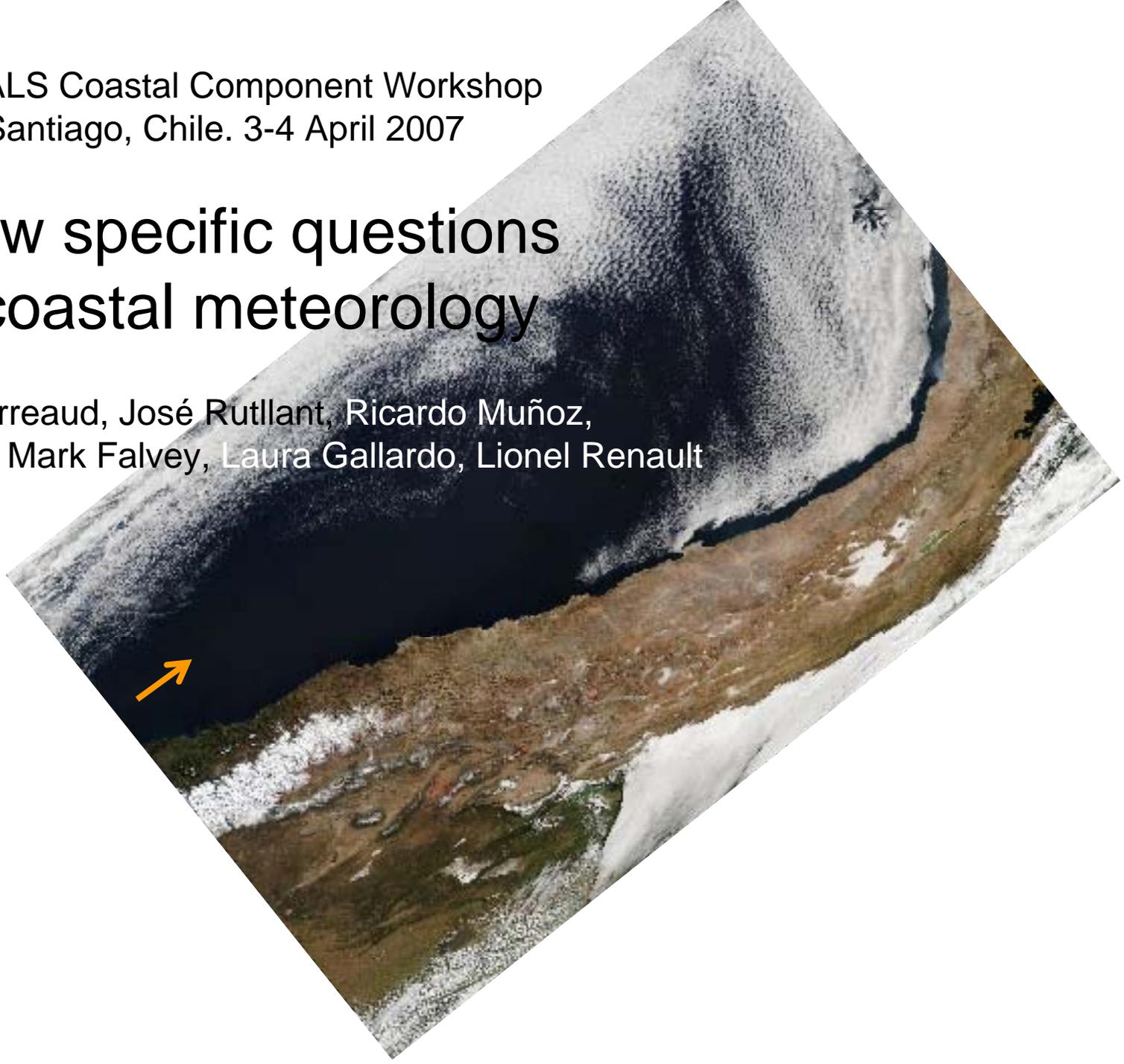


VOCALS Coastal Component Workshop
Santiago, Chile. 3-4 April 2007

A few specific questions in coastal meteorology

René Garreaud, José Rutllant, Ricardo Muñoz,
Jorge Carrasco, Mark Falvey, Laura Gallardo, Lionel Renault



POCS (drifting from the coast?)

