The Pre-VOCA Model Assessment: Results and Plans for the Next Phase

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with help from
participating modeling groups

Overview

- PreVOCA experiment background
- Summary of earlier results – October averages
- The diurnal cycle at the stratus buoy
- Modelling synoptic changes
- The next phase of the modeling experiment

PreVOCA

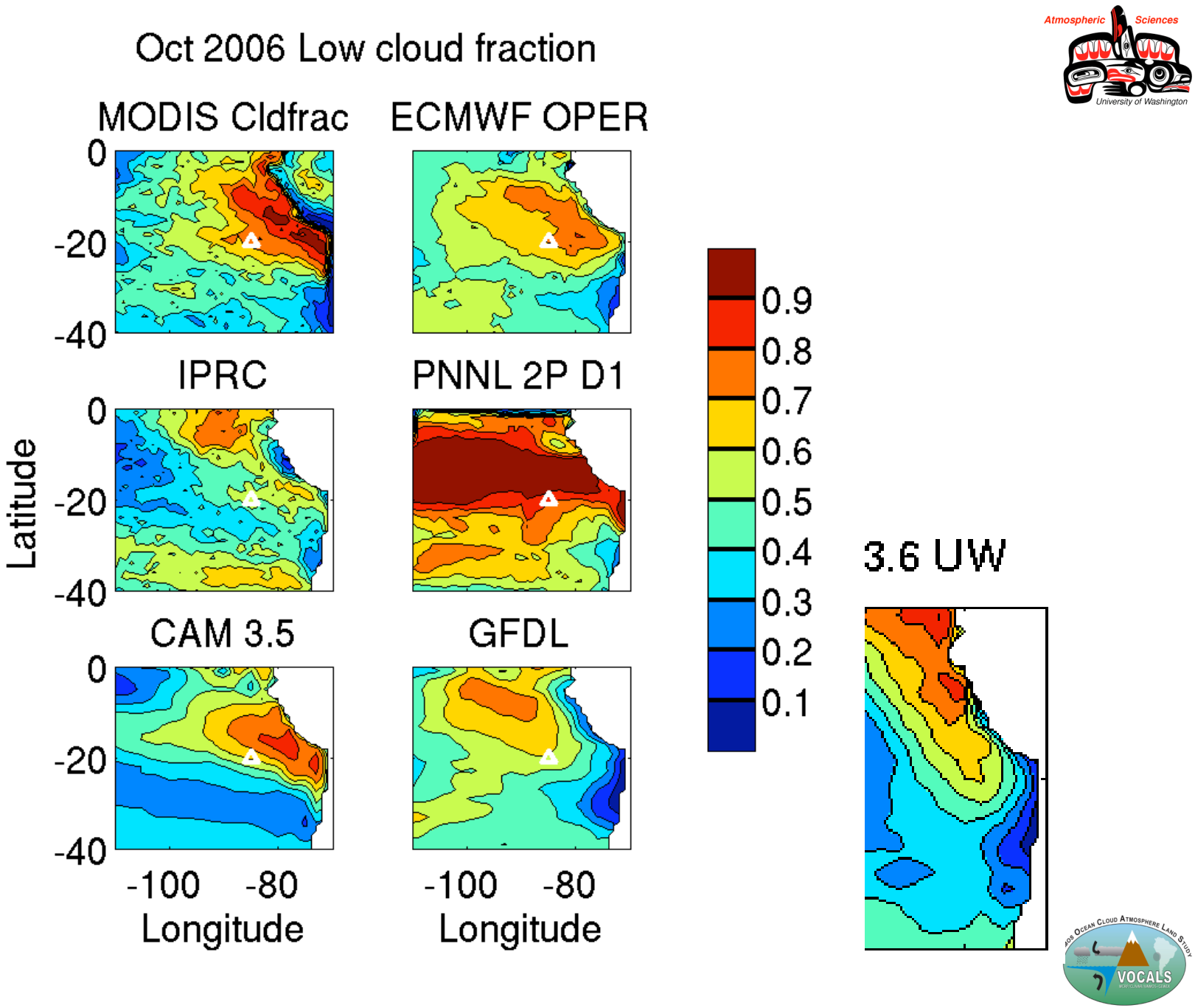
Goal: Assess the forecast skill and biases of global/ regional model simulations of SE Pacific boundary-layer clouds and aerosols on diurnal and longer timescales.

Method: Compare model hindcasts for October 2006 over the SE Pacific. Operational/Global models run daily forecasts. Regional models typically run a month-long simulation continuously forced at domain boundaries.

Website:

www.atmos.washington.edu/~robwood/PreVOCA/index.html

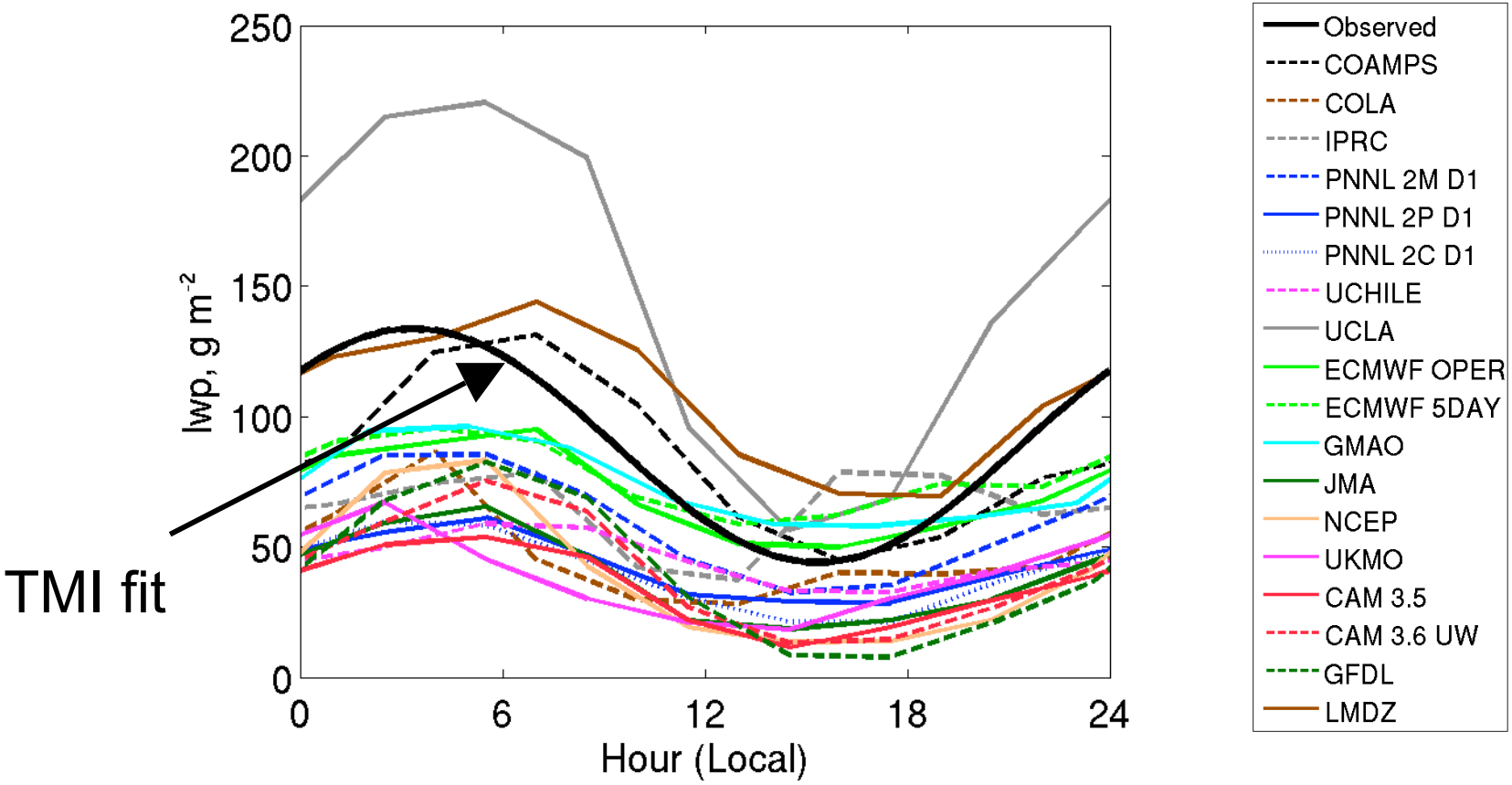
Model	Levels	**Resolution** [km] (inner domain)
NRL COAMPS	42	81 (27)
COLA RSM	28	50
IPRC Reg_CM (IRAM)	28	~25
PNNL (WRF-Chem)	44	45 (15)
UCLA (WRF)	34	45 (15)
U. Chile (WRF)	43	45
ECMWF oper. 3-12h forecast	91	~25
ECMWF 5-day forecast	91	~40
ECMWF coupled fcst ensemble	62	~125
GMAO GEOS-5 DAS	72	~56
JMA 24-30h forecast	60	~60
NCEP oper. 12-36h forecast	64	~38
UKMO oper. 12-36h forecast	50	~40
LMDZ	38	50
NCAR CAM3.5/6	26/30	250
GFDL	24	250


