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
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...the remaining 50% of coastal meteorology
Simulated (MM5) structure of the coastal jet

Garreaud and Muñoz 2005
WHOI Stratus-2004 Cruise

a. Sounding-height section of potential temperature (every 3K) and wind speed (9,12 m/s)

b. Individual soundings (T: Solid blue, Td: dashed blue, wind speed: red)
Steady-state Dynamics

\[
\frac{\partial u}{\partial t} + u \frac{\partial u}{\partial x} + v \frac{\partial u}{\partial y} = \frac{1}{\rho} \frac{\partial p}{\partial x} + f v - \frac{C_d}{H} \frac{u |\bar{v}|}{\rho}
\]

\[
\frac{\partial v}{\partial t} + u \frac{\partial v}{\partial x} + v \frac{\partial v}{\partial y} = -\frac{1}{\rho} \frac{\partial p}{\partial y} + f u - \frac{C_d}{H} \frac{v |\bar{v}|}{\rho}
\]

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)
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

Renault et al. 2006
Impacts of Jet Events on SST

Wind, SST and SST anomalies

Renault et al. 2006
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?

Rob Wood, 2006
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.)

Garreaud, Falvey, Muñoz
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 \(p_0=900 \text{ hPa}\), the proportion of trajectories that have passed over continental topography at above surface altitudes of less than 2000 m.
Key features of diurnal cycle
Max. amplitude of V-wind off northern Chile
Nocturnal decoupling of wind on coastal strip
Coastal clearing
Coastal gradient of pressure exhibits a large diurnal cycle off N. Chile
Afternoon decrease in sfc. pressure associated with subsidence diurnal cycle
How the AMBL reacts to the diurnal cycle of W?