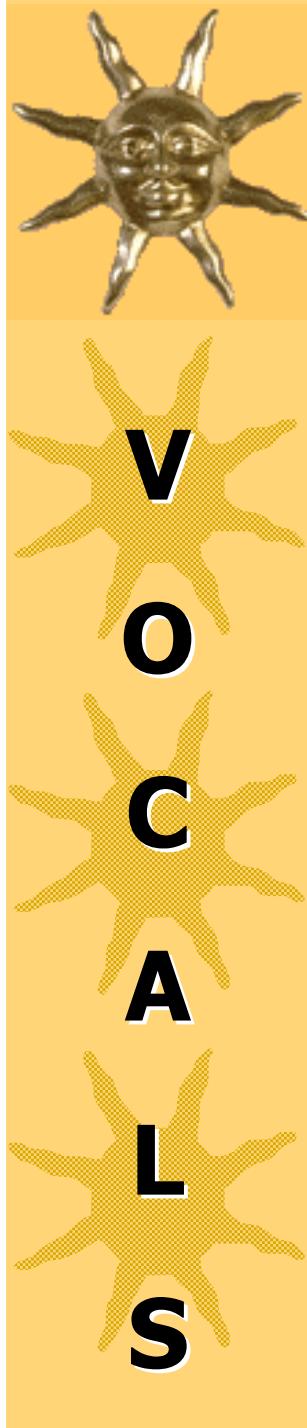


**7th CLIVAR VAMOS Panel Meeting  
VAMOS Ocean Cloud Atmosphere and Land  
Studies (VOCALS) Working Group**

**VOCALS REPORT**

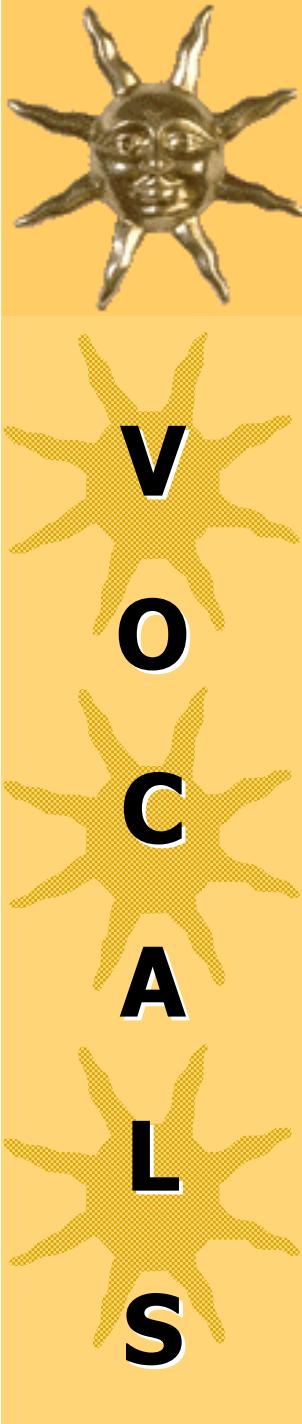
**presented by  
Robert Weller**

**24 March 2004**



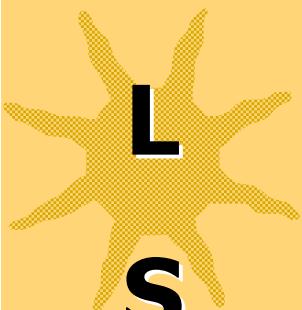
## **VOCALS GOAL**

The overall goal of VOCALS is to develop and promote scientific activities leading to an improved understanding and model simulation of southeastern Pacific stratus decks, their interaction with weather systems (including deep convection), the seasonal cycle and interannual climate variations over South America, and their feedback with the underlying ocean. These activities include diagnostic and modeling studies, sustained observations, and pilot and enhanced observational programs. Participants currently include scientists from countries on the west coast of South America and the USA.



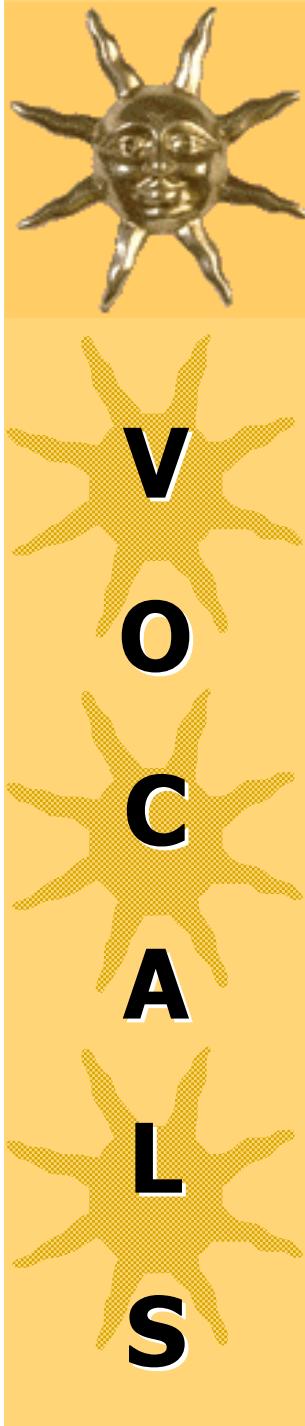
## ***VOCALS Scientific Issues (1)***

- On what time and space scales does continental heating/mechanical forcing impact boundary layer cloud/radiative forcing?
- How sensitive is the overall tropical circulation and ENSO to variations of Eastern Pacific cloud topped boundary layer properties and why?
- What are dominant S/I feedbacks among Sc clouds, surface winds, upwelling, coastal currents and SST in E Pacific?
- Does natural and anthropogenic aerosol variability significantly modulate the Sc?



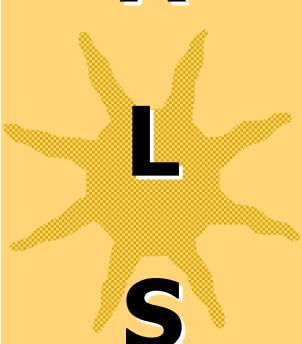
## ***VOCALS Scientific Issues (2)***

- What processes control SST and upper ocean heat content and structure over the domain?
- What is the connectivity of the ocean to remote regions?
- How sensitive is the stratus deck to local ocean variability?