Oct 2006 Low cloud fraction
MODIS Cldfrac
ECMWF OPER
IPRC
PNNL 2P D1
CAM 3.5
GFDL
Latitude
0
-20
-40
-100
-80
Longitude
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
3.6 UW
Atmospheric Sciences
University of Washington
VOCALS

Summary of Comparison of October 2006 Means

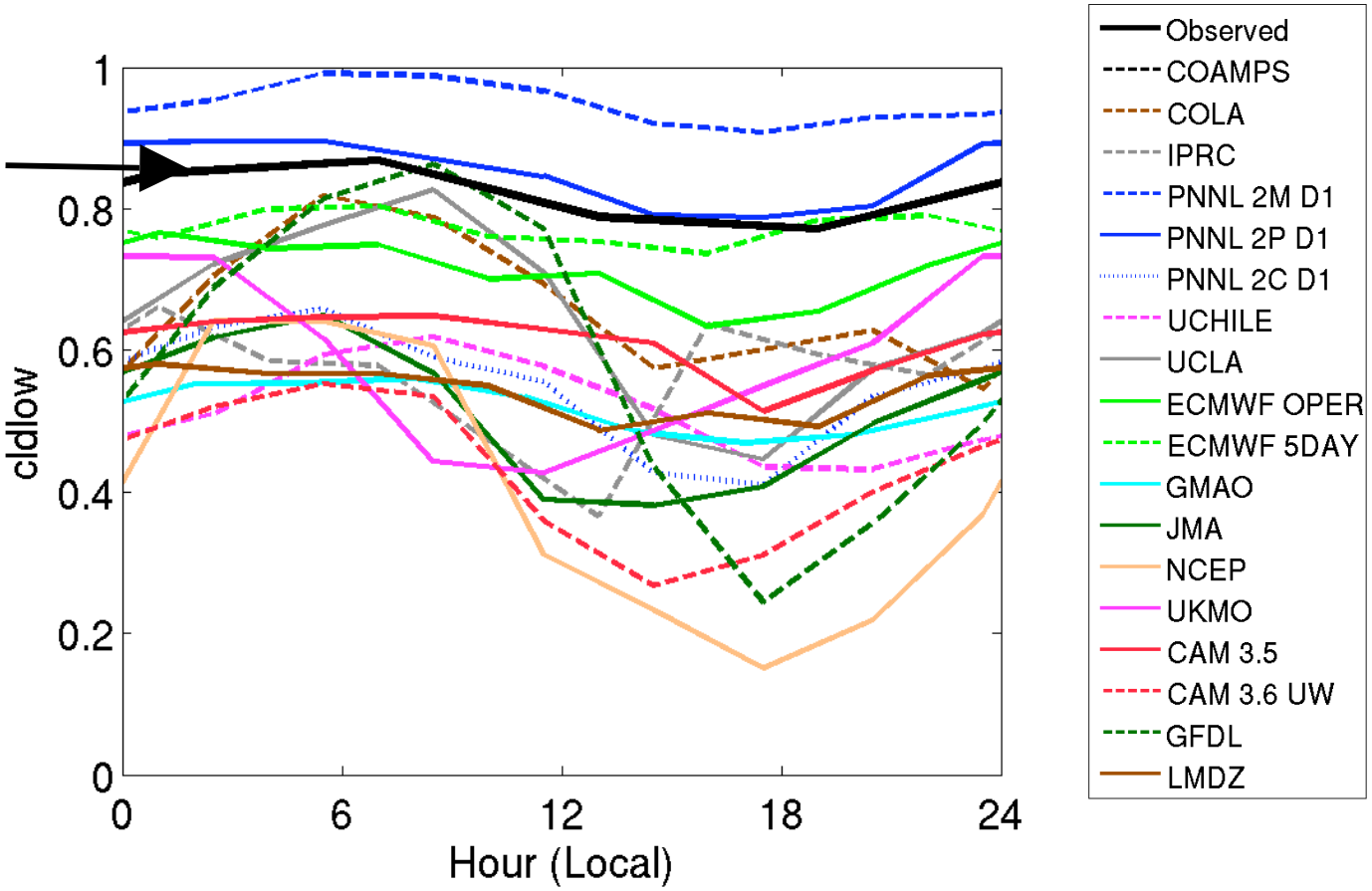
- Model winds agree well with QuikSCAT and with each other.
- Model mean subsidence agrees fairly well.
- Much scatter in PBL/Sc properties such as boundary layer depth and cloud fraction, especially among the regional models.
- UKMO and ECMWF models perform best overall, correctly capturing most geographic variations in PBL depth/structure and cloud cover.

LWP Diurnal Cycle at 20S 85W



Low cloud diurnal cycle at 20S 85W

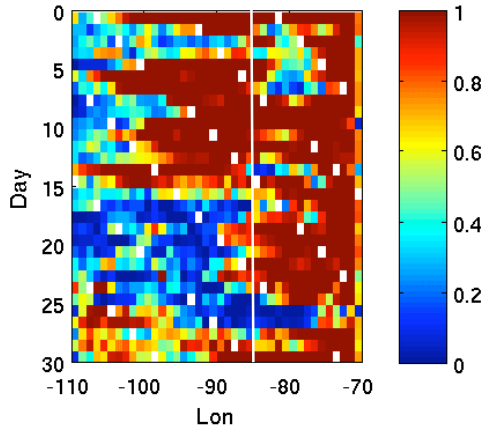
Ship-based Visual Observations



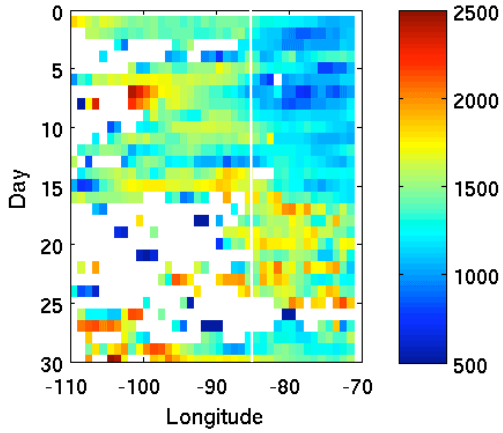
Evolution of clouds along 20 S
October 2006

Time

MODIS
Total Cloud Fraction



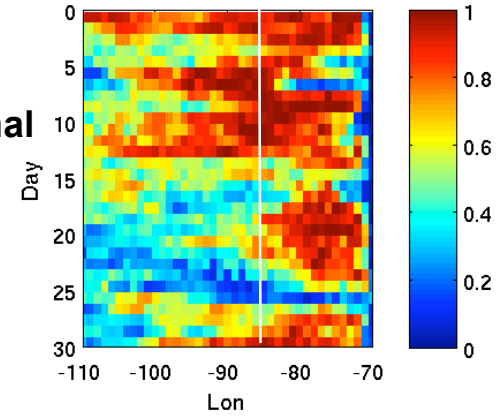
MODIS
Cloud-top Height [m]



