

# Operational Models: Readiness Now

*Martin Köhler, ECMWF with Hua-Lu Pan, NCEP and Shouping Wang, NRL*

## observational data:

- EPIC
- DYCOMS-II
- GLAS cloud top
- GCSS Pacific Cross-Section
- ocean buoys
- AOSN field campaign (COAMPS)
- cloud vector winds
- QuikSCAT winds
- radiosonde winds
- SST for coupled GCMs

## model evaluation: ( $dt=12h$ to 10yr)

### • the good

- $q_{mix}$   $\pm 0.5$  g/kg
- $\theta_l$   $\pm 0.5$  K
- $LWP$   $\pm 50$  g/m<sup>2</sup>
- $CC$   $\pm 10$  %
- $\Delta T_{inv}$   $\pm 2$  K

### • the bad

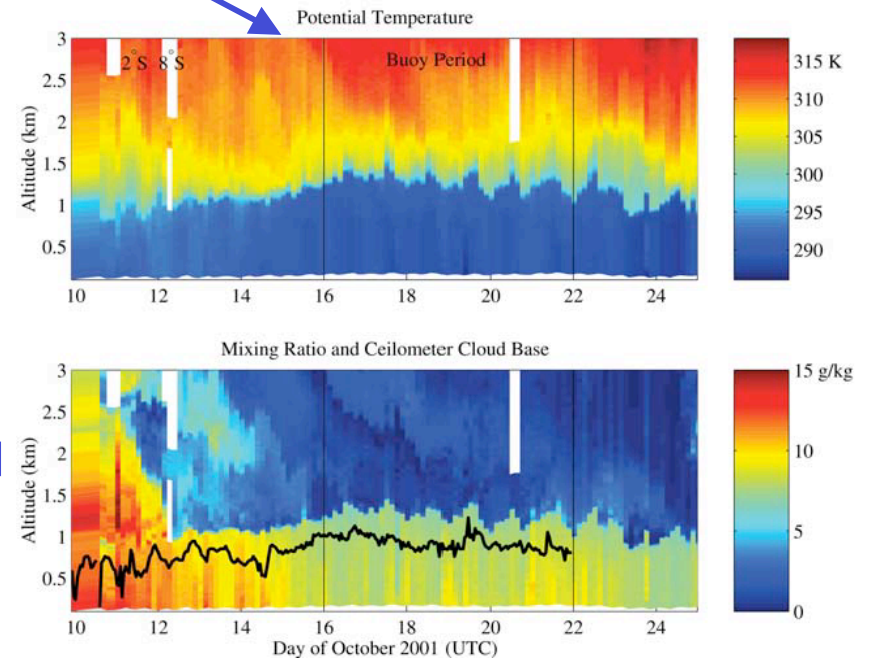
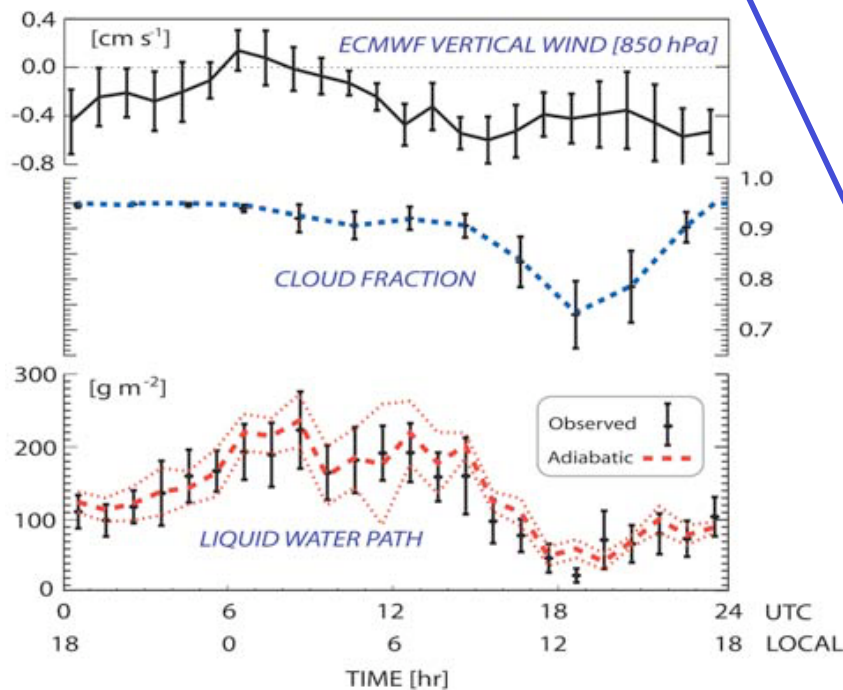
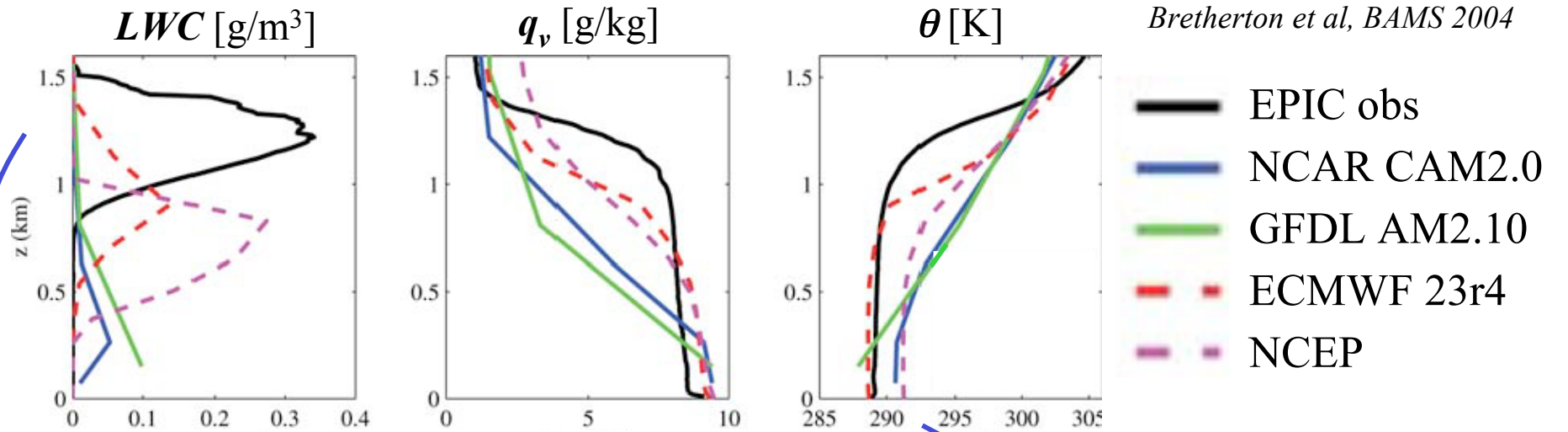
- $SST$   $\pm 2$  K
- $u_{sfc}$   $+ 1$  m/s
- inv. height - 200 to 500m

### • the unknown

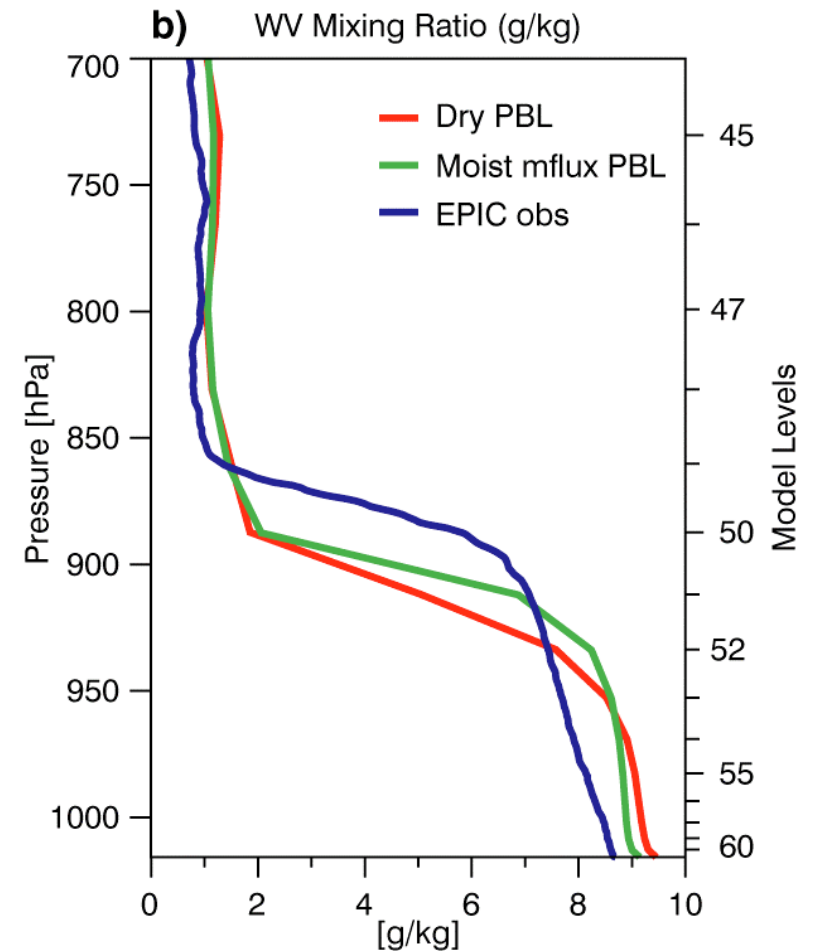
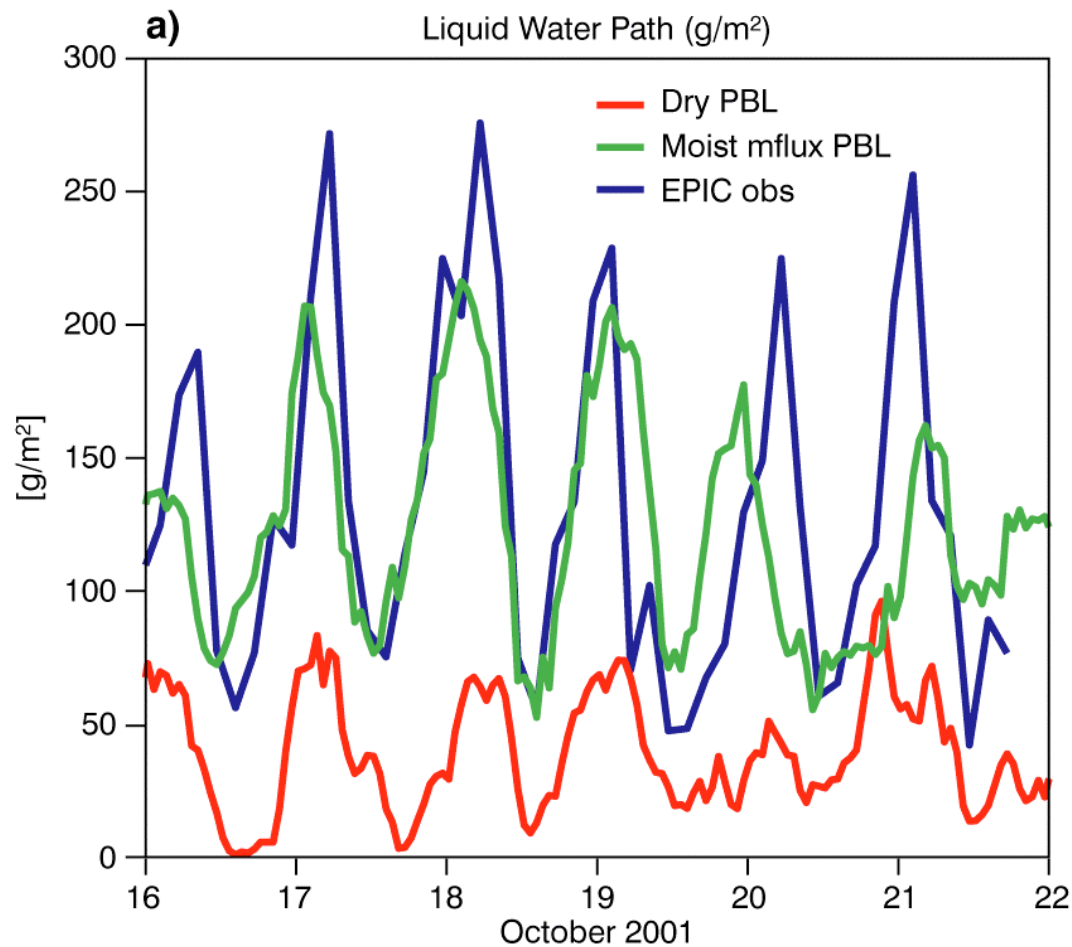
- $w$   $\pm 50\%$
- $u_{850}$   $\pm 2$  m/s
- drizzle ?
- aerosols ?