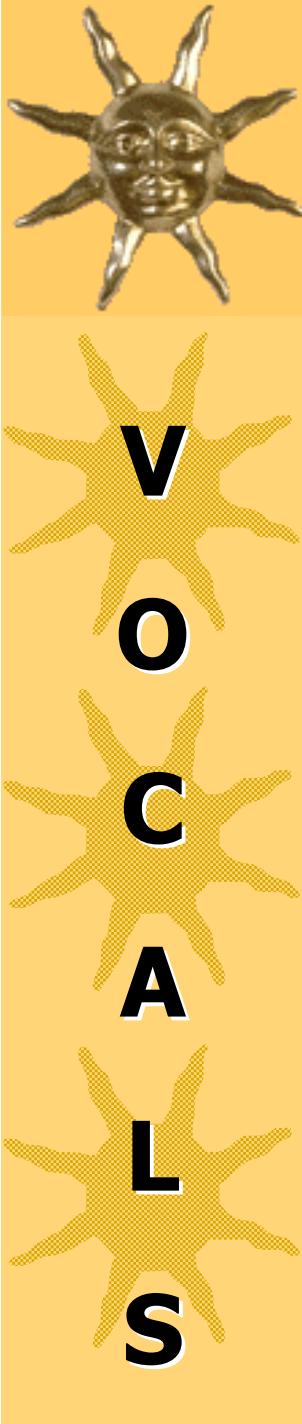
## **VOCALS STRATEGIES (1)**

- Oct 2007 process study preceded by enhanced monitoring.
- Global and mesoscale model evaluation and improvement (e.g parameterization development) using multiscale data sets.
- Model sensitivity studies to refine hypotheses and target observations.
- Science by synthesis/use of existing data sets, enhancement through targeted instrument procurement, algorithm evaluation and development, and enhanced observation periods.



## ***VOCALS STRATEGIES (2)***

Co-ordination with oceanographic, aerosol, cloud process communities, including CLIVAR CPT, CLOUDSAT, etc.

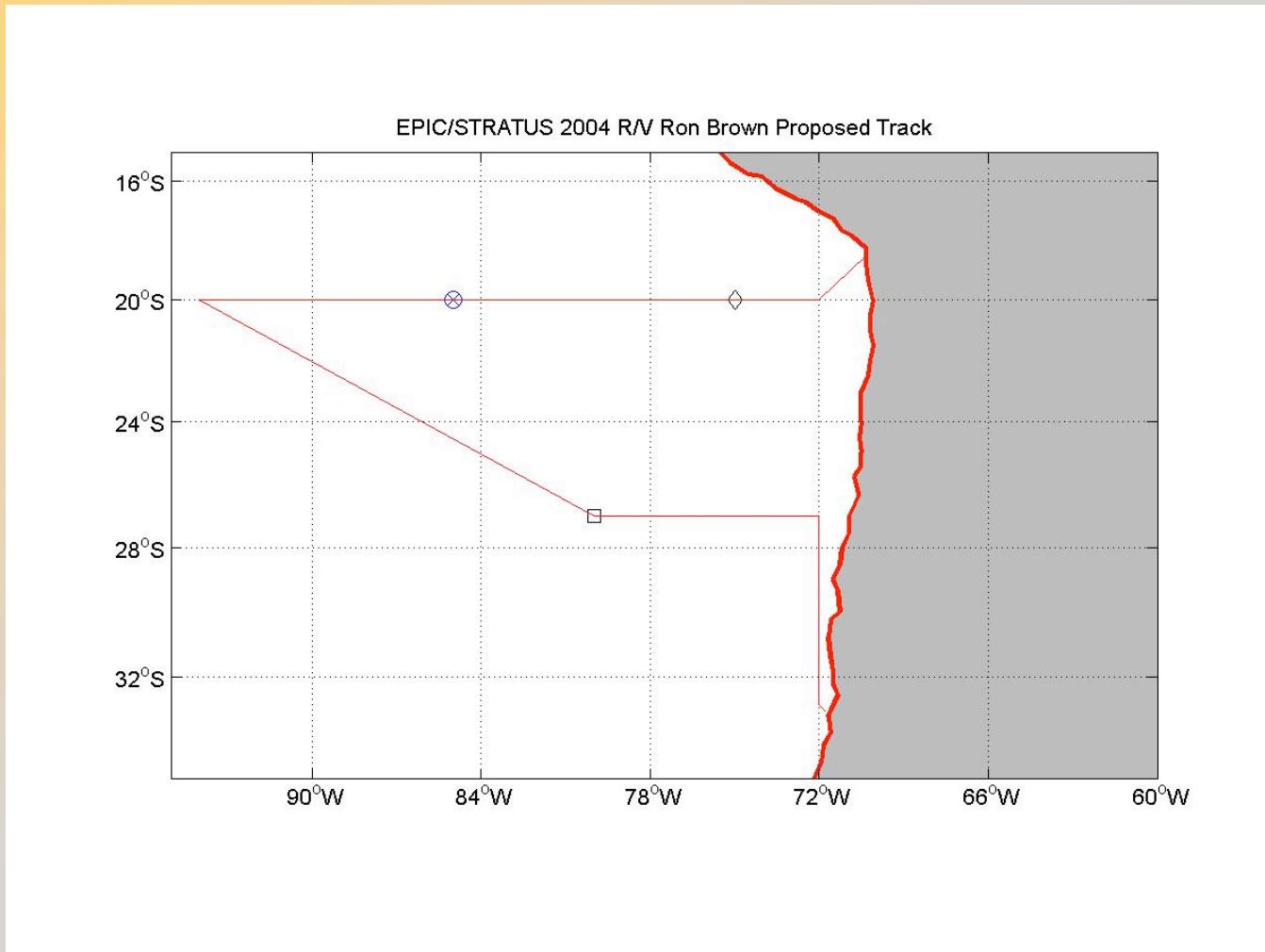


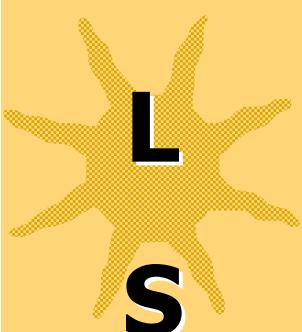
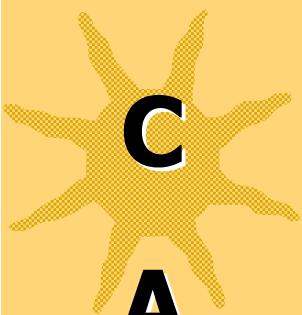
## ***HYPOTHESIS GENERATION***

- Cloud microphysics/drizzle (POCS); spatial/temporal variability of cloud deck
- Diurnal cycle (role of Andes, Sc dynamics), propagating subsidence wave
- Role of Andes/flow blocking in influencing Sc.
- WHOI and DART buoy/ocean energy budget
- Interest in coastal oceanography/meteorology of region, including O-A interactions thru trapped coastal (e.g. Kelvin) waves, coastal jets, upwelling region.
- Impact of tropical and extratropical disturbances on stratus cloud deck
- Feedback between cool SST, ABL stability, cloud cover

