Coupled Ocean-Atmosphere Interactions in the Southeast Pacific

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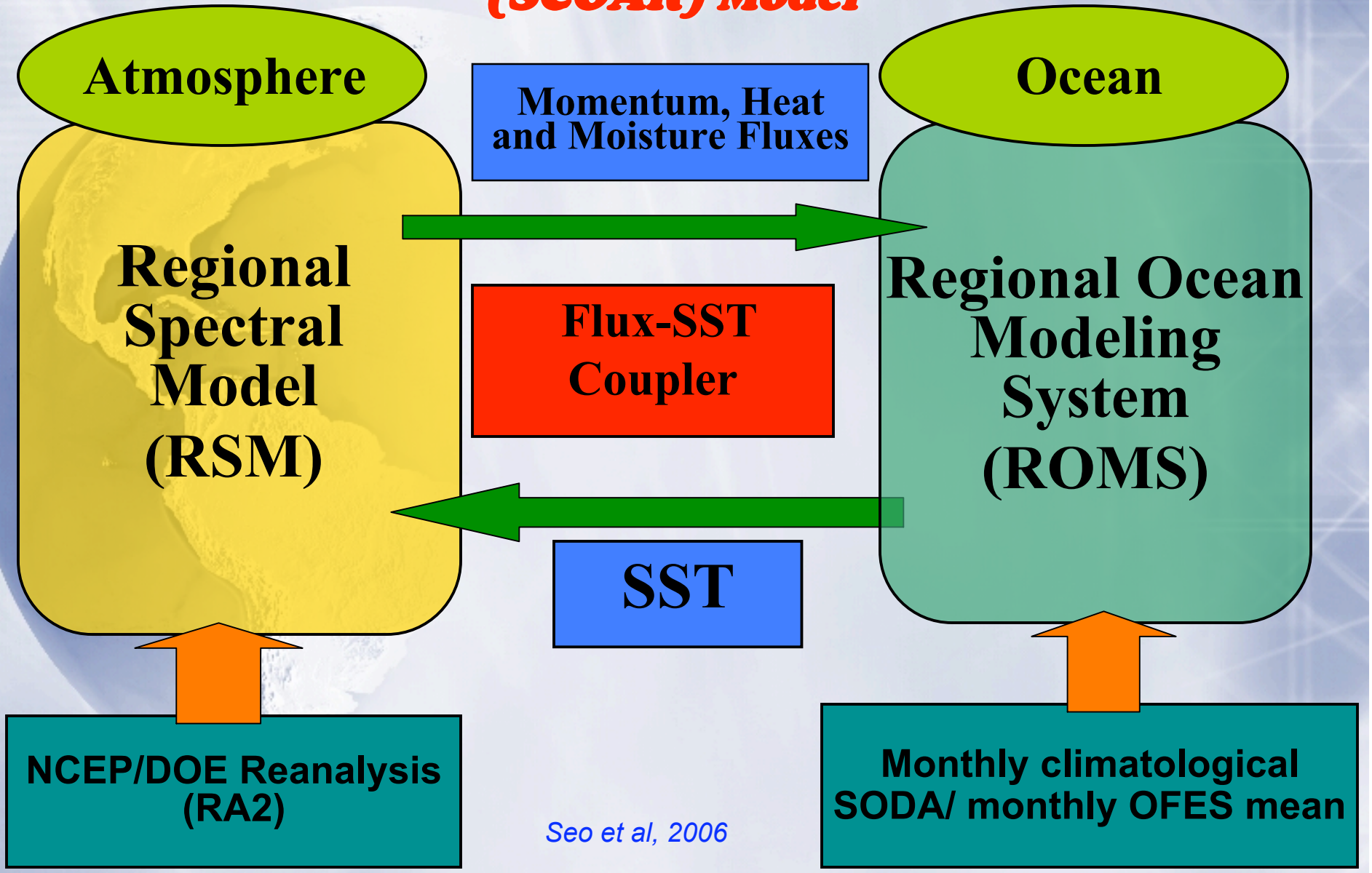
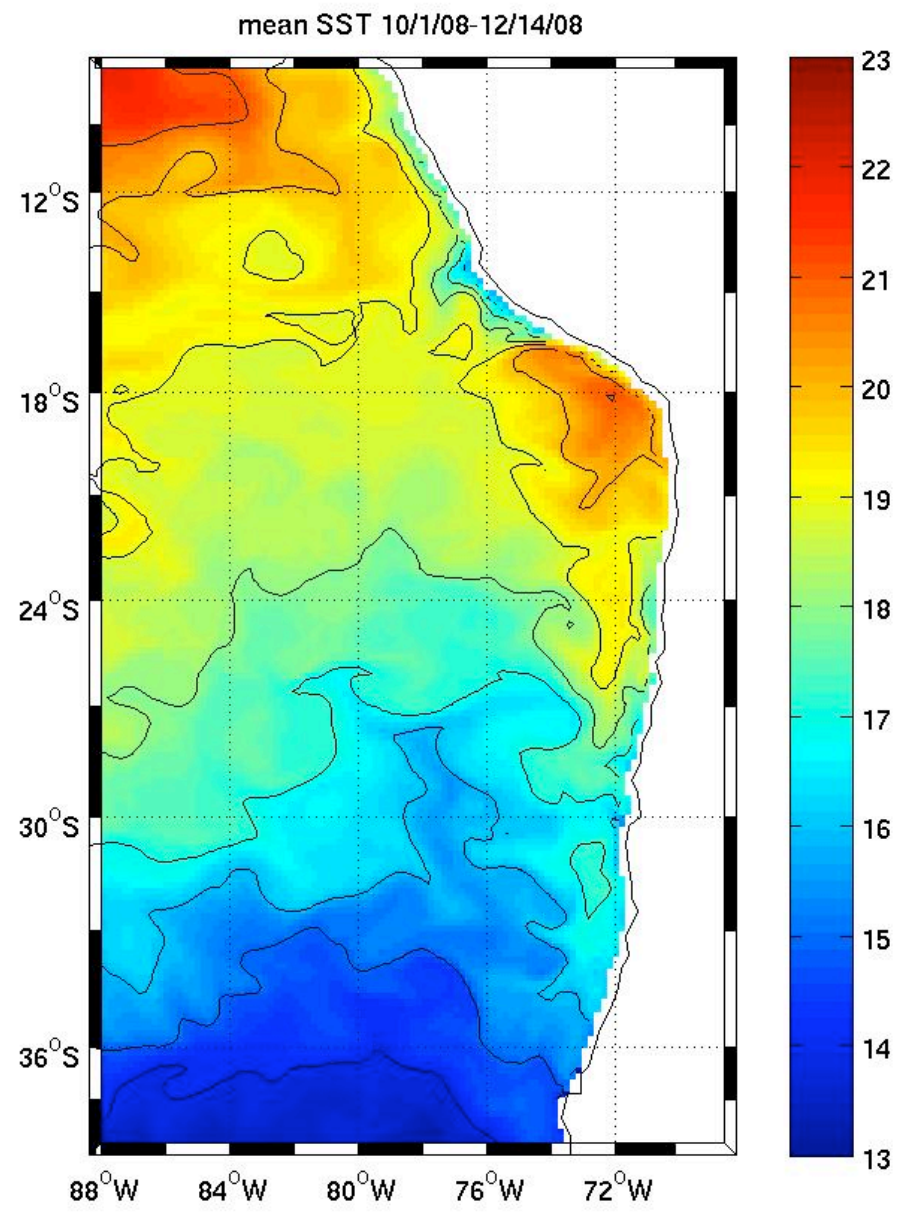
Scripps Coupled Ocean-Atmosphere Regional (SCOAR) Model