# EPIC: Peruvian stratocumulus – model comparison

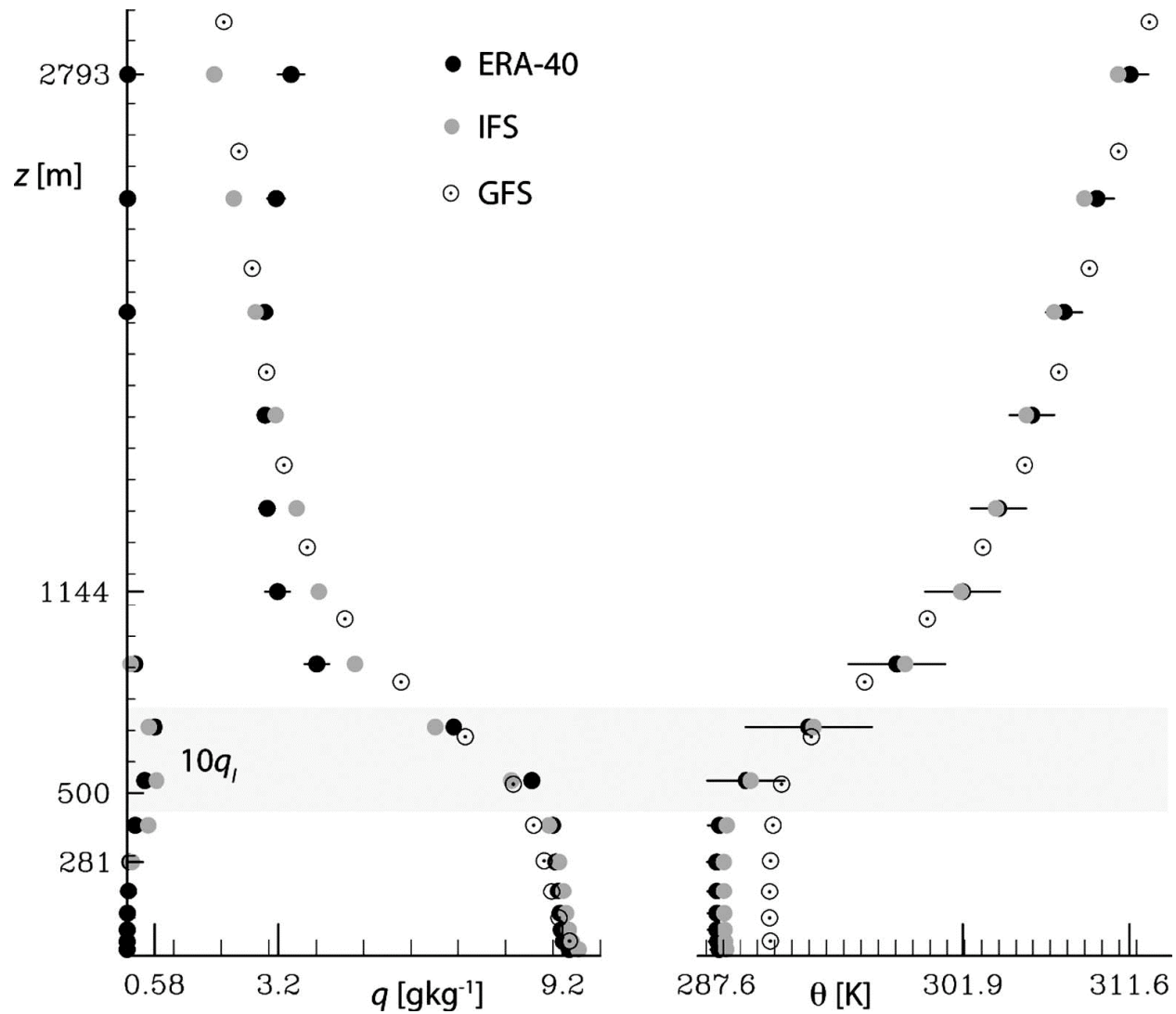
Bretherton et al, BAMS 2004



# Stratocumulus: EPIC column from 3D forecasts

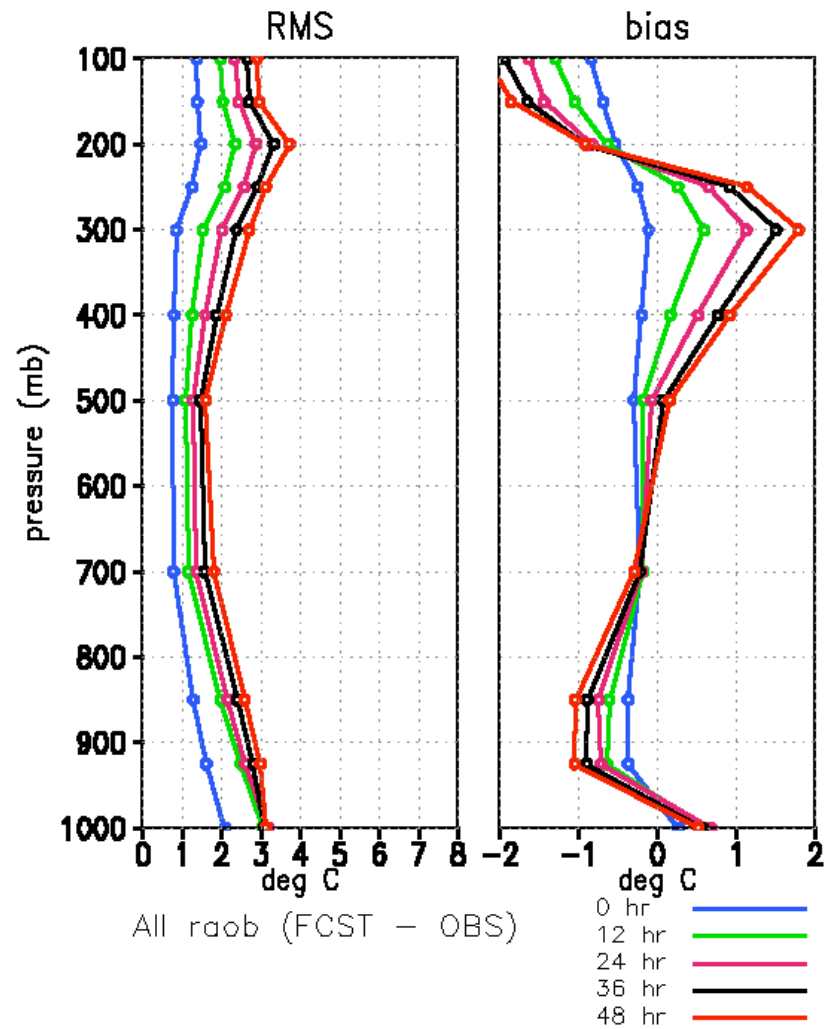


# Stevens et al 2007: DYCOMS vs ECMWF vs NCEP



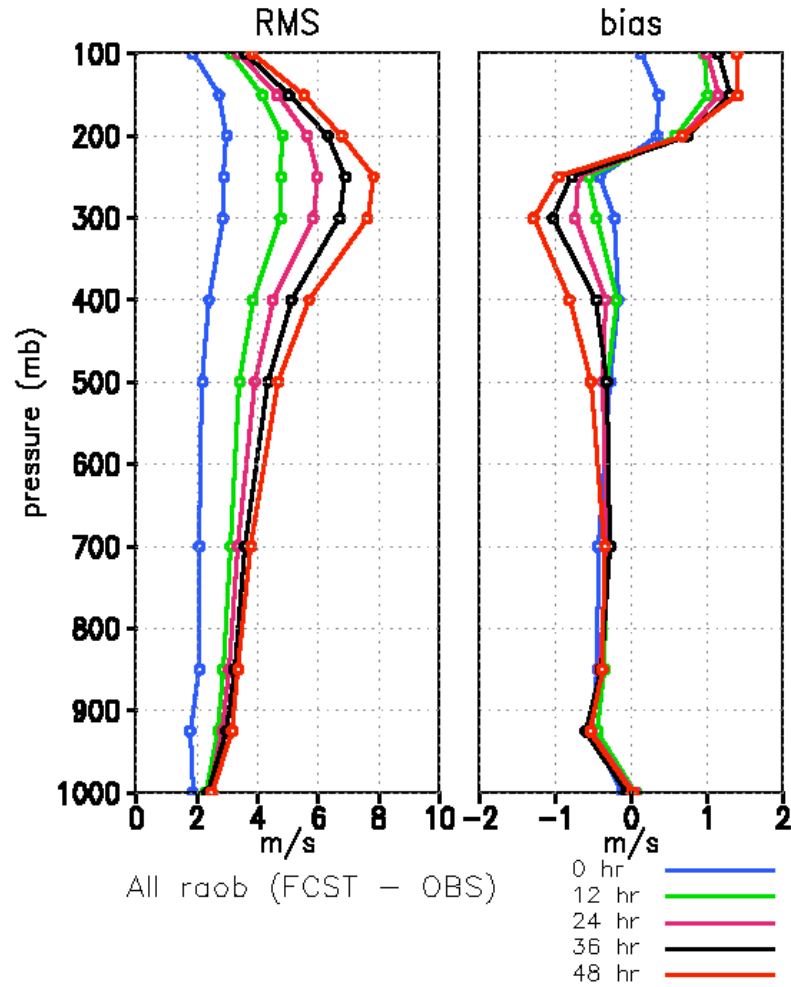
# Shouping Wang, NRL: COAMPS Forecast Statistics (East Pacific)