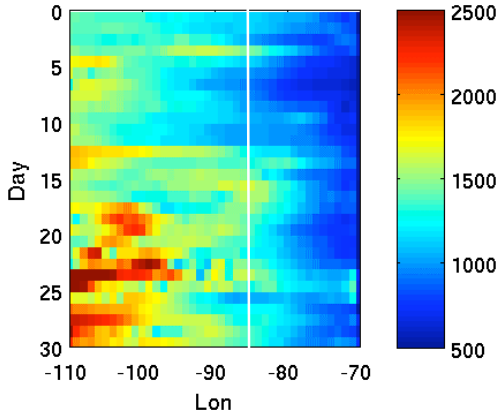
Zuidema et al. (2009)

ECMWF Operational Model

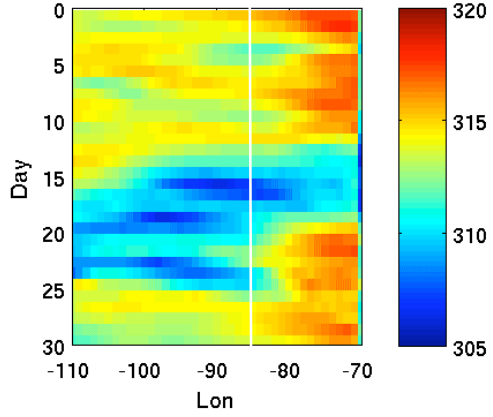
Low Cloud Fraction



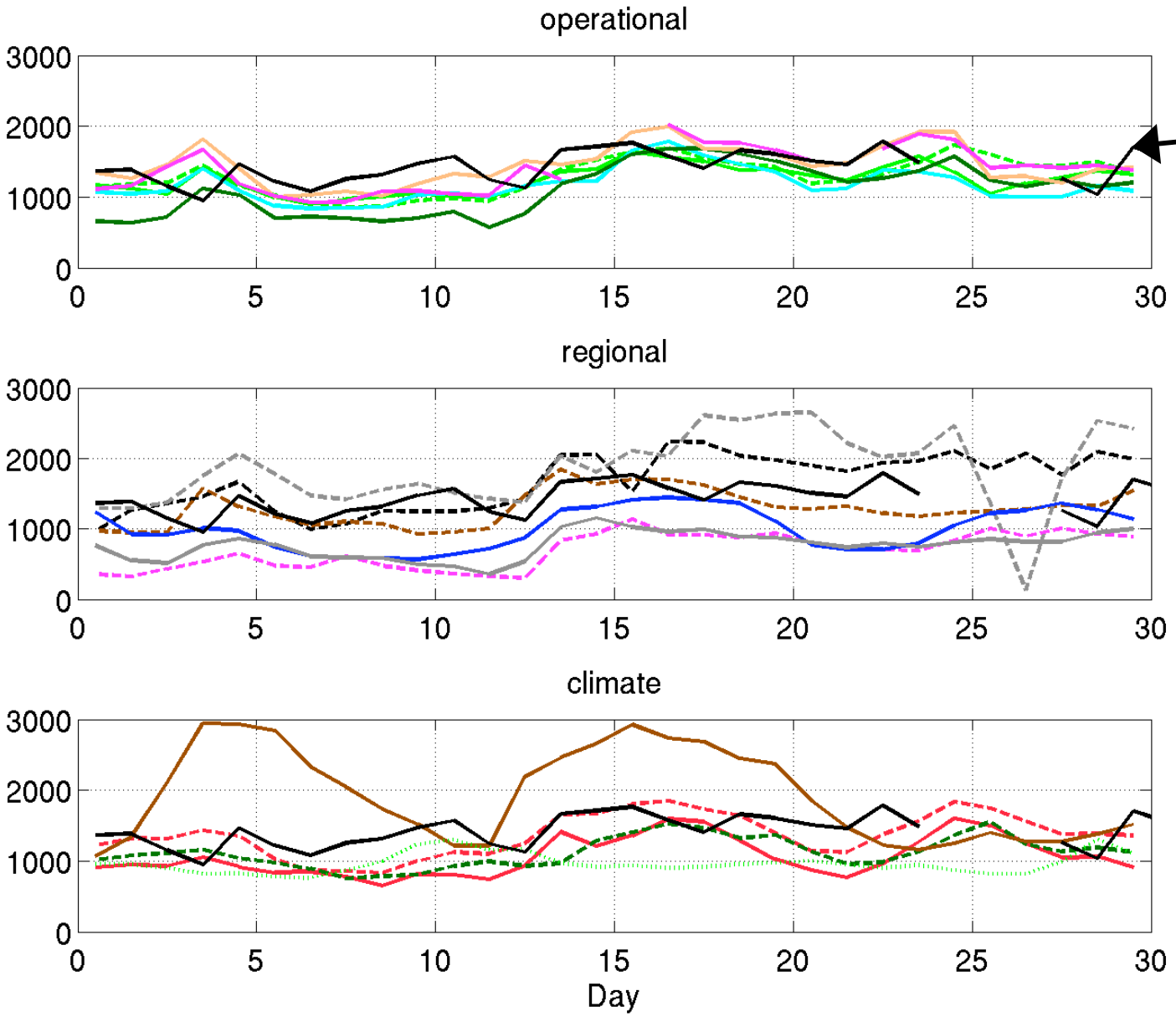
BL Depth [m]



θ at 700 hPa [K]



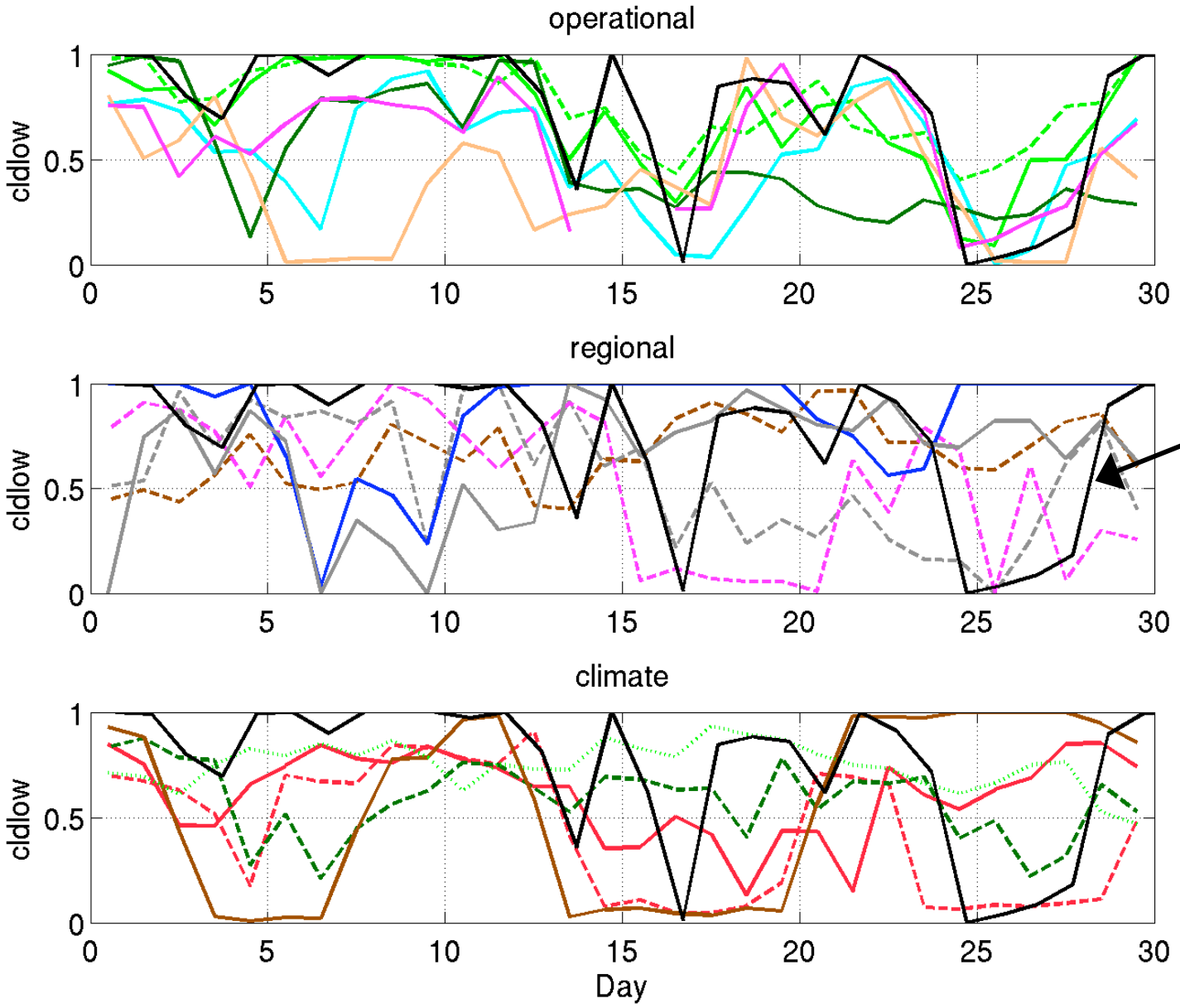
BL Depth at 20S 85W



MODIS

Zuidema et al. (2009)

