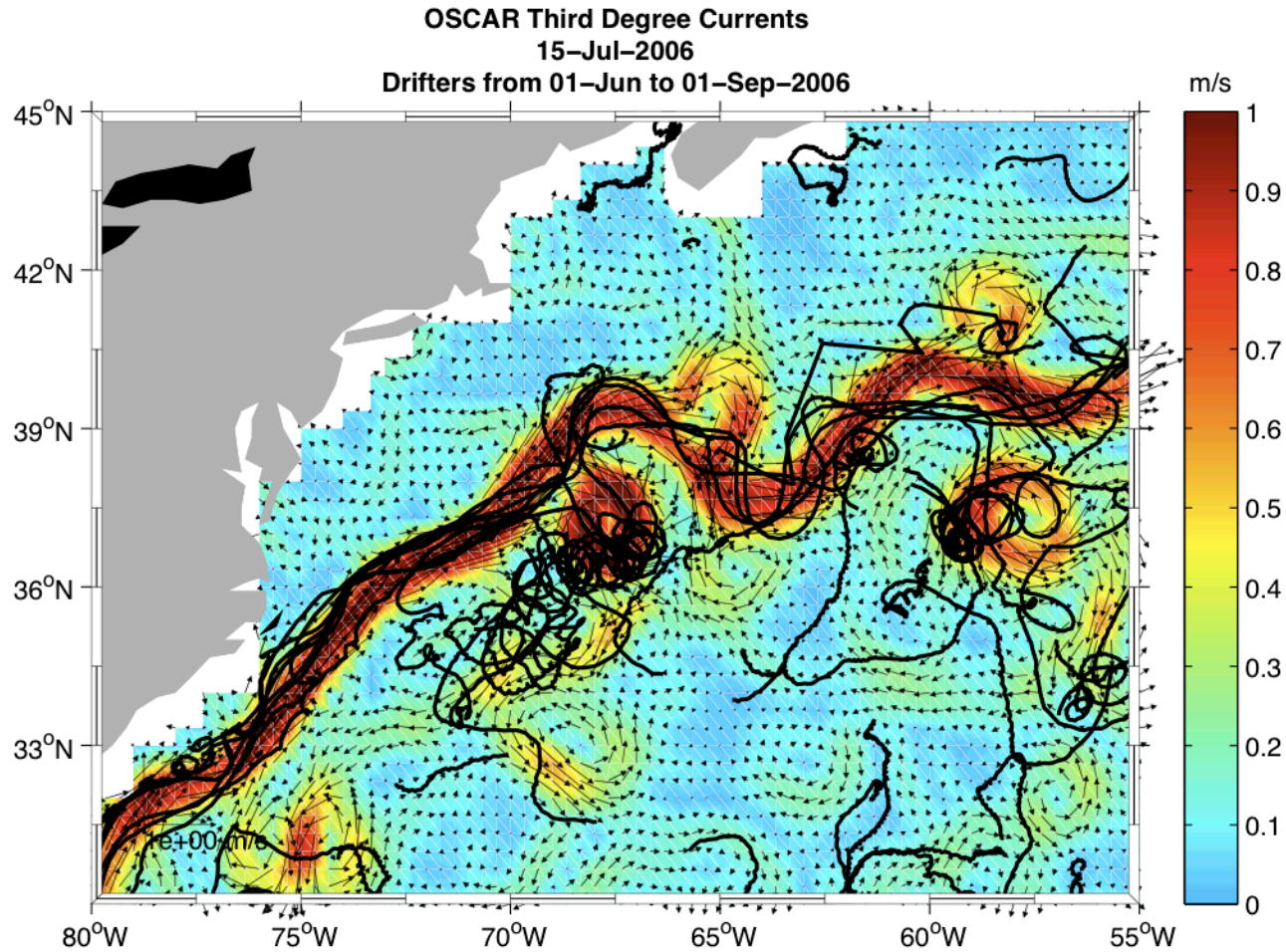


Validation with in situ

- OSCAR is routinely validated by comparison with *in situ* data
 - Global validation using drifting buoy velocities from the Global Drifter Program (NOAA/AOML www.aoml.noaa.gov/phod/dac/gdp.html, R. Lumpkin)
 - Point validations against mooring velocities
 - One-time use of drifter climatology to set the coefficients for the turbulence parameterization, otherwise independent of drifters

