Near-shore surface winds along the coast of Peru/Chile as derived from altimetry

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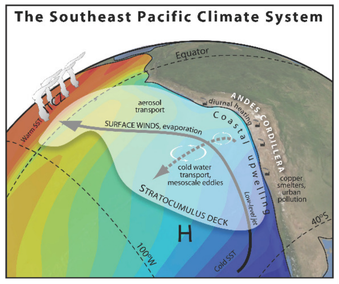
SUMMARY

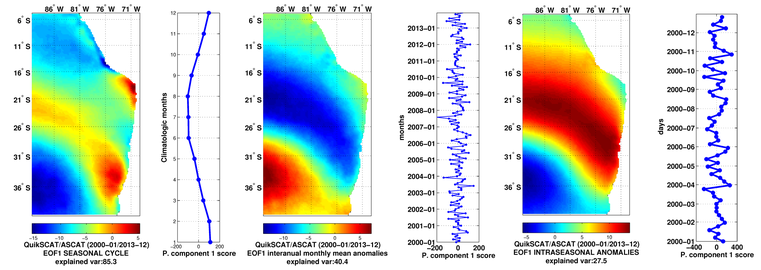
The mesoscale atmospheric surface circulation in the Humboldt current system results from the complex of interactions between the ocean and atmosphere at a variety of spatial and temporal scales. Due to limitations in the scatterometer winds and the scarcity of in situ observations, there are difficulties in documenting the coastal mesoscale circulation which is thought to be influencial on the upwelling dynamics. Combined use of high-resolution atmospheric modelling and altimetry may help gaining insights on such issue.

- Here we use the along-track altimetry-derived wind data Saral, Jason1, Jason2 et ENVISAT satellites on nominal and interleaved tracks, to estimate wind amplitude near shore and document its variability at intraseasonal to interannual timescales.
- The wind intensity is estimated through the inversion of the radar backscattering coefficient.
- The focus is on the so called wind drop-off zones and coastal jets associated with topographic effects in the central Peru and Chile regions where upwelling favourable winds vary seassonaly.



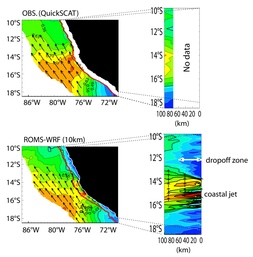
C.R. Mechoso 2014, The SouthEast Pacific climate system

A FACT: Mesoscale circulation near the coast (first 50km) plays a key role at HCS



The surface atmospheric circulation in the South-Eastern Pacific is composed of two dominant timescales of variability, seasonal, interannual and intraseasonal (see figure above), which result from distinct climatic phenomena.

- For instance, at intraseasonal timescales, the extra-tropical storms modulates the South Pacific anticyclone that in turn is related to the along-shore surface winds off Central Peru (Dewitte et al., 2011) and Central Chile (Renault et al., 2012). These aspects of the atmospheric circulation needs to be considered when interpreting the altimetric data that will not resolve all theses timescales of variability.
- High-resolution atmospheric and coupled (see figure on the right) simulations suggest a large spatial variability with the presence of a local intensifications (coastal jets) between 14°S and 16°S and a sharp on-shoreward decrease elsewhere (wind drop off).



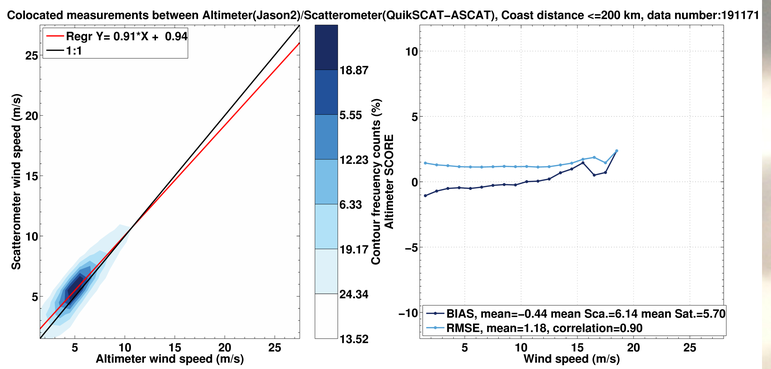
METHODOLOGY: Altimeter Quality control and validation/calibration methods

- Valid oceanics points were matched in time/position with gridded scatterometer (25 km).
- Collocated Altimeter-Scatterometer were compared and general preliminary statistical parameters evaluated by platform and coast distance.
- In order to produce monthly averages, the alongtrack data were grouped in equidistant cells every 7 km.
- The alongtrack/Gridded datas that belong to bins located a distance from the coast between 50-60 km were used for derive the calibration coeficients for coastal cells (distance less than 50 km.)
- Calibration of all altimeters is performed against scaterometter swath datasets Coastal Metop-A/Metop-B and QuikSCAT (12.5)km setting the matching criteria to 25km - 30 min.
- The skill of the calibration was verified using independent coastal gridded products (25 km).

