The Eastern South Pacific constitutes a natural lab to understand future oceans

- Highest natural productivity gradient from coast to most oligotrophic waters known
- Strong climate teleconnections through atmospheric and ocean processes
- Intense natural Anoxic Marine Zone
- Natural ocean acidification: High pCO$_2$ – Low pH waters
- Unexplored deep ocean habitats (seamounts, trench, basins)
What is the role of mesoscale activity in governing energy and matter transfer and ecosystem dynamics in open ocean ecosystems in the ESP?

How do large-scale perturbations impact transport and gradients in physical-chemical water properties and the dynamics of the ESP?

How do key functional plankton groups adapt to changing ocean chemistry and impact biogeochemical cycling in the ESP?

What are the community structures and the biogeochemical characteristics of the deep and abyssal waters of the ESP?
Mesoscale Processes

The ESP exhibits regions of high mesoscale activity transporting waters with coastal signatures (e.g. high salinity, low $O_2$) into the oligotrophic open ocean (poor in nutrients and phytoplankton/chlorophyll-a).

Observations


Pizarro (unpublished data).
Mesoscale Processes

Related to Research Focus 4: Marine biophysical interactions and dynamics of upwelling systems

Yvonne Montes
ROMS-BIOEBUS
2000-2004

Geophyiscal Research Institute, Lima
Change in South Pacific Ocean Circulation

- Warming and Sea level Rise
- Expansion of Subtropical Gyre
- Intensification of Surface Circulation
Intensification of SST gradient across the South Pacific Ocean (~1 °C in 10 years)
Time series station offshore Dichato

Temperature Anomalies averaged over 1-80 m depth (Oct 2002 - Sep 2013)

Related to Research Focus 2: Decadal variability and predictability of ocean and climate variability
Adaptations in a Changing Ocean

Desertification and Declines in $O_2$ and pH

Low-Chlorophyll areas are expanding at an average rate of 2.9% per year.

Decrease of 0.1 pH units (30% increase of acidity) since the industrial revolution; the doubling of ocean acidity is expected by 2100.
Deep Ocean Processes and Communities

Ecological & biological significant but unknown Areas
Sea Mounts and Submarine Canyons Ecosystems

ONLY COASTAL AREAS HAVE RECEIVED ATTENTION

Number of records of species

- >22,200
- 1,250-22,200
- 70-1,250
- 6-70
- 1-6

OBIS DATA BASE FOR MARINE SPECIES
Approaches

Compilation and analysis of historic data

Numerical Modeling
- Hydrodynamic and bio-physical models

Laboratory Analysis
e.g. Perturbation experiments on cultured and natural communities in microcosms

Time-series observations
- satellite remote sensing
- moorings
- glider sections

Research Expeditions
Planned Expeditions for the next 5 years
Meso-scale Processes Cruises 2014 and 2015

JF Is. Mooring and repeated glider sections for at least 2 years

Bio-chemical-physical sampling along the section in 2014 and 2015 with RV Cabo de Hornos
Education

PROGRAMS AND SUMMER SCHOOLS

- Marine Biology (PUC)
- Marine Biology (UdeC)
- Oceanography (PUCV)
- Geophysics (UdeC)
- Oceanography (PUCV)
- Oceanography (UdeC)
- Environmental Sciences (UdeC)
- Ecology (PUC)
- Oceanography (UdeC)
Our Vision

We seek to become an internationally recognized institute for ocean research and education that leads the exploration of the central and eastern South Pacific and best serves the country and the society at large.

Our commitment is to provide an intellectually stimulating environment for the generation and dissemination of transformative knowledge and new understanding in a creative, bold, and collaborative way.
Cabo de Hornos
a multi-purpose research vessel for
Oceanography
Fishery
Geology
Bathymetry

Photo Courtesy: CONA, Chile
Cabo de Hornos

Length: 74.1 m
Autonomy: 35 days with 10.5 knots
Maximum Speed: 14.5 knots
Ship crew: 41
Scientific/Technical crew: 25
Costs: ~ 15 million $ US / day
After the 27F 8.8 Earthquake + Tsunami

Chilean Oceanography is back on its feet and better than ever