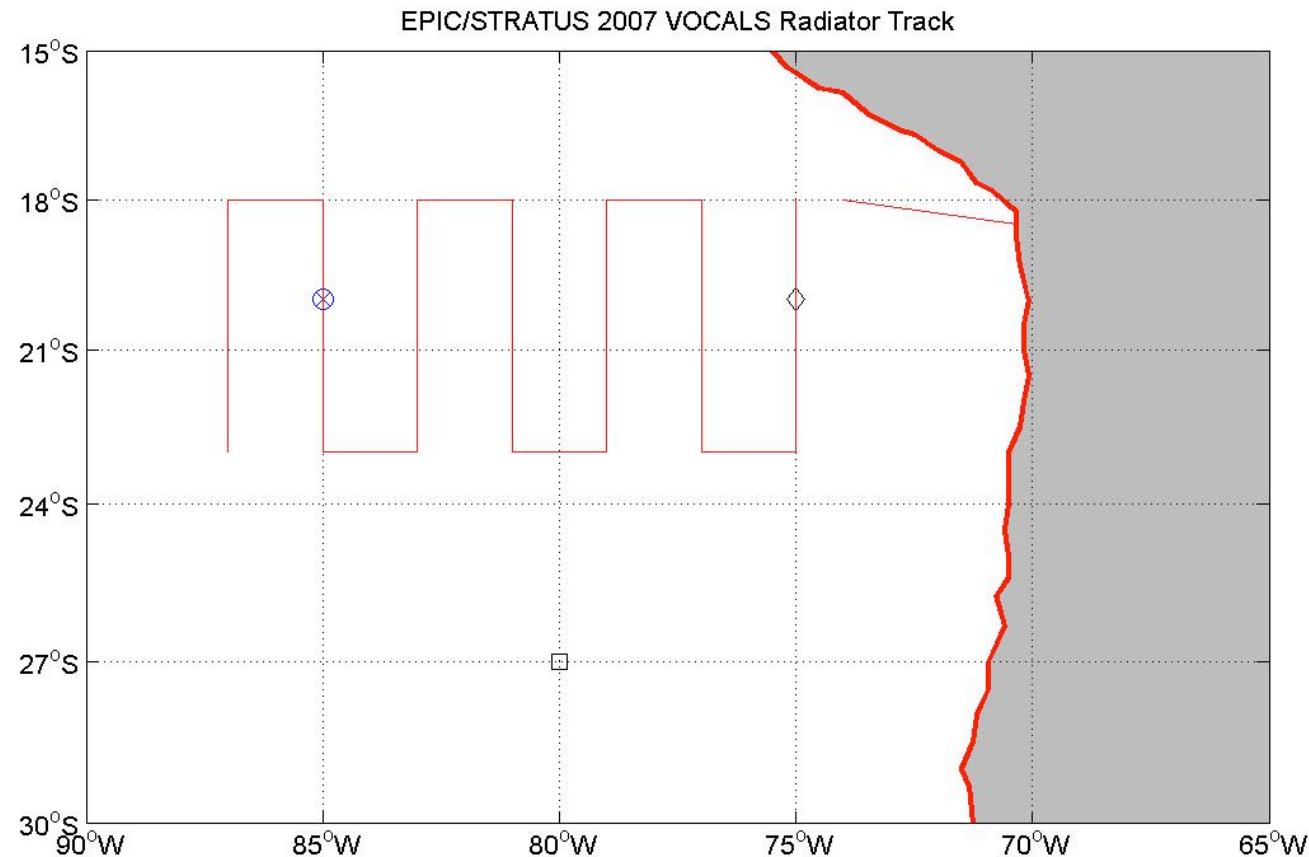
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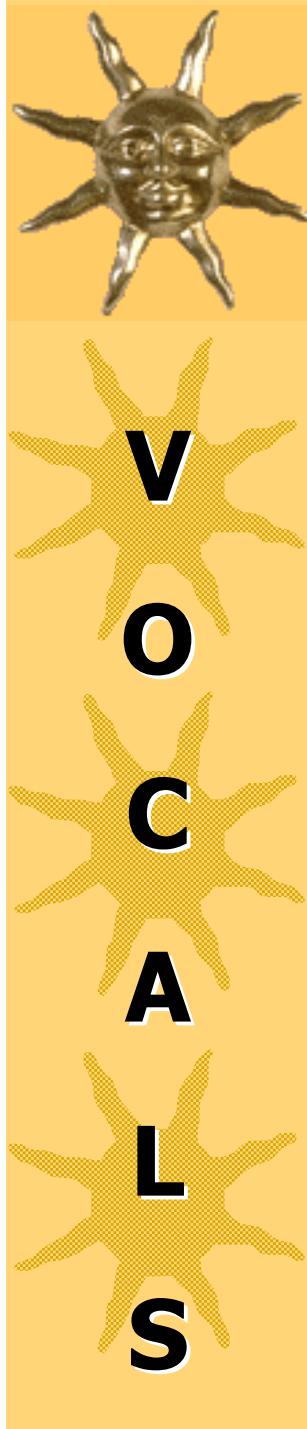
# 2004 PREPARATION





# 2007 PLAN





# PLANNING (1)

## VOCALS

2007 Process Study - Oct 2007

Aircraft - Chris Bretherton

cloud radar, aerosols, cloud microphysics, fluxes  
dropsondes, SST, passive microwave (cloud liquid water)  
Iquique

Aerosondes - Steve Esbenson (Bob Wellerto contact)

San Felix/Iquique

flying radiosonde temp/humidity/ radiation  
aerosols

Ship1 - Chris Fairall

cloud radar, fluxes, aerosols, C-band,lidar, biology

SeaSoar/ADCP

Ship 2 Oscar Pizarro

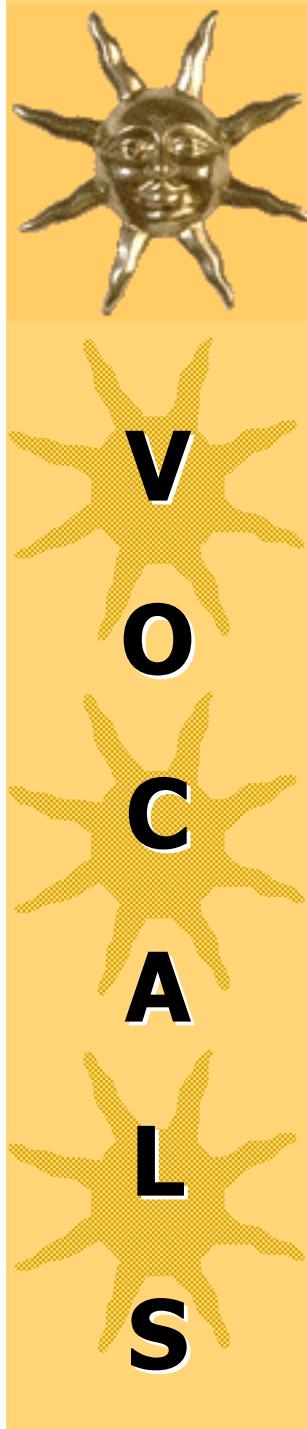
coastal oceanography and meteorology, biology