THE DATA: What has been used for this study

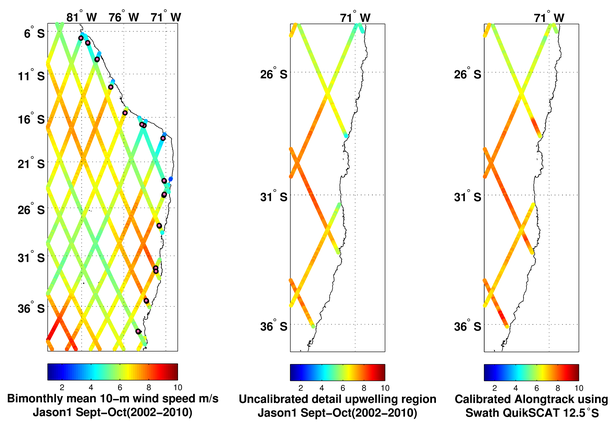
Satellite	Dates	Repeat cycle	Format
Envisat(Altimeter)	2002-2010	35 days	Alongtrack
Jason 1(Altimeter)	2002-2009	10 days	Alongtrack
Jason 2(Altimeter)	2008-2013	10 days	Alongtrack
Saral(Altimeter)	2013-present	35 days	Alongtrack
QuikSCAT L3 25 km	2000-2009	Daily	Gridded
ASCAT L3 25 km	2007-present	Daily	Gridded
QuikSCAT L2 12.5 km	2002-2010	Daily	Swath
Metop-A ASCAT Coastal 12.5 km	2010-present	Daily	Swath
Metop-B ASCAT Coastal 12.5 km	2012-present	Daily	Swath
WRF V3.5,FNL-OSTIA 36 km	2007-2012	Hourly	Gridded

Global statistics



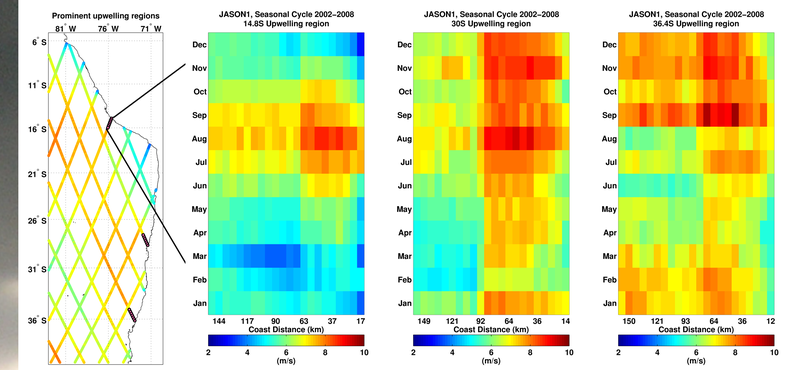
The results indicate that near the coast (within the first 200km from the coast), scatterometer winds are in relative good agreement with altimetric winds. Still the altimetric winds are slightly lower (larger) for values of wind speed lower (larger) than 5m/s. The error (RMSE) between both products is of the order of 1.5 whatever the values of wind speed.

Coastal Calibration: An example for the central Chile region

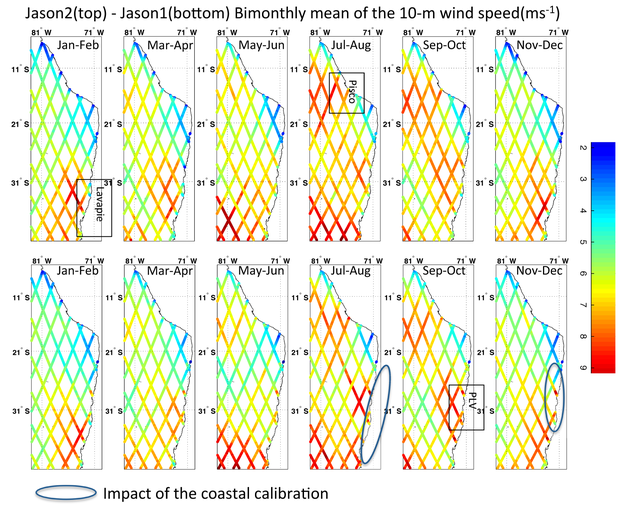


Satellite	Dates	Calibration function	Latitude	BIAS	RMS	Corr.
Envisat	2002-2010	U°10 = 1.14*U10-0.69	-32.73 /-32.29	-0.37	1.4	0.87
Jason 1	2002-2009	U°10 = 1.07*U10+0.33	-32.73 /-32.29	-0.70	1.37	0.88
Jason 2	2008-present	U°10 = 1.01*U10-0.75	-32.73 /-32.29	-0.44	1.18	0.90
Saral	2013-present	U°10 = 1.05*U10-0.65	-32.73 /-32.29	-0.20	1.17	0.91

Seasonal and interannual fluctuations of the along-shore winds in prominent upwelling regions: Pisco (15°S), Punta Lengua de Vaca (30°S) and Punta Lavapie (36.4°)



The seasonal cycle of the wind speed is estimated from the calibrated altimetric data. Of Pisco (15°S) a coastal jet extending up to 60km from the coast can be observed in July-August, whereas during the reste of the year, the wind amplitude decreases sharply shoreward. Over central Chile, there is a large meridional variability in the wind amplitude, with still a coastal jet extending over the first 100km from the coast that peaks in Aug-Nov. The wind drop-off is more pronounced in Mar-Apri.



Conclusion

- Although not providing the wind direction, we prove the utility of the altimetric winds for documenting the variability of the coastal atmospheric surface circulation at intraseasonal to seasonal timescales in the HCS, and for gaining confidence in the model simulations.
- The study is a necessary stage for get a quality-controlled and fully calibrated and validated datasets.