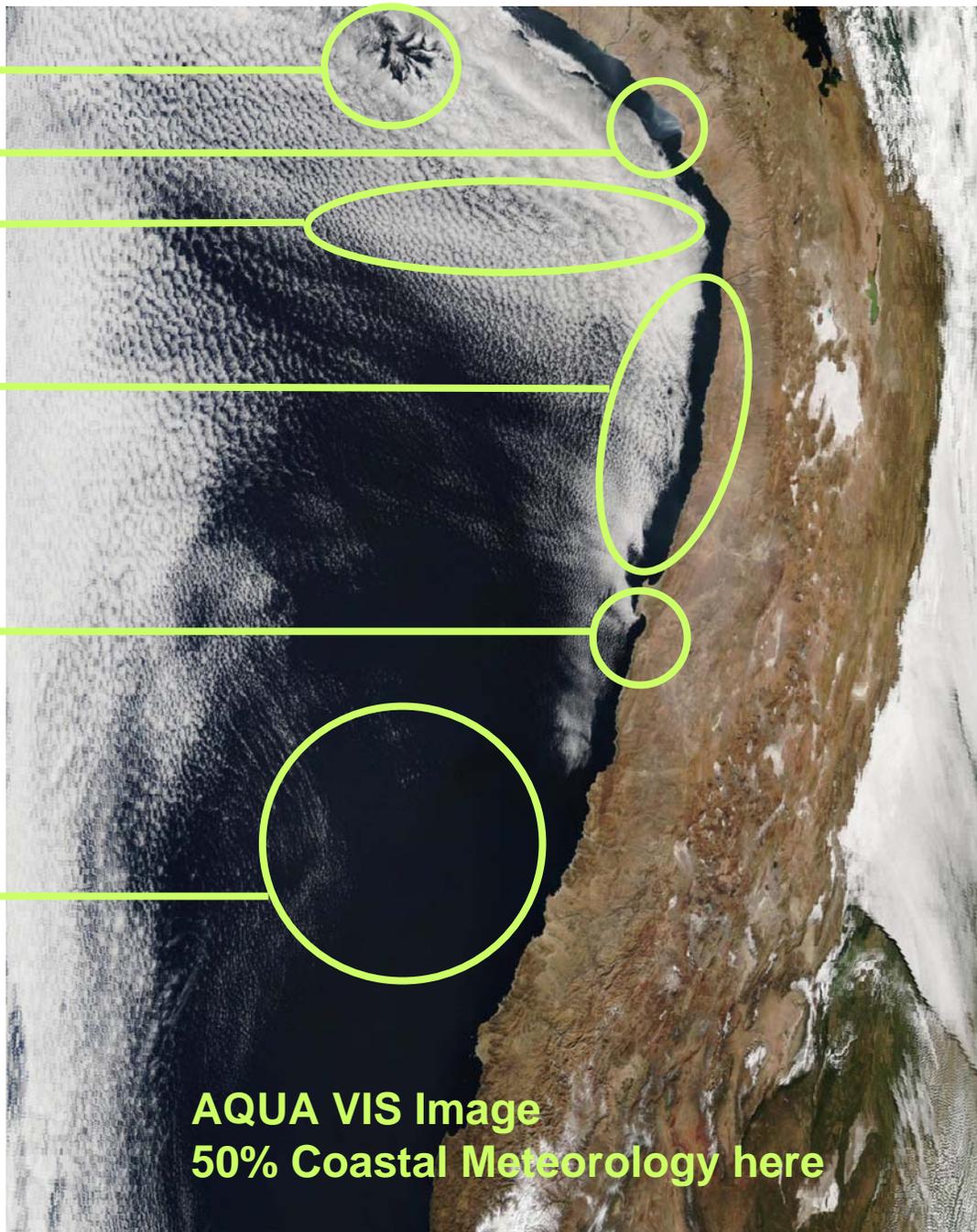
Continental air pollution

Solid-broken SCu deck

Coastal diurnal clearing

Persistent cloudy regions

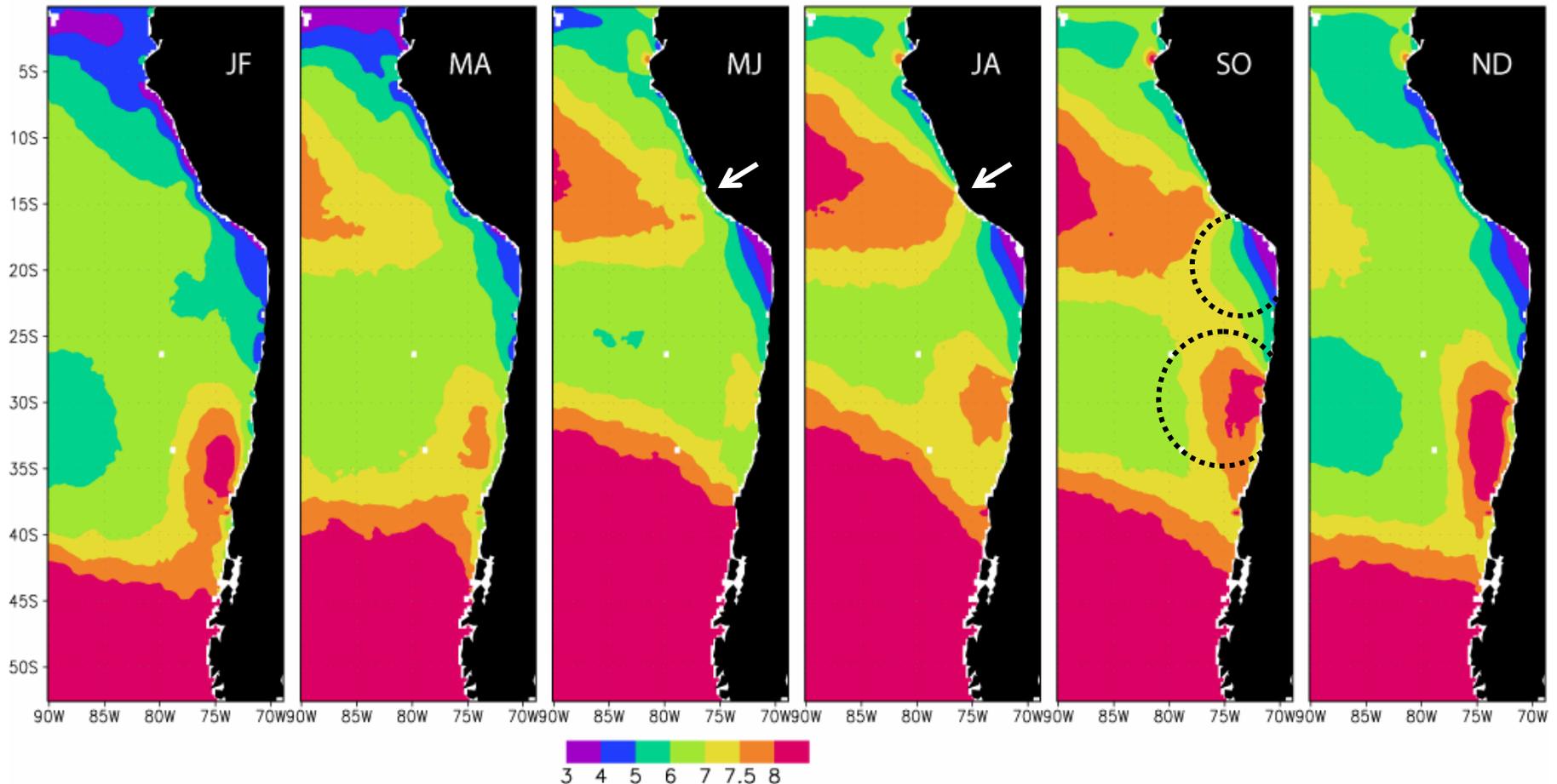
Synoptic-scale clearing



AQUA VIS Image
50% Coastal Meteorology here

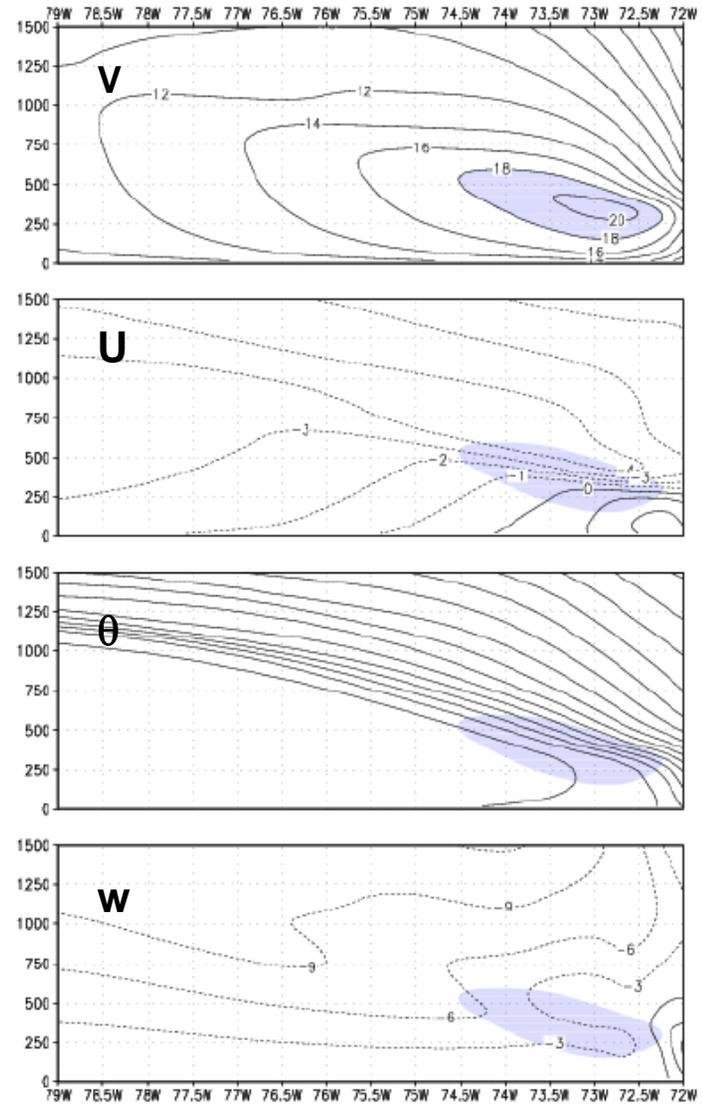
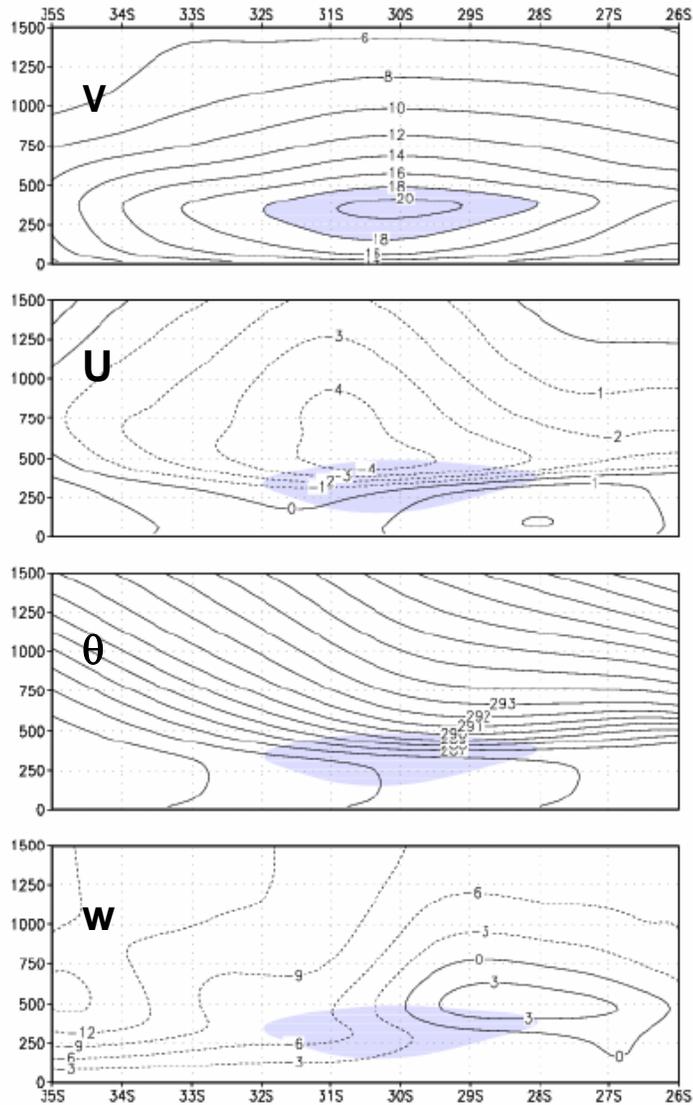
...the remaining 50% of coastal meteorology

QuikScat surface wind speed climatology (2000–2005)



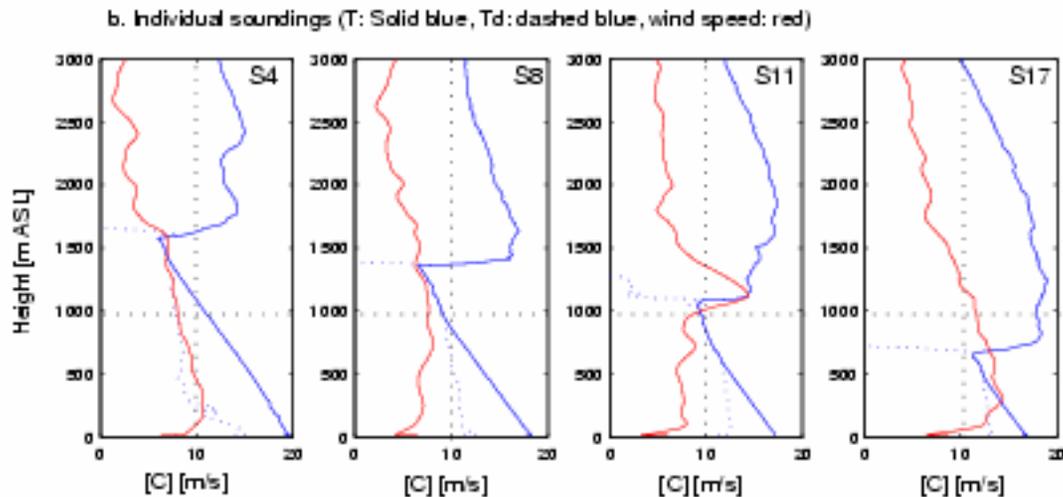
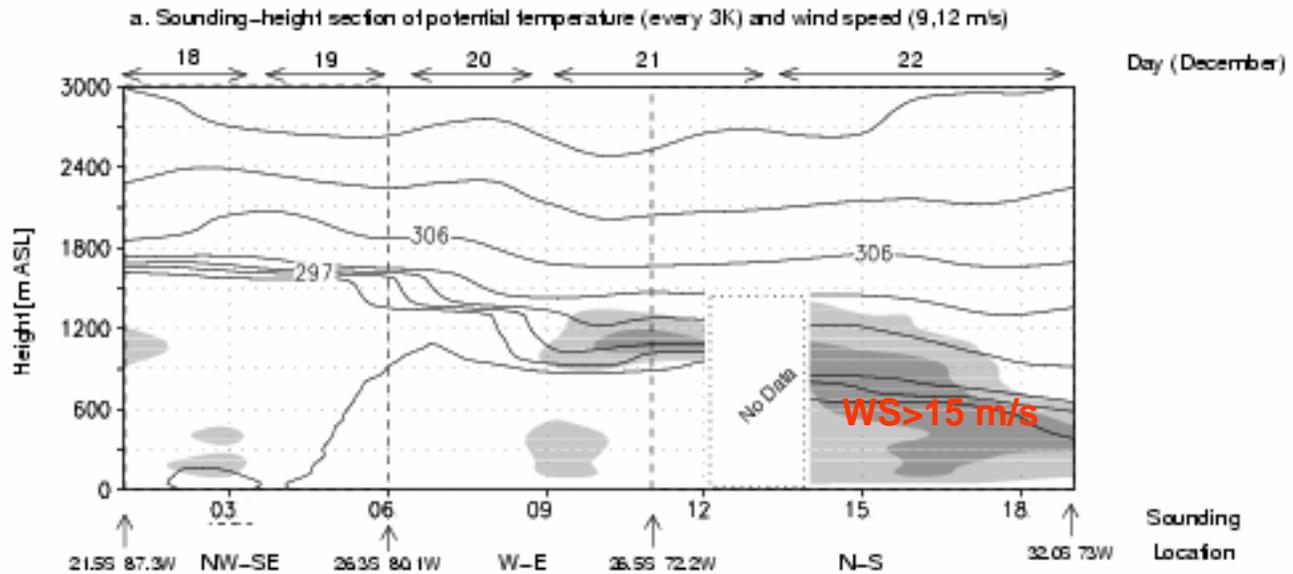
Among several interesting features of the sfc. ws field, we focus on the coastal jet off central Chile and the low-speed area around 18°S. Also notice the wind maximum @ 15°S only present during JJA