Seo et al, 2006

Model Domain



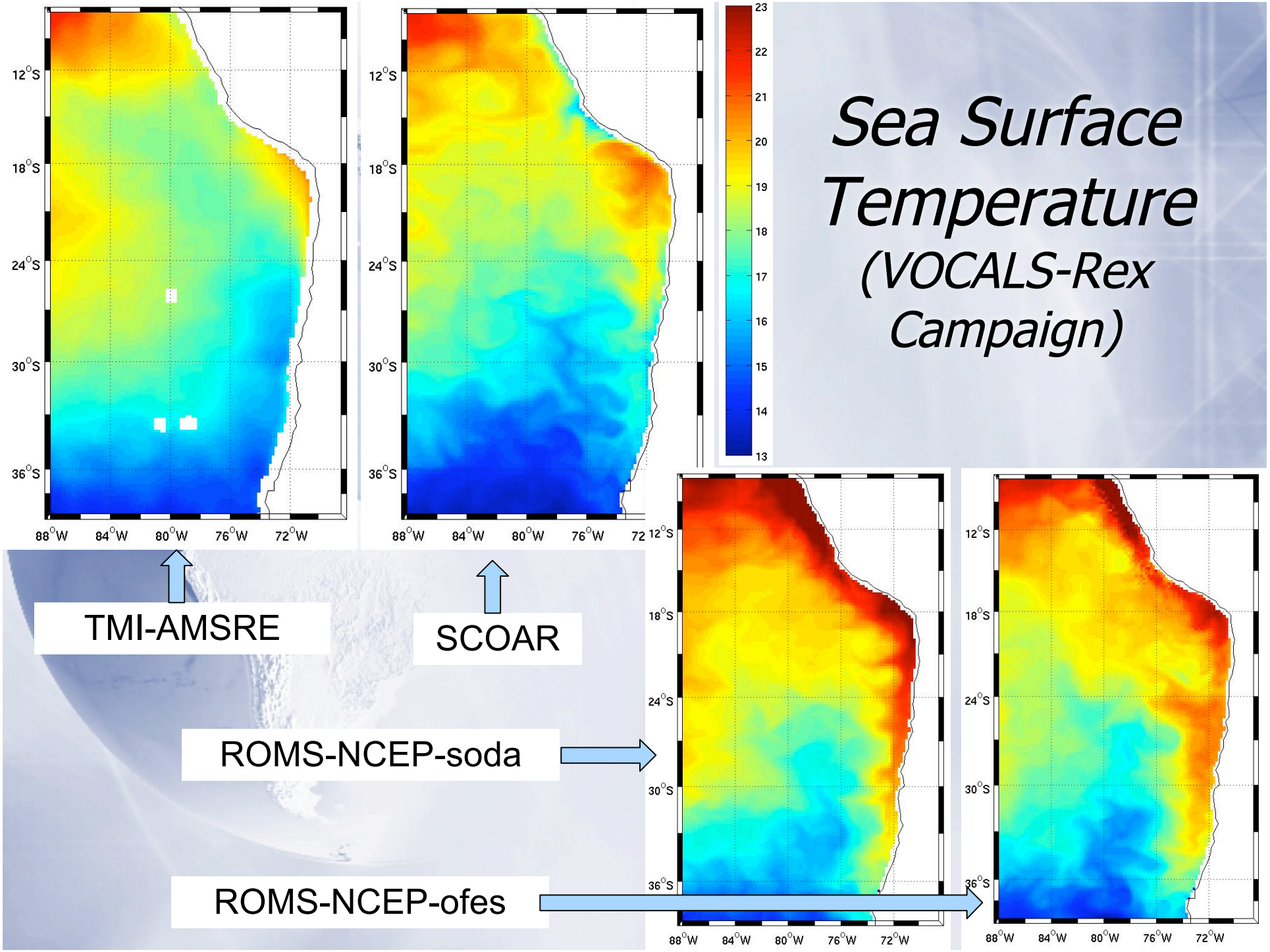
- 88W to 68W, 8S to 38S
- Grid resolution:

  horizontal = 20km

  atmosphere = 28 layers

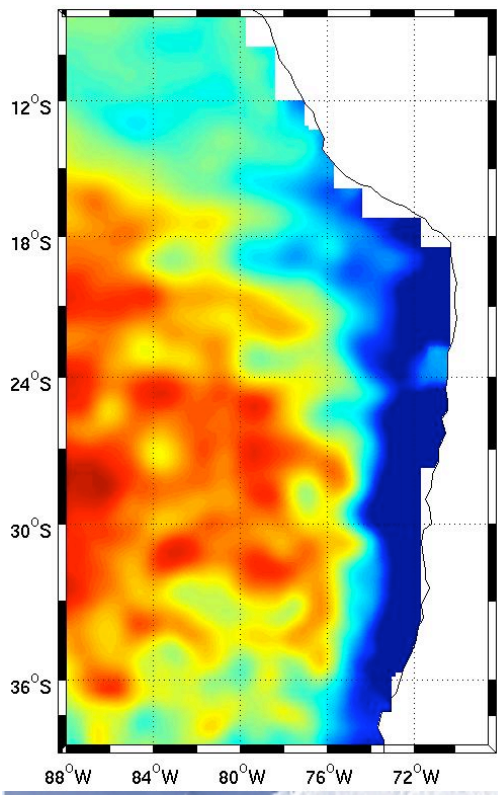
  ocean = 30 layers
- Ocean spin up with NCEP forcing for 10 years
- Time periods: 1999-2007 10/1/08-12/14/08
- Atm. boundary downscaled from NCEP RA2
- Ocean boundary taken from monthly output of OFES and SODA clim.