CPPS cruise - Rodrigo Nunez, Pilar Cornejo, Jose Rutllant,

Antonio Rodriguez, Efrain Rodriguez

Edwin Pinto, Eduardo Lazo

costal oceanography and meteorology



## PLANNING (2)

WHOI buoy - Bob Weller  
air-sea flux, Temp, sal, veloc

SHOA buoy - Rodrigo Nunez  
instrumentation, work soon to add

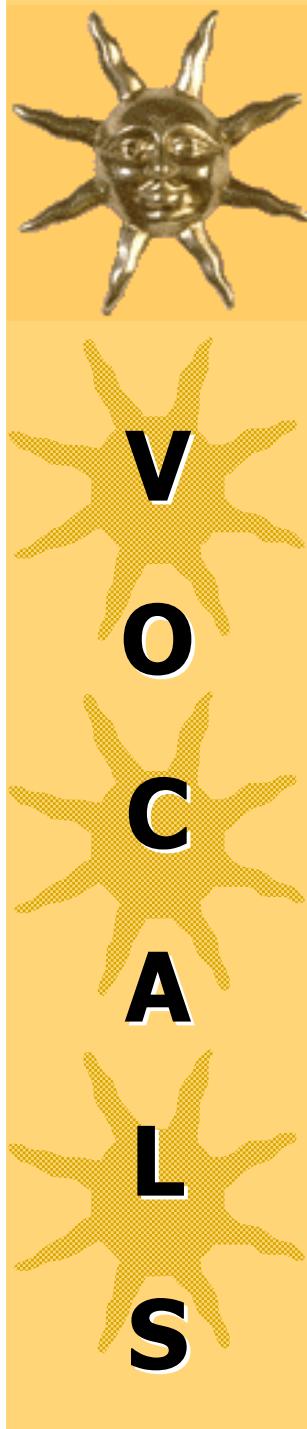
Easter Island transect - Rodrigo Nunez  
Coastal moorings - Oscar Pizarro  
add temp, T/S/P sensors

Argo floats/surface drifters - enhancement for Oct 2007  
Bob Weller/Mike Patterson

San Felix - Jose Rutllant, Rene Garreaud, Bruce Albrecht,  
Chilean met, Steve Esbensen, radiosondes  
power  
low power ceilometer, aerosols,  
wind profiler, cloud radar, aerosondes

Coastal observations - Rene Garreaud  
enhancement

Satellite Bretherton/Wood  
Data Management - Williams



## PLANNING (3)

Preparation for 2007:

CPPS      coastal cruise every year

Research cruise data

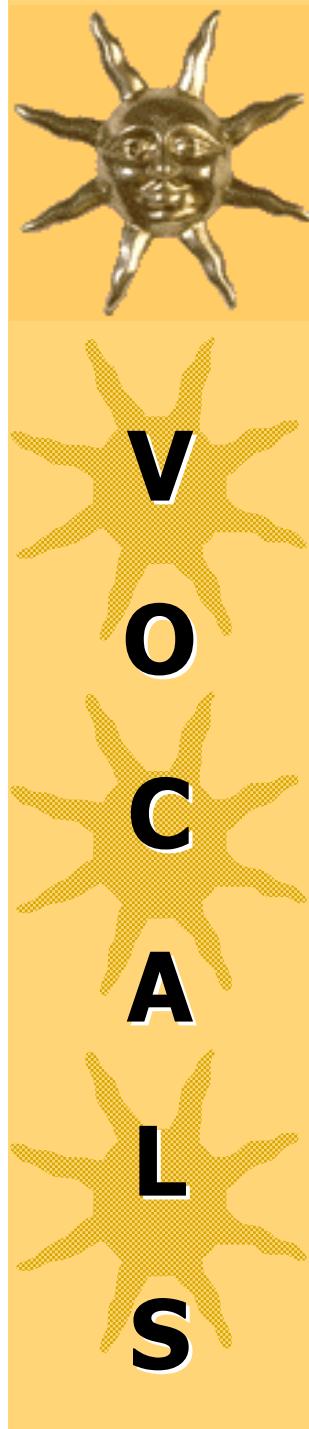
San Felix      mid 2006 enhanced instrumentation

DART buoy      enhanced instrumentation

Remote sensing

Modelling      CIIIFEN, UdeC, U Chile  
Brtherton CPT, Roberto Mechoso

Deploying ARGO floats, SST drifters



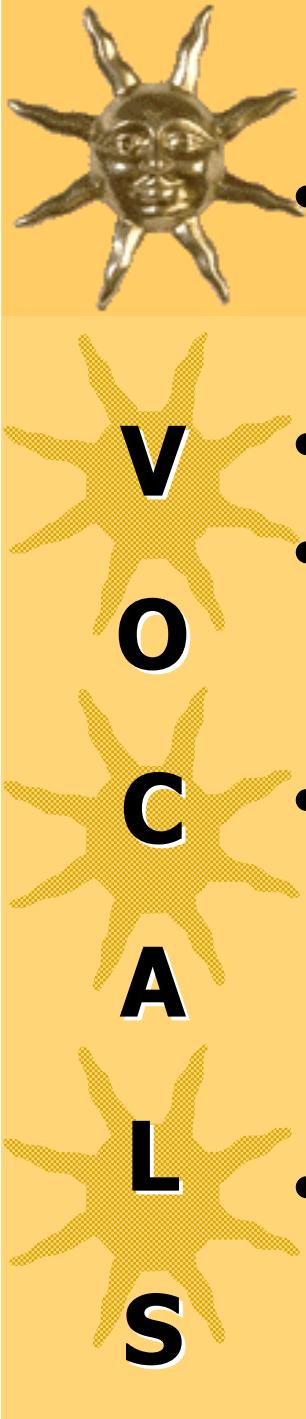
# TIMELINE

March 2004	VPM7 assignments
May 2004	Chile/Peru naval cruise
June 1 2004	revised VOCALS plan
June 2004	CLIVAR Baltimore
Oct 2004	CPPS cruise
Nov 2004	Arica-Valparaiso cruise, WHOI buoy
Jan 2005	VOCALS field/modelling workshop
	Valparaiso meeting
March 2005	VPM8
May 2005	Chile/Peru naval cruise
Oct 2005	CPPS cruise
Nov 2005	
March 2006	VPM9
June 2006	San Felix enhanced
Oct 2006	dry-run workshop
Oct 2006	CPPS cruise
Nov 2006	
March 2007	VPM10
Oct 2007	VOCALS process study



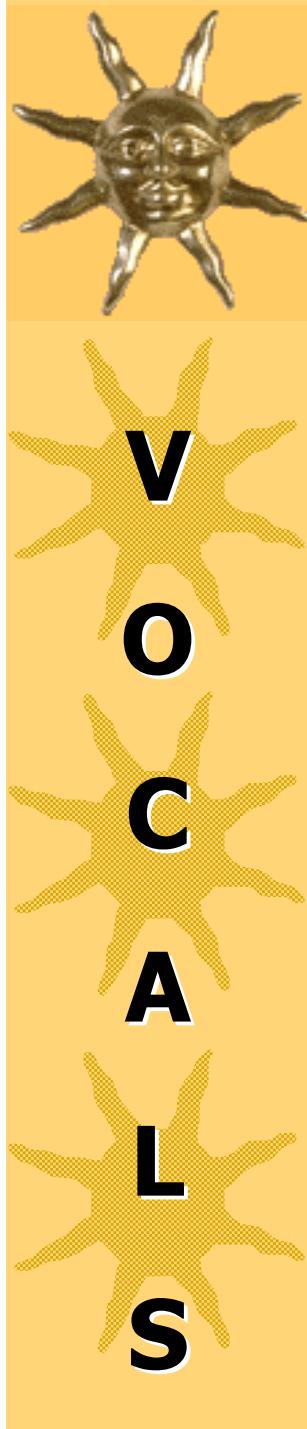
# RECOMMENDATIONS (1)