COAMPS E\_PAC Grid 2 (27km)  
Temperature June 2006

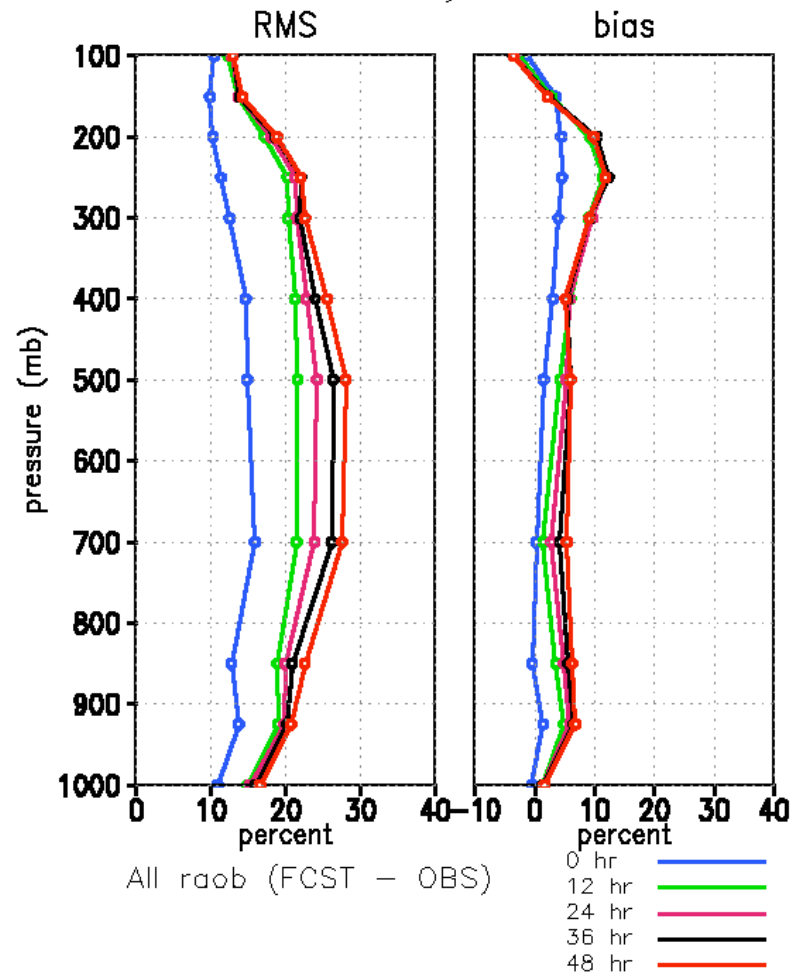


# Shouping Wang, NRL: COAMPS Forecast Statistics (East Pacific)

COAMPS E\_PAC Grid 2 (27km)  
Wind Speed June 2006

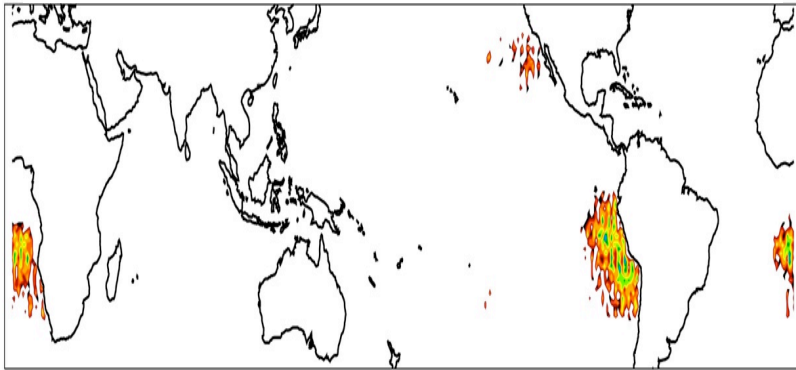


COAMPS E\_PAC Grid 2 (27km)  
Relative Humidity June 2006

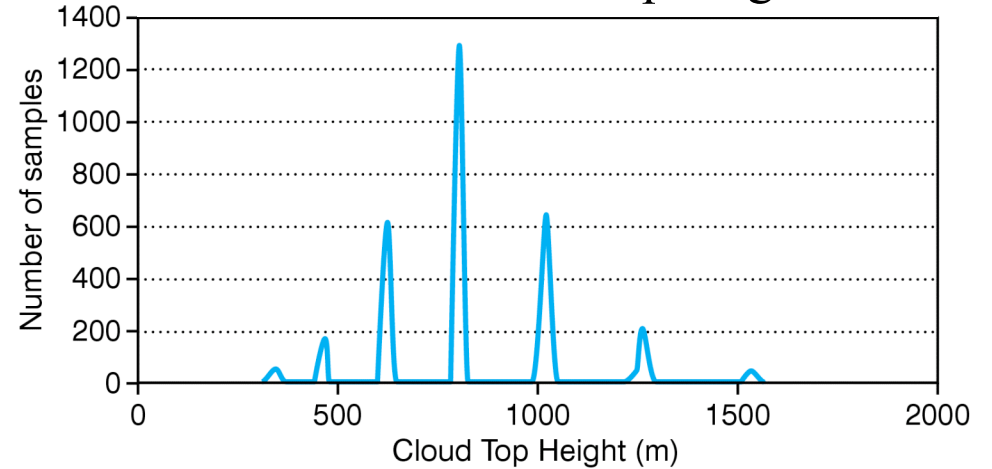


# ECMWF vs GLAS observations: cloud top height

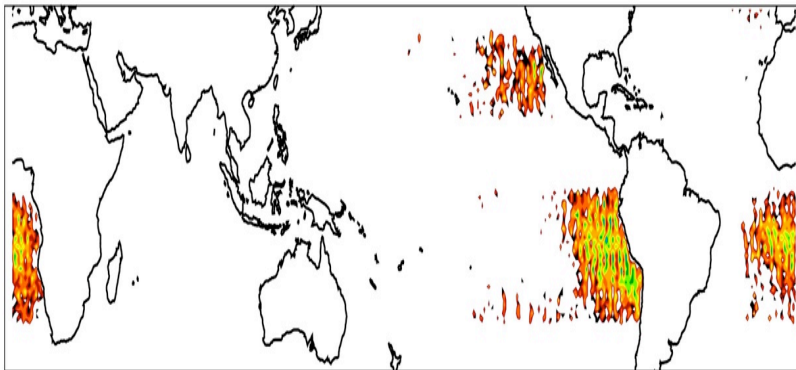
ECMWF strcu fraction



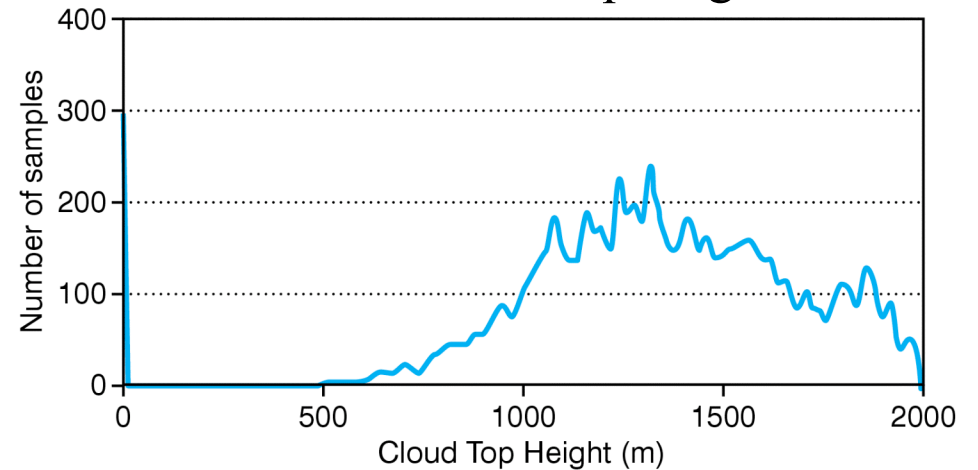
ECMWF cloud top height



GLAS strcu fraction



GLAS cloud top height



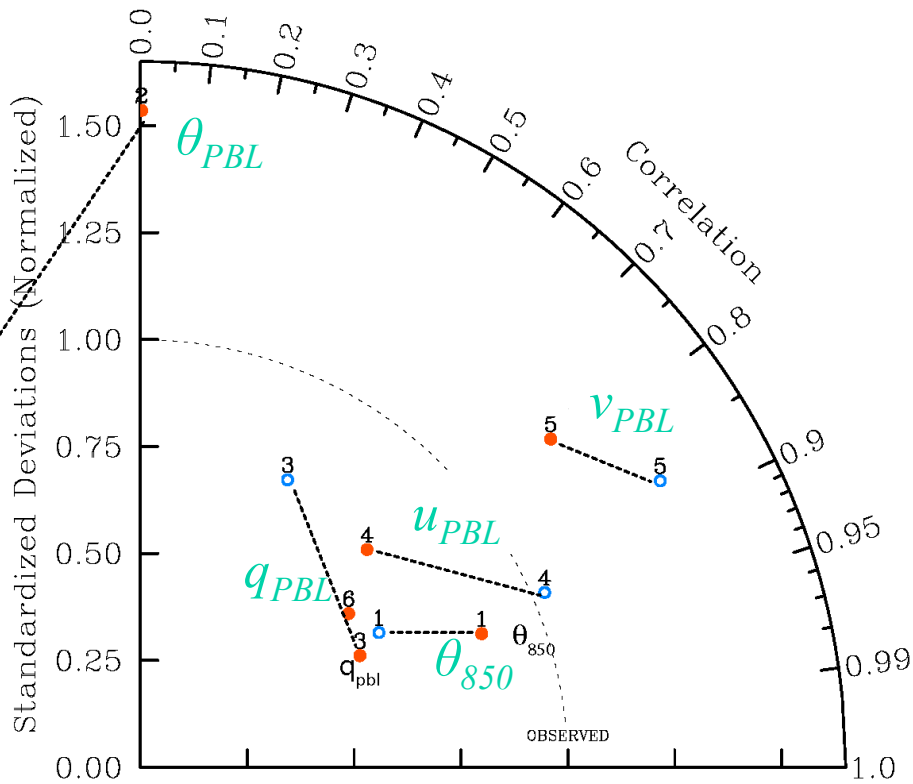
cloud top < 2km, cld > 80%

Maike Ahlgrimm

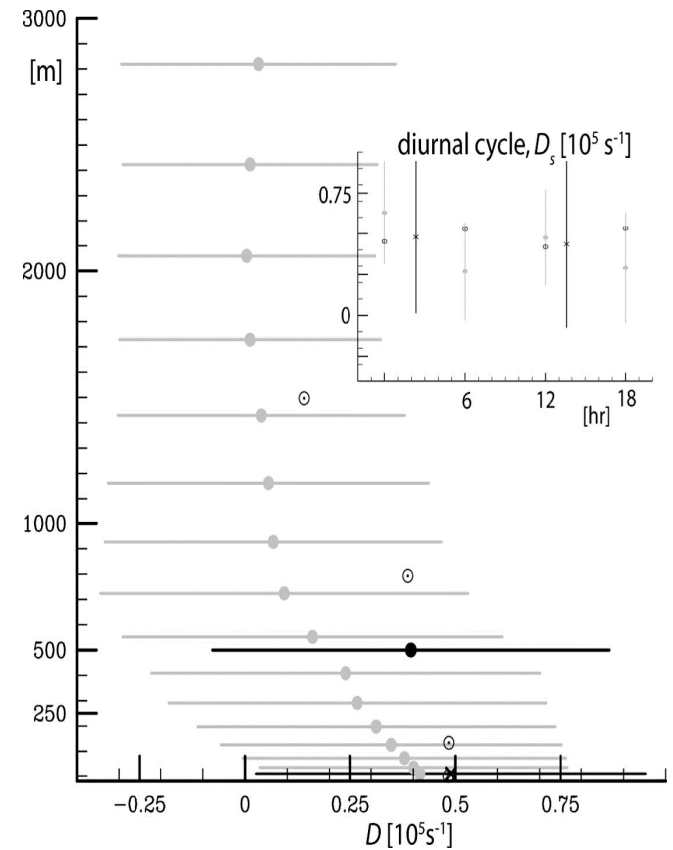
SC top too low!