Sea Surface Temperature (VOCALS-Rex Campaign)

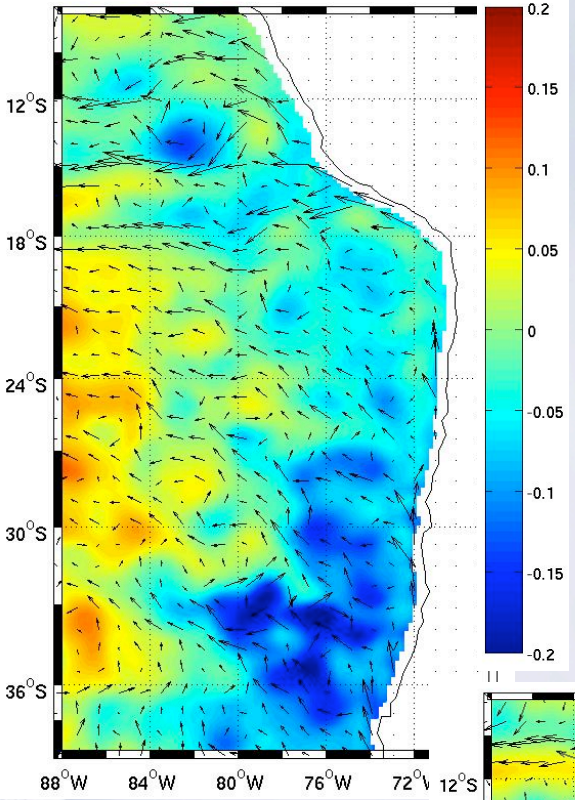


Sea Surface Height & Surface Current

(VOCALS-Rex Campaign)



