

The Pre-VOCA Model Assessment

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with help from

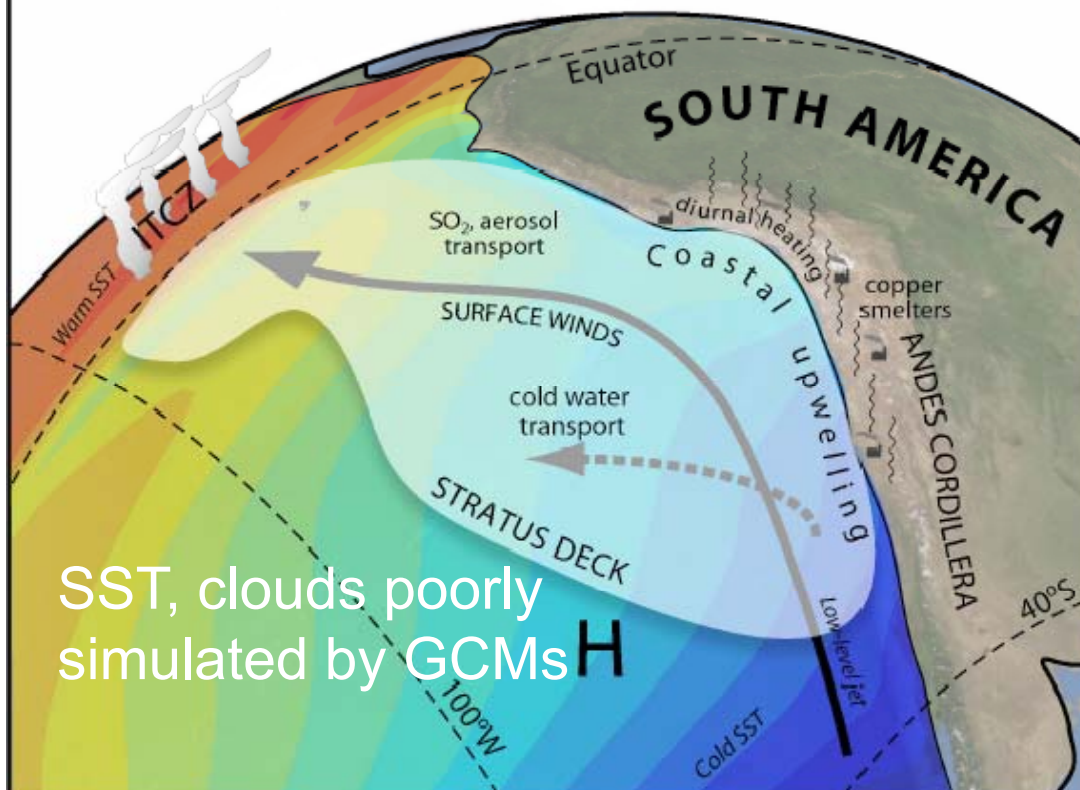
participating modeling groups,

Dave Leon (U Wyo), Rhea George (UW)

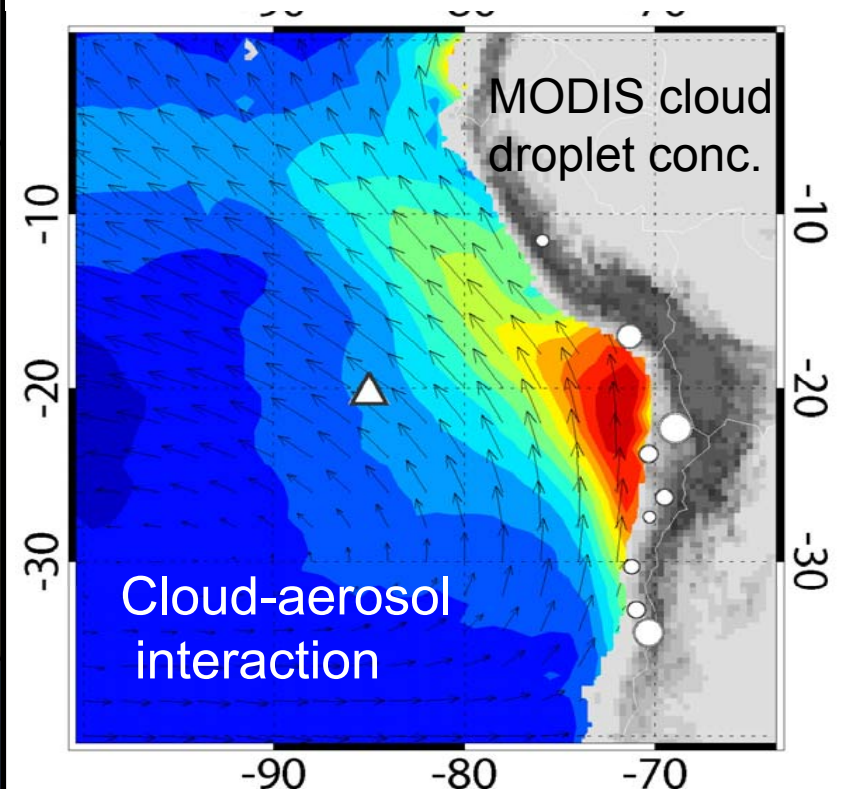
Southeast Pacific Climate - A Modeling Challenge

World's most
persistent subtropical
low cloud regime.

The Southeast Pacific Climate System



SST, clouds poorly
simulated by GCMs



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.

WHAT? Daily hindcasts for October 2006 over the SE Pacific.

WHY? Learn how to optimally use REx, satellite and cruise data for model assessment and improvement.

WHO? 14 modeling groups using regional and global models, including climate models run in forecast mode.

WHEN? Data submission is complete; analysis in progress, journal submission early 2009.

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
LMDZ	38	50
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
NCAR CAM3.5/6	26/30	250
GFDL	24	250



PreVOCA observational data



ISCCP FD	Radiative fluxes at surface, TOA
TMI	LWP, WVP
AMSR	LWP, WVP
MODIS	Cloud fraction, optical depth, droplet size, cloud-top height
NOAA ESRL Stratus Cruises	Temperature, moisture soundings, surface fluxes, drizzle properties, aerosols
QuikSCAT	Ocean surface winds
NCEP Reanalysis	Vertical velocity
CALIPSO	Cloud top height
COSMIC	Temperature soundings
CloudSat	Drizzle properties



Analysis



PreVOCA analysis focus:

Cloud/PBL structure and their dynamical setting.