Low Cloud at 20S 85W



MODIS

Further Conclusions from PreVOCA

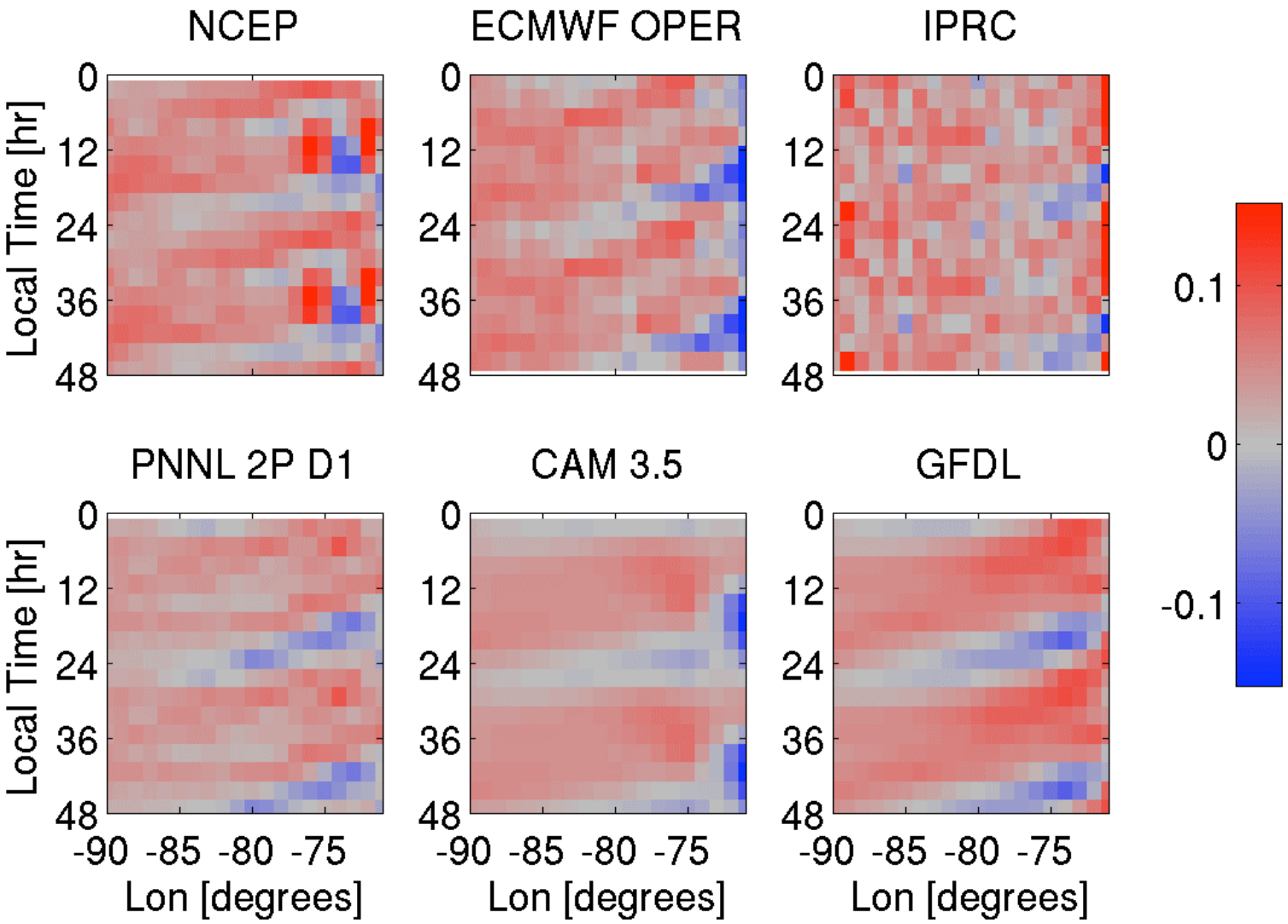
- Diurnal cycle of LWP has similar phase but weaker amplitude than observed at buoy.
- Diurnal cycle of cloud fraction is overestimated in some models.
- Diurnal upsidence wave similar to Garreaud and Munoz (2004) is present in most models.
- Mid-month BL deepening is captured qualitatively in most models, but cloud changes vary widely among models.
- Paper to be submitted to JGR…

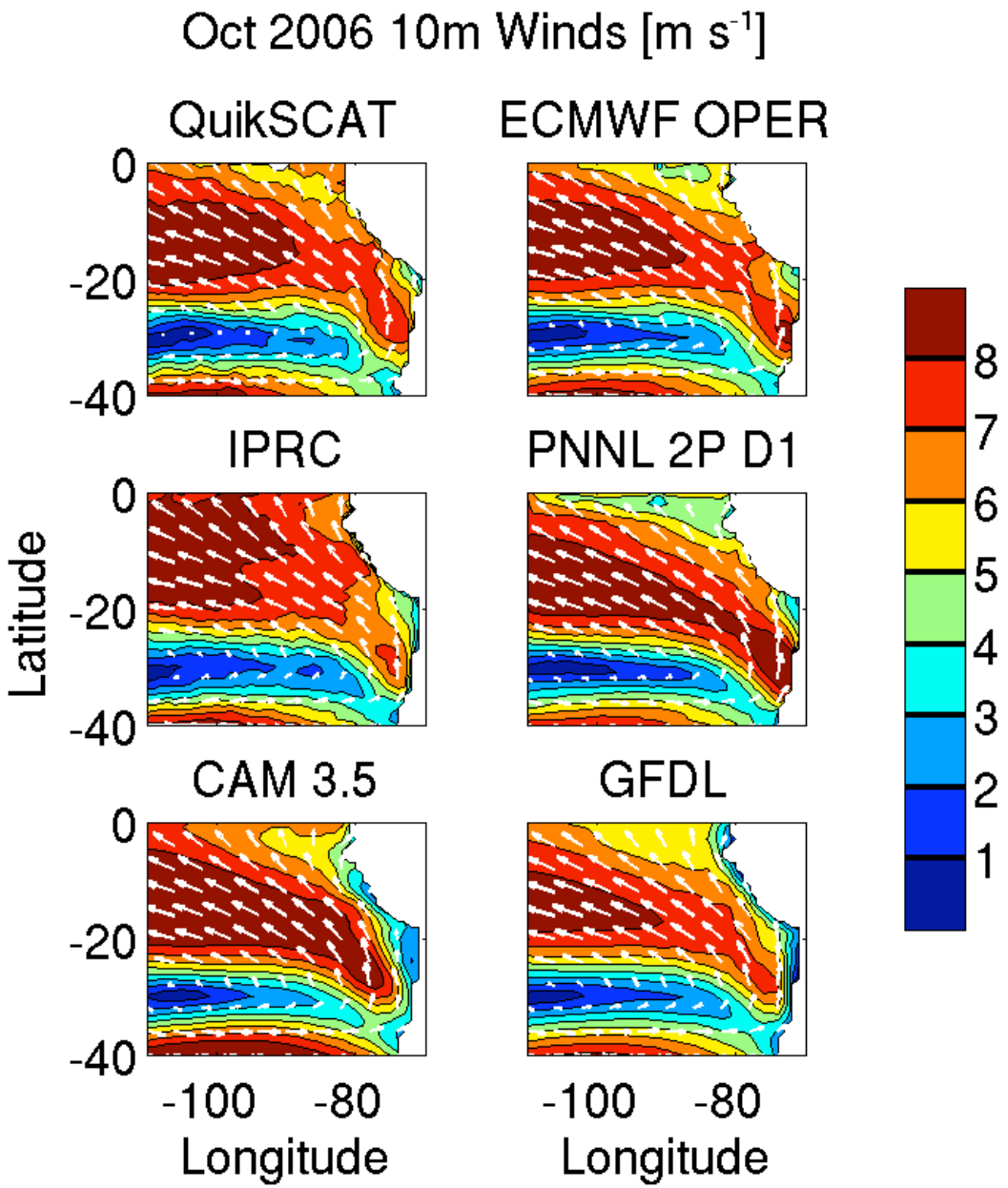
The next phase...