Validation against drifting buoy velocities

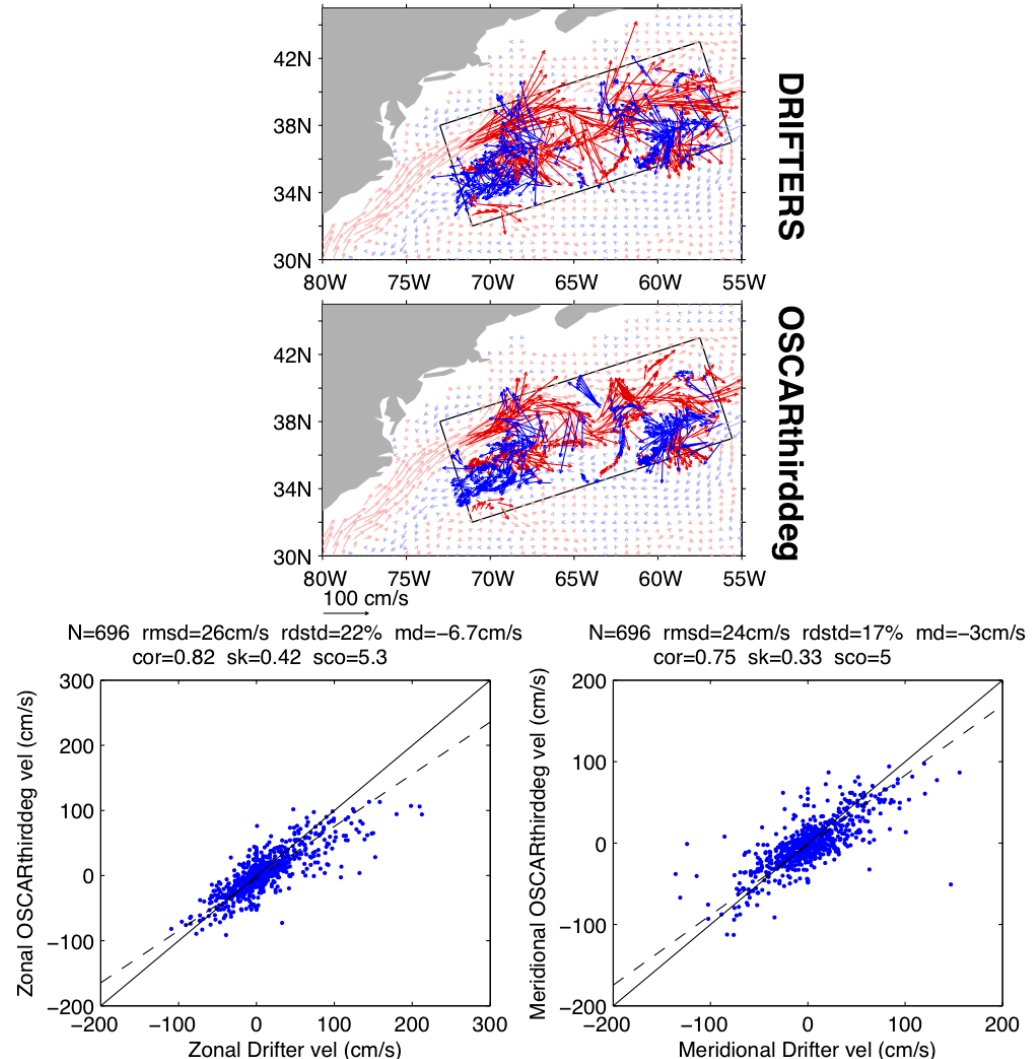
- OSCAR is compared to drifting buoys in the Gulf Stream. Snapshot of OSCAR, 3 months of drifter tracks