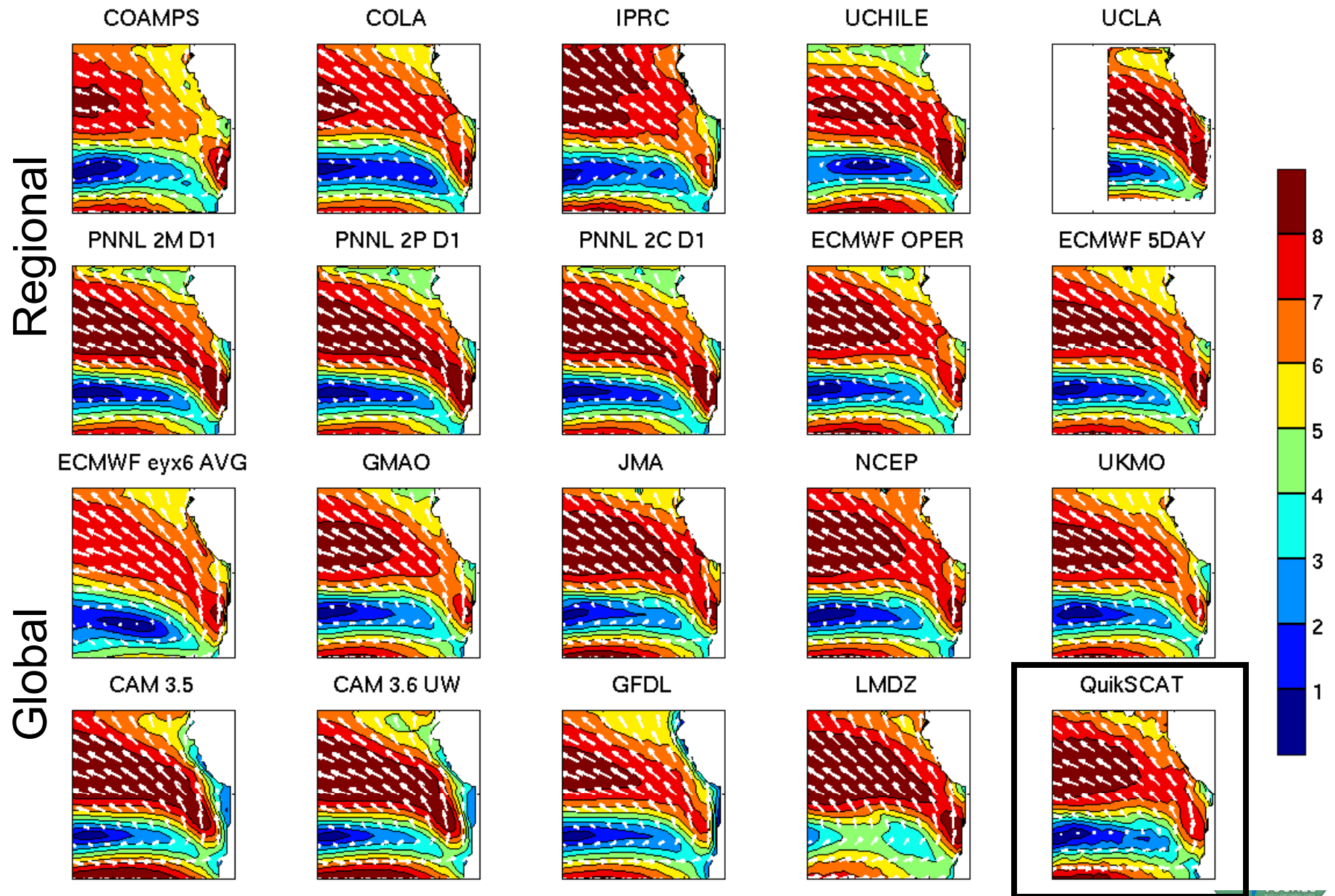
Shown here: Monthly mean

Also analyzed: Diurnal cycle, subsidence waves

Soon: Synoptic variability



Oct 2006 10 m vector wind (m s⁻¹) - models agree fairly well ¹⁸

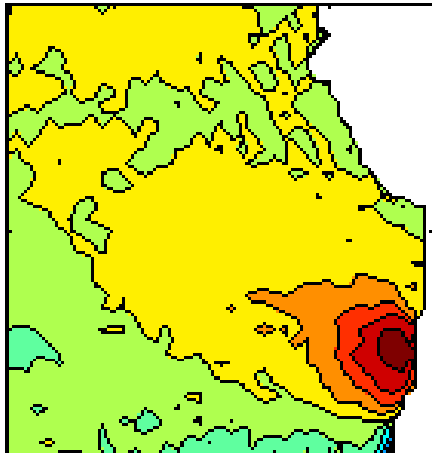


Omega at 850 hPa (Pa s^{-1}) - also not too bad