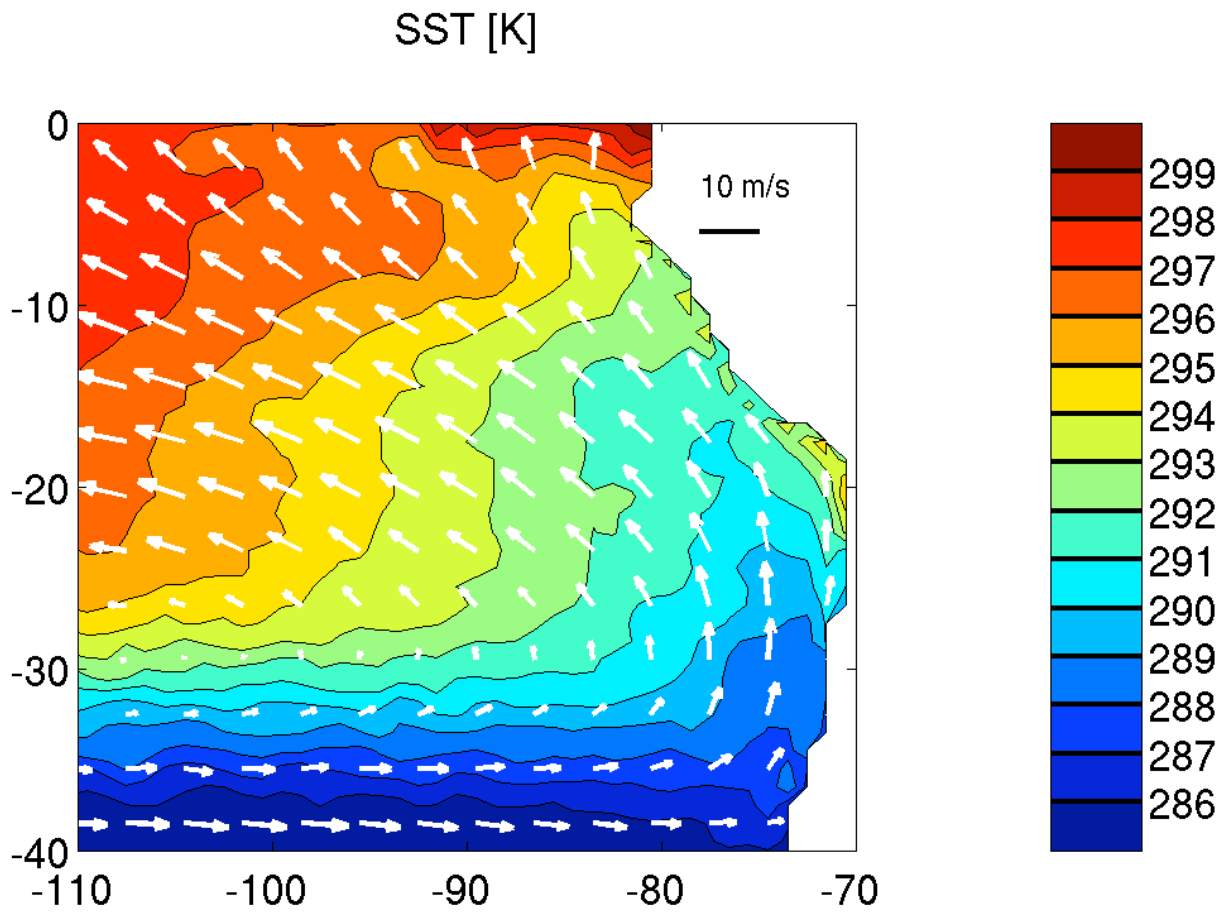
- VOCA: Similar protocol to preVOCA using REx observations from 15 Oct -15 Nov 2008
- Specify or parameterize emissions of various aerosol and gas species in a standard protocol.
- Compare aerosol and gas concentrations to in-situ measurements, testing modelling of transport, diffusion and deposition.
- Compare cloud-top effective radius with satellite.
- Assess modeling of aerosol processing by clouds.
- To be discussed on Tuesday afternoon…

Extra Slides

Model Upsidence Wave




Oct 2006 10m Winds [m s-1]
QuikSCAT
ECMWF OPER
IPRC
PNNL 2P D1
CAM 3.5
GFDL
Latitude
0
-20
-40
-100
-80
Longitude
8
7
6
5
4
3
2
1


SST [K]
10 m/s
0
-10
-20
-30
-40
-110
-100
-90
-80
-70
299
298
297
296
295
294
293
292
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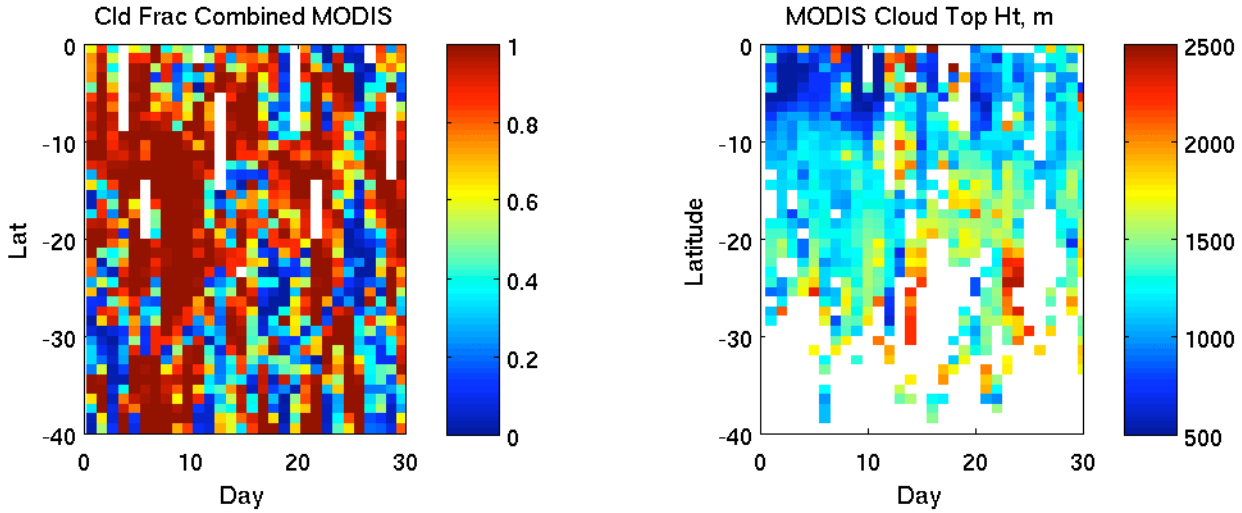
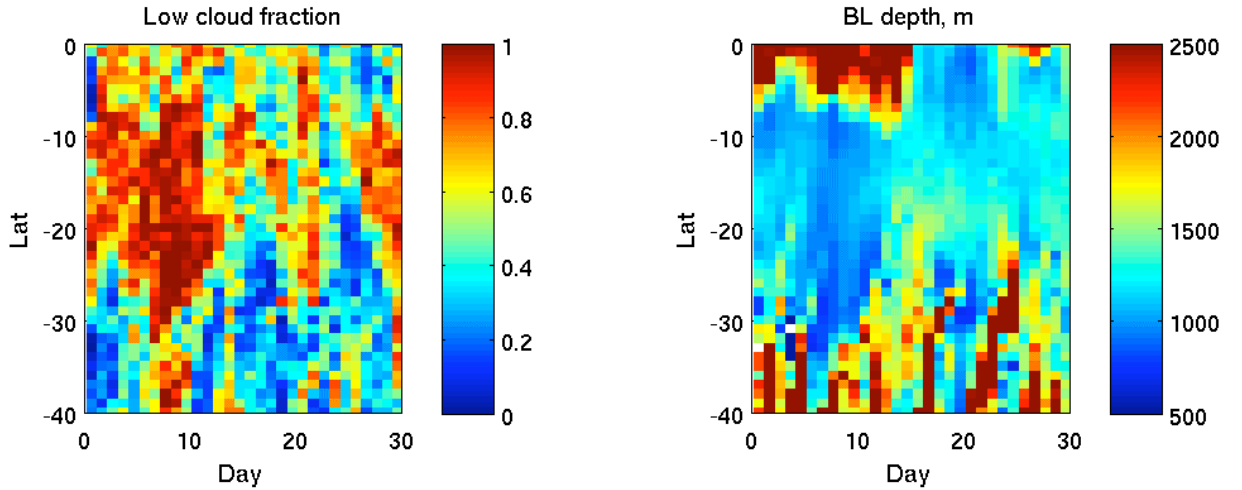
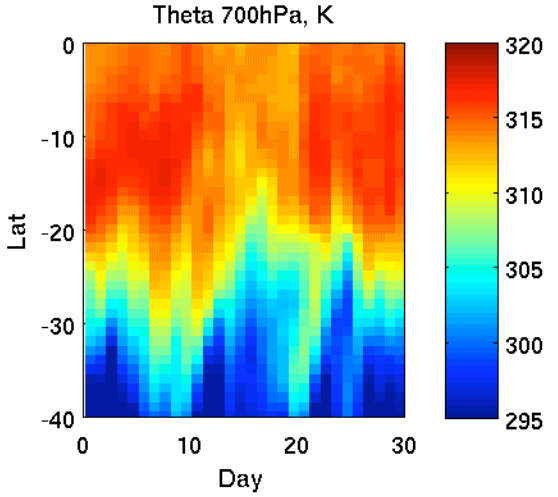
287
286