# Stevens et al 2007: DYCOMS vs ECMWF vs NCEP

## Taylor diagram

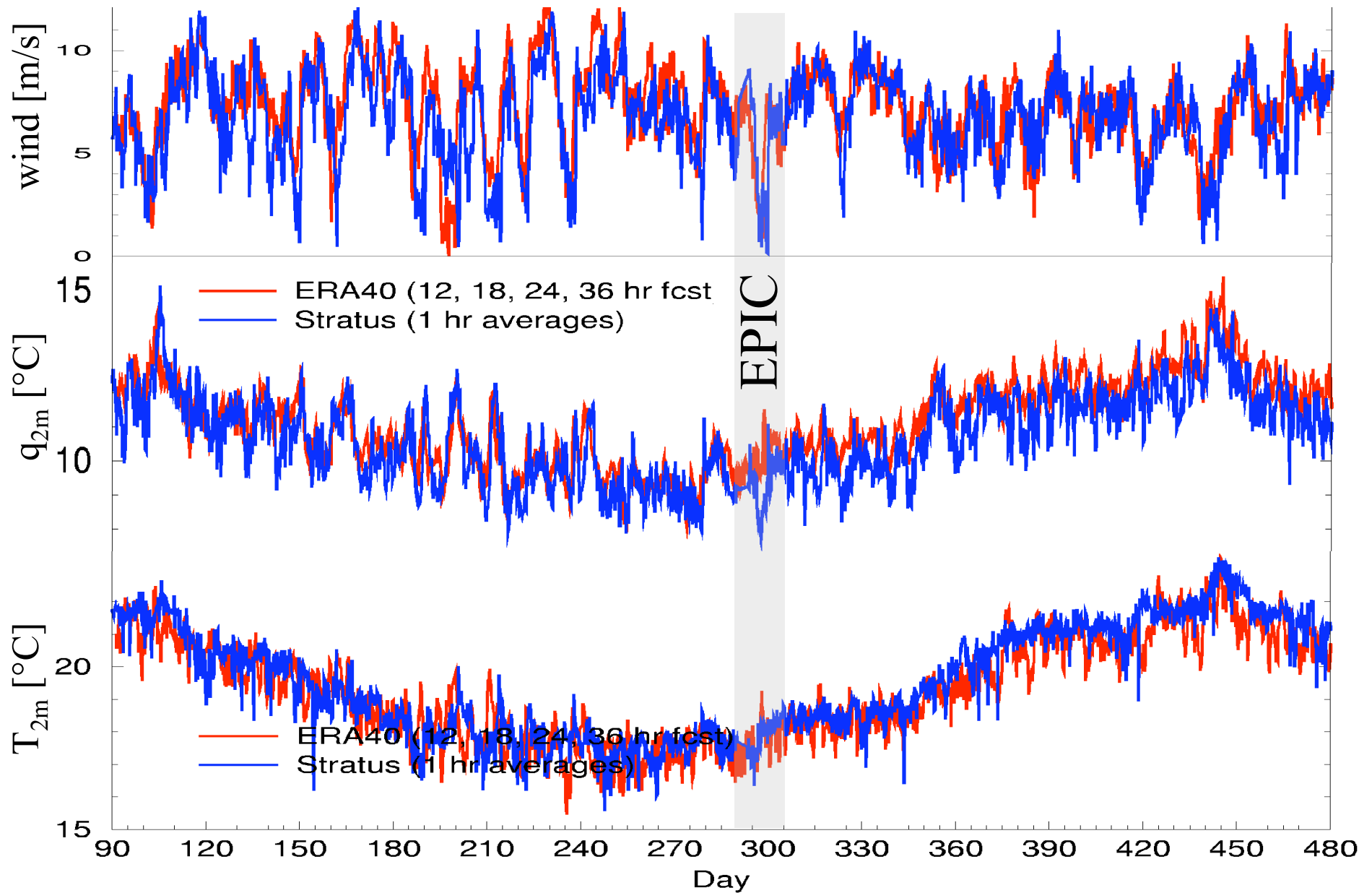


## Divergence

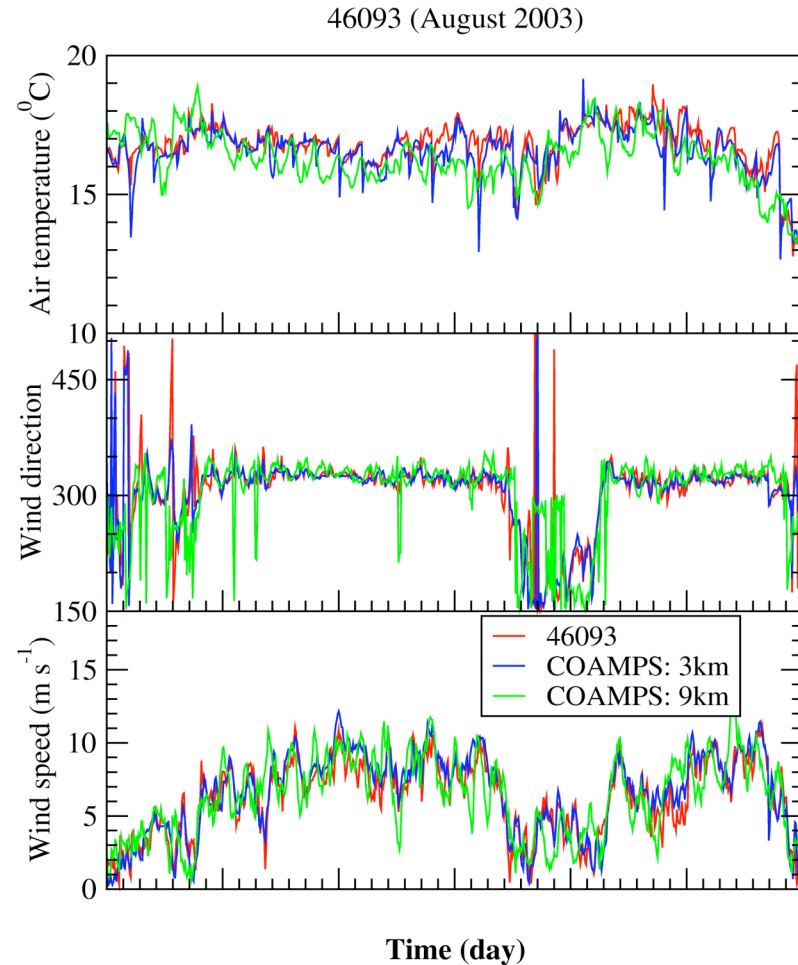
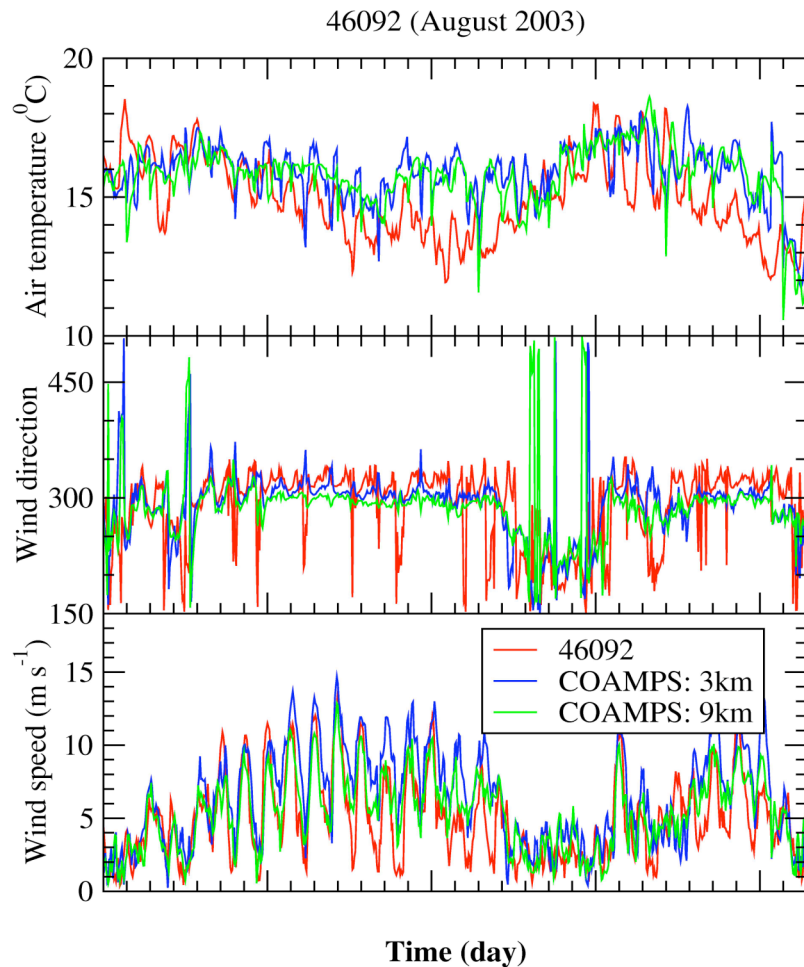