- Major continuing efforts in diagnostic, sensitivity, parameterization studies of SE Pac stratocumulus and variability based on past field studies, satellite/model products, and observational enhancements.
- Add an [ocean diagnostic](#) study component based on ARGO/ODA, cruises, WHOI buoy aimed at better understanding of ocean upwelling/lateral heat transport processes and their reln. to atmospheric variability.
- Global atm./coupled, mesoscale atm., and [regional ocean modeling](#).
- VOCAL [radiator fin'](#) coupled O-A-L expt (Oct 07)



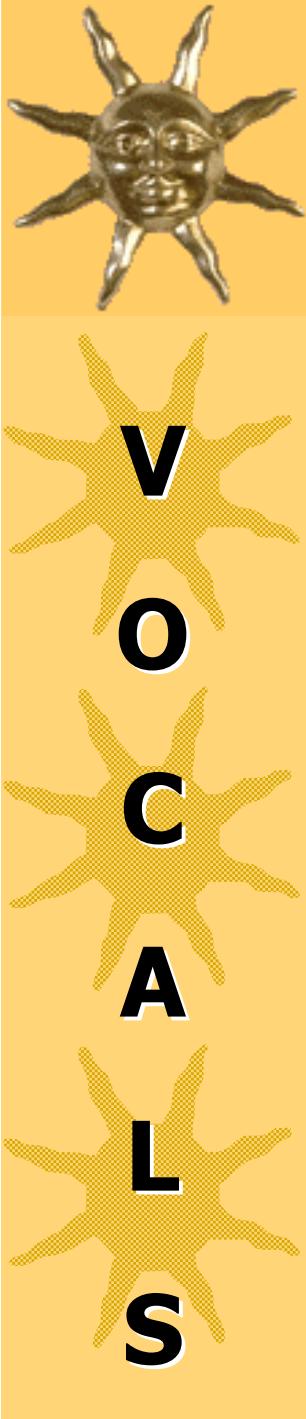
## RECOMMENDATIONS (2)

- Augment San Felix Island instrumentation with wind profiler, radiation, microwave LWP, and aerosol sampler.
- Augment DART buoy, coastal buoy, coastal stations
- NOAA/ETL sfc/remote sensing instrumentation on Pacific and Atlantic buoy maintenance cruises, as well as in RICO.
- Develop a VOCAL data set through a distributed satellite/model/in situ data archive maintained by JOSS. Archive ECMWF and NCEP hi-res column data at WHOI buoy, SFI in co-ordination with CEOP.
- Coordinate with proposed US CLIVAR cloud-climate sensitivity “climate process team” to feed into coupled model development.



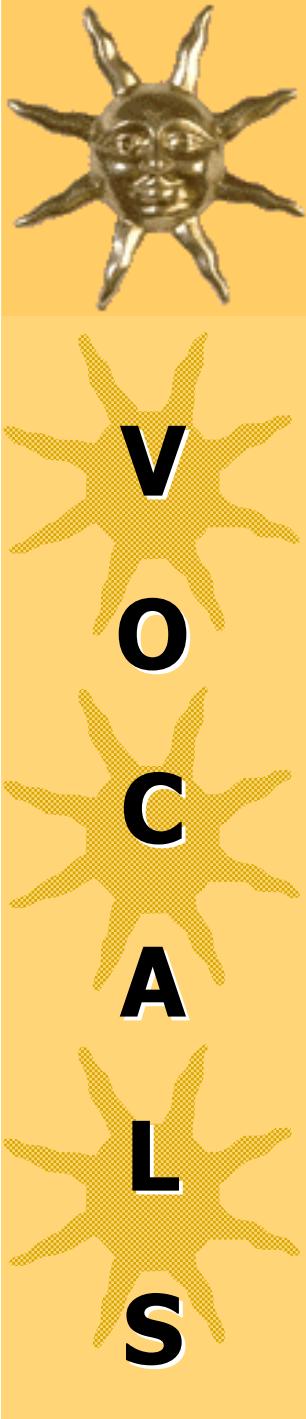
## Recommendations (3)

- Improve cloud/aerosol instrumentation on the R/V Ronald Brown (cloud radar and aerosol sampling) as part of her standard equipment package.
- Organize a special VOCALS cruise and flights to co-ordinate, evaluate and synthesize the long-term sampling from buoys, drifting floats, coastal and island stations and satellites.
- Support a radiosonde observation period at San Felix or Juan Fernandez Islands in co-ordination with the VAMOS/SALLJ field campaign.



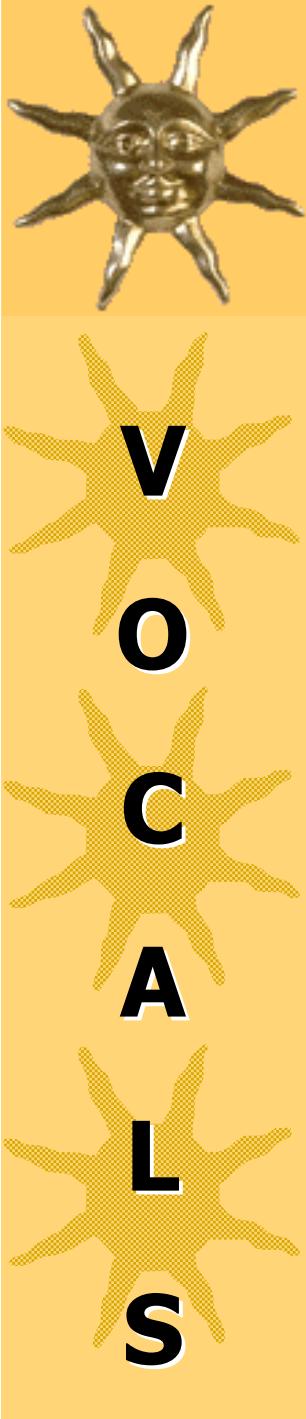
## RECOMMENDATIONS (4)

- SCM/LES of diurnal cycle/drizzle in Scu
- Satellite observations
  - JOSS: Coordinate sat. obs. for RICO site
  - Diagnostic studies, analysis, post-processing
- Mesoscale modeling:
  - UCH (Rene et al.), synoptic scale/diurnal variability, parameterization, connection to Andes heating.
- Global modeling:
  - UCLA/UR-Uruguay: mean circulation, ENSO feedbacks, interaction with orography on seasonal timescale.
  - CAM-UW: PBL