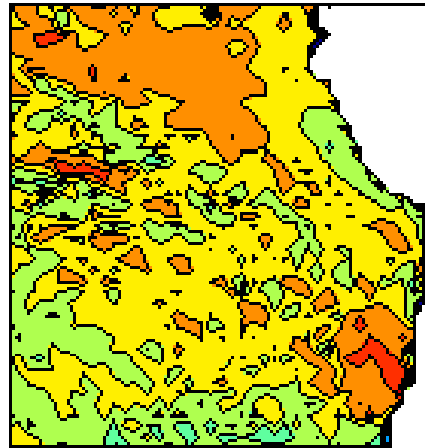


Regional

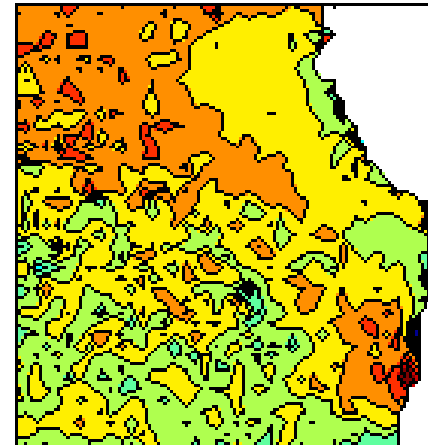
UCHILE



COAMPS

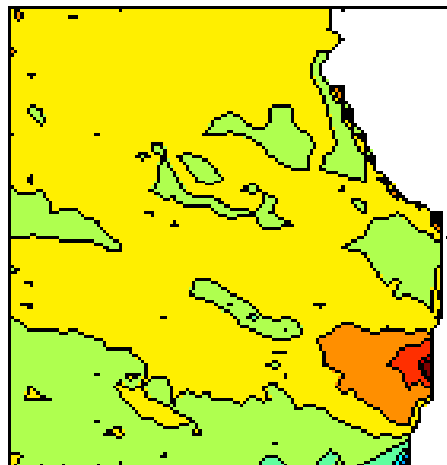


IPRC

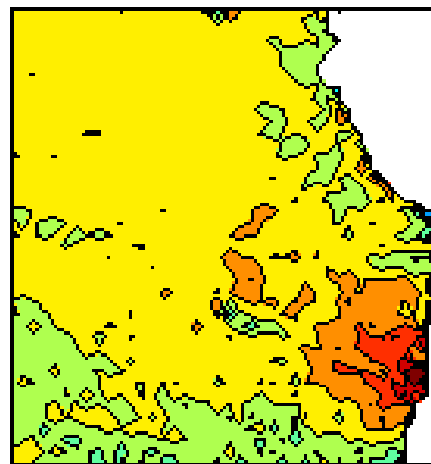


Global

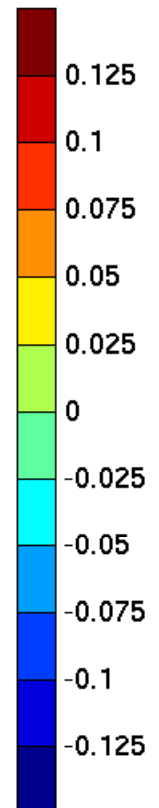
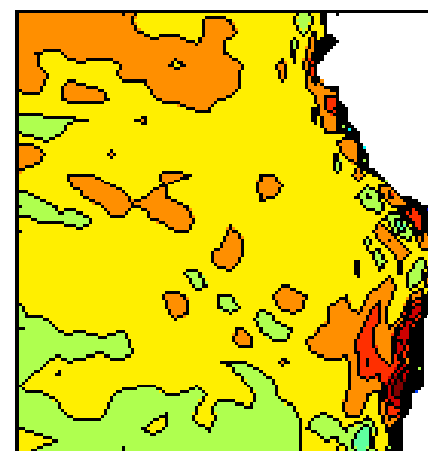
UKMO



