

VOCALS cloud and surface flux observations for coupled model evaluation

Simon de Szoeke

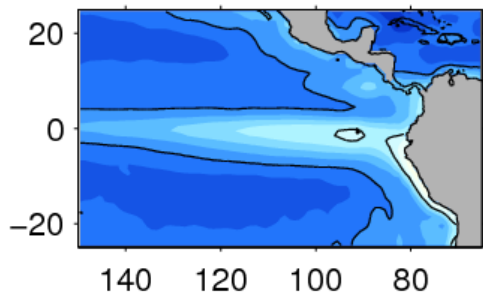
Chris Fairall

NOAA/ESRL Physical Sciences Division

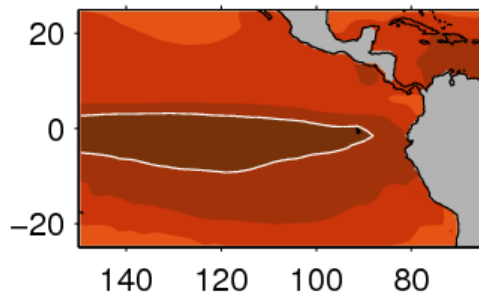
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2009 AMS Annual Meeting, Phoenix, Arizona

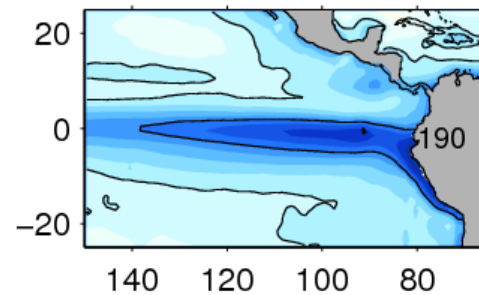
turbulent flux
WHOI OAFIux



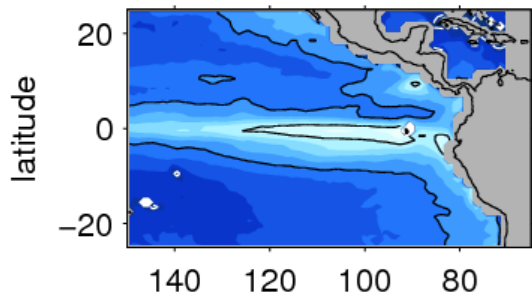
net radiative flux
ISCCP FD



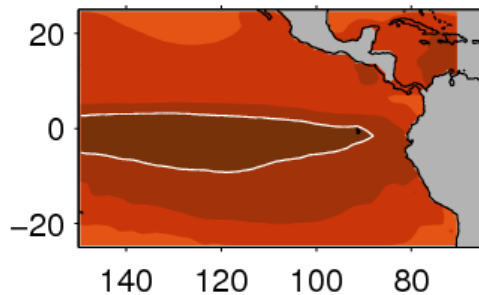
ocean residual
WHOI OAFIux



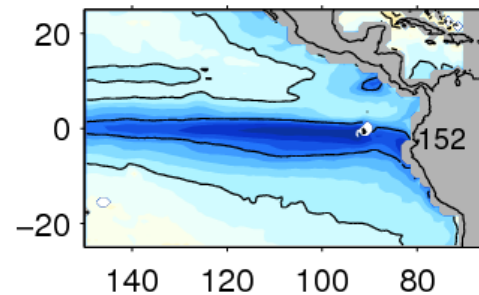
UW Hybrid



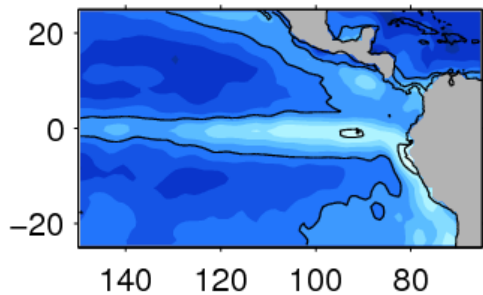
ISCCP FD



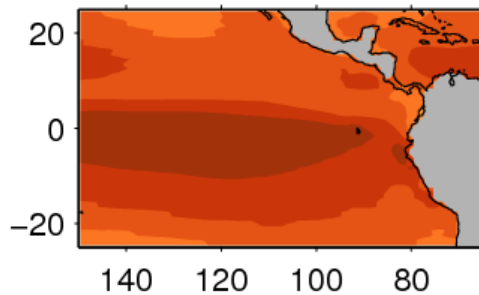
UW Hybrid



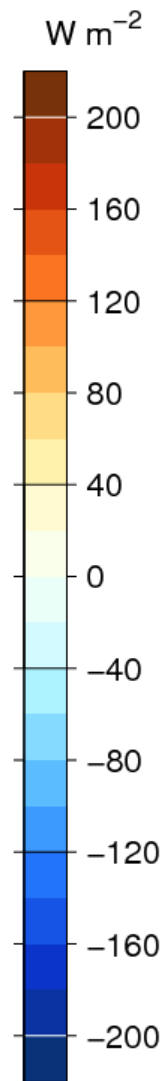
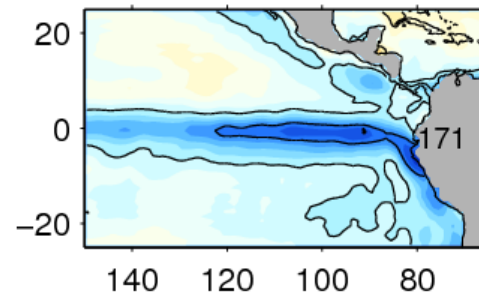
NCAR CORE