Simulated (MM5) structure of the coastal jet



 $V > 18 \text{ m/s}$

WHOI Stratus-2004 Cruise



Steady-state Dynamics

$$\frac{\partial u}{\partial t} + u \frac{\partial u}{\partial x} + v \frac{\partial u}{\partial y} = \frac{1}{\rho} \frac{\partial p}{\partial x} + fv - \frac{C_d}{H} u |\vec{v}|$$

$$\frac{\partial v}{\partial t} + u \frac{\partial v}{\partial x} + v \frac{\partial v}{\partial y} = -\frac{1}{\rho} \frac{\partial p}{\partial y} + fu - \frac{C_d}{H} v |\vec{v}|$$

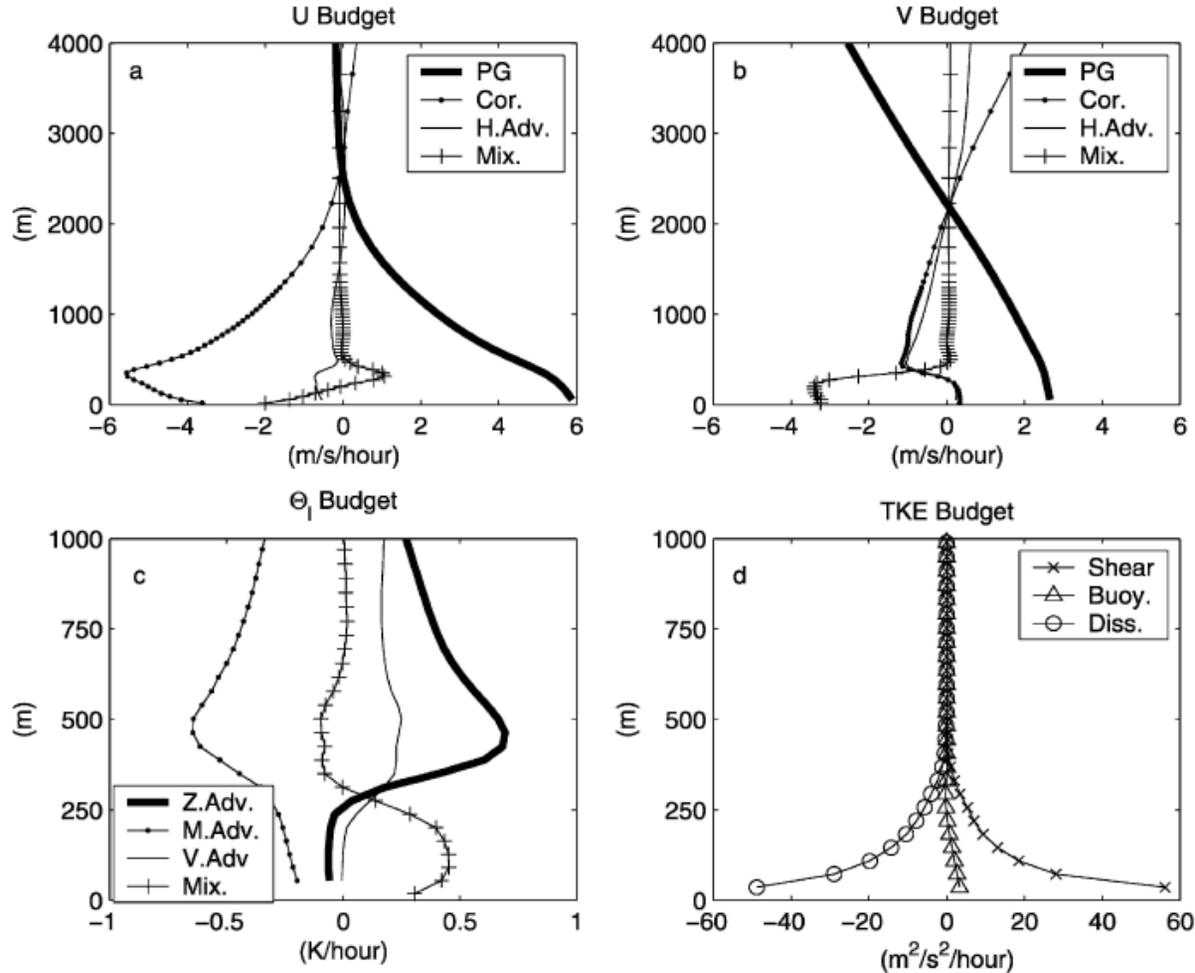
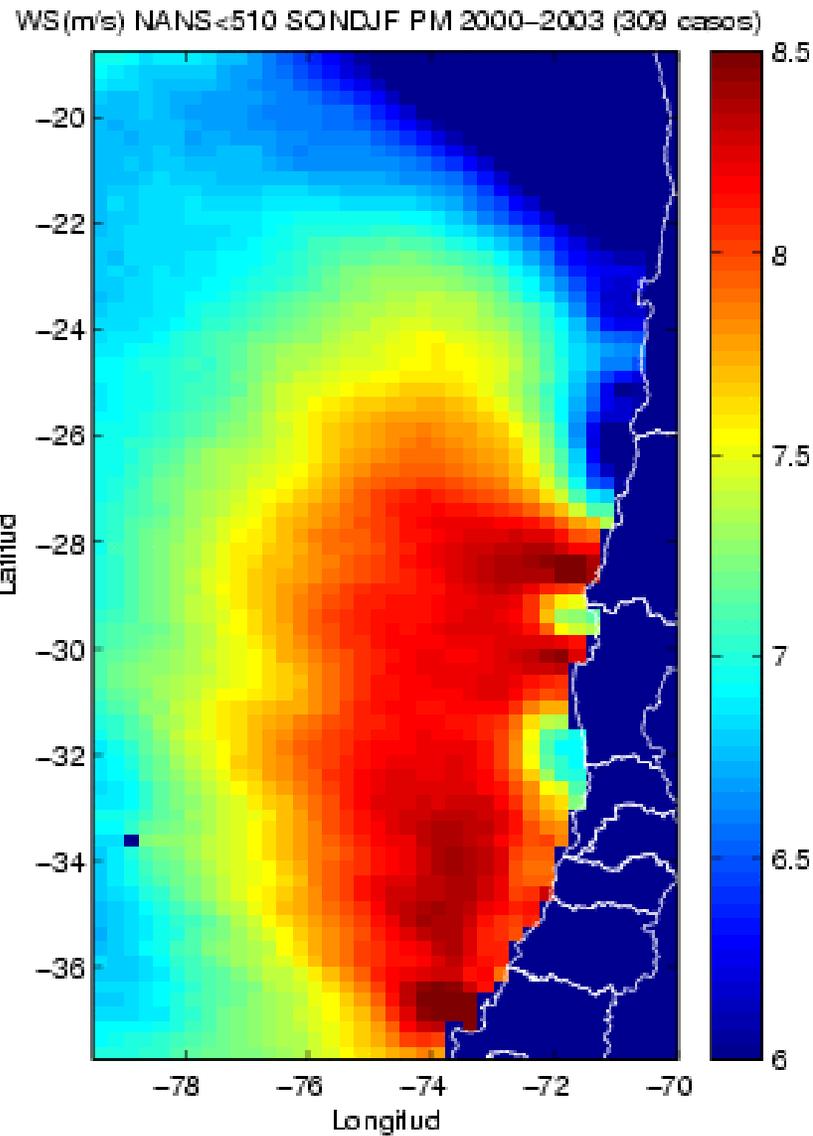
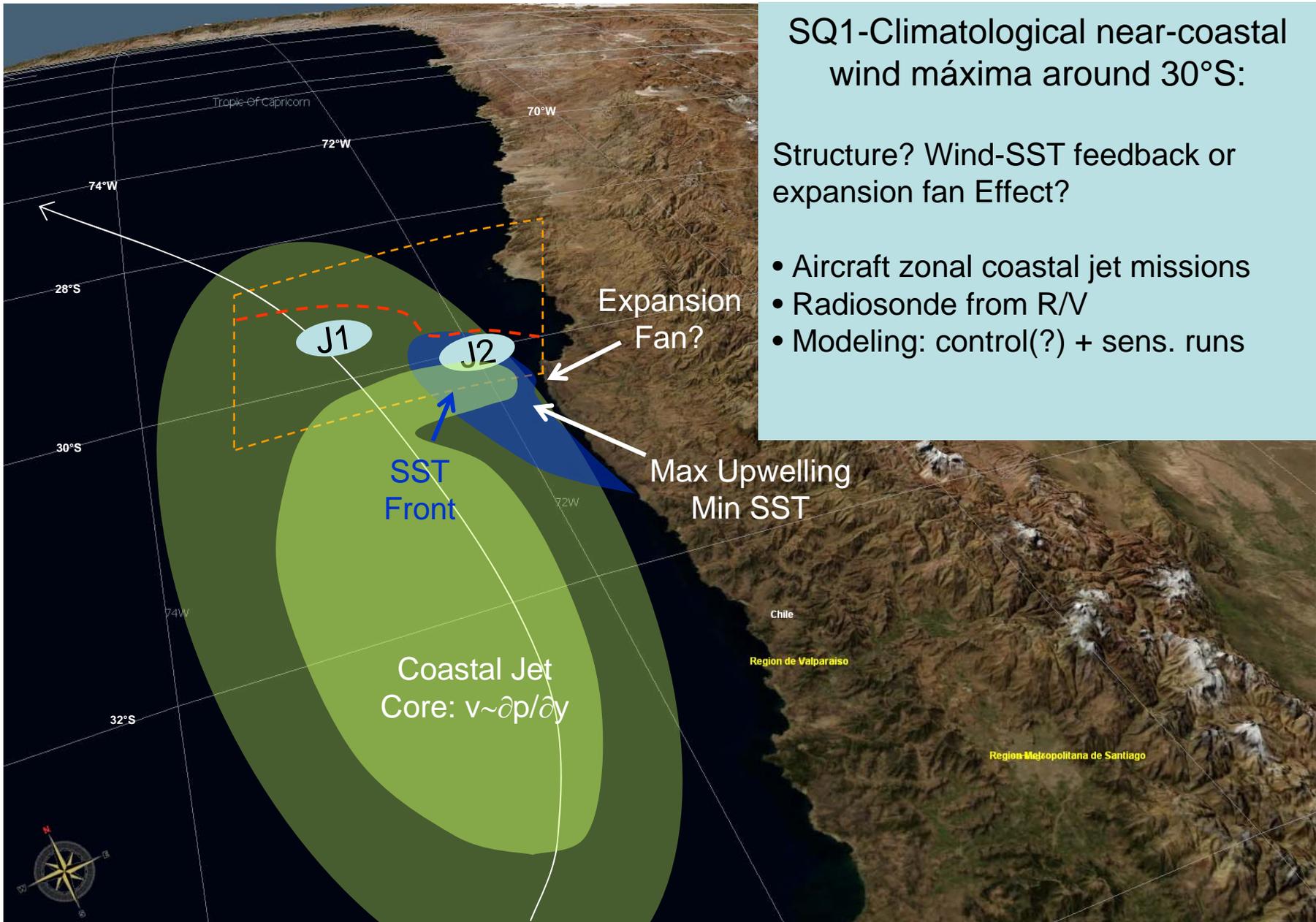


FIG. 8. Mean vertical profiles of terms in the budgets of (a) zonal momentum, (b) meridional momentum, (c) liquid water potential temperature, and (d) turbulent kinetic energy, for point at 30.2°S, 72.8°W.