# IMET buoy (Anton Beljaars & Bob Weller)



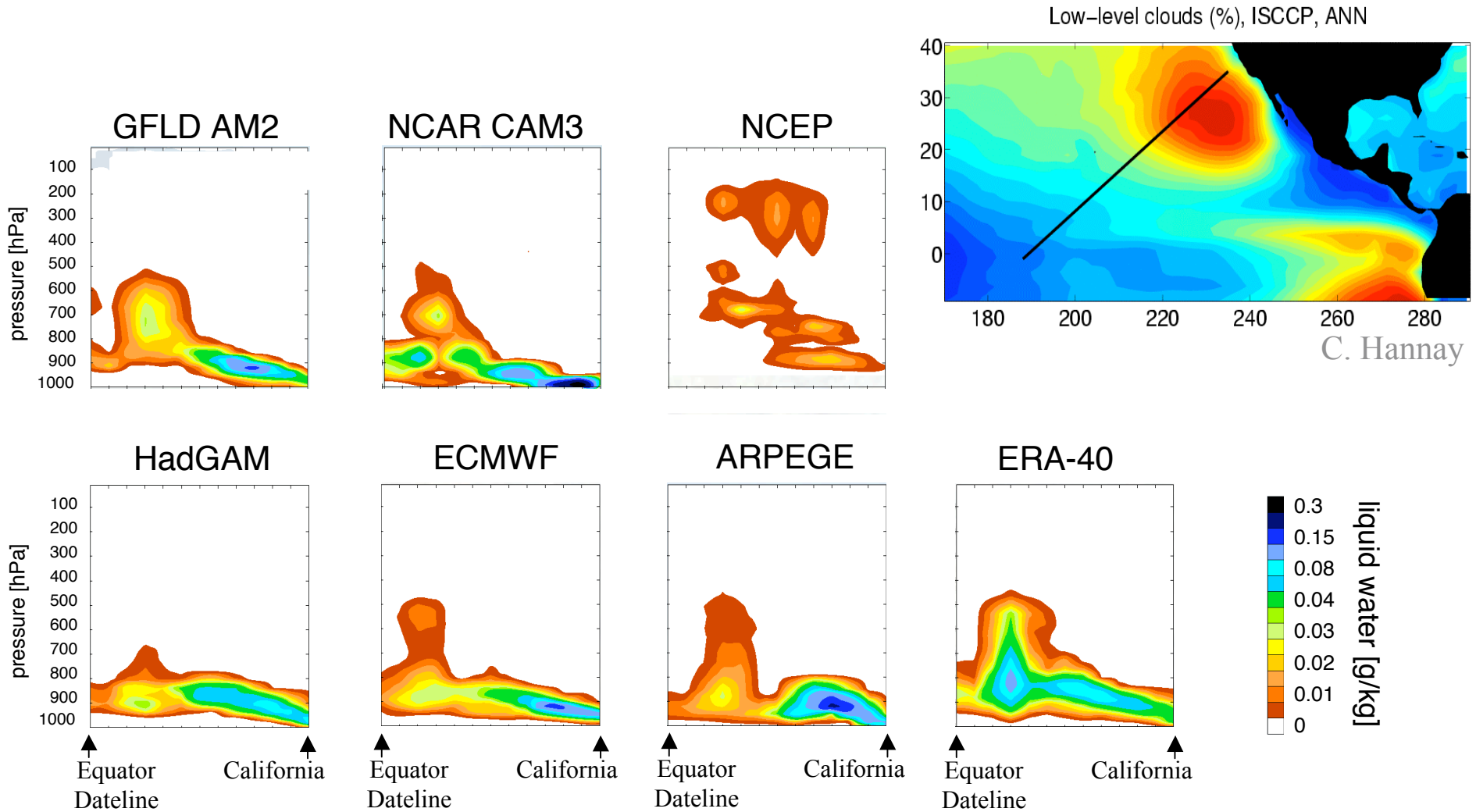
# Shouping Wang, NRL: COAMPS vs 2 buoys off Monterey



Field	Bias		RMS	
	3-km	9-km	3-km	9-km
Temp.	0.93	0.79	1.56	1.60
Speed	1.48	0.41	2.60	1.80
Dir.	9.10	35.0	47.0	48.0

**AOSN field campaign in the vicinity of Monterey Bay, California**

# GCSS Pacific Cross-Section Intercomparison



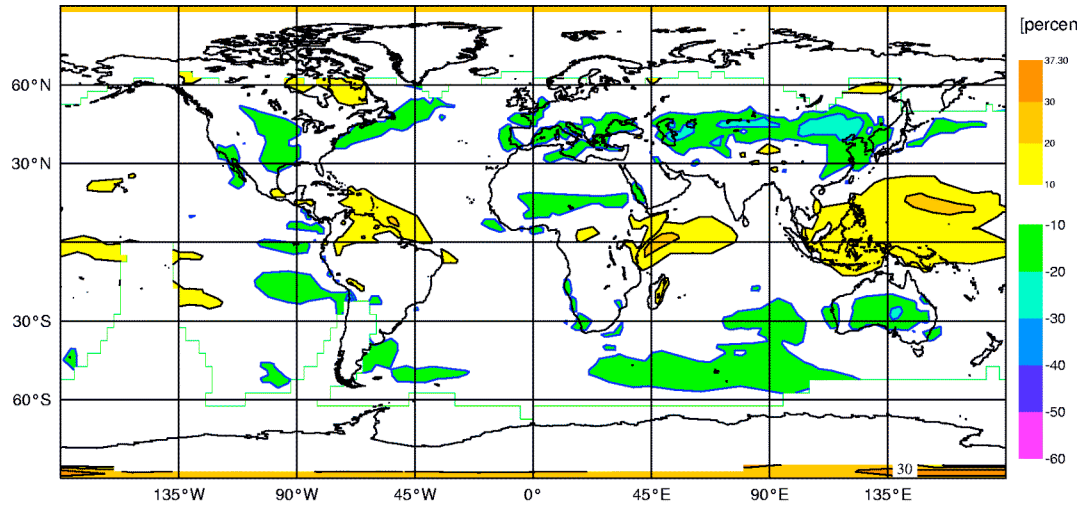
Joao Teixeira

JJA1998

# Cloud cover against ISCCP D2

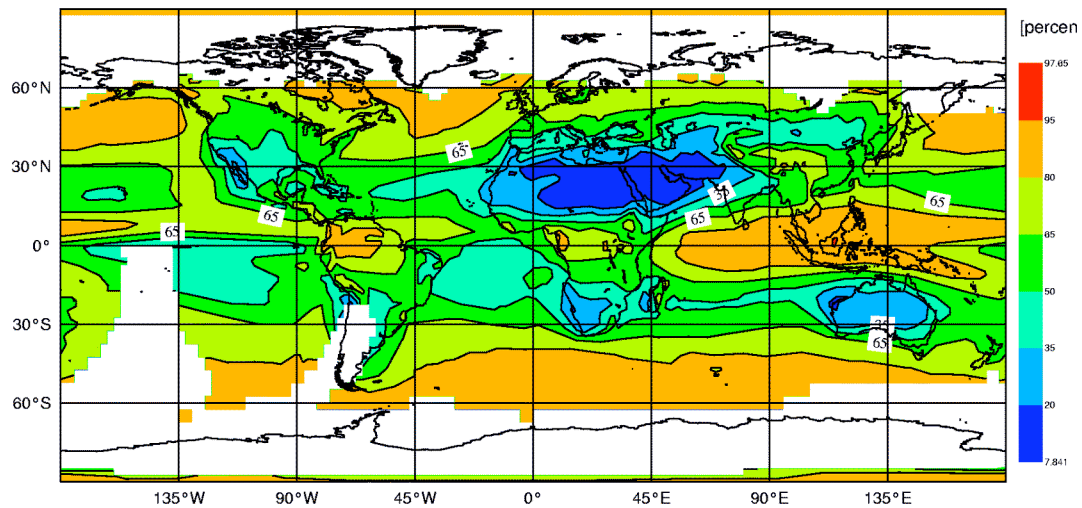
CY32R3 - ISCCP

Difference evnb - ISCCP 50N-S Mean err -1.53 50N-S rms 8.56



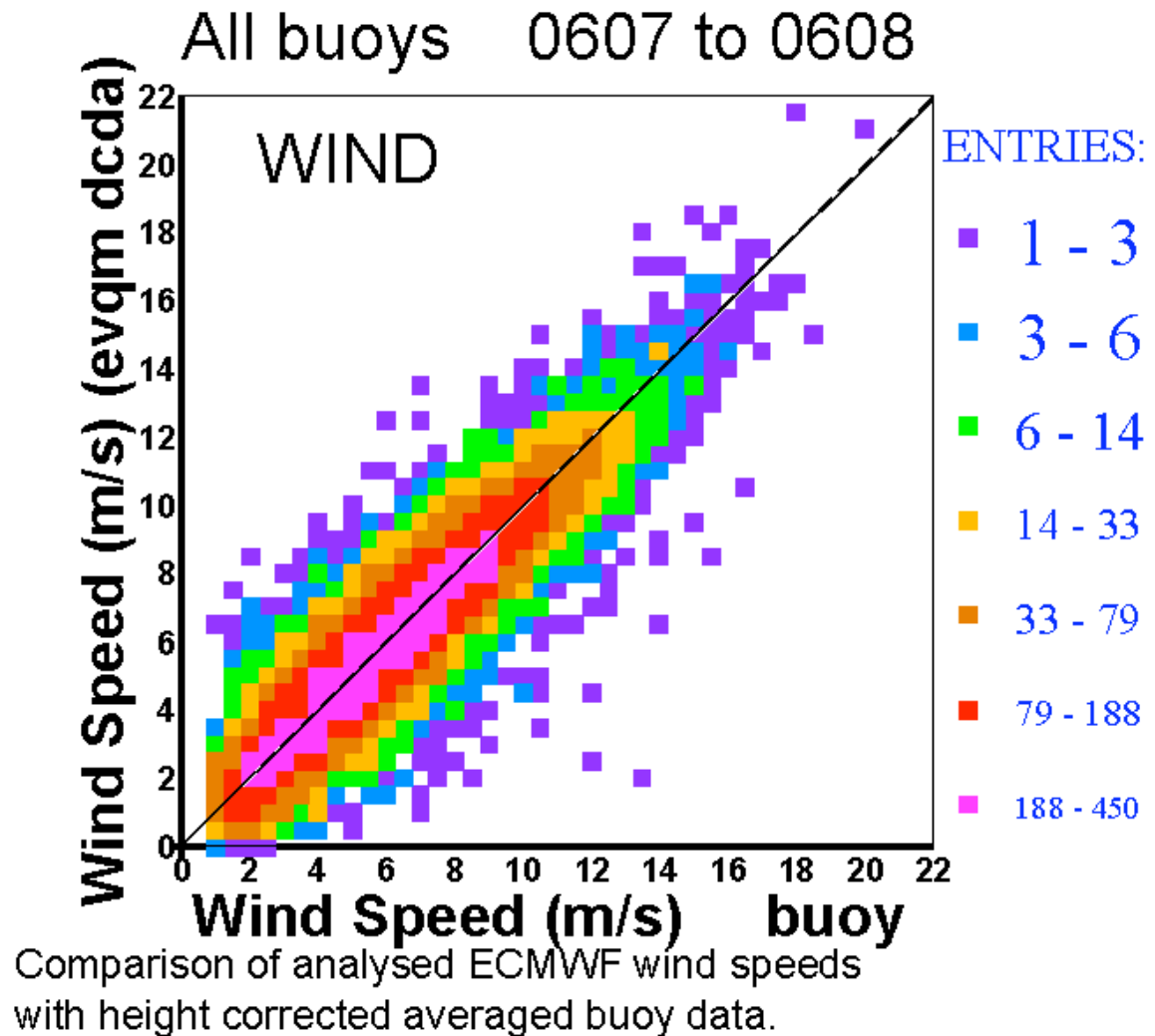
ISCCP D2

Total Cloud Cover evd1 Sep 2000 nmon=12 nens=4 Global Mean: 62.5 50N-S Mean: 60.3