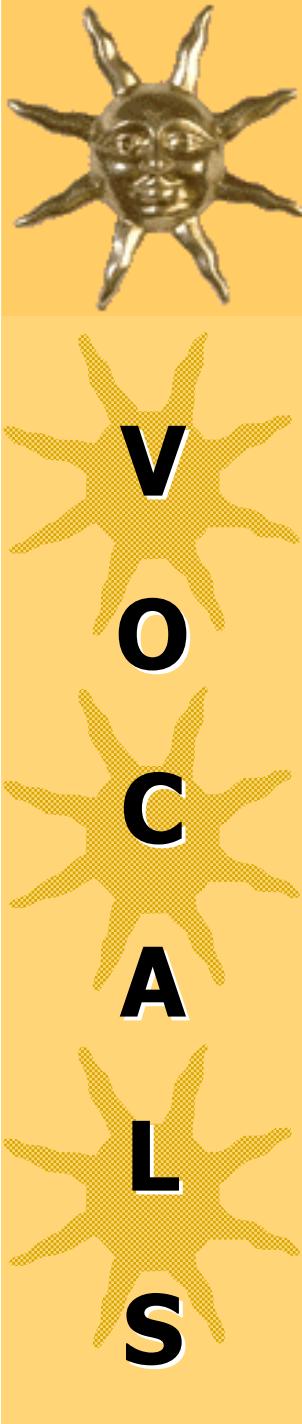
## RECOMMENDATIONS (5)

- Ocean diagnostic studies:
  - Ken T., Bob W., Ted Strub, Pilar C.
  - O. Pizarro, A. Miller
  - Ocean data assimilation, ECCO .vs. buoy
  - Horizontal heat transport via eddies



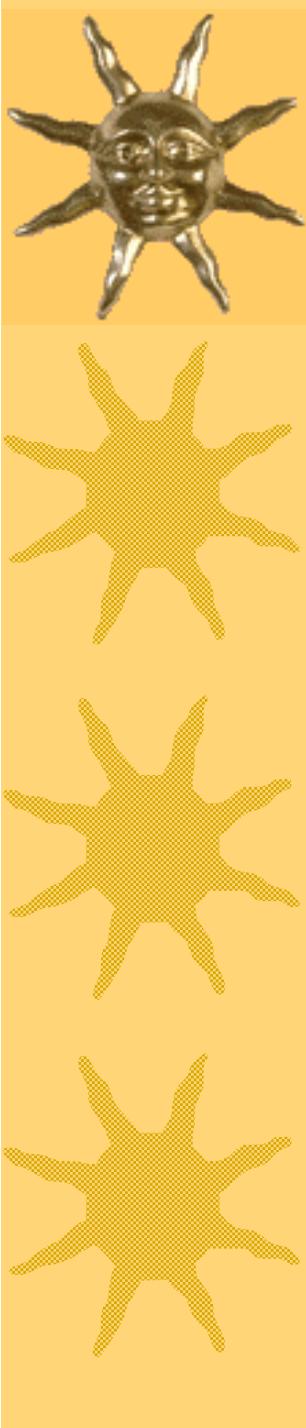
## RECOMMENDATIONS (6)

- Ocean regional modeling
  - Patrick M. (France), coastal E.P, Bibliography
  - Oscar Pizarro's colleague @ Concepcion
  - Pablo Lagos (Princeton ocean model)
  - Art Miller (Scripps)
- CPT
- Field Experiment “SE Pacific Radiator” (Oct. 07)

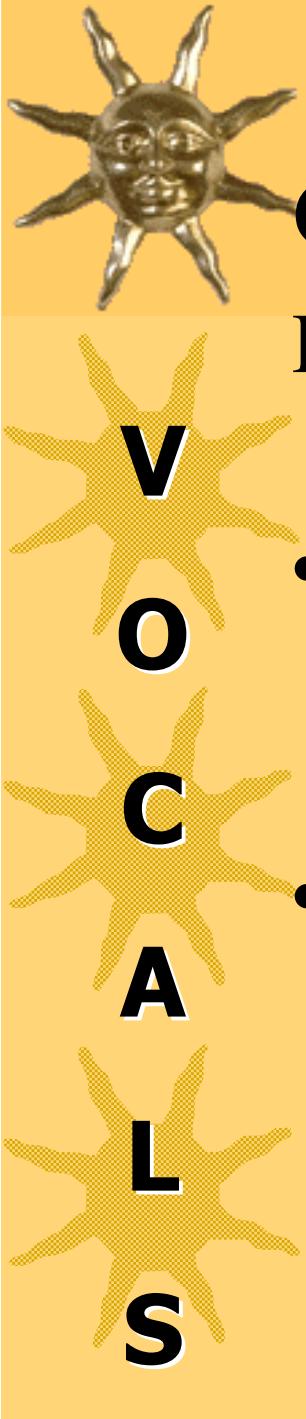


# VOCALS

- THANKS TO ESPOL (PILAR)  
AND TO VAMOS



# RECOMMENDATION

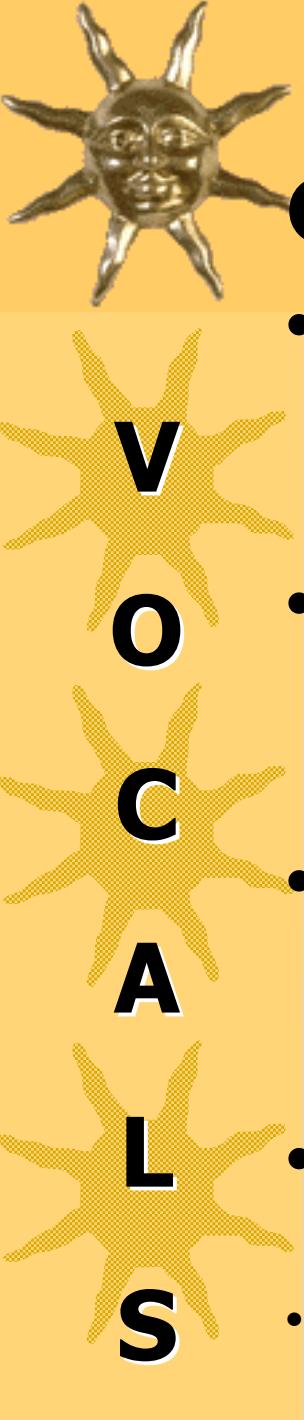


# SCIENCE ISSUES (1)

## Cloud/drizzle/aerosol interactions

Further offshore, usually larger cloud drop radius

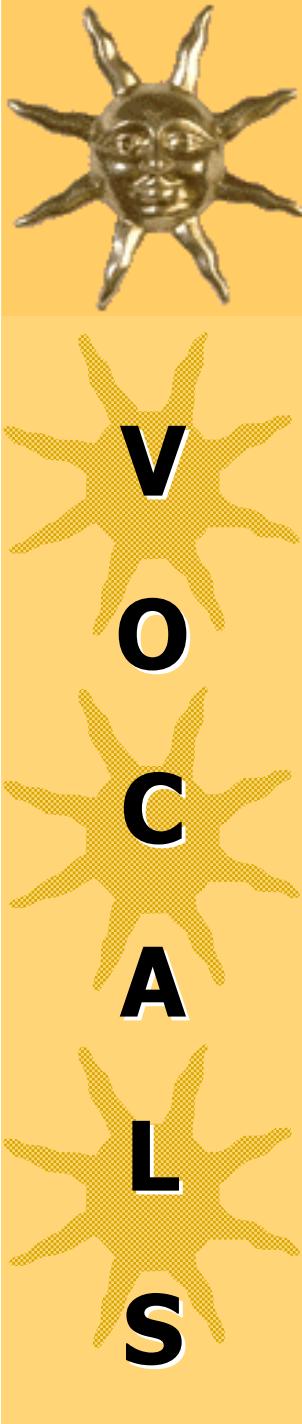
- Why? More aerosol near the coast?  
Pollution? Ocean productivity, DNS?  
Salt/wind?
- How does this feedback on mean Sc  
albedo? Vertical PBL structure?