ECMWF OPER

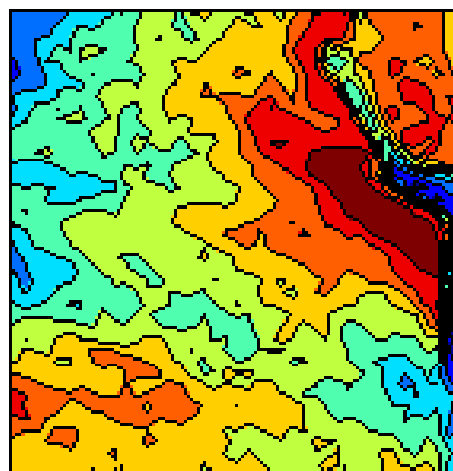


NCEP

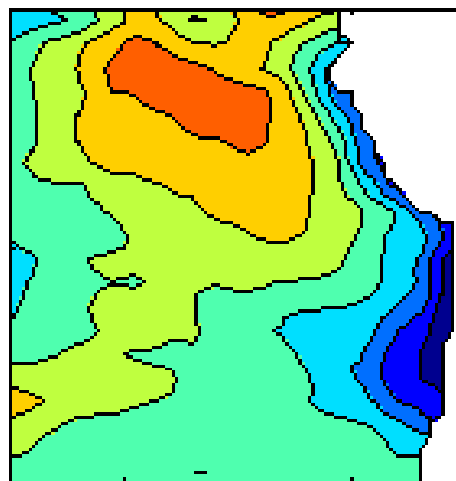


Low Cloud Fraction

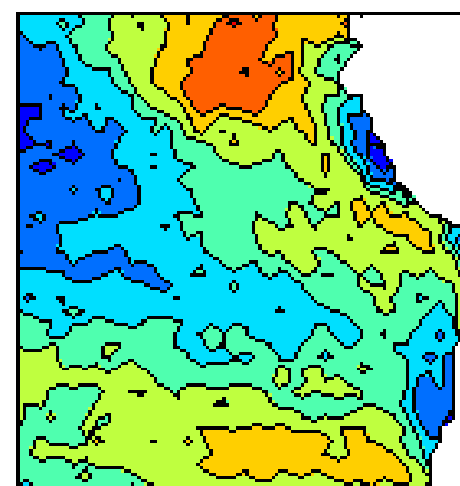
MODIS Total Cldfrac



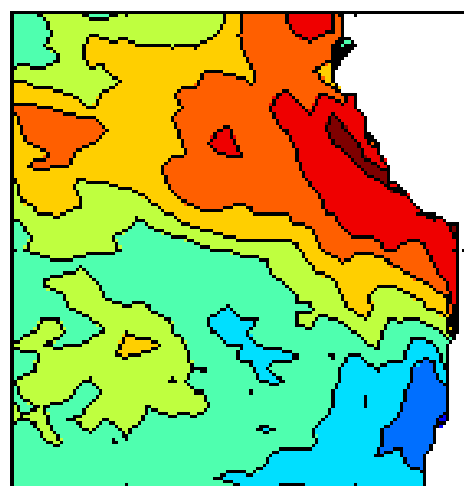
GFDL



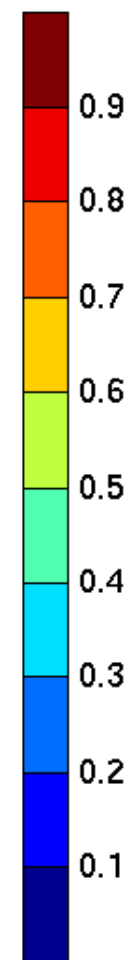
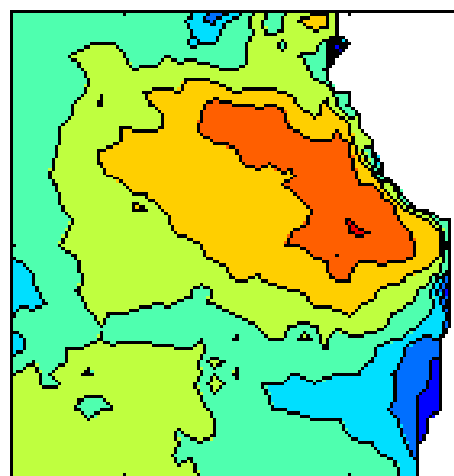
IPRC



UKMO



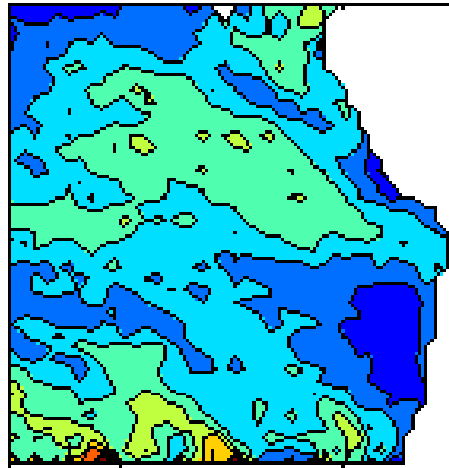
ECMWF OPER



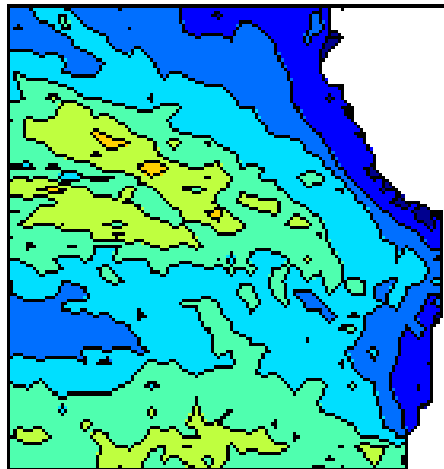
Liquid Water Path (g m^{-2})



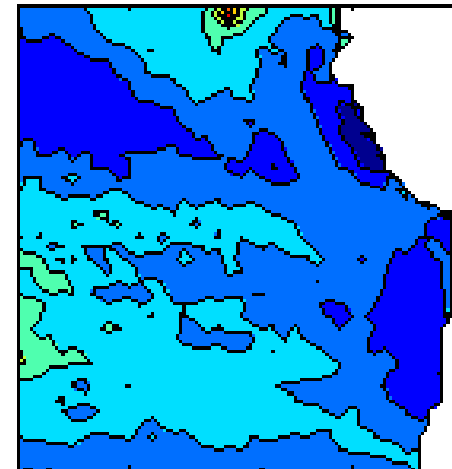
TMI Observed



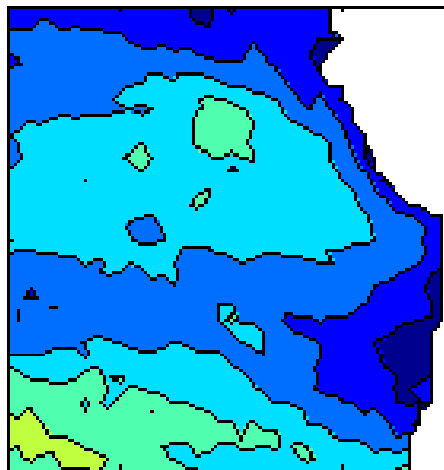
COAMPS



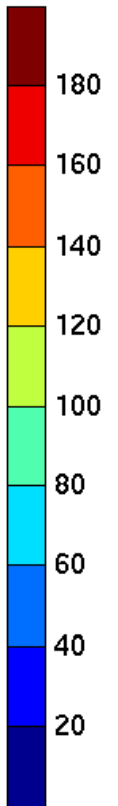
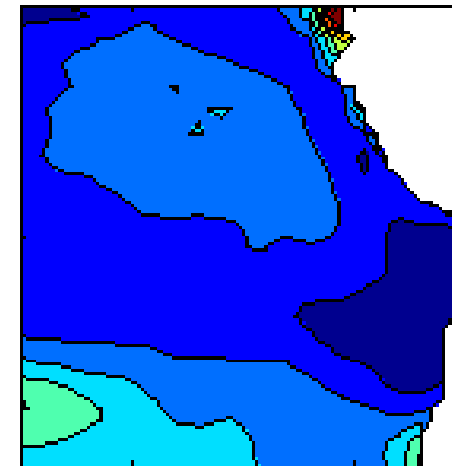
IPRC