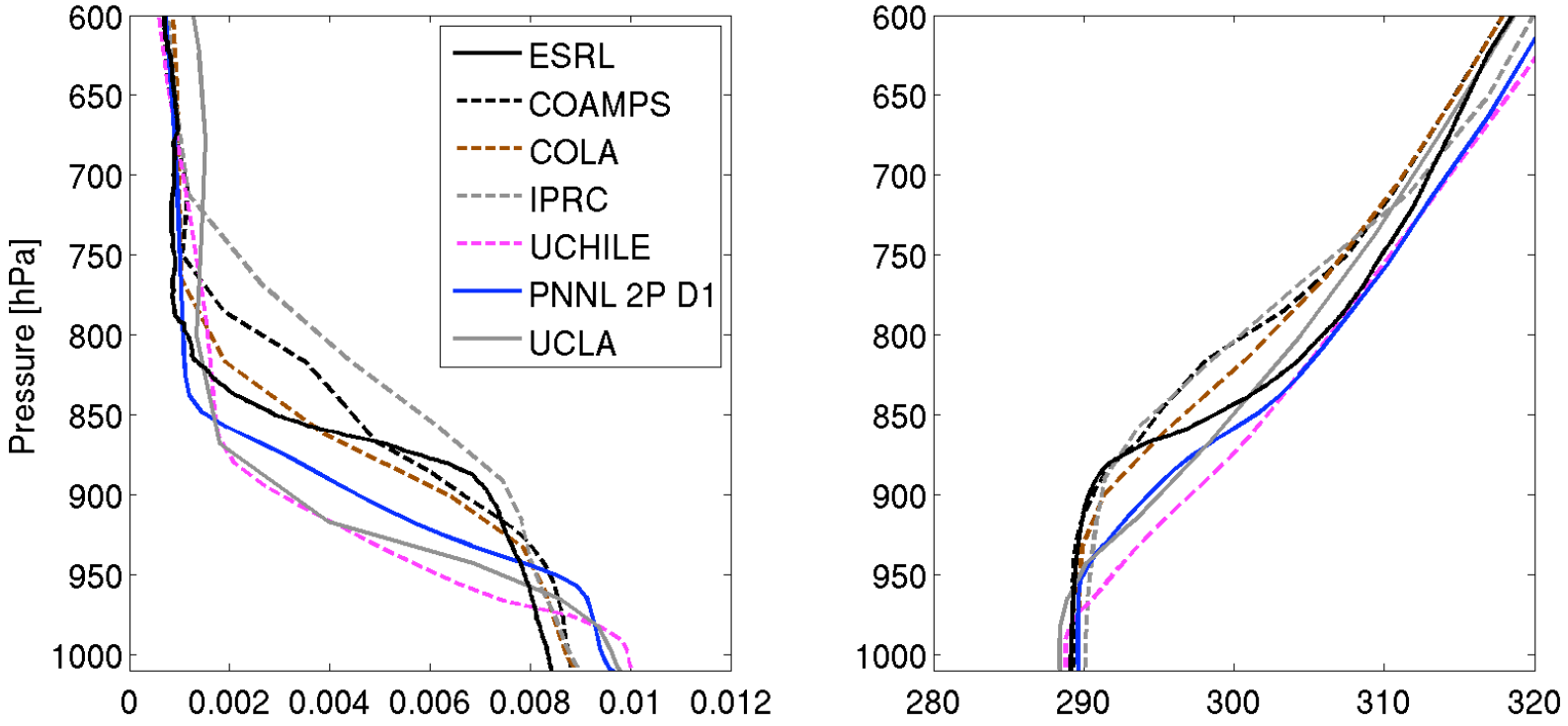


ECMWF OPER, Oct 2006 85W

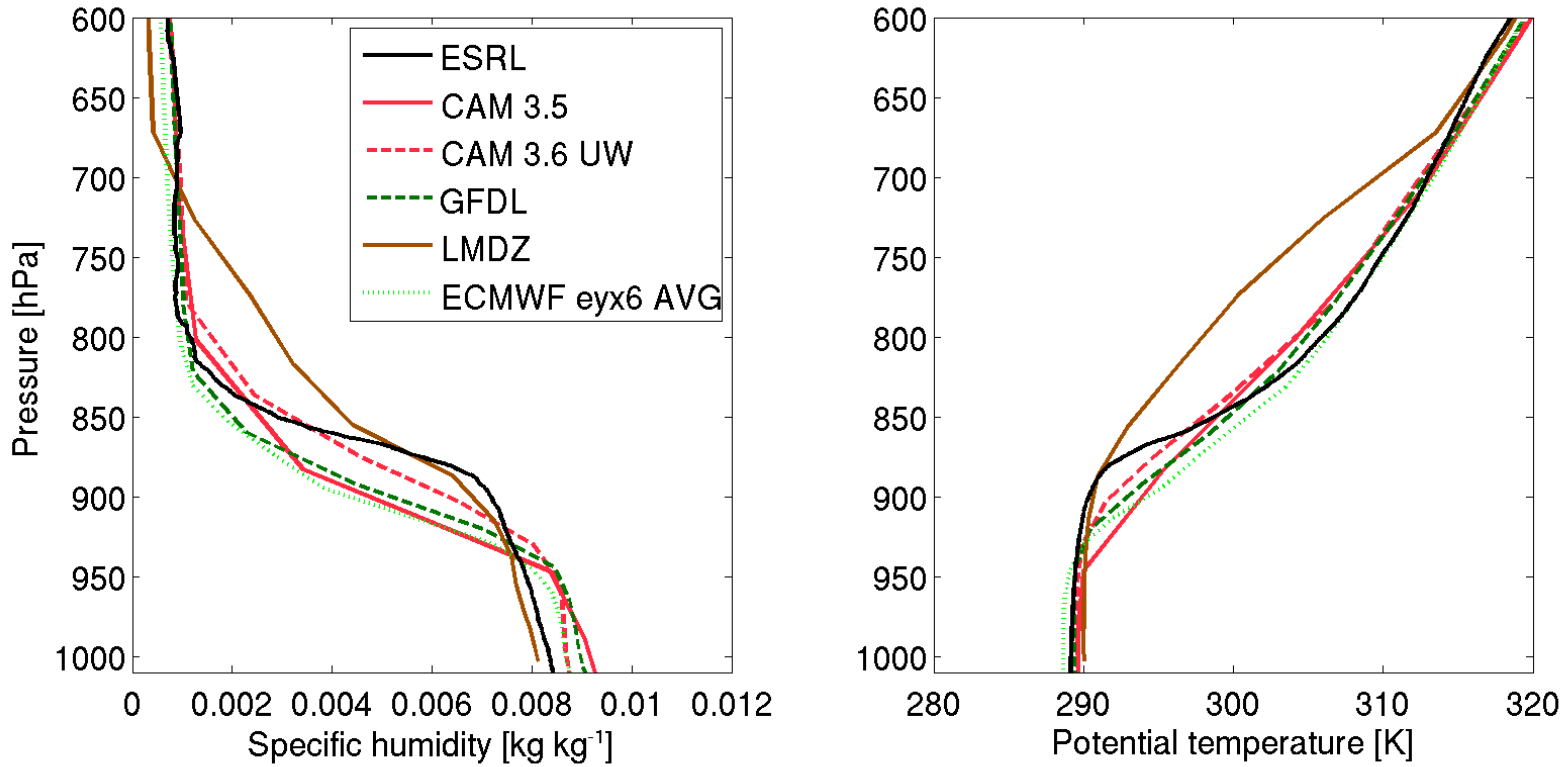




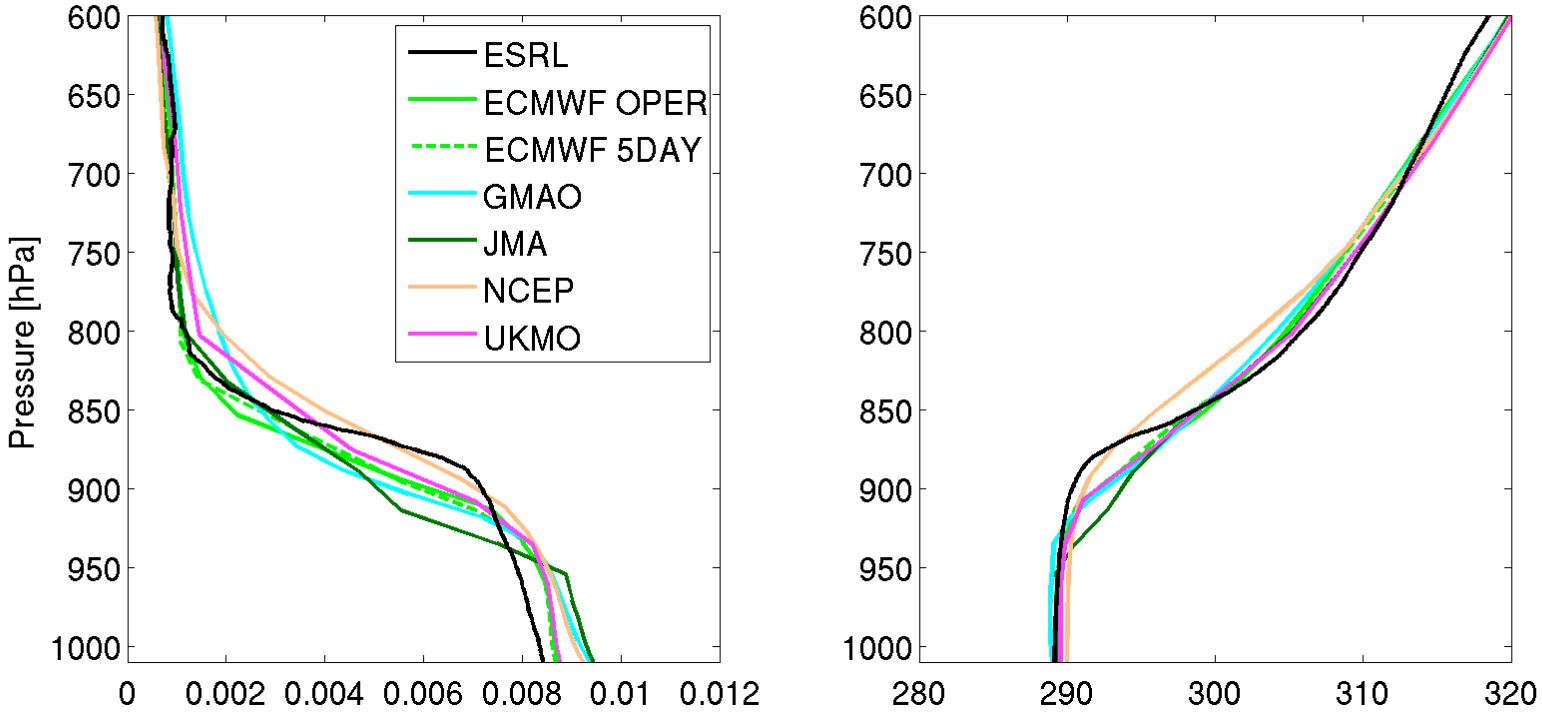
Regional Models
20S 85W