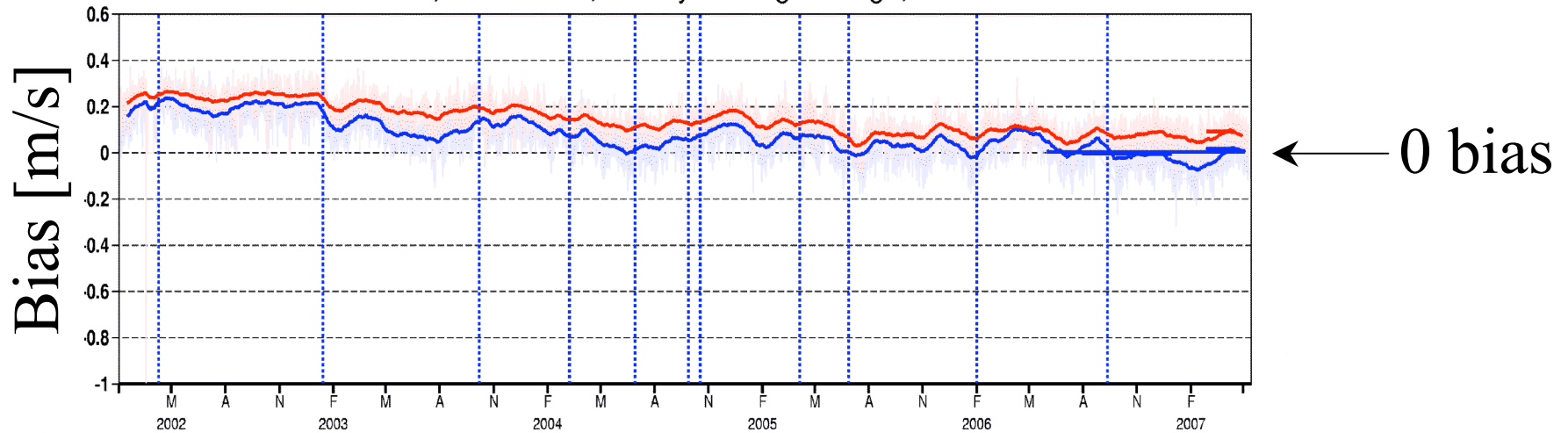
## ECMWF buoy verification

model mean: 6.08 m/s  
buoy mean: 6.12 m/s  
bias: -0.04 m/s  
RMSE: 1.12 m/s  
correlation: 0.916

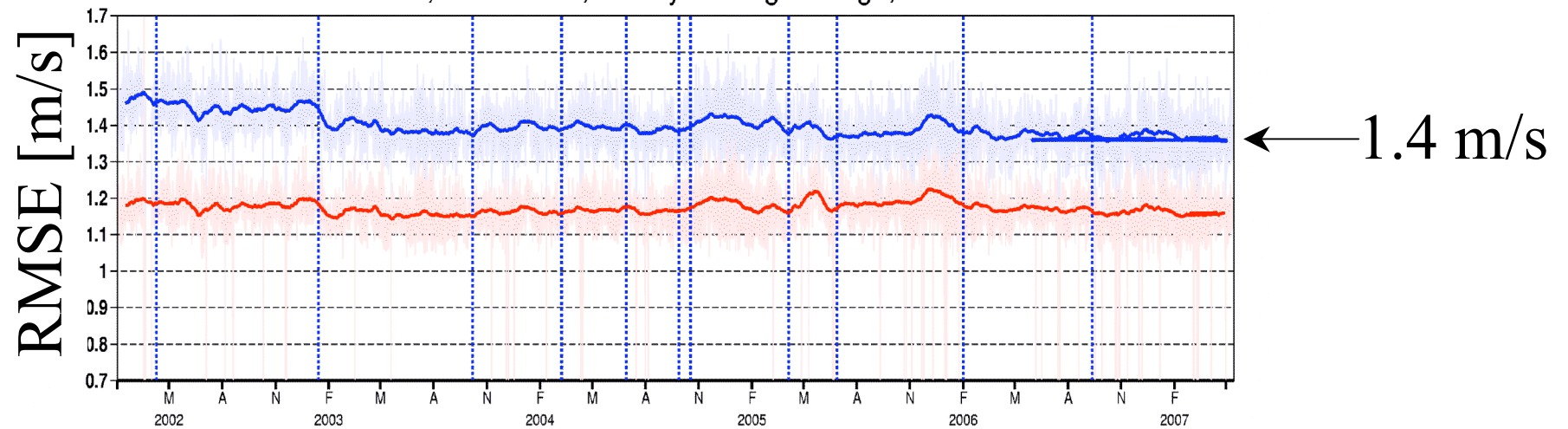


# QuikSCAT winds: Bias and RMSE

QuikSCAT (50km) versus ECMWF FGAT (BLUE) and Analysis (RED)  
WIND SPEED, nodes 5-34, 30-day moving average, AREA= GLOB

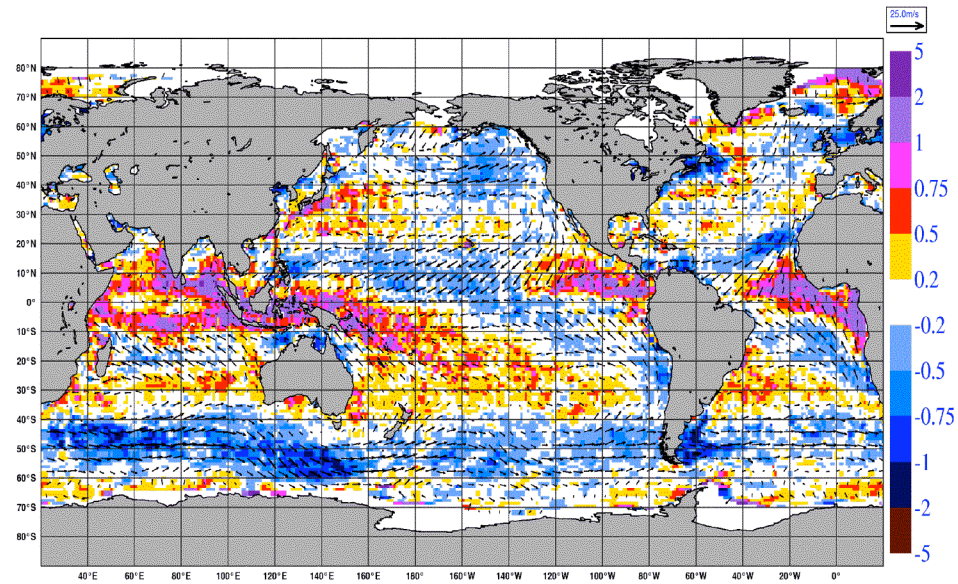


QuikSCAT (50km) versus ECMWF FGAT (BLUE) and Analysis (RED)  
WIND SPEED, nodes 5-34, 30-day moving average, AREA= GLOB