Validation against drifting buoy velocities: Gulf Stream

- OSCAR surface velocities are interpolated onto drifter locations (which have been averaged over 1 day). Zonal and meridional currents vs drifter velocities are plotted on the scatter plot. Solid line = equal amplitude, dotted line = best-fit line through data.
- Drifter data distributed by NOAA/AOML www.aoml.noaa.gov/phod/dac/gdp.html
- Very good performance in dominantly geostrophic areas, such as the Gulf Stream.
- Correlation coefficient $r=0.82$ for zonal, $r=0.75$ for meridional velocities

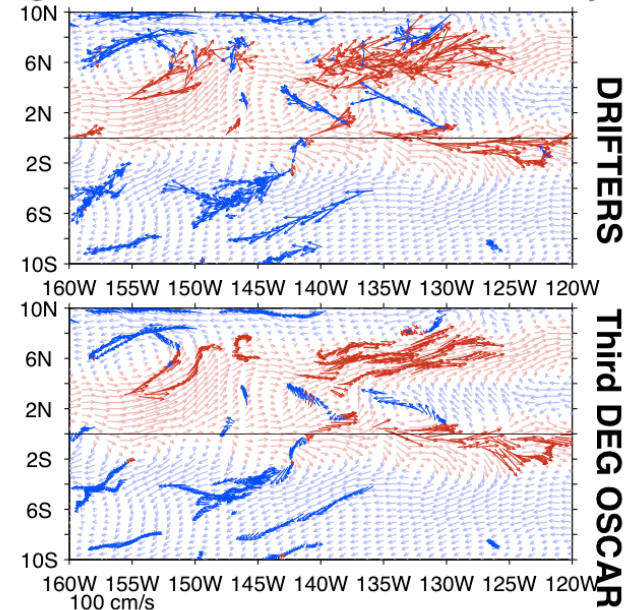
OSCARthirddeg & DRIFTER DATA: Jun.01,2006–Sep.01,2006
Background field: OSCARthirddeg monthly mean



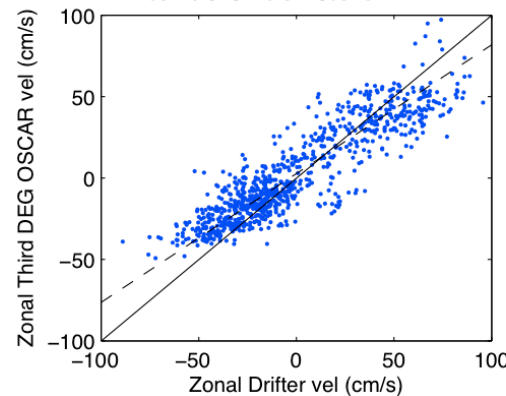
Validation against drifting buoy velocities: Equatorial Pacific

- OSCAR surface velocities are interpolated onto drifter locations (which have been averaged over 1 day). Zonal and meridional currents vs drifter velocities are plotted on the scatter plot. Solid line = equal amplitude, dotted line = best-fit line through data.
- Correlation coefficient $r=0.90$ for zonal, $r=0.48$ for meridional velocities

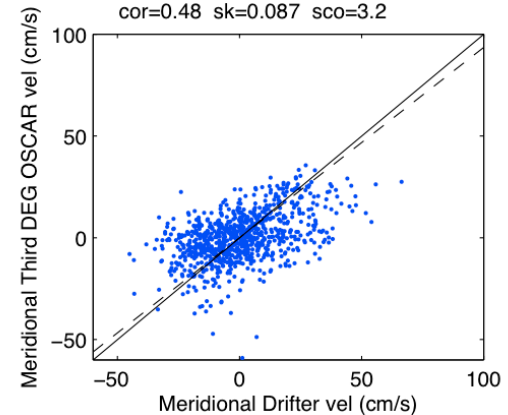
Third DEG OSCAR & DRIFTER DATA: Jun2006
Background field: Third DEG OSCAR monthly mean