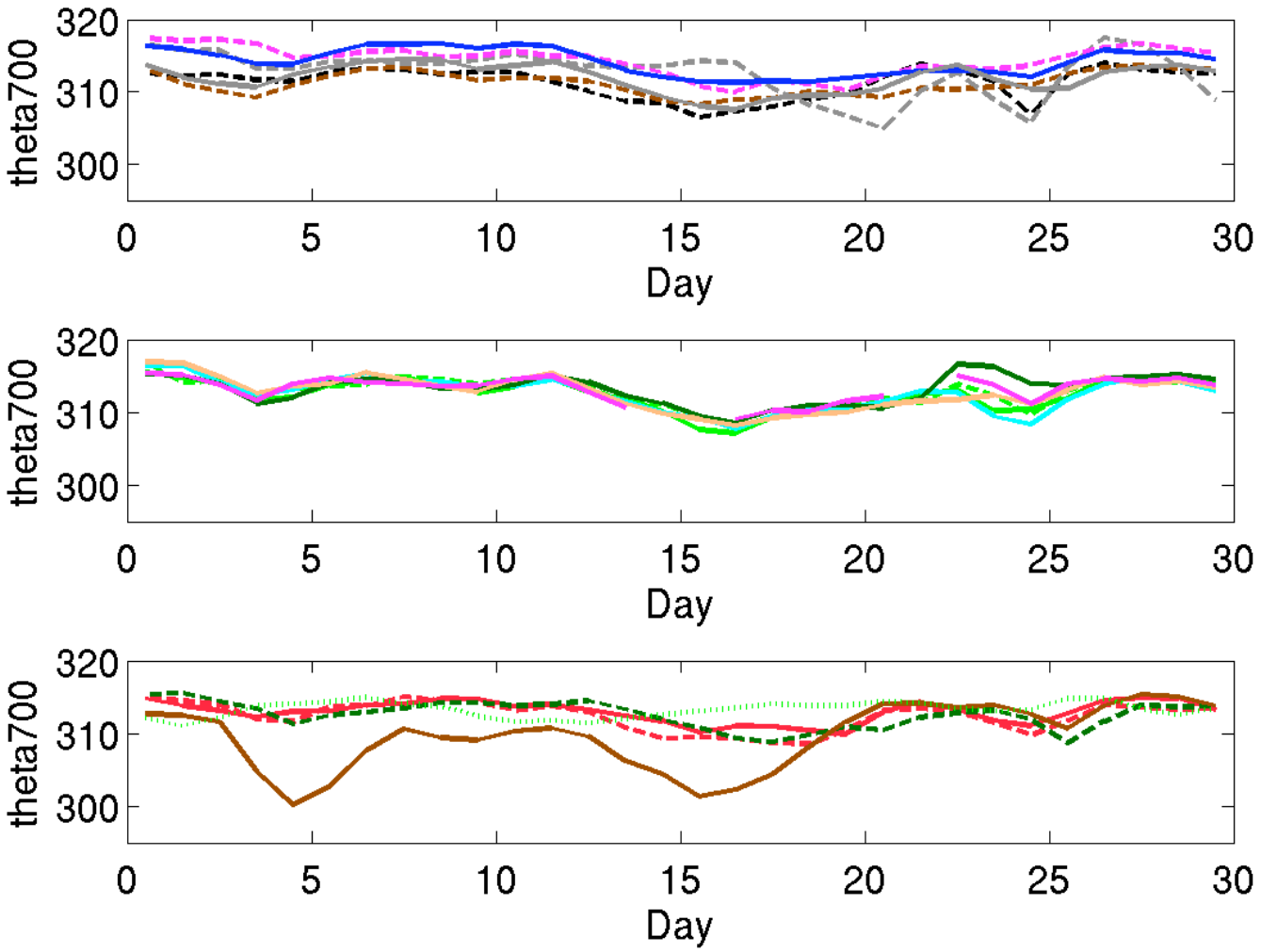


Climate Models
20S 85W



Operational Models
20S 85W




theta700
320
310
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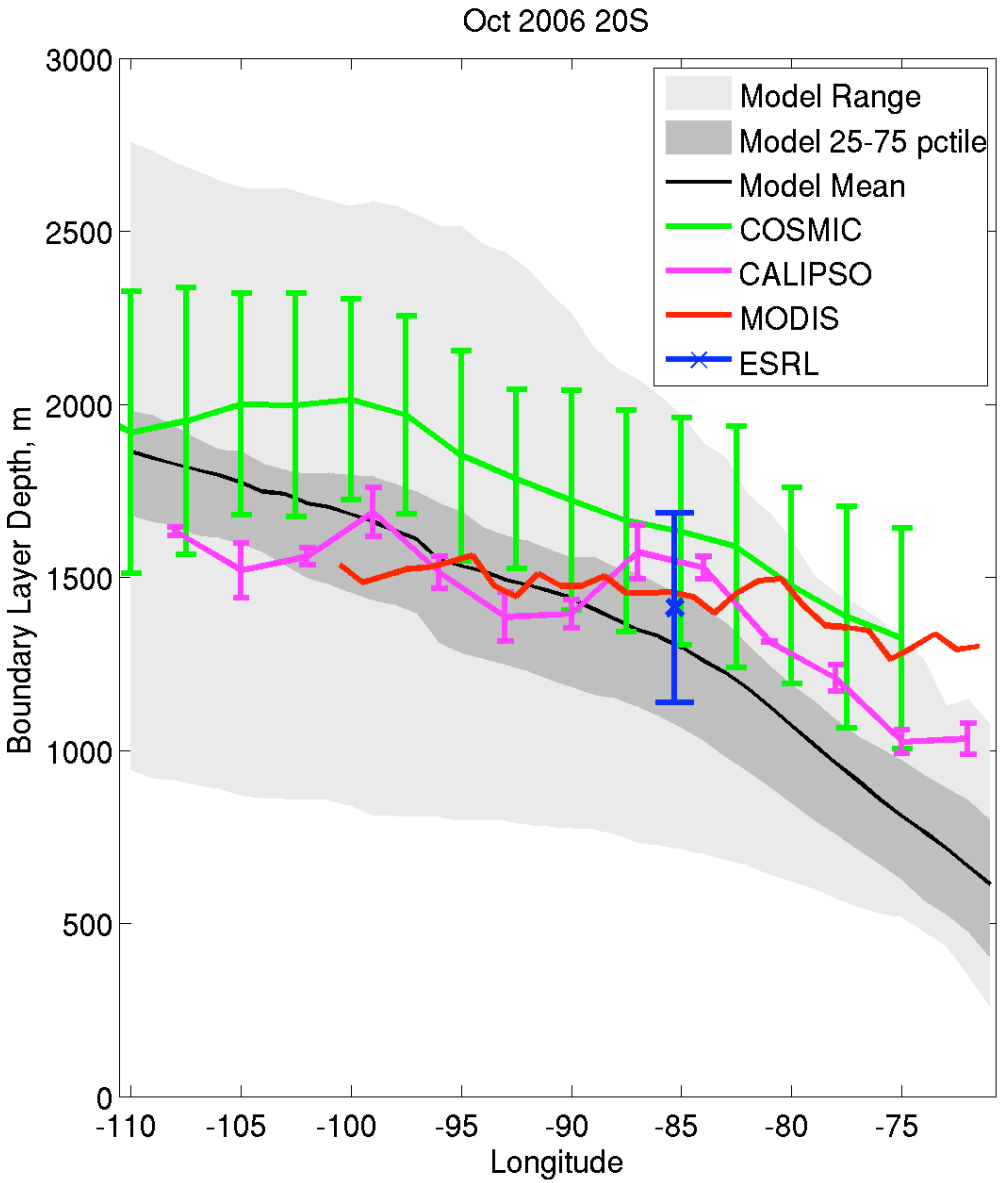