SQ1-Climatological near-coastal wind máxima around 30°S:





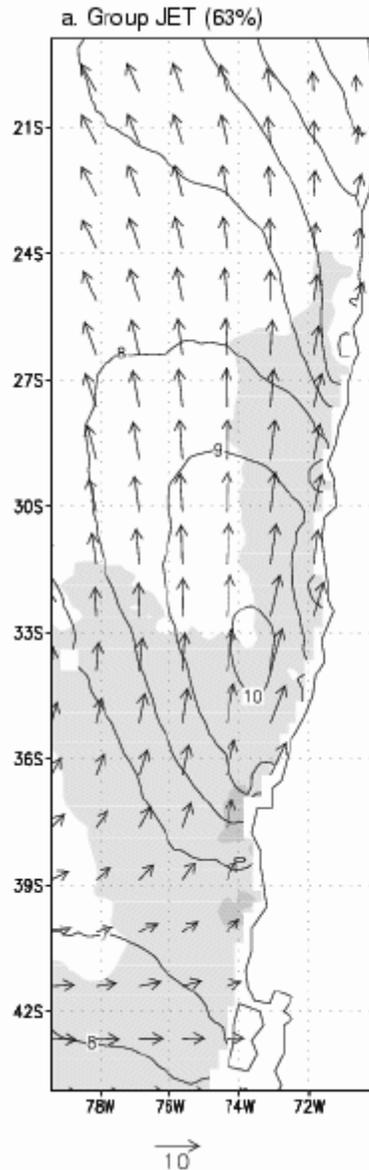
SQ1-Climatological near-coastal wind máxima around 30°S:

Structure? Wind-SST feedback or expansion fan Effect?

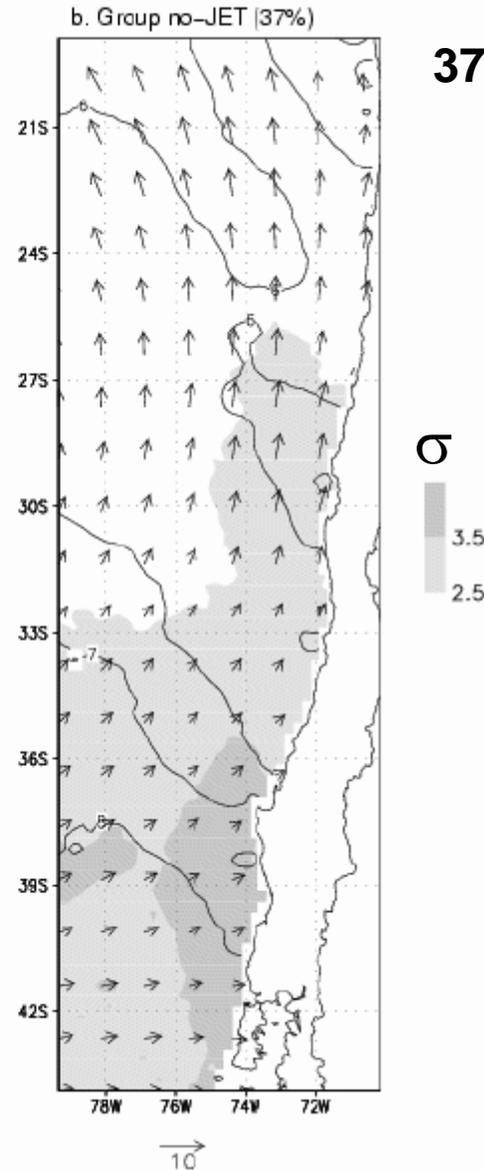
- Aircraft zonal coastal jet missions
- Radiosonde from R/V
- Modeling: control(?) + sens. runs

Jet-structure in mean field produced by frequent (weekly) jet events

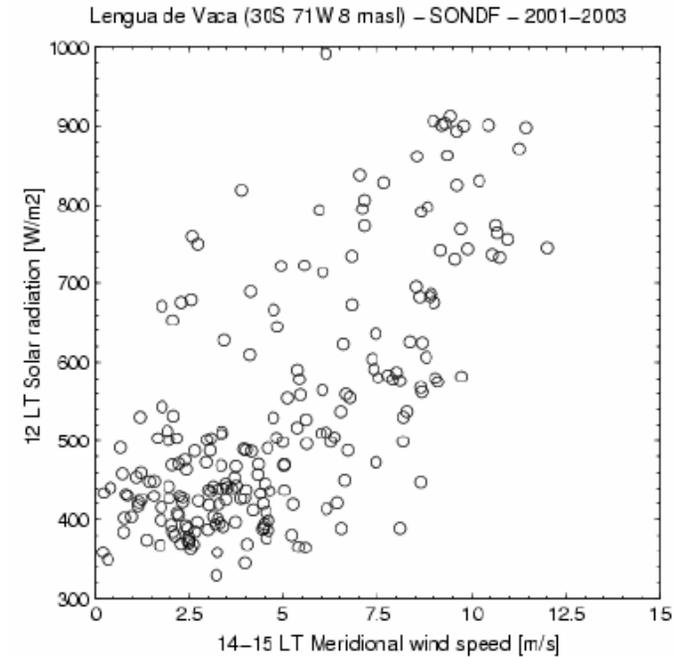
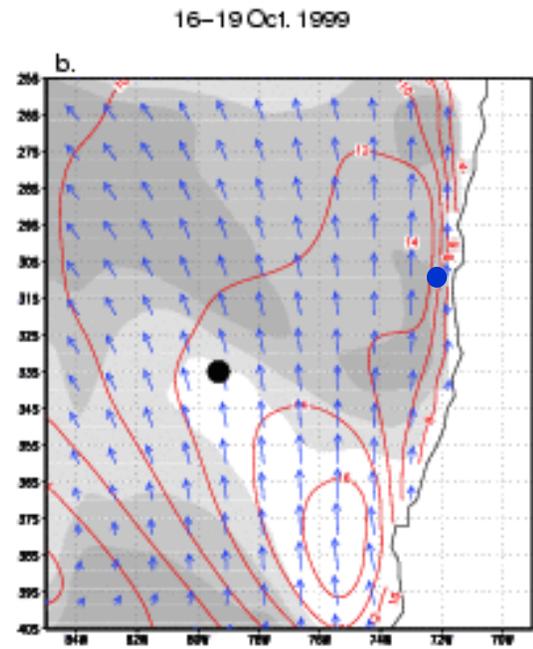
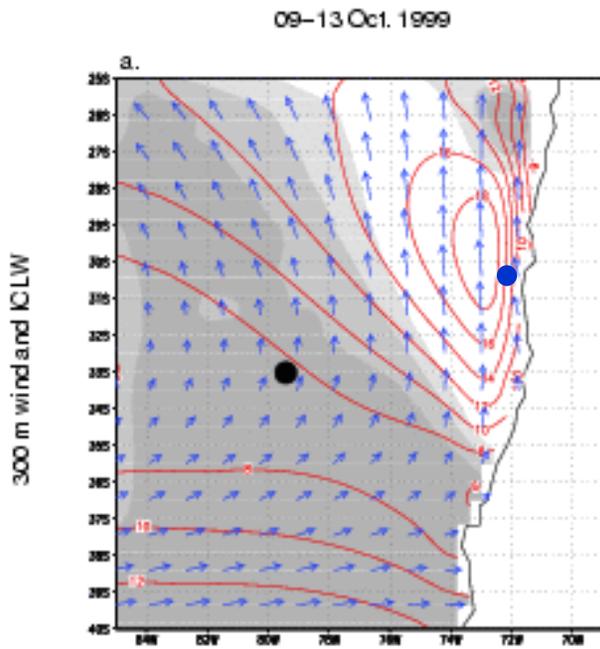
63% of days



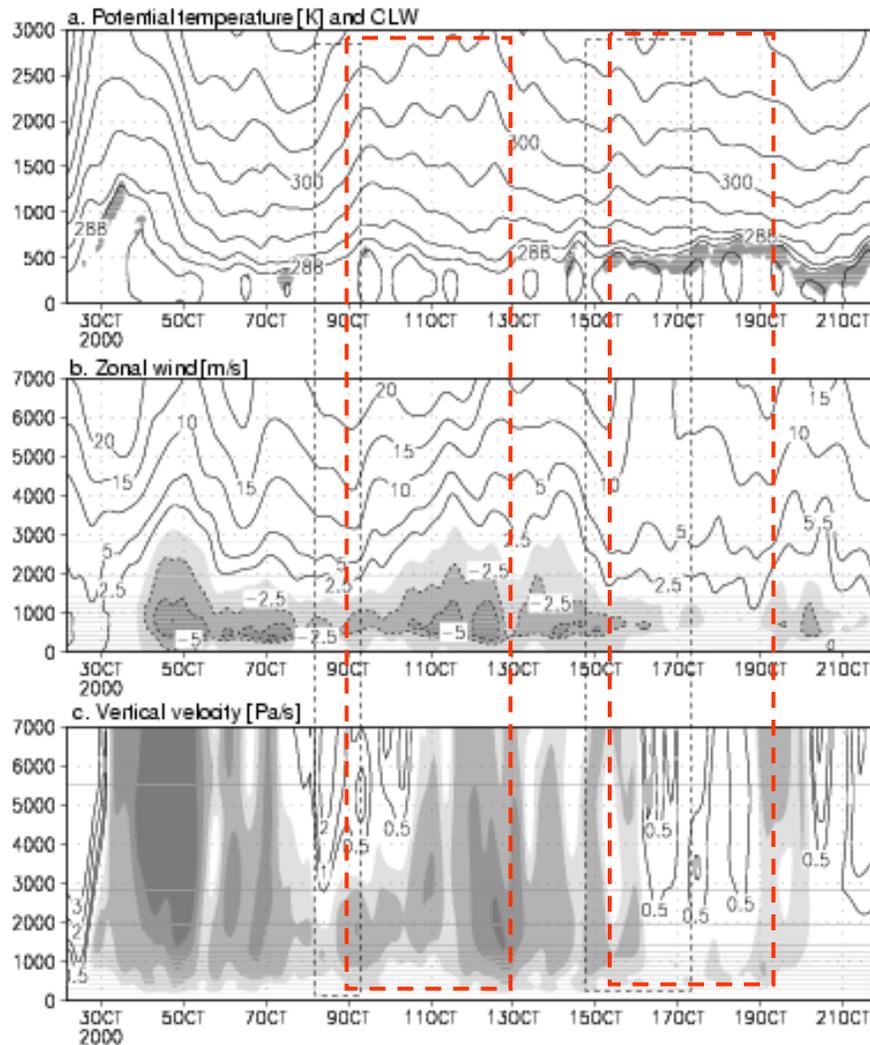
37% of days



SQ3. Coastal Jet under Clear Skies...Why? (+300 W/m² reaching the surface)