## SCIENCE ISSUES (3)

### OCEAN (2)

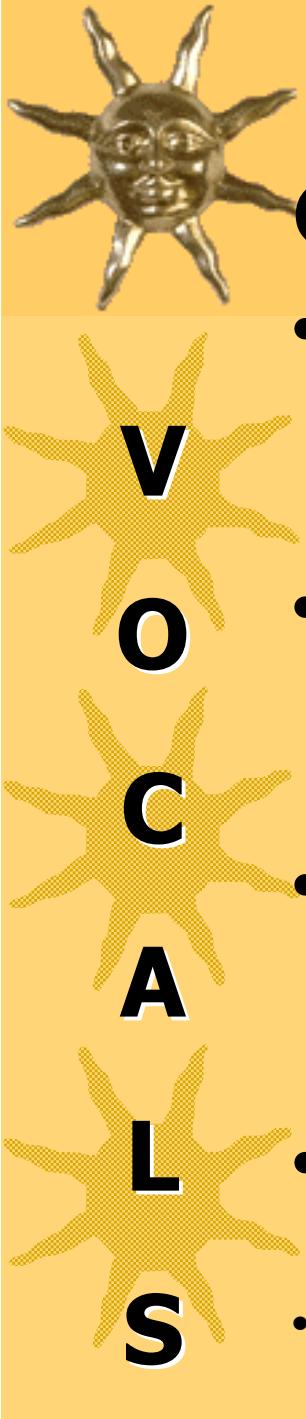
- Space/time nature of eddy heat transport offshore
- Vertical ocean (and atmosphere) cross-section along a latitude line
- Regional ocean modeling of 1500 km nearest South American coast
- Coastal wind jet and relation with coastal upwelling and clouds



**7th CLIVAR VAMOS Panel Meeting  
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**VOCALS REPORT**

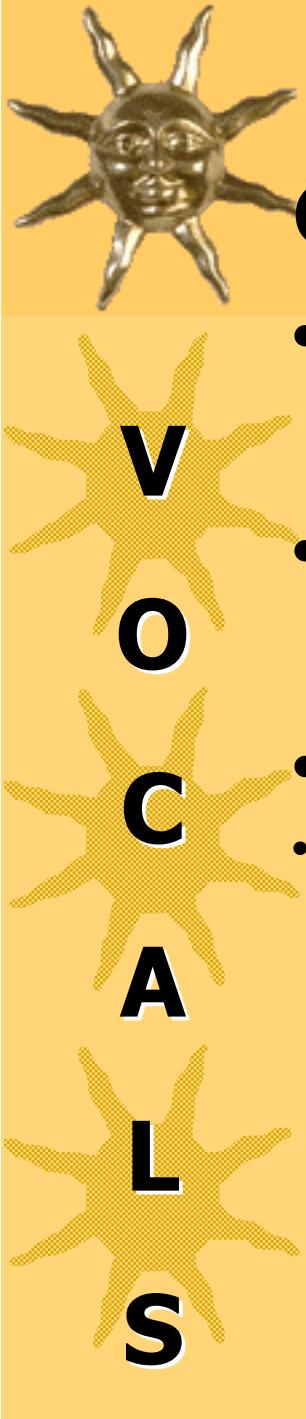
**24 March 2004**



## SCIENCE ISSUES (4)

### CLOUD-PBL DYNAMICS

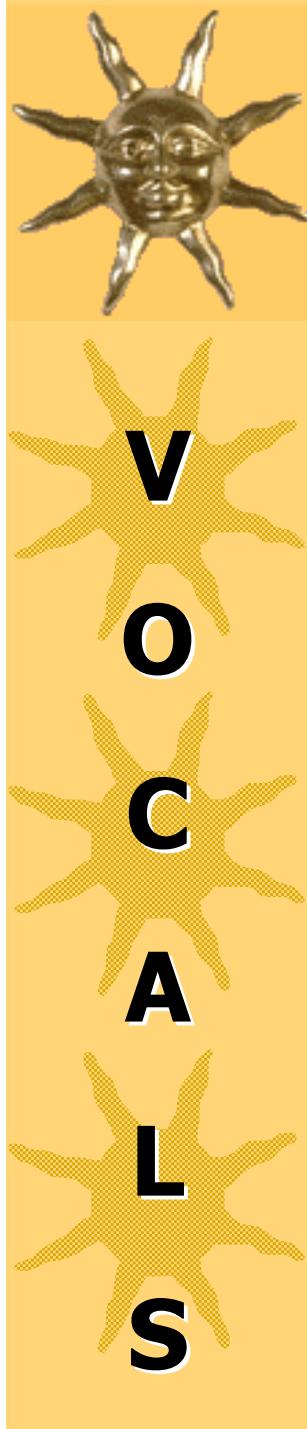
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## SCIENCE ISSUES (5)

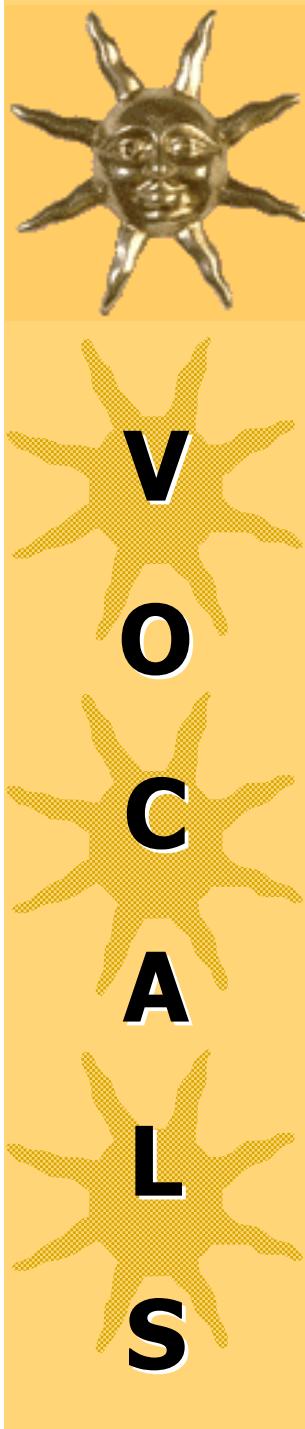
### COUPLED DYNAMICS

- Seasonal cycle of SST
- Continental influence on long timescales
- Cloud feedbacks on ENSO
-