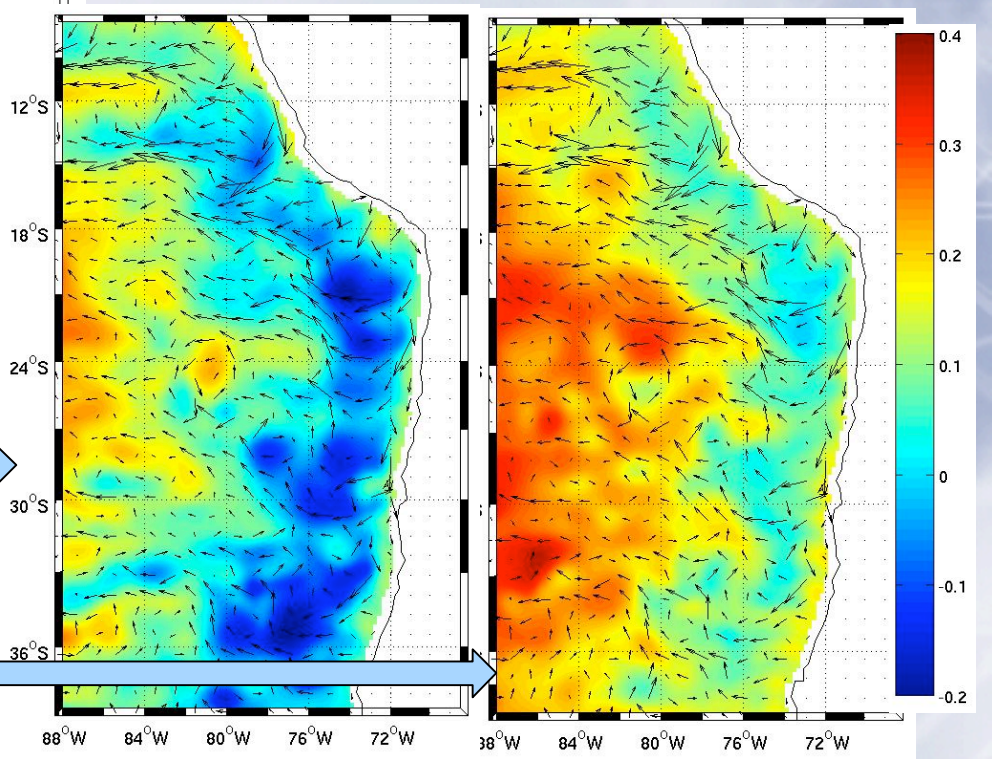
AVISO



SCOAR

ROMS-NCEP-soda

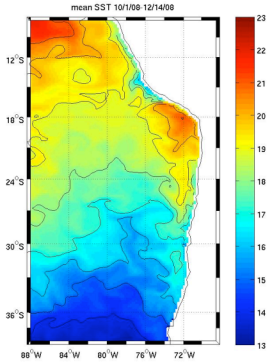
ROMS-NCEP-ofes



Sensitivity Tests

Expt. Run	Boundary conditions	Forcing Wind	Forcing SST
SCOAR-soda	SODA	RSM	ROMS
SCOAR-ofes	OFES	RSM	ROMS
ROMS-NCEP-soda	SODA	NCEP	---
ROMS-NCEP-ofes	OFES	NCEP	---
ROMS-QSCAT-soda	SODA	QSCAT	---
ROMS-QSCAT-ofes	OFES	QSCAT	---
RSM-NCEP	---	---	NCEP
RSM-TMI_AMSRE	---	---	TMI_AMSRE
RSM-SCOAR-soda (multiple IC)	---	---	Monthly SCOAR-soda
RSM-SCOAR-ofes (multiple IC)	---	---	Monthly SCOAR-ofes

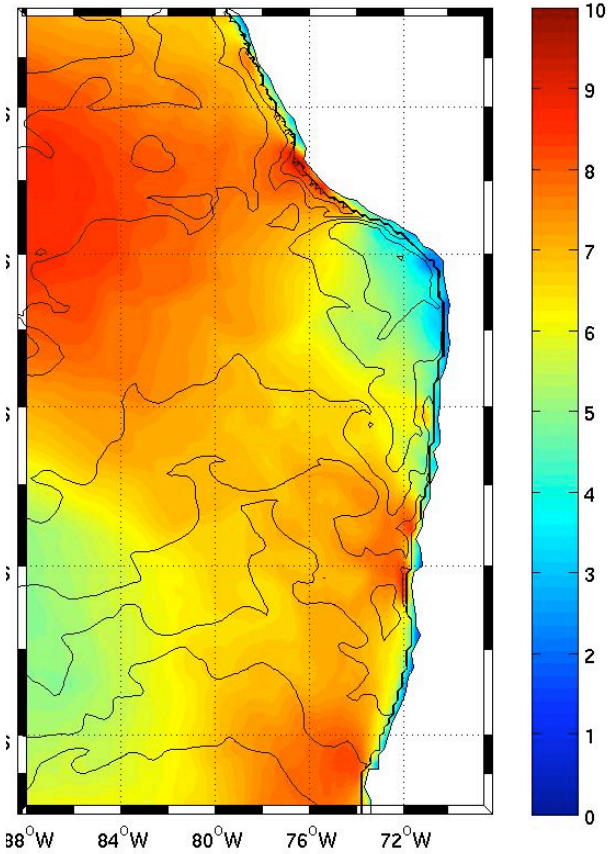
- Atmospheric model: separating out initial condition vs SST forcing impact on winds and atmospheric state
- Ocean model: choice of boundary conditions and its influence on ocean state
- Ocean model: momentum and heat fluxes contribution to SST distribution



