The Ocean Response to Wind Relaxations off California, U.S.A.

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We calculated wind stress anomalies from QuikSCAT, relative to the May-August mean pattern, for ~80 wind relaxations.



The composite wind anomalies show 3 stages.

wind stress anomaly along mean direction, averaged over ~80 relaxation events



What causes the periodic weakening of upwelling-favorable winds at Pt. Conception in summer?

A 500-mb ridge & northeast extension of the NPH pressure system.

How are the Pt. C. wind relaxations related to relaxations/reversals off N. California and Oregon?

e.g. Mass and Bond (1996); Bond, Mass, Overland (1996), Bane et al. 2005, 2007 Pt. C. relaxations are a later stage of the same synoptic pattern that causes wind relaxations/reversals off N. California and Oregon.

Do the Pt. C. relaxations vary with climate variations and/or jet stream position, like wind reversals off Oregon do?

Yes, Pt. C. relaxations are more likely when the jet stream is displaced poleward.

What is the regional-scale ocean response?

The timing of Pt. C. wind relaxations is related to the latitude of the jet stream and to the North Pacific Gyre Oscillation.

wind relaxations start at Pt. C. when jet stream is displaced poleward

wind relaxations start during more positive NPGO



The wind relaxations cause SST anomalies up to ~1000 km offshore.

warming associated with Oregon wind relaxation

Dominant signal is cooling associated with intensified vinds between relaxations

Advection of coastal water? No, too far from the coast.

Can wind-driven mixing & Δ surface heat flux explain the SST anomaly, or is it upwelling from wind stress curl?

Does wind-SST coupling 2 limit the response?

warming associated with Pt. C wind relaxation? time lag > 2 days but weak.



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The poleward warm flows at Pt. C. behave differently when the wind is stronger before a relaxation.





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this flow pattern will not lead to larval recruitment north of Pt. C.



Wind relaxations cause moderate changes in temperature stratification near the surface.

María Aristizábal



near-surface ocean temperature stratification anomaly from moorings



Wind relaxations modulate the semidiurnal internal tide, which supplies nitrate to kelp forests. María

Maria Aristizábal





Could we use satellite SST to study the ocean response to wind relaxations at coastline bends where there are no moorings?

Can we estimate the baroclinic pressure gradient force around Pt. C. from MODIS Aqua SST? How does the pgf compare to a mooring-based estimate? How much does "cloud bias" affect the results? How does the pgf depend on wind forcing?

CA

coastal-trapped buoyant flow in MODIS Aqua GHRSST L2P SST

"overshooting" buoyant flow



What is the regional-scale ocean response to wind relaxations?

* warm ocean flows at Pt. C. follow the coast or go offshore depending on prior wind forcing

* SST changes over 100s-1000s of km offshore

* modulated internal tide — and kelp forest nitrate supply?

Ongoing work:

- * heat budget for SST anomalies
- * conditionally averaged water velocity from moorings
- * scatterometer-based index of wind relaxation times