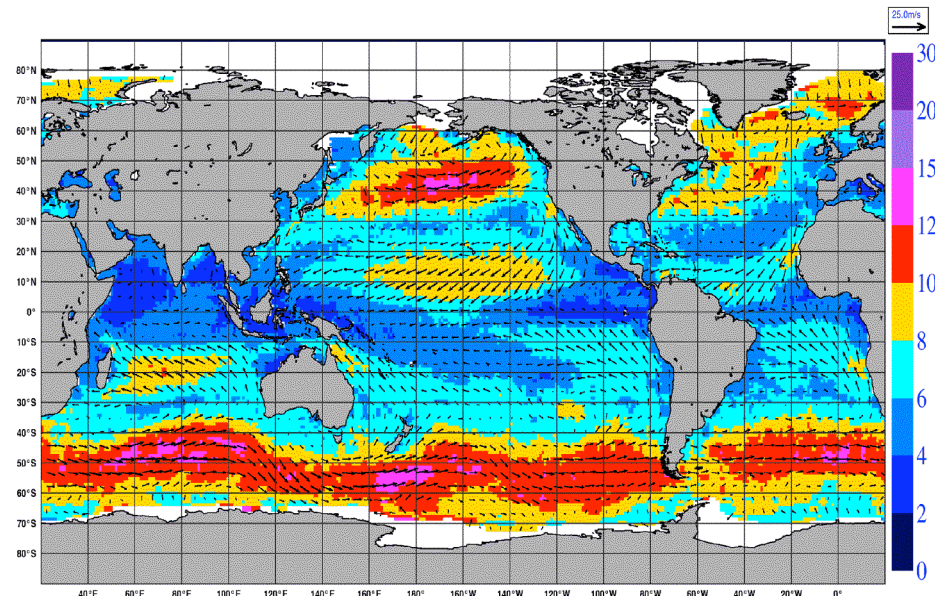


# QuikSCAT winds

bias=0.06m/s

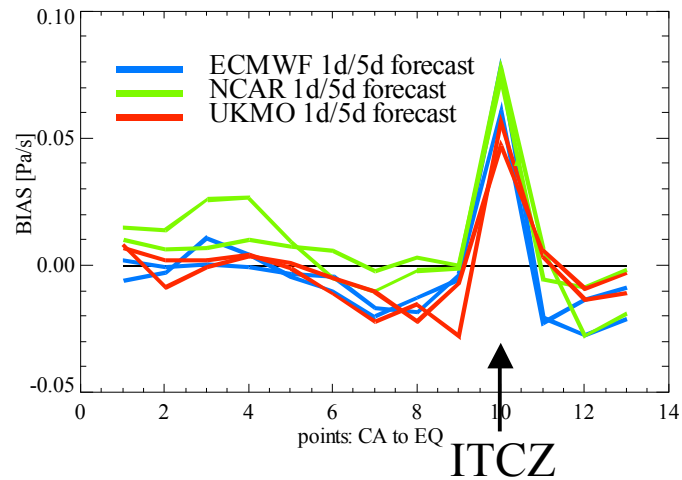


QuikSCAT=7.17m/s

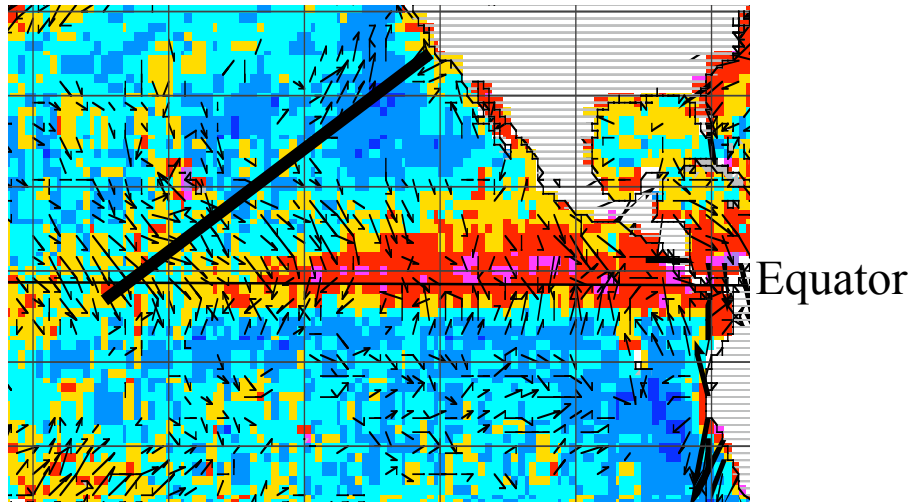


# GCSS Pacific Cross-section Project

## $W$ Bias at 500hPa

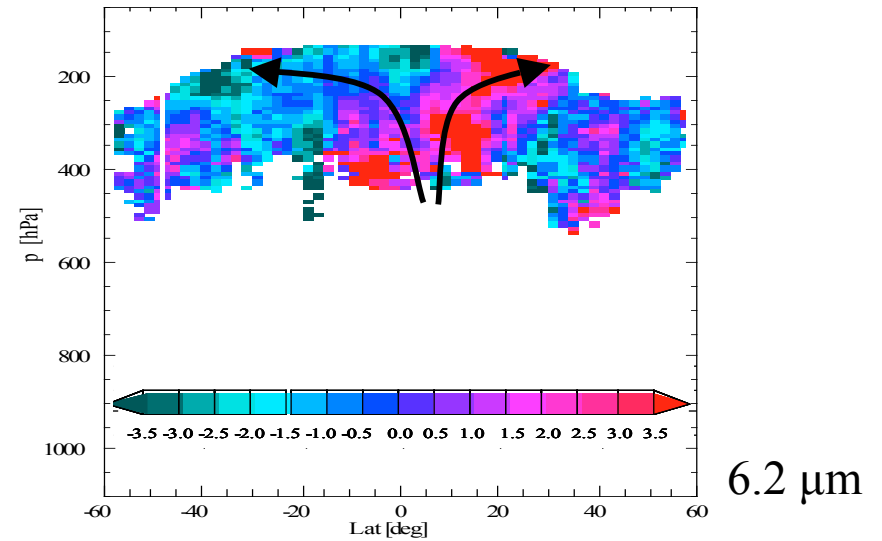


## sfc vector wind: QuikSCAT vs ECMWF FG



Hans Herbach

## $V$ -Bias: METEOSAT-8 vs ECMWF FG

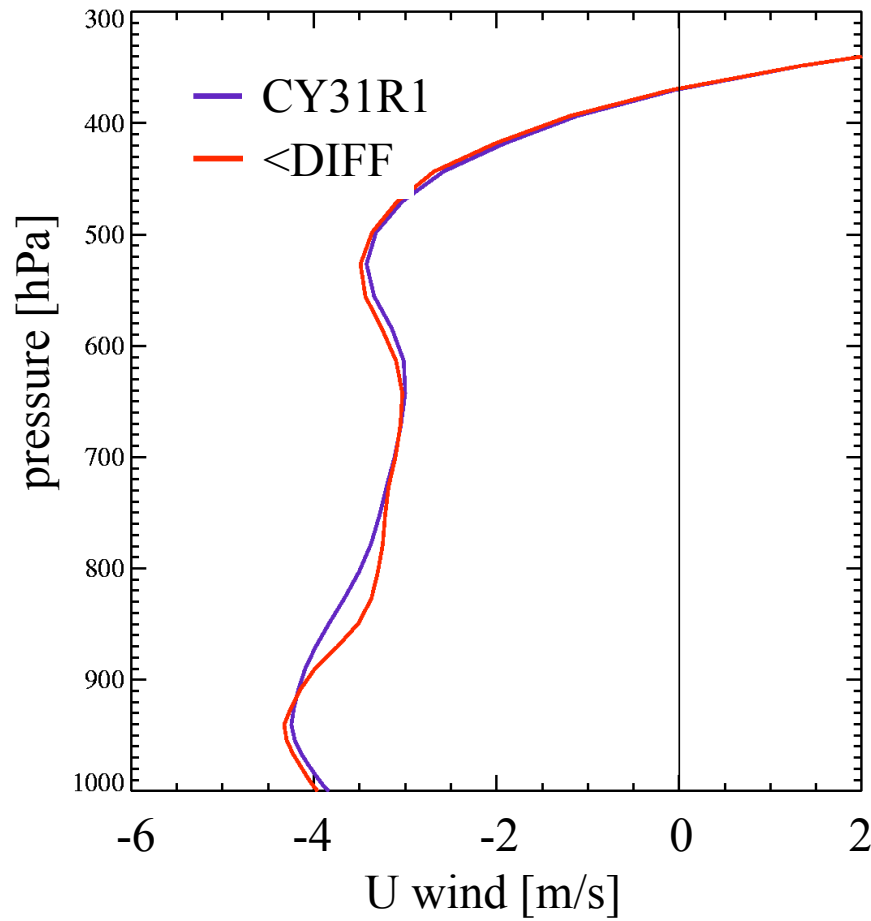


Claire Delsol.