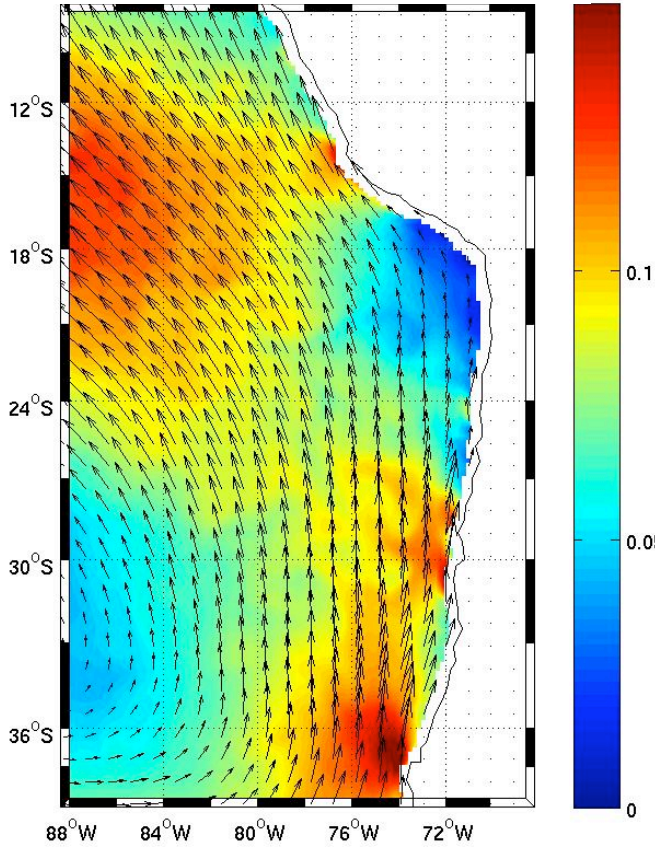
SST-winds-upwelling

$$w_{Ek} = \frac{curl(\tau)}{\rho f}$$

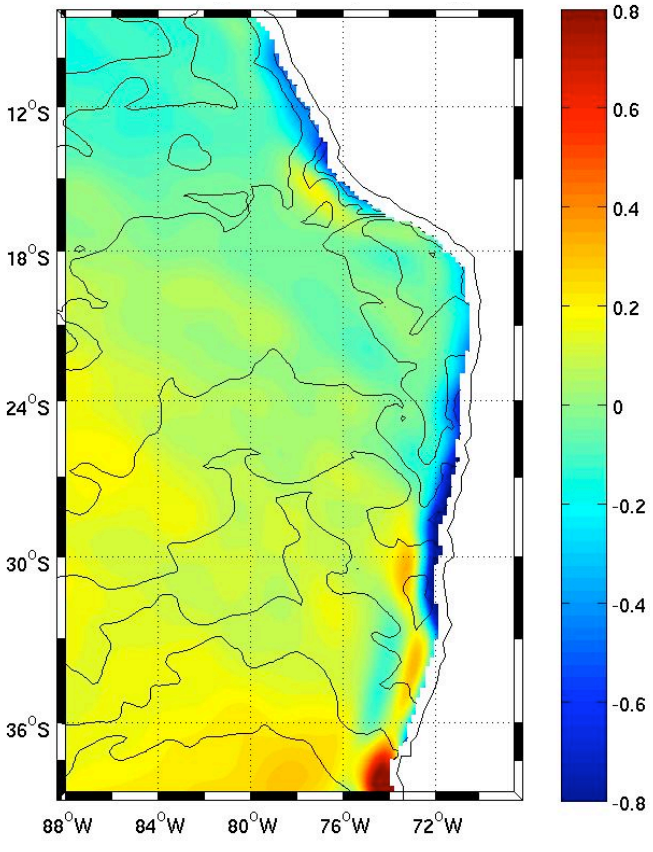
Mean winds (m/s) with SST contours



Mean surface wind stress (N/m^2)



Ekman pumping velocity (m/day)



??? Scientific Questions ???

- How strongly do the coastal winds induce upwelling that cools SST off the coast of Peru and Chile?
- How does latent heat loss from the ocean over the VOCALS region covary with mesoscale ocean-atmosphere variables and influence the overall SST distribution?
- How does mesoscale SST impact the overlying PBL structure and thereby influencing the overall cloudiness of the Southeast Pacific region?
- ……

Proposed Experiments

- ***Hindcast 1:*** *Fully-coupled SCOAR run for 1999-2007.*

- ***Hindcast 2:*** *Downscaled uncoupled RSM (atm.) runs for 1999-2007.*
  - Downscaled RA2 using monthly mean SST specified from Hindcast 1
  - Downscaled RA2 using monthly mean SST prescribed from NCEP Analysis
  - Downscaled RA2 using monthly mean SST specified from TMI-AMSRE Optimum Interpolated SST

- ***Hindcast 3:*** *Uncoupled ROMS (ocean) runs for 1999-2007.*
  - *ROMS forced with monthly mean stresses and heat fluxes computed from Hindcast 1*
  - *ROMS forced with wind stresses and heat fluxes from the coarse resolution NCEP RA2*
  - *ROMS forced by satellite observations (QuikSCAT winds)*

Championship Finals:
Peru vs. Chile

Who will "SCOAR"???