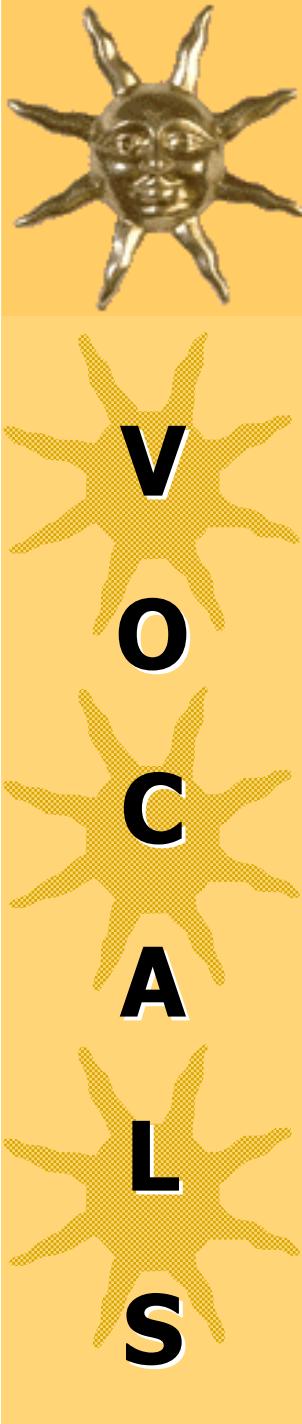
## ***BACKGROUND***

- Increased awareness of the role of the Eastern Pacific in the Global Climate System.
- Concrete scientific hypotheses resulting from empirical studies and investigations with theoretical and numerical models.
- Increase interest and concern as to the role of the atmospheric aerosol.



## ***READINESS***

- EPIC and CIMAR pilot cruises, DYCOMS field study.
- Regional human and instrumental infrastructure.
  - o Buoys and coastal networks.
  - o Regional modeling capabilities.
- Development of new generation remote sensing.
  - o Satellite.
  - o Surface based.



Galapagos I.



Lima

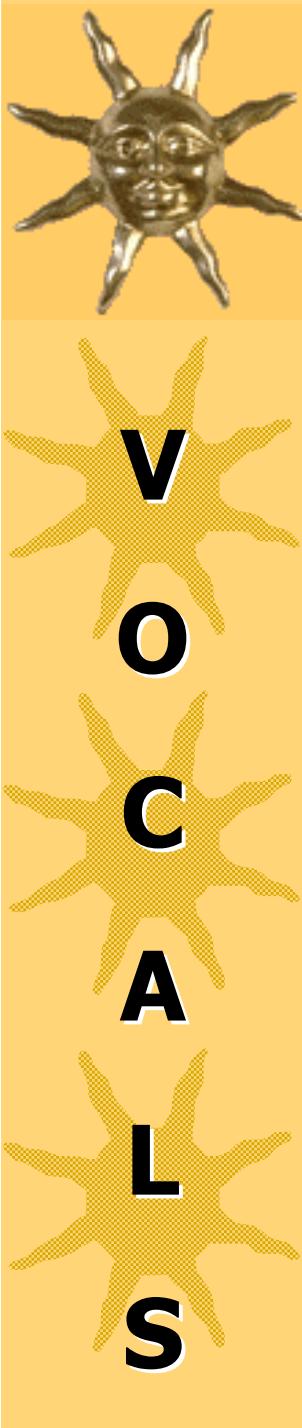
Arica

WHOI buoy



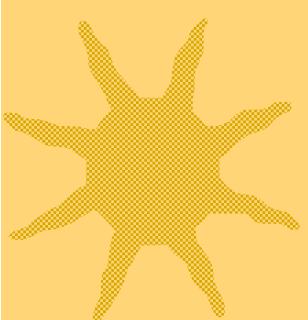
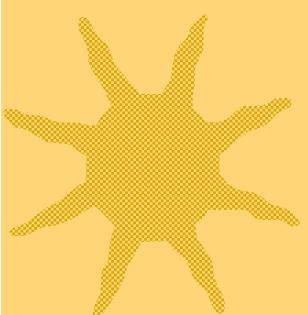
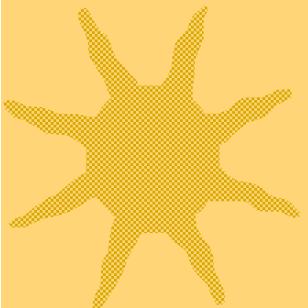
San Felix I.

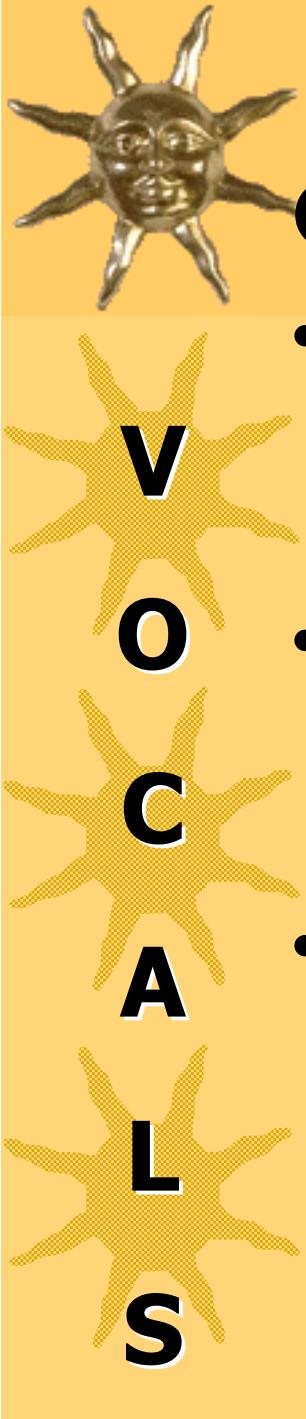




## Recommendations (1)

- Augment San Felix Island instrumentation through the deployment of ceilometer, wind profiler and aerosol sampler.
- Co-ordinate with ECMWF, NCEP and CPTEC to provide high resolution column data over selected VEPIC study areas.
- Develop a VOCALS data set through a distributed data archive maintained by JOSS, in co-ordination with CEOP.
- Support of “climate process teams” to evaluate existing observations and simulations in the VOCALS region, perform model sensitivity studies, develop retrieval algorithms and physical parameterizations.





## SCIENCE ISSUES (2)

### OCEAN (1)

- Ekman .vs. eddy heat transport to the west .vs. air-sea interaction
- Vertical mixing at buoy: role of “sagging trades”, comparison with ocean GCMs
- Horizontal extent of nutrients and relation to offshore transport mechanisms