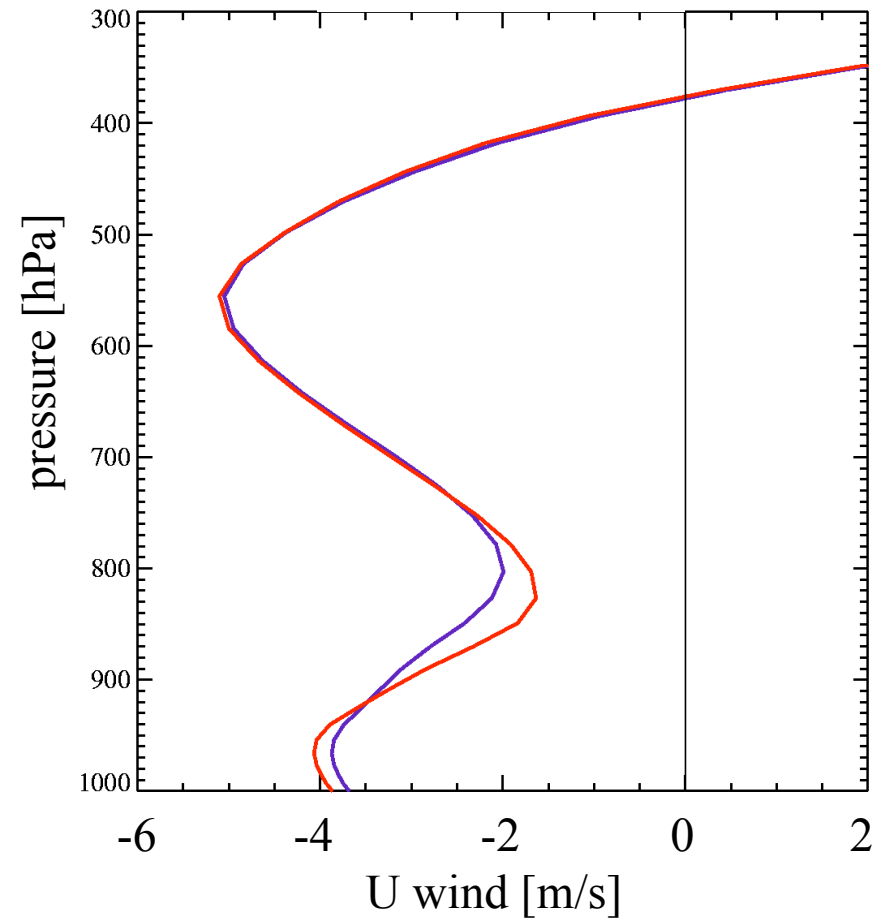


# SE Pacific U-profiles

## Analysis



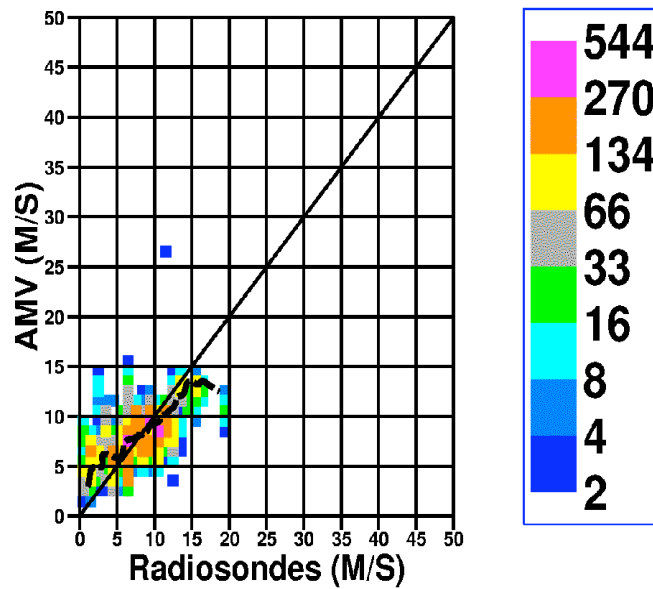
## 48h Forecast



# Cloud Vector Winds versus Radiosondes

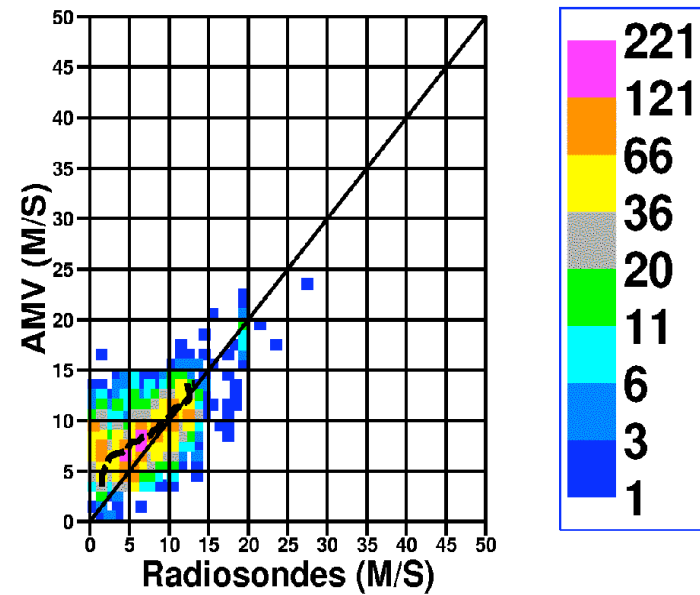
Ascencion & St. Helen

AMV  
1 JUL - 31 AUG 2006  
700-1030hPa  
WINDSPEED



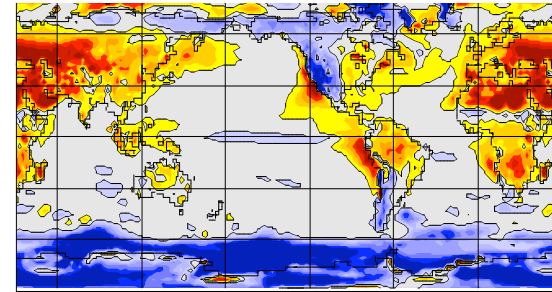
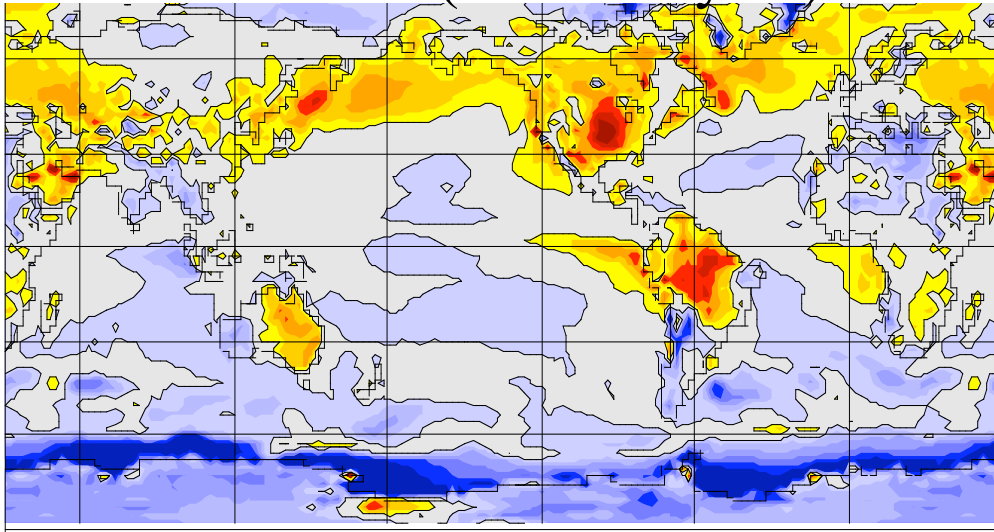
French Pacific Islands

AMV  
1 JUL - 31 AUG 2006  
700-1030hPa  
AREA: (30S,160W) - (0S,120W)  
WINDSPEED

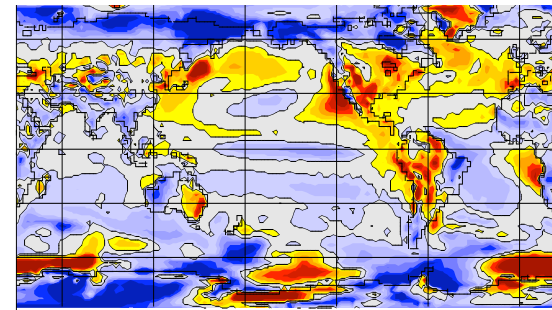


# DEMETER CGCM Surface Temperature Bias [K]

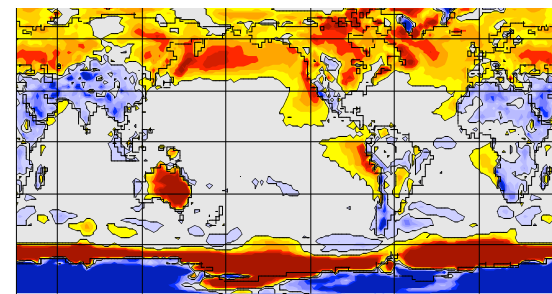
ECMWF (ERA40 cycle)



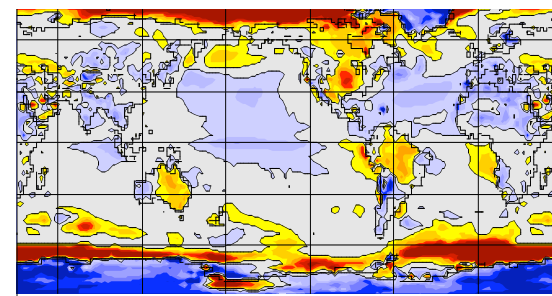
UKMO



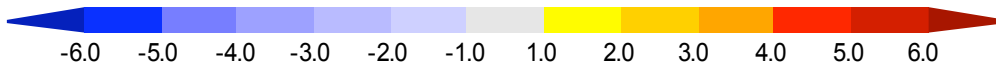
MPI



Meteo  
France



LODYC



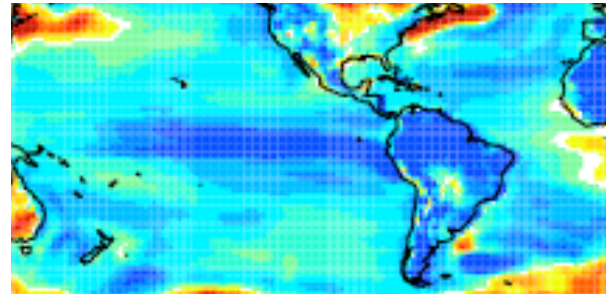
4-6 month forecasts  
Aug/Sep/Oct 1987-1996  
9 ensemble members  
comparison to ERA-40

[www.ecmwf.int/research/demeter](http://www.ecmwf.int/research/demeter)

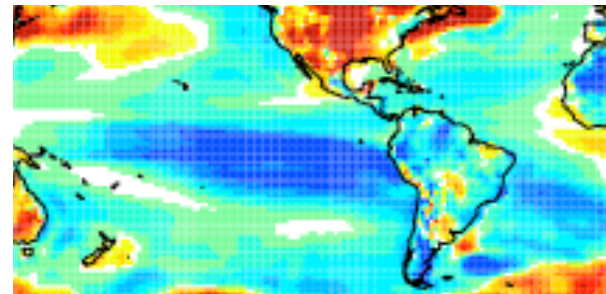
**coupled ECMWF-ERA40**  
**Surface temperature – years 3-4 of integration**

Antje Weisheimer  
ENSEMBLES

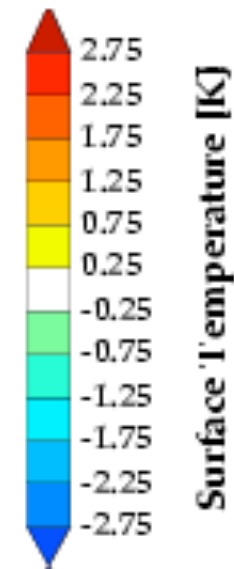
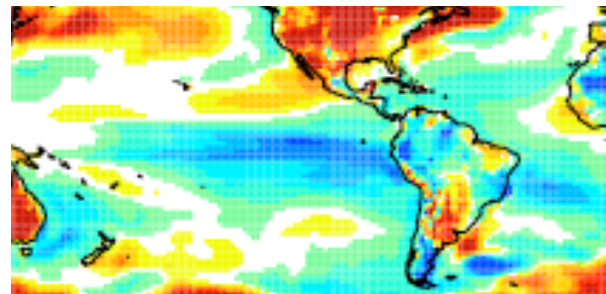
**CY31R1: Sept 2006**



**CY32R1: June 2007**



**CY32R3: Fall 2007**

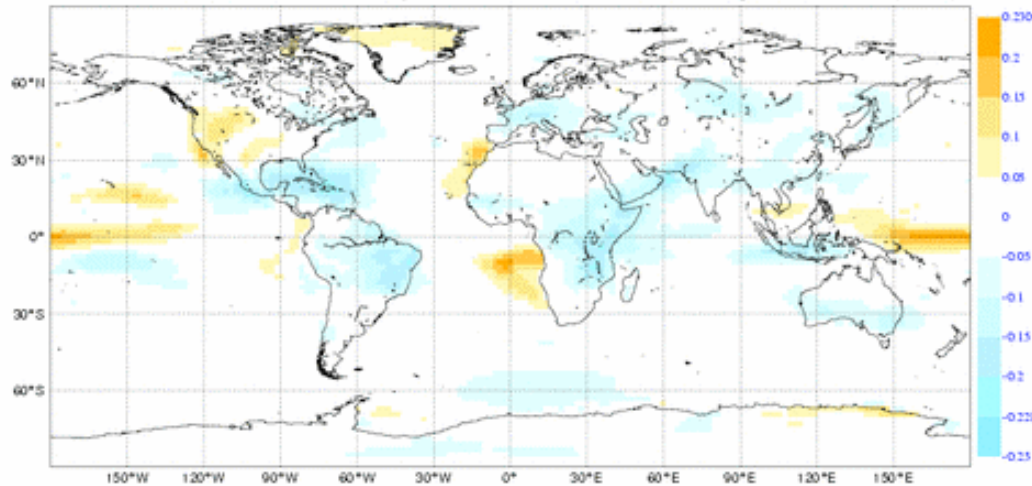


model cycle: impl. date

**EC EARTH (ECMWF uncoupled) future 2XCO2 scenario**

Pier Siebesma, KNMI

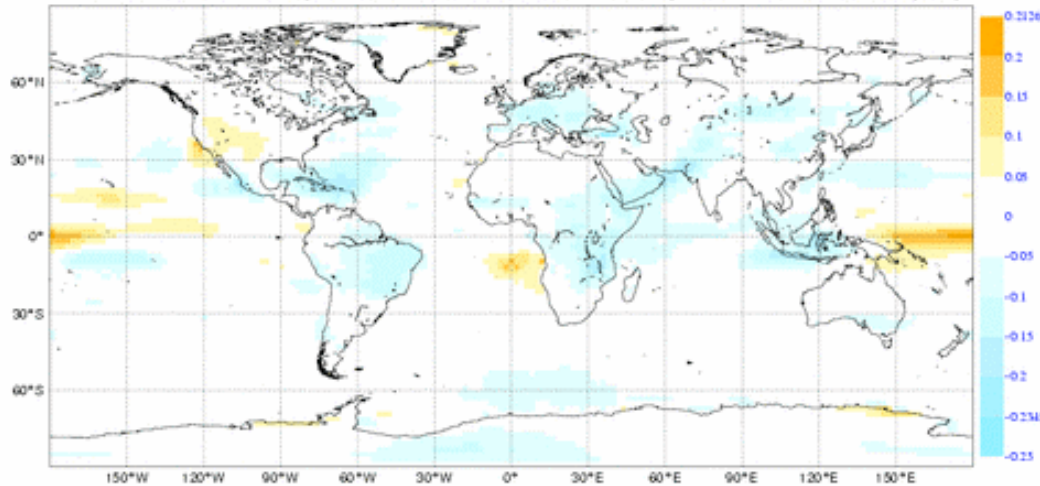
Total cloud cover driven by future SSTs - climatological SSTs (JJA)



$\Delta$  CC

Standard model (cy31r1)

Total cloud cover driven by future SSTs and increased cloud-top entrainments - control (JJA)



$\Delta$  CC

Enhanced top-entrainment model

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