NCAR CORE

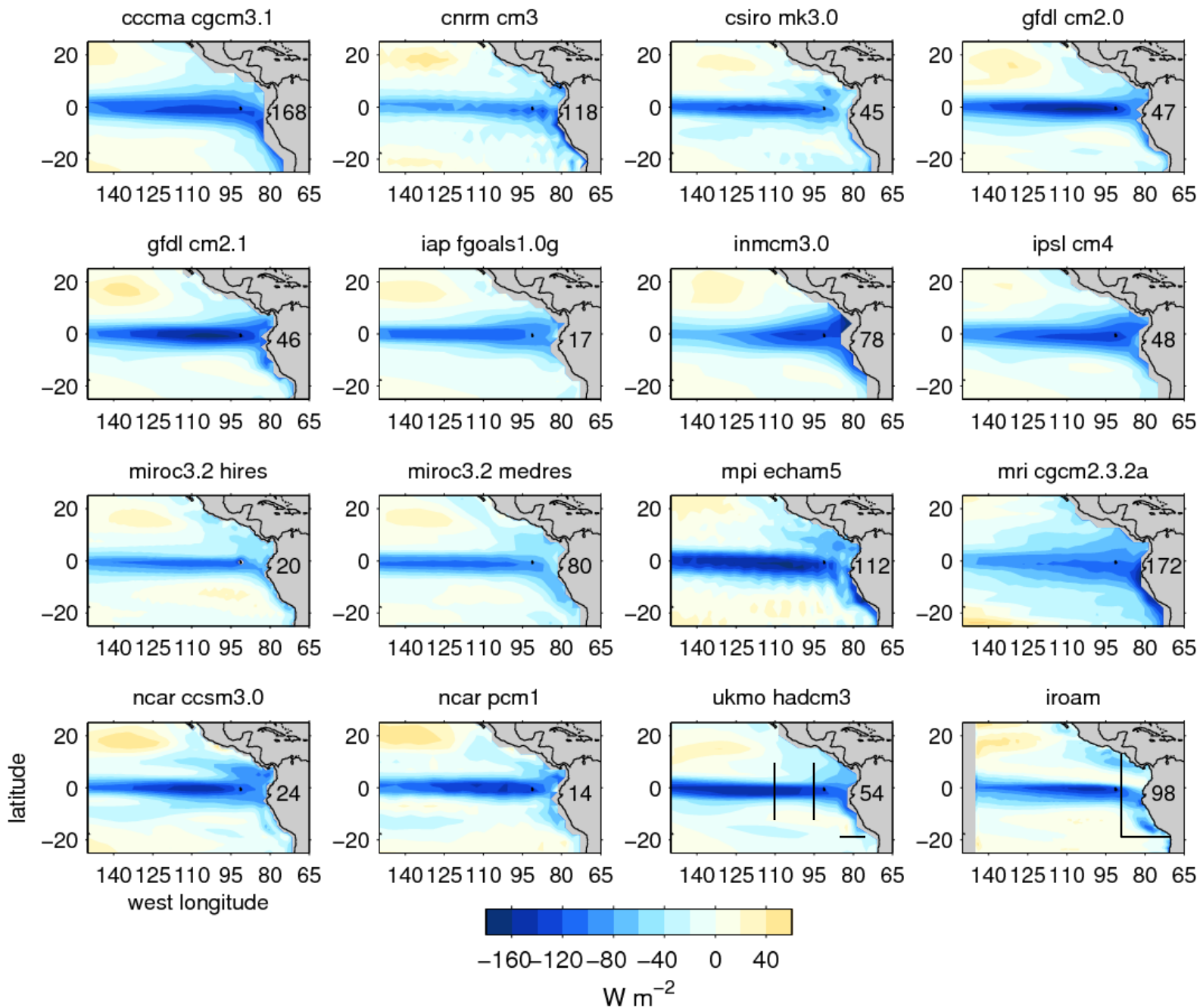


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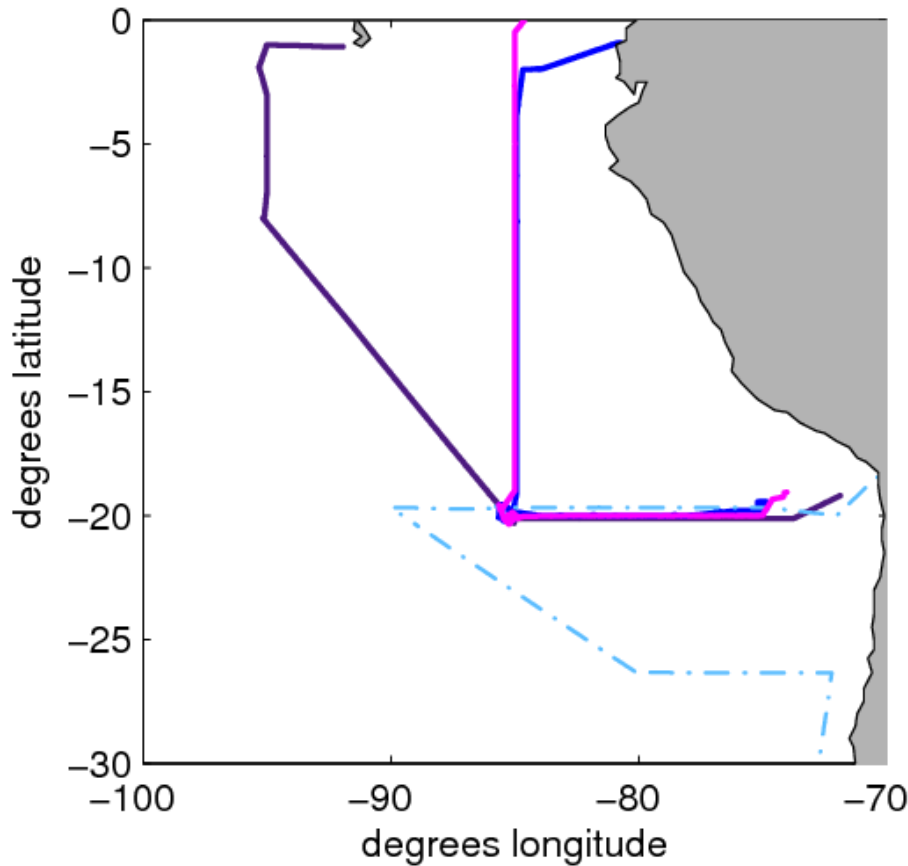


west longitude