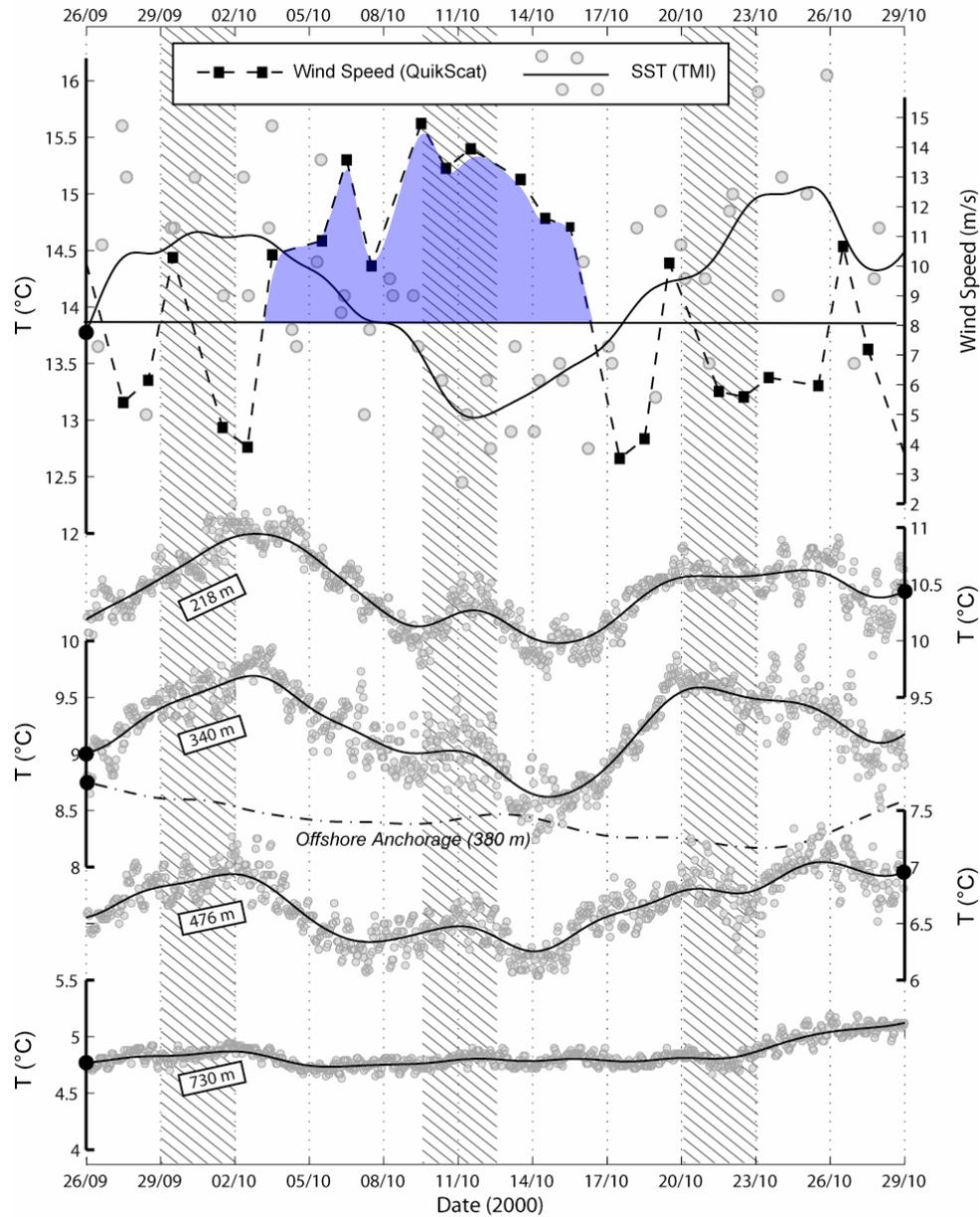


30S 73.5W ●

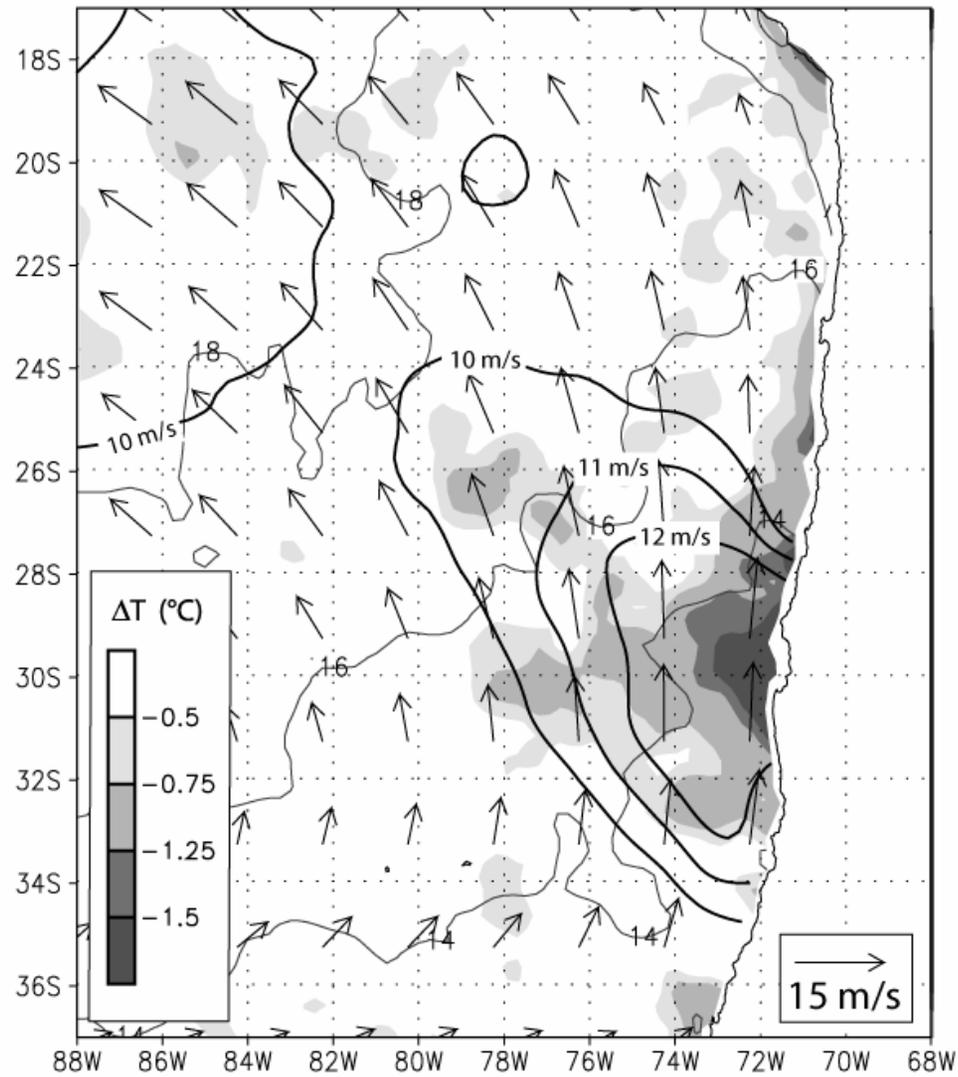


Coastal clearing could be produced by offshore advection of dry air and/or enhanced subsidence...what are the relative roles?

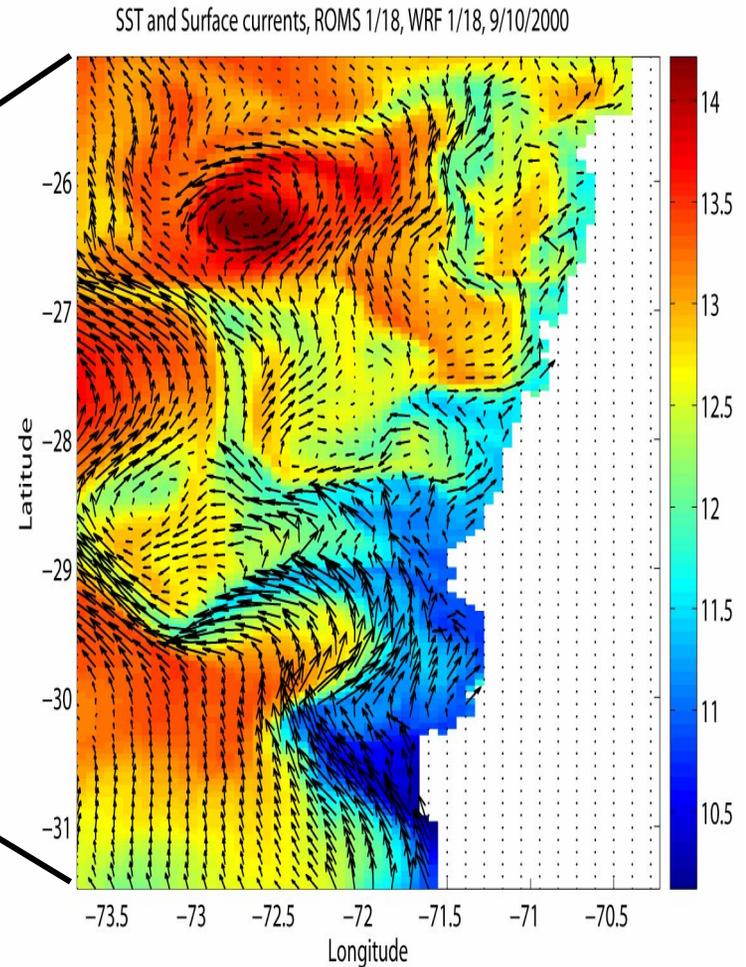
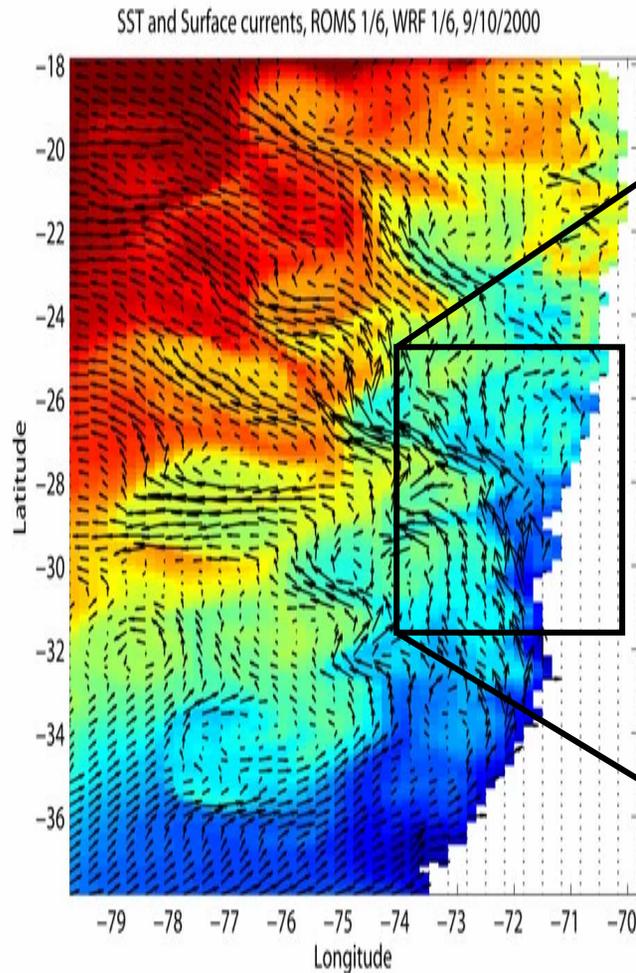
SQ4. Impacts of Jet Events on SST