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cor=0.9 sk=0.54 sco=6

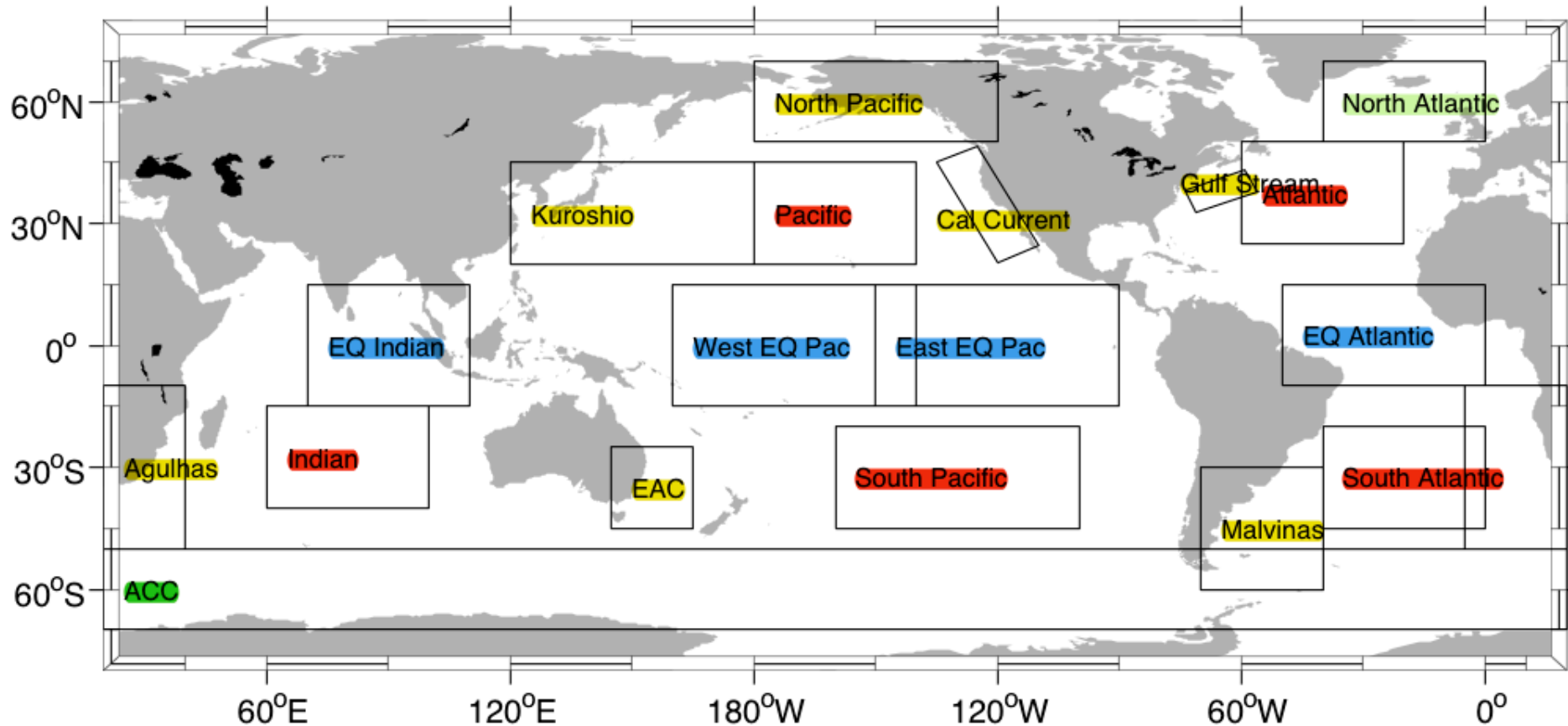


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cor=0.48 sk=0.087 sco=3.2

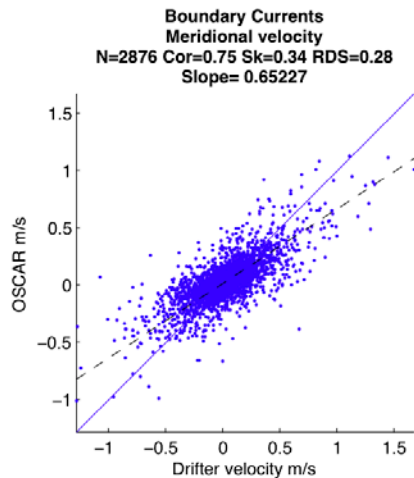
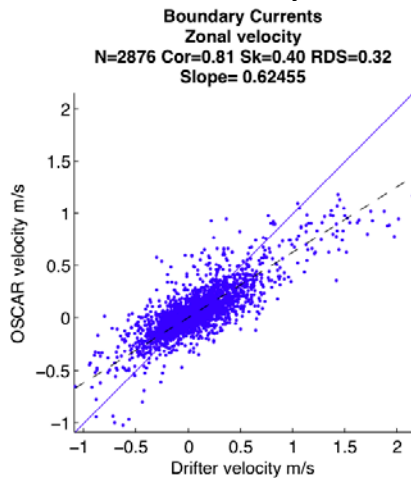


Validation against drifting buoy velocities: Regions