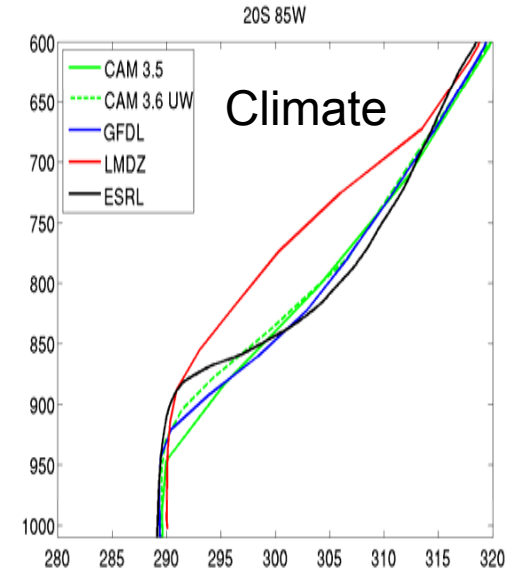
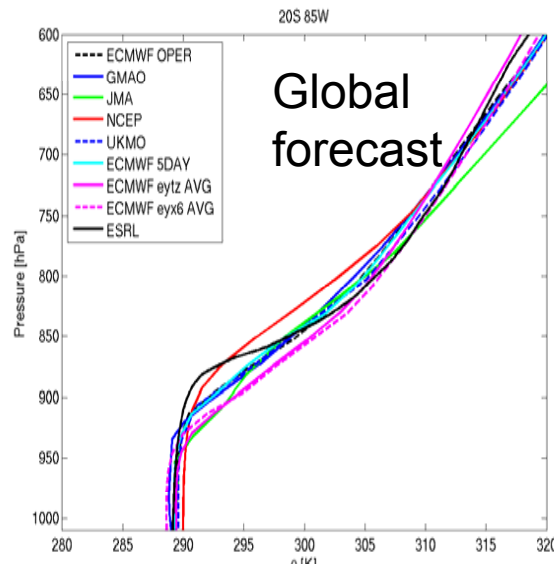
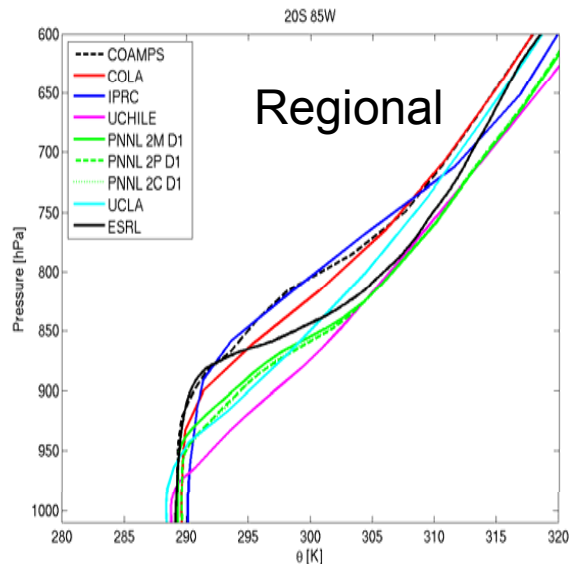
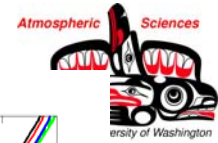
ECMWF OPER



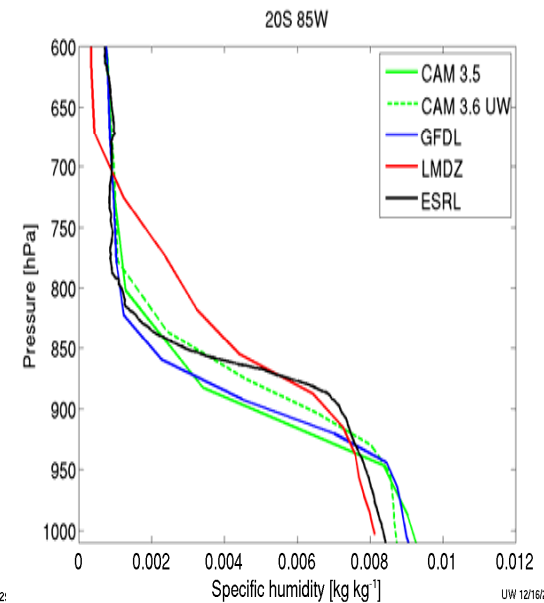
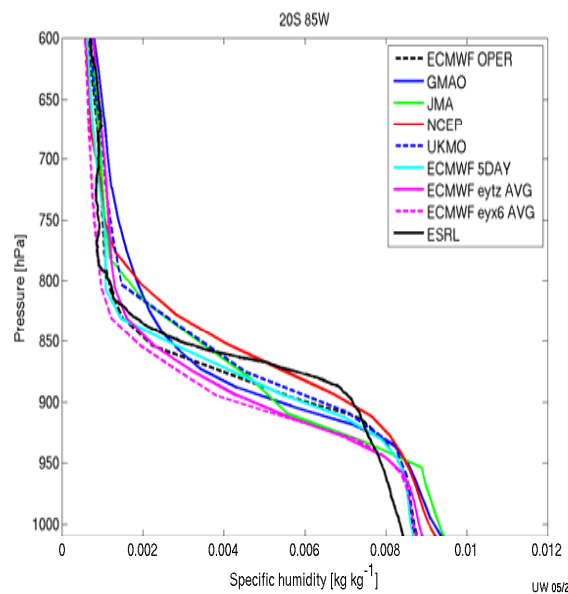
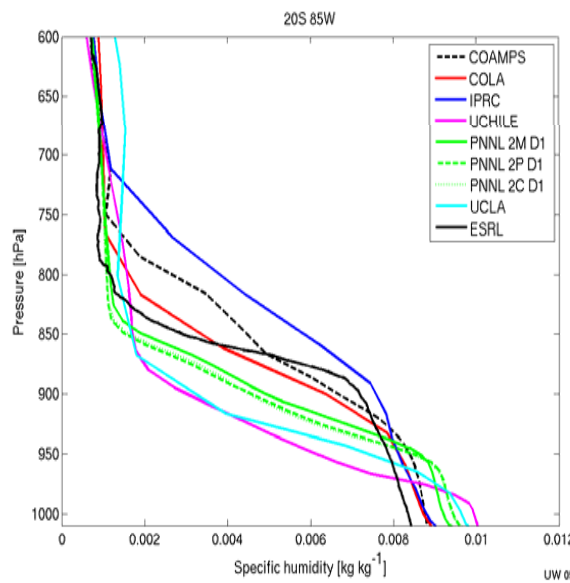
GFDL