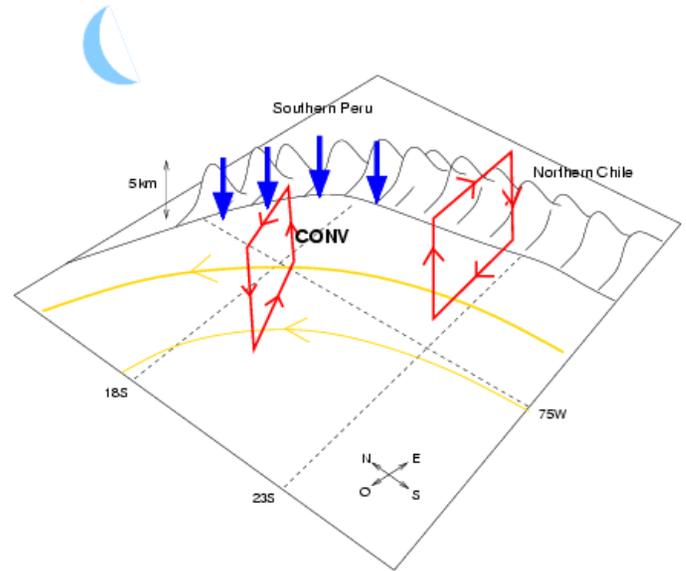
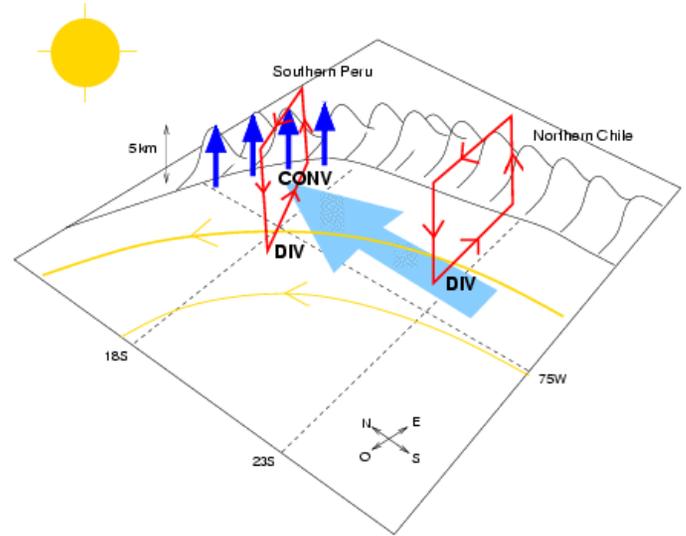
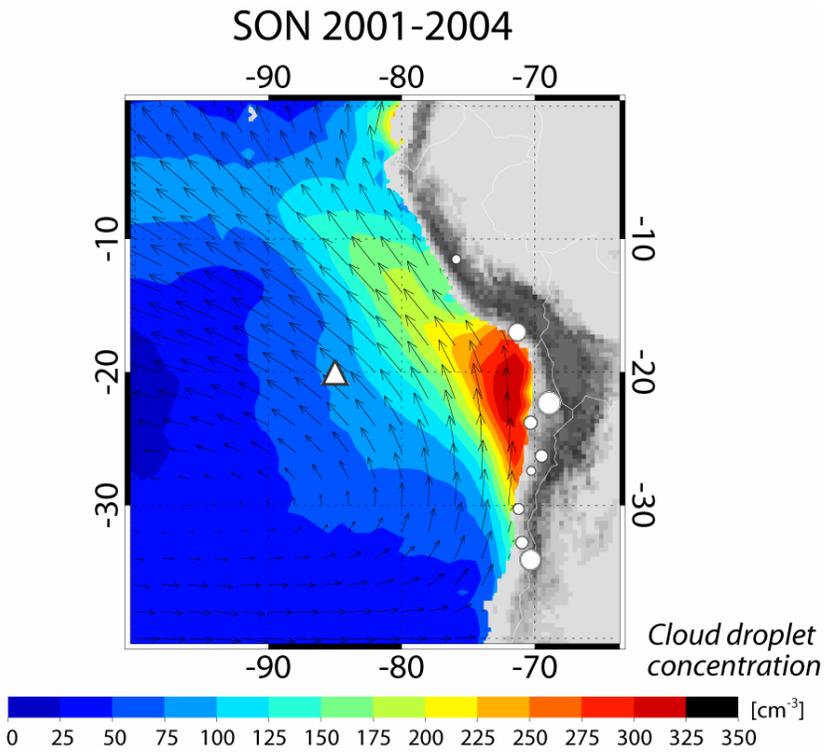
Impacts of Jet Events on SST



To understand/quantify the response of the surface ocean to coastal jet events we propose ship-borne observations, aircraft observations (at onset, height and demise of the event), as well as modeling experiments (in progress, WRF+ROMS)

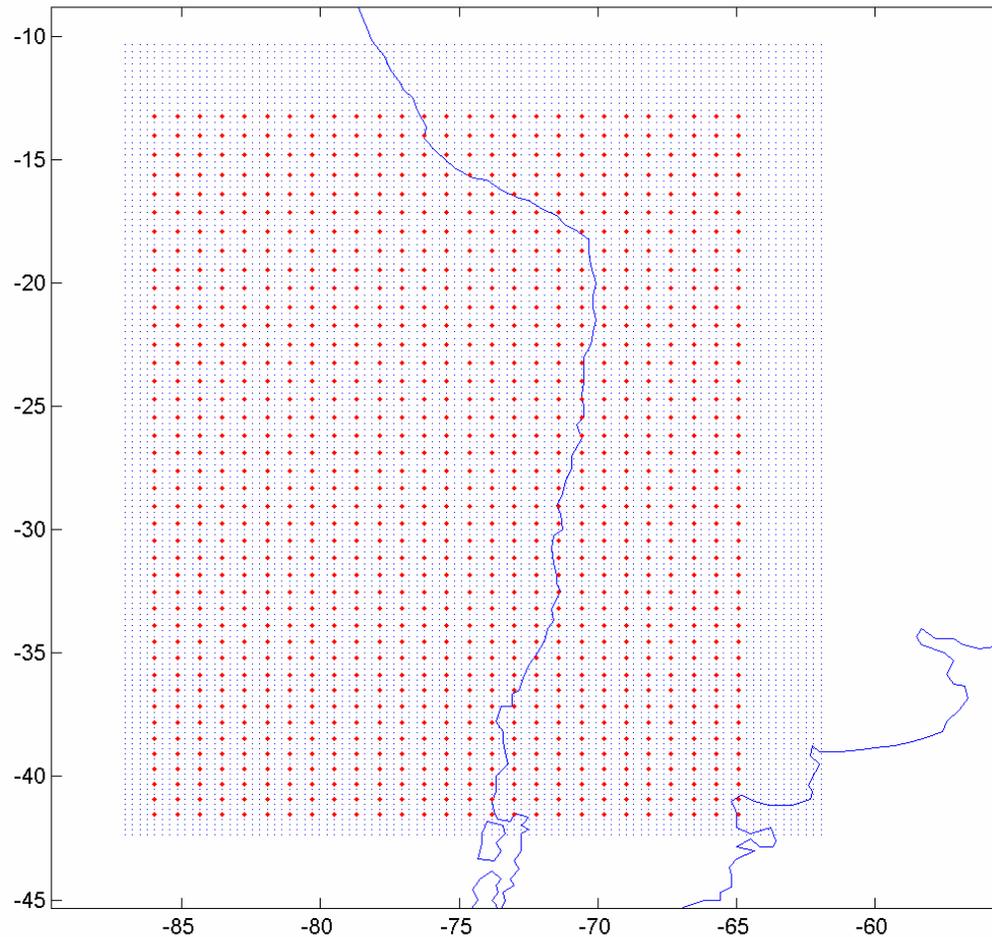


Near-stagnation zone at 18°S
 Collocated with maximum en CDC
 Topographically induced? How deep?
 Sometime flush?