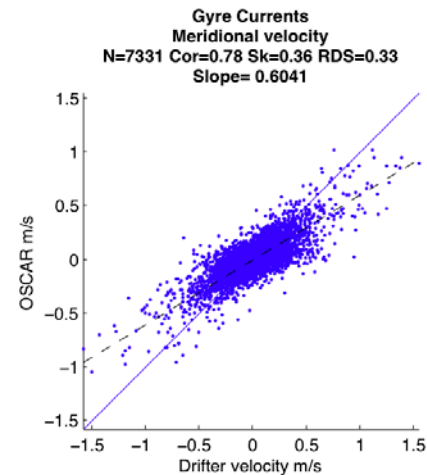
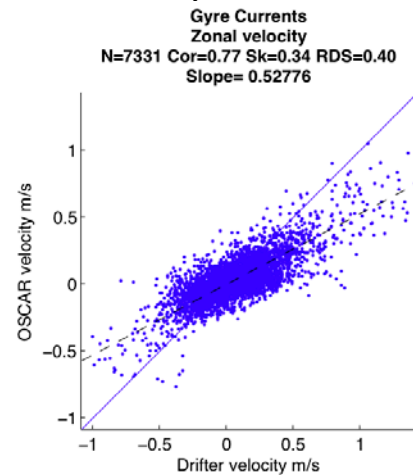
- Analyze by regions for 2 sample months, 01-Sep to 31-Oct 2007
 - Yellow= Boundary Currents
 - Red = Open Ocean "Gyres"
 - Blue = Equatorial Currents
 - Green = ACC



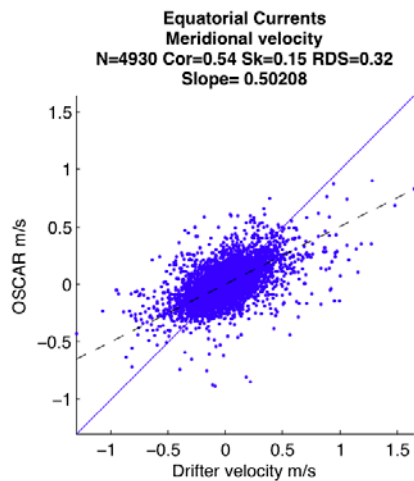
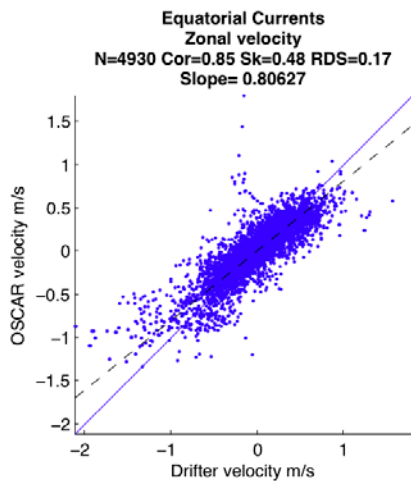
Boundary Currents $r=0.81, 0.75$