20S 85W sounding comparisons



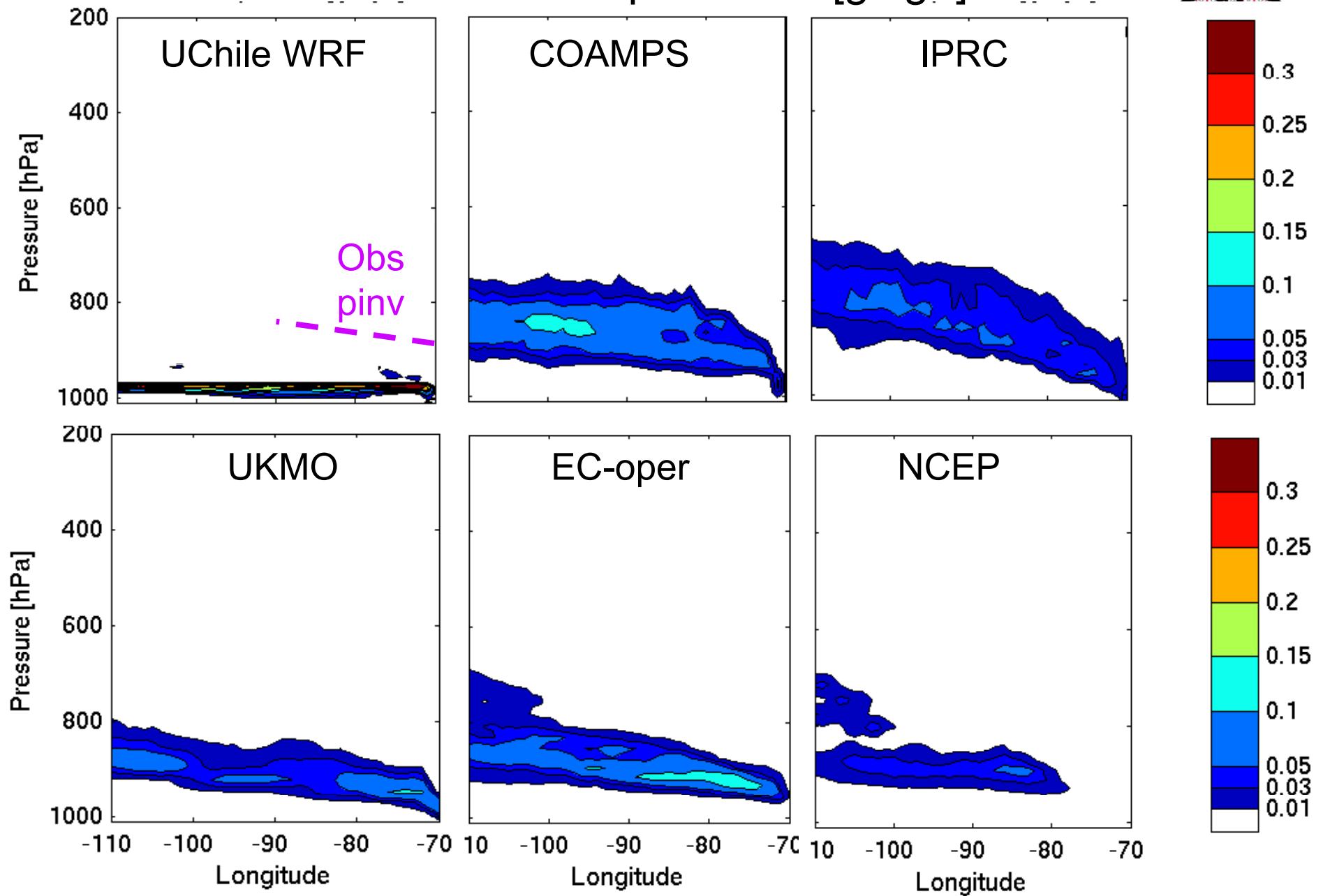
θ



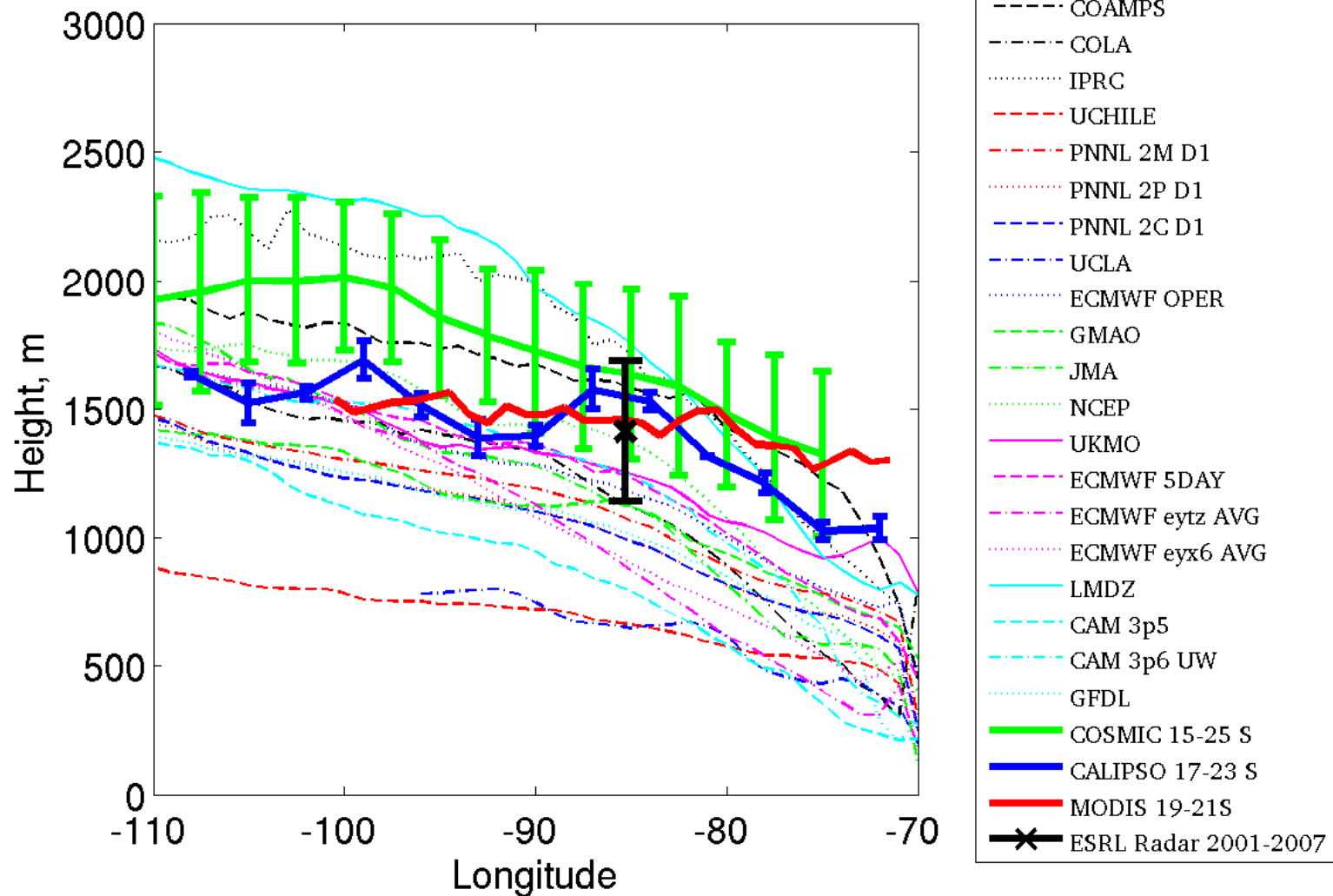
q_v