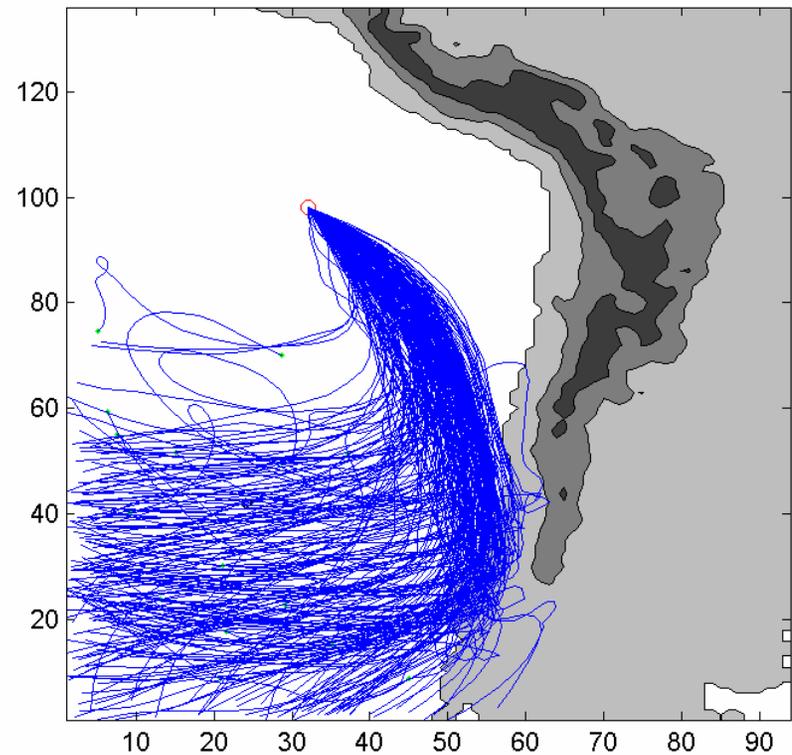
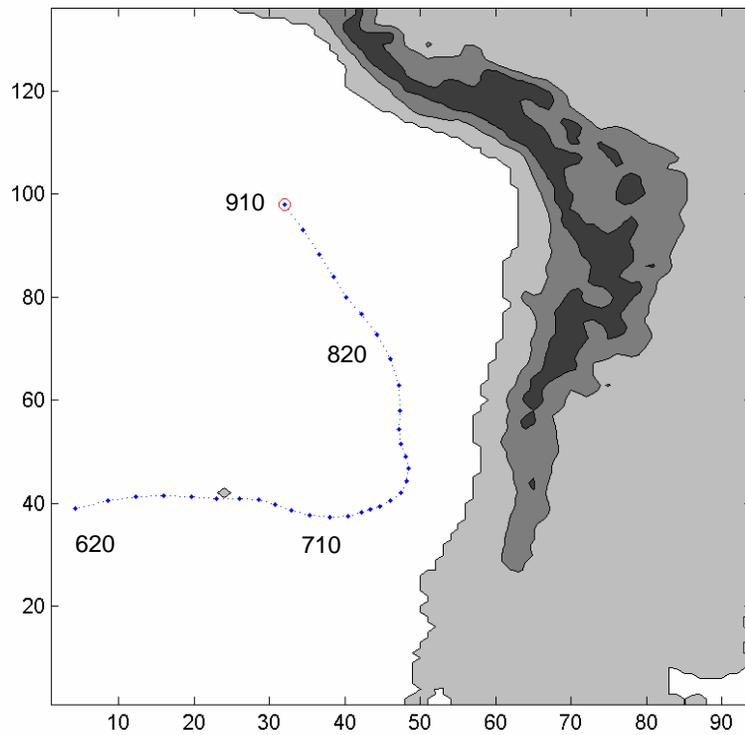


MM5 simulation, Sep-Oct 2003, single domain, 30 km hor. res. (blue dots)

120-hr backward and forward 3-D trajectories were calculated for 920 selected points (red dots), every 6 hr at 6 vertical levels (990, 950, 900, 860, 830, 800 hPa aprox.)



Trajectory information (lat,lon,pres,temp,rh) was saved every 3 hours.
Quite a bit of data: $6 \times 920 \times (24/6) \times 50 \times (120/3) \times 5 = 220 \text{ Mill !!}$

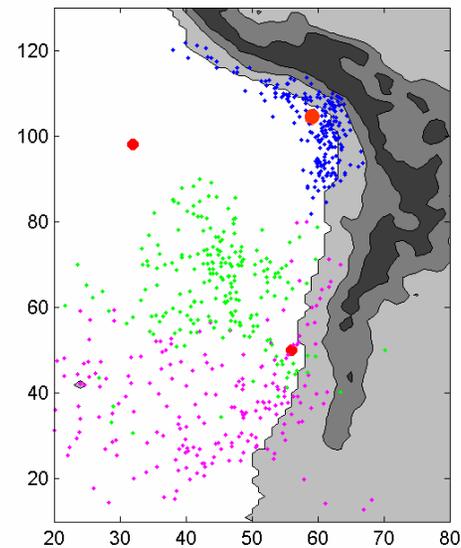
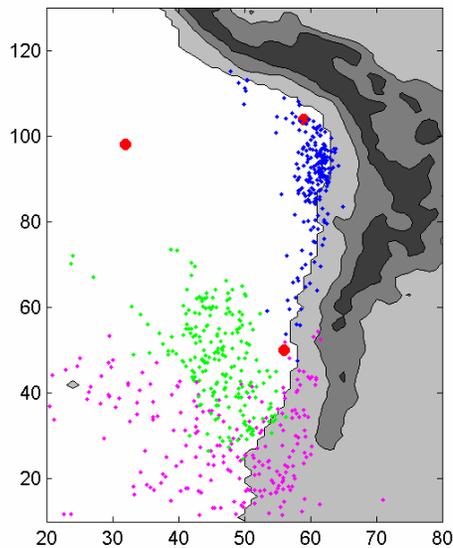
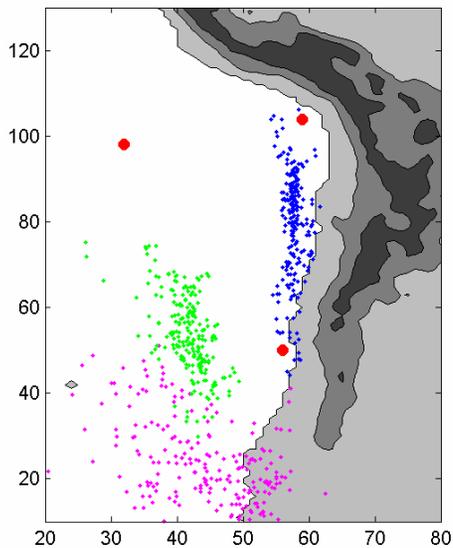


$P_0=995$ hPa
(near surface)

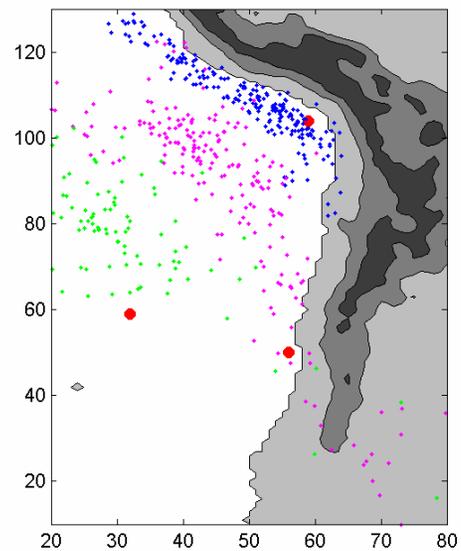
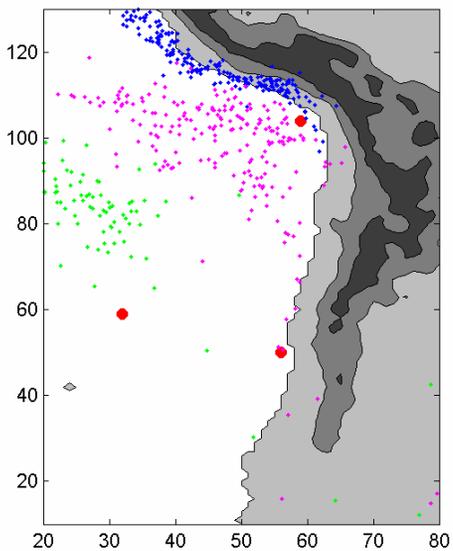
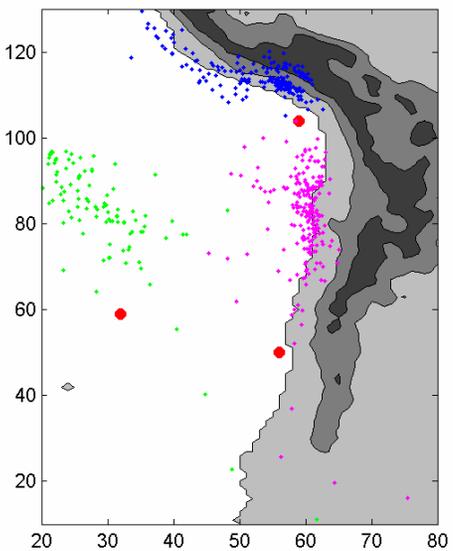
$P_0=950$ hPa
MBL