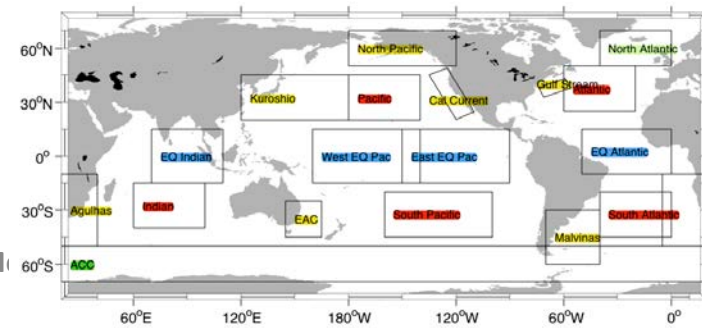
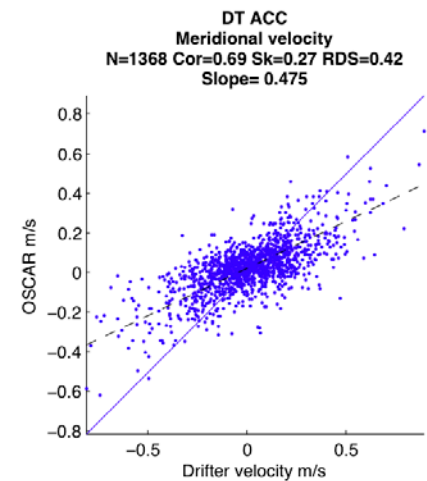
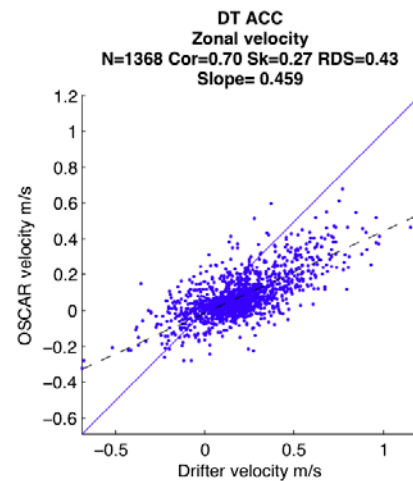
Open Ocean $r=0.77, 0.78$



Equatorial $r=0.85, 0.54$



ACC $r=0.70, 0.69$



Strengths, Limitations, Areas of Development

- **Strengths**
 - OSCAR is a completely independent surface current calculation from *in situ* measurements, which allows for a global assessment of velocities
 - Simple physics, separable components
- **Limitations**
 - Cannot capture the submesoscale
 - Cannot capture rapidly changing currents
 - Does not cover near coast (50-100km)
 - No predictive capabilities yet
- **Main area of development** in the next 2 years: NASA funded project to develop the the wind-driven component
 - add time-dependent wind-driven dynamics
 - with no temporal smoothing
 - using an improved turbulent mixing scheme
 - more sophisticated than constant eddy viscosity
 - include mixed layer depths and transition layers
 - include explicit vertical variation
 - at present the vertical variation is implicit, currents are averaged over the top 30 m.

GlobCurrent Context

- Exclusively satellite-derived surface currents
 - together with drifters, allows for 2 independent surface current measurements
- Well established dataset, large user base
- OSCAR currents compare well with drifting buoy velocities, particularly in strongly geostrophic areas (consistent correlation coefficients of $r=0.8-0.9$)
- Complementary reference dataset for synergistic products (i.e. for products that blend *in situ*/ remotely sensed/ model output data).