20S Cloud liquid water [g kg^{-1}]



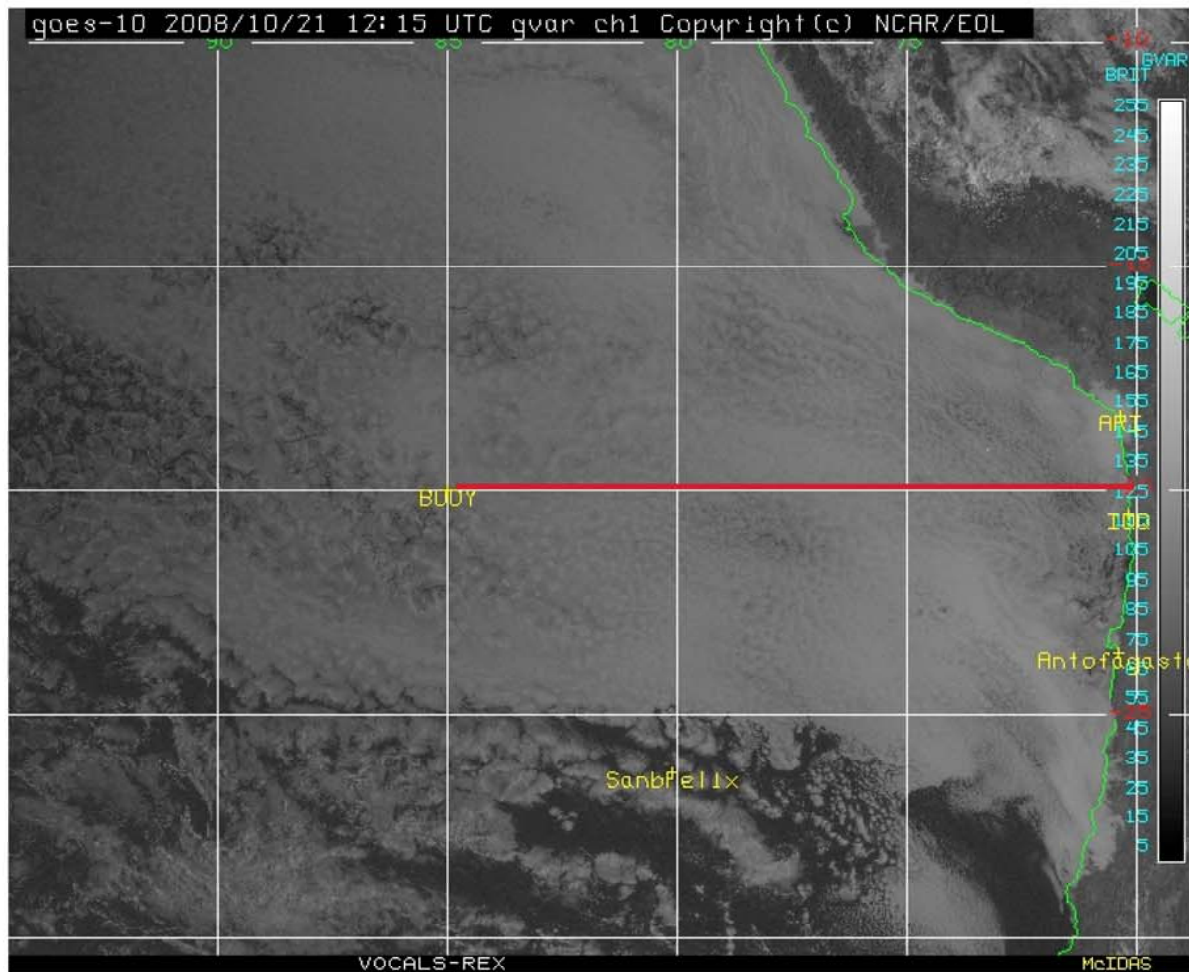
Mean Boundary Layer Depth Along 20S



C130 RF03 (21 Oct 2008) - 'typical'