$P_0=850$ hPa
Inversion

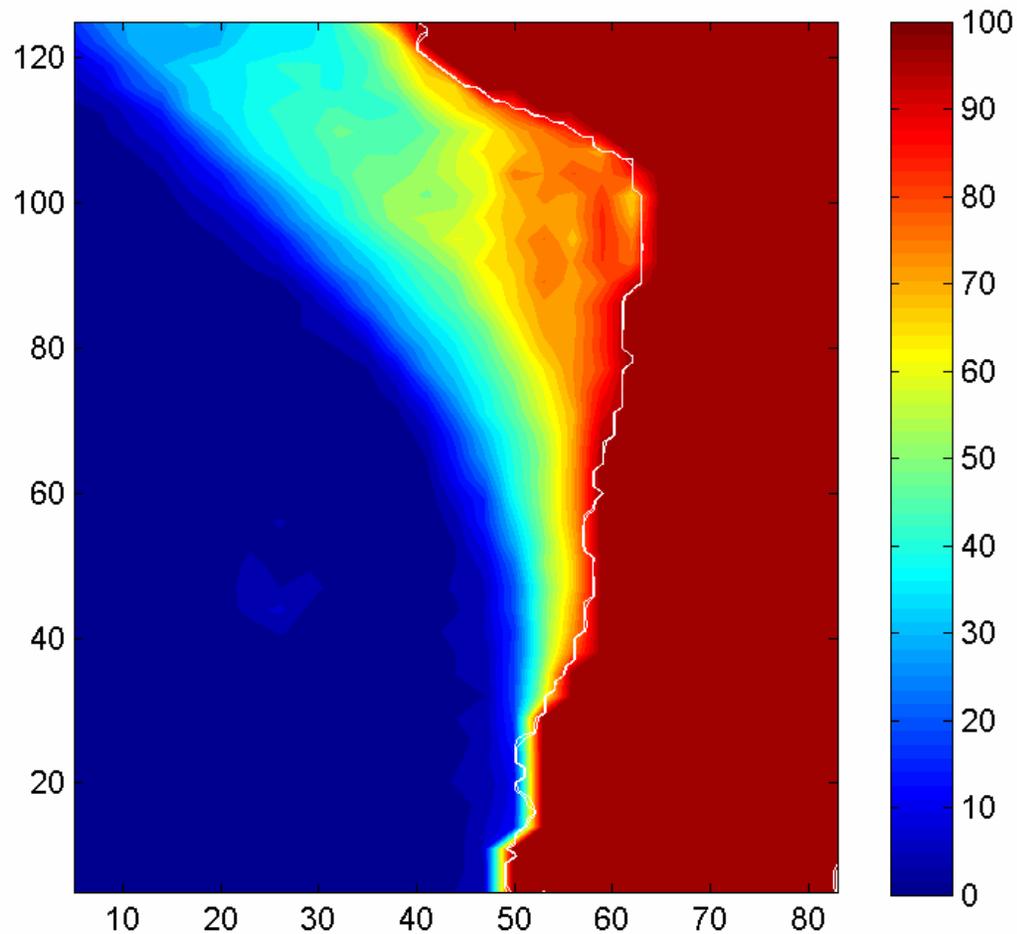
-36 hr



+36 hr

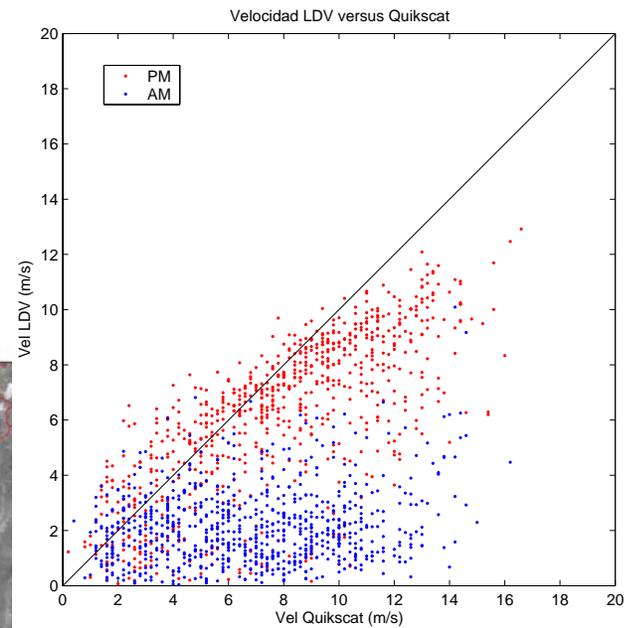
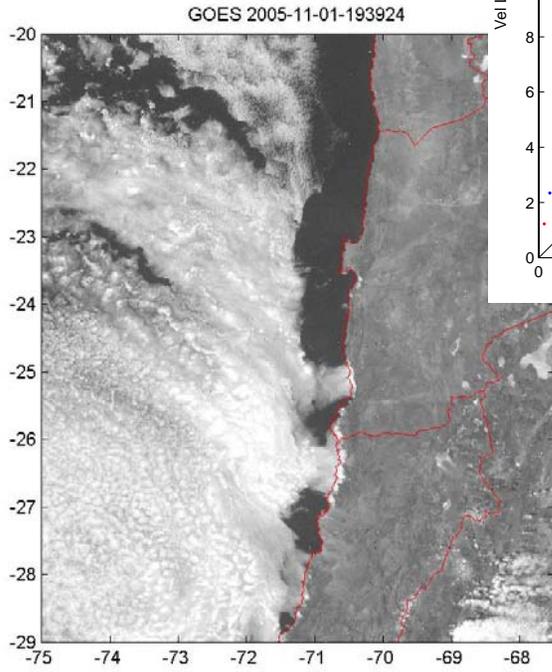
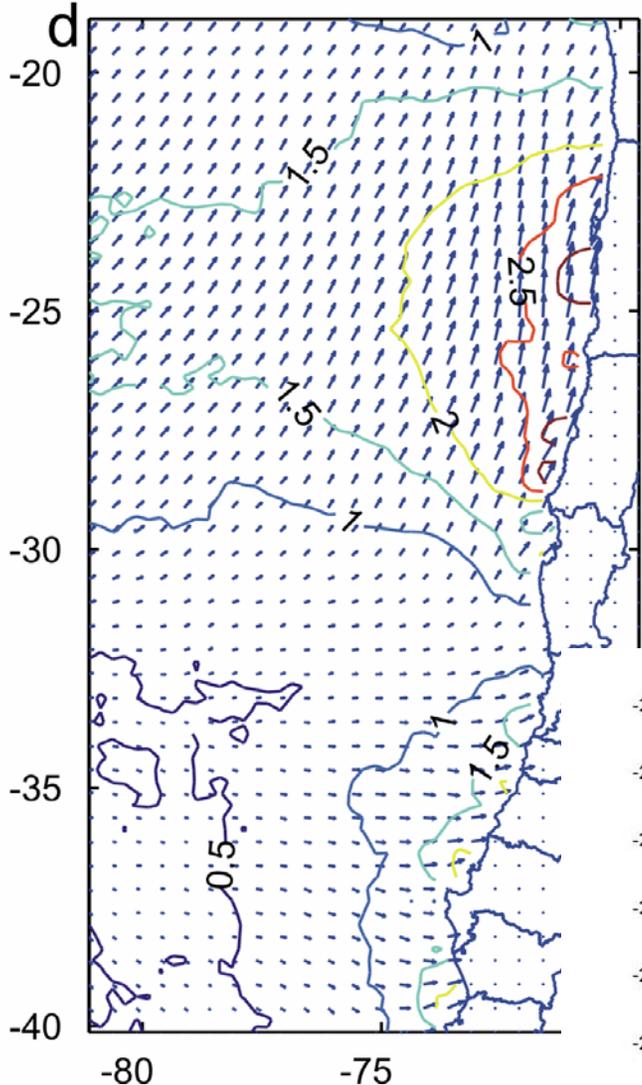


Show for each starting point ($p_0=900$ hPa), the proportion of trajectories that have passed over continental topography at above surface altitudes of less than 2000 m

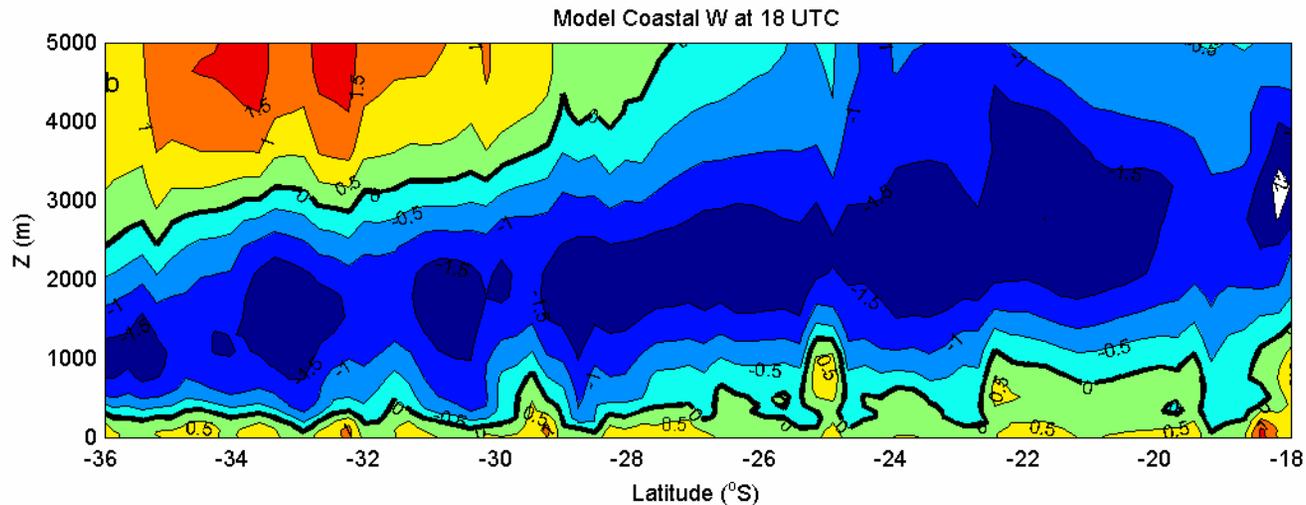
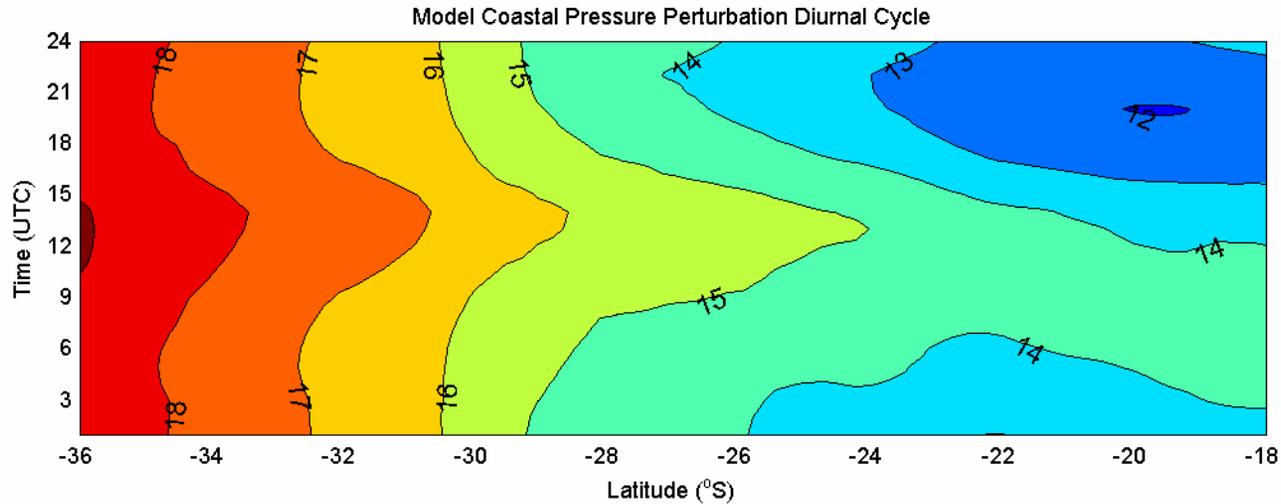


QS VEL PM-AM OCT-MAR 2000-2004

Key features of diurnal cycle
Max. amplitude of V-wind off northern Chile
Nocturnal decoupling of wind on coastal strip
Coastal clearing



MM5 Model Results for Sep-Oct 2003 (Muñoz 2007)



Coastal gradient of pressure exhibits a large diurnal cycle off N. Chile
Afternoon decrease in sfc. pressure associated with subsidence diurnal cycle
How the AML reacts to the diurnal cycle of W?