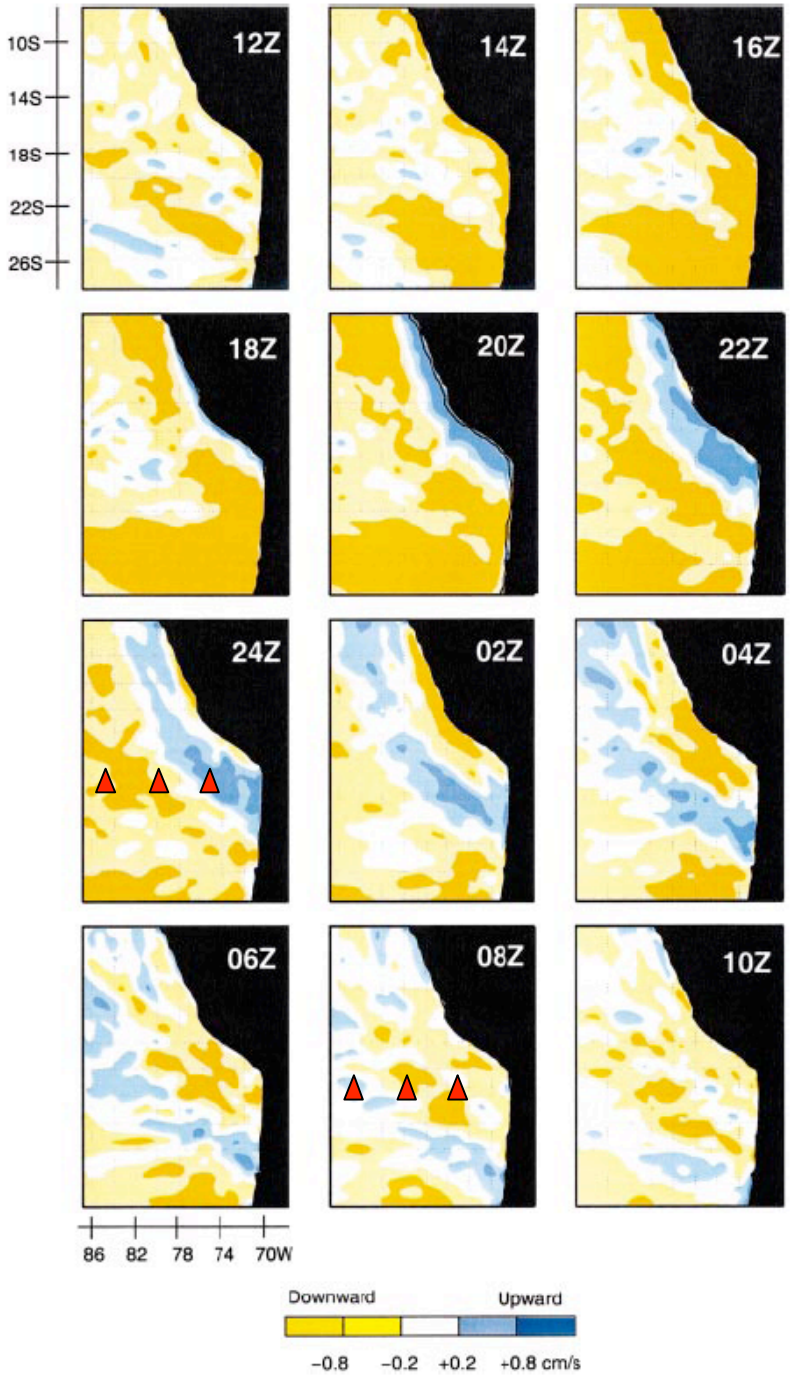
30
Day

Mean Boundary Layer Depth Along 20S



w at 800hPa



Modeled ‘Upsidence’ Wave

November 14-28 2001

Garreaud and Munoz (2004) *J. Climate*