The VOCALS-Peru Cruise Progress Report
RV Jose Olaya Cr. 2008-10

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Hypotheses and VOCALS-Peru Work Packages
I. HYPOTHESES

VOCALS-Peru is devoted to better understand air-sea-land-cloud interactions at a regional scale in southern Peru and their impacts on the local ecosystem.

H1: There is a strong feedback/interaction between the variability of the atmospheric coastal wind, the upwelling cell and the associated thermic front and cloud clearing between Pisco and San Juan.

H2: There is a strong interaction between oceanic physical structures and biogeochemical/fish community structures and distribution.
Work Packages

WP 1 – Atmosphere: Coastal Wind Jet Structure and Cloud Clearing

WP 2 – Physical and Biogeochemical characteristics of the upwelling cell (plume and front)

WP 3 – Biological properties: Community structures, interface fluxes and Fish distribution

WP 4 – Ocean/atmosphere interactions and biological response
II. Study Region:

2.1. Mean Conditions in October
2.2. The regional climate setting in 2008
II. Study region: Survey track and stations, beneath, the mean average of total fraction of cloud clearing area (%) for October, as obtained from SeaWIFS data.
Synoptic oceanic conditions: Presence of an upwelling equatorial Kelvin wave during the cruise.

Equatorial Kelvin wave (in cm) as estimated by a linear model forced by QuickSCAT winds (baroclinic mode 1).

20°C isotherm variation during the same period (from the TAO array).
Mean SST (TMI) and Wind (QuickSCAT) between 13th-18th October 2008

SST (TMI) and Wind (QuickSCAT) timeseries, 77W-155
III.

VOCALS Peru Cruise Observations
Radiosonde data

- 131 out of 132 successful launches
- Of these, 60% reached above 15 km, all reached above 5 km.
- 60% were launched within 3 hour intervals to achieve high horizontal resolution (~10 km) near the coast and sample the diurnal cycle.
Vertical structure of air temperature and along-shore winds (Pisco)
Characteristics of the marine PBL

Some preliminary observations:

- Strong thermal inversions were typical ($\Delta \theta \sim 10$ K) but in other cases they were very eroded.

- Inversion levels varied between 870 and 980 hPa.

- Very dry air above the PBL (RH apparently as low as 1%) in many cases, with moist intrusions in others.

- Vigorous turbulent motions apparent in the wind

- Trade-wind jet generally located under the thermal inversion
Low-level coastal winds

Some preliminary results

- Stagnant flow downstream of Paracas peninsula
- Strong wind west of Paracas peninsula, but with strong temporal variability
- Results consistent with the mesoscale (< 50 km) jet observed in 1976-77 (JOINT II).

Sounding 27
Surface hydrology (CTD data)

SST (°C)

SSS (PSU)

Density (kg m\(^{-3}\))

Oxygen (mL L\(^{-1}\))
Vertical distribution of temperature (°C) along 3 sections

San Juan

Pisco

Callao
Vertical distribution of salinity (psu) along 3 sections

San Juan

Pisco

Callao
Vertical distribution of oxygen (mL L^{-1}) along 3 sections
Currents obtained from ADCP measurements

Vertical Average

VOCALS, San Juan, Cross-shore VMADCP

Along-shore VMADCP
Biological measurements

-Chlorophyll-a and Phytoplankton-

Chlorophyll-a (µg L⁻¹)

Phytoplankton volumes (mL m⁻³)
Biological measurements

- Anchovy eggs and Fish distributions-

**Anchovy eggs (egg m\(^{-3}\))**

**Anchovy (m\(^2\) nm\(^{-2}\))**

Simrad EK-60 echosounder, 120kHz

VOCALS PERU
02-18 Octubre, 2008

Simrad EK-60 echosounder, 120kHz
Glider “Pytheas” deployment
European Gliding Observatories (EGO)/IMARPE/LOCEAN/LEGOS

Slocum-type glider (0-200 m depth)
First 6 sections of glider Pytheas and averaged currents for the 0-200m layer

~70 nm offshore

1 profile each ~500 m
T,S,O2,Chl-a,Turbidity
Trajectories of 8 surface drifters deployed during VOCALS Peru Cruise
Conclusions

Present results are still preliminary, however there are some features that can be drawn from the presented data set:

1. There exists very strong coastal winds in the first 50km from the coast.
2. The thermal inversion is constant between 1000-1500 m.
3. There seems to be a good interaction between some physical and biogeochemical/biological variables: strongest winds confined in the nearshore 35 nm with the lowest SST, very low dissolved-oxygen concentrations associated with strong productivity in terms of fluorescence (also observed in glider data), very large concentrations of chlorophyll-a, plankton volumes, anchovy eggs and dense concentrations of anchovy.
4. After further data processing, we will get better knowledge of the interactions presented, and we would be able to evaluate the level and mechanisms of these interactions.
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...the 00-04:00/12-16:00 hrs watch)