Ocean Dynamics in the HCS

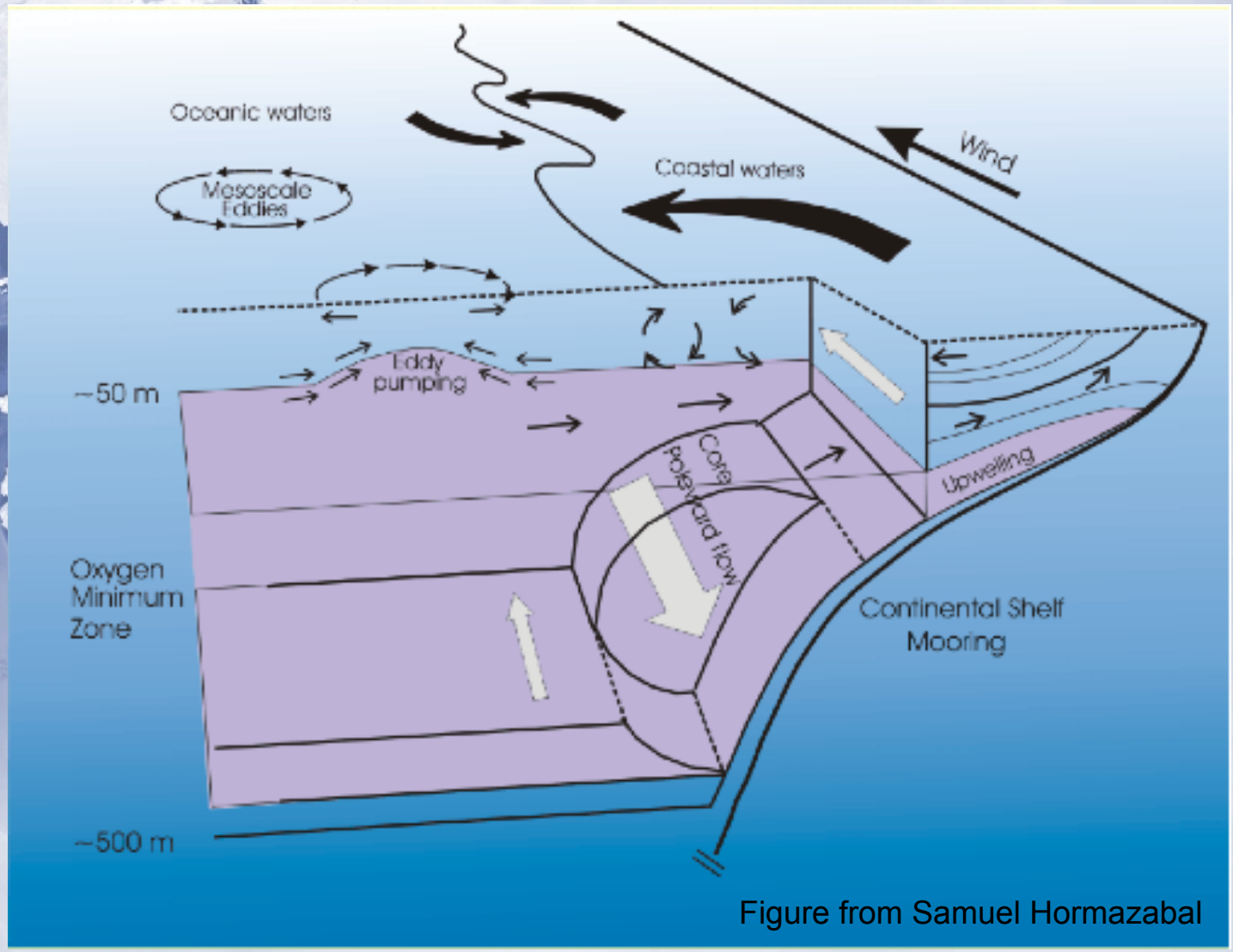
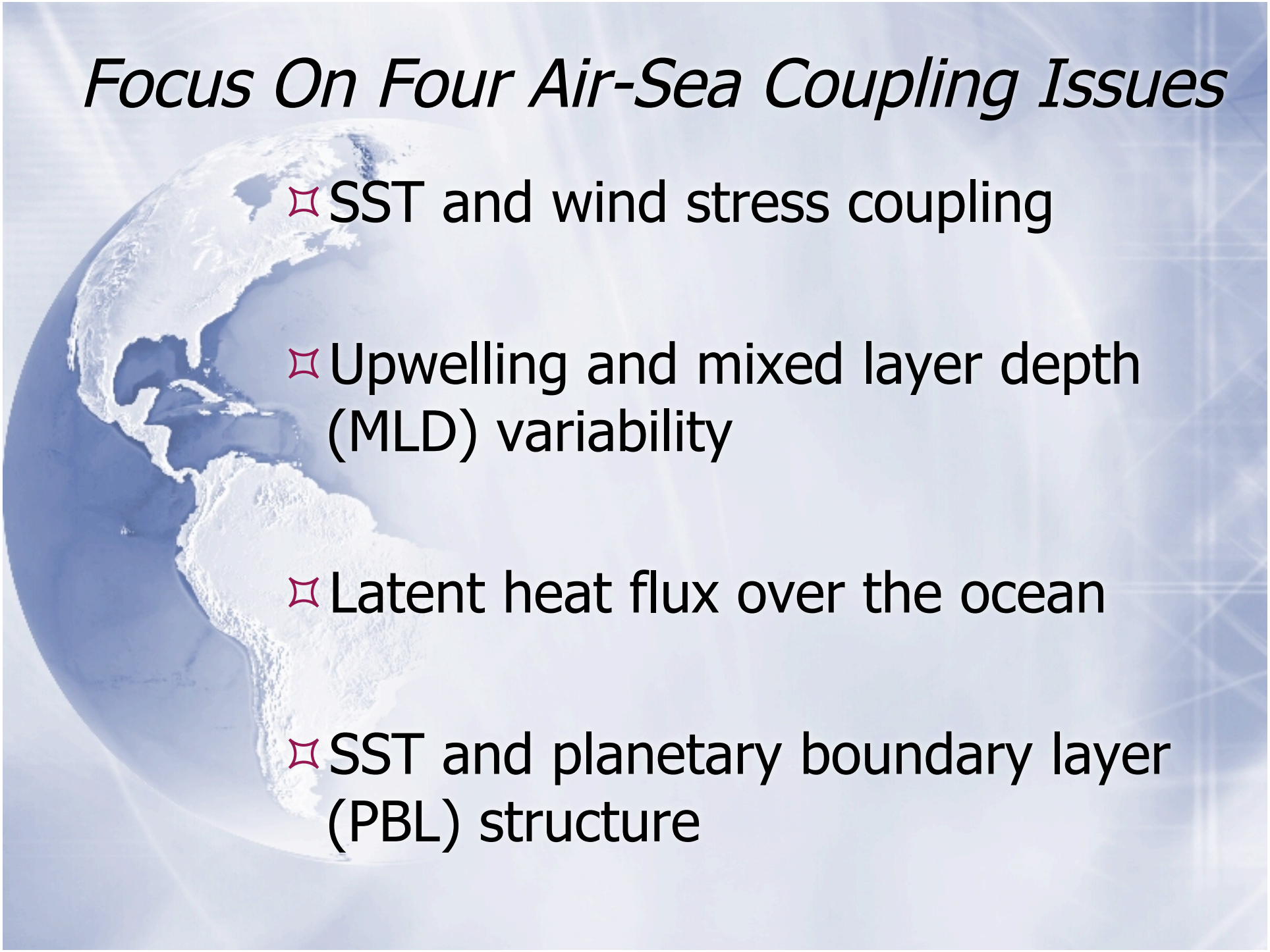


Figure from Samuel Hormazabal

Focus On Four Air-Sea Coupling Issues



- SST and wind stress coupling
- Upwelling and mixed layer depth (MLD) variability
- Latent heat flux over the ocean
- SST and planetary boundary layer (PBL) structure