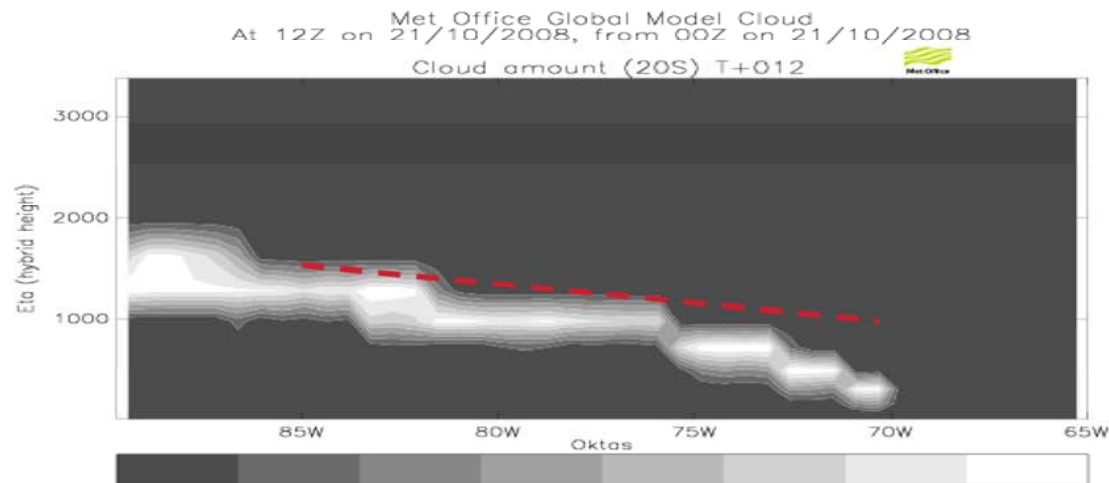
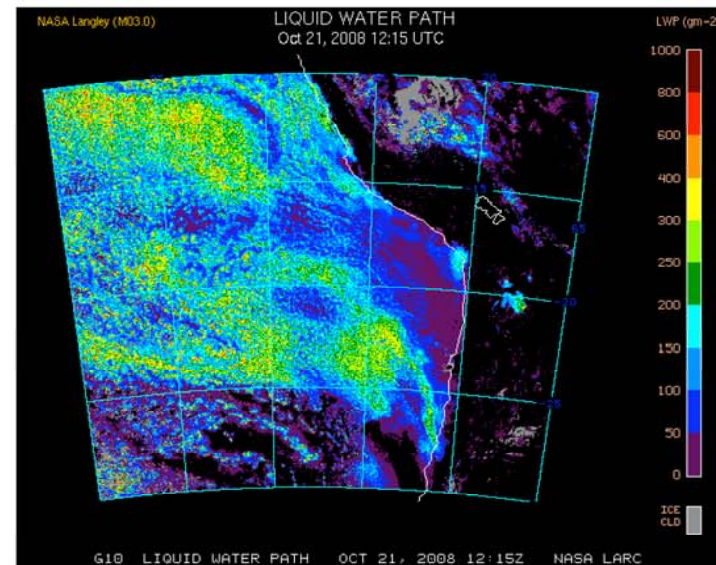
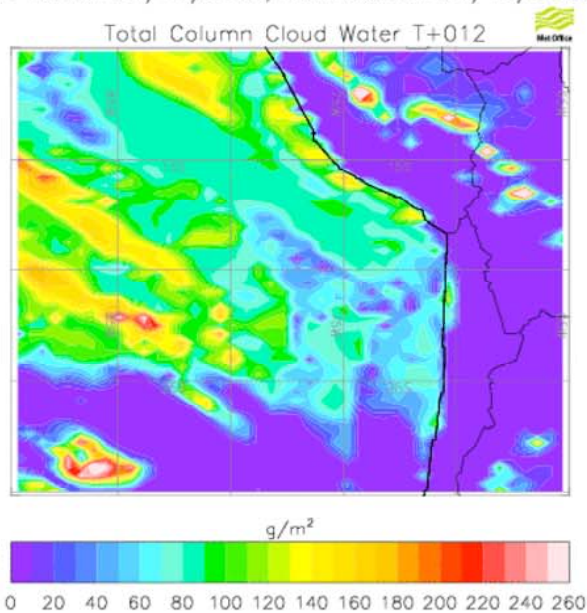
Sloped inversion: 1000m (70W) -1600m (85W), solid Sc



UKMO global forecast model performance



Met Office Global Model Cloud Liquid Water
At 12Z on 21/10/2008, from 00Z on 21/10/2008



...does a creditable
job at representing
the Sc.



Conclusions from PreVOCA



- Much scatter in PBL/Sc properties, esp. among the regional models: an issue for aerosol-cloud interaction?
- UKMO and ECMWF models perform best overall, correctly capturing most geographic variations in PBL depth/structure and cloud cover.
- Sharpness of inversion challenges even the highest-resolution models.
- Cloud variability and aerosol feedbacks are cutting-edge challenges to the best global and regional models.
- VOCALS SE Pacific datasets are wonderful tools for assessing and improving cloud and aerosol simulations.



From PreVOCA to VOCA...



- VOCA: Similar protocol to preVOCA using REx observations from 15 Oct -15 Nov 2008
- More focus on chemical transport, aerosol concentrations and r_{eff} vs. in-situ and CALIPSO data.
- We will send out a detailed protocol early this year. All modeling groups are welcome (with or without chemical transport modeling capability).



Extra Slides



VOCALS



The VAMOS Ocean-Cloud-Atmosphere-Land Study

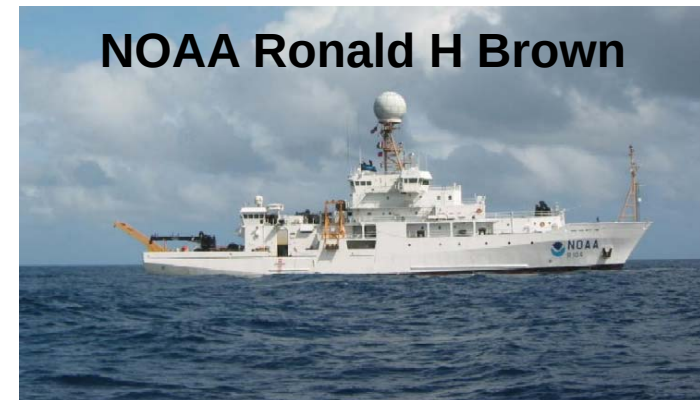
- A multiyear study of boundary layer cloud, aerosol, and upper ocean heat/constituent transport
- WHOI stratus flux-reference buoy at 20S 85W (2000+)
- Annual instrumented cruises in austral spring (starting with EPIC 2001 stratocumulus cruise).
- Regional Experiment (REx) in Oct.-Nov. 2008, including 4 aircraft based in northern Chile, two ships, coastal site: PI: Rob Wood (UW).
- Satellite data analysis of cloud properties
- Atmosphere and ocean modeling (LES to global).



Data from REx for Model Assessment



- ~35 days of Ron Brown ship observations near 20S (cloud radar, scanning 5 cm radar, lidar, sondes, surface met/fluxes, aerosols, sulfur chemistry, oceanography)
- Numerous night/day flights sampling 20S along 70-85W (aerosols, chemistry, cloud radar, dropsondes).



Great cloud radar, microphysics, aerosol data