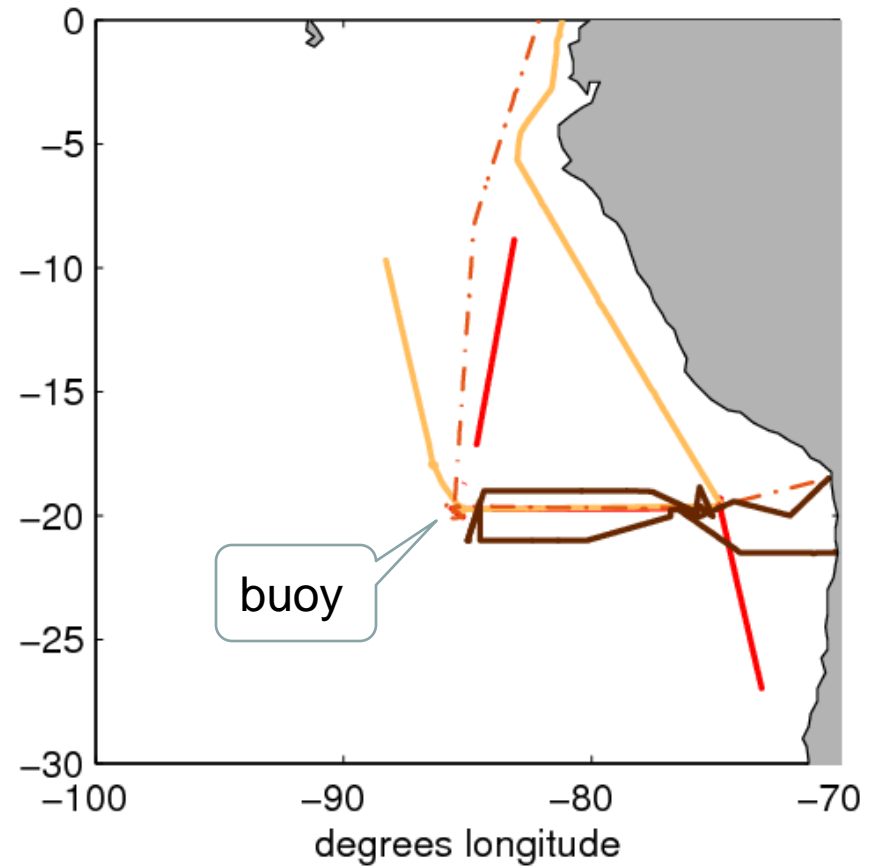
Total surface flux (+up)



7 years of Stratus/VOCALS ship tracks



2001 Oct 22		Oct 24
2003 Nov 21		Nov 23
2004 Dec 10		Dec 07
2005 Oct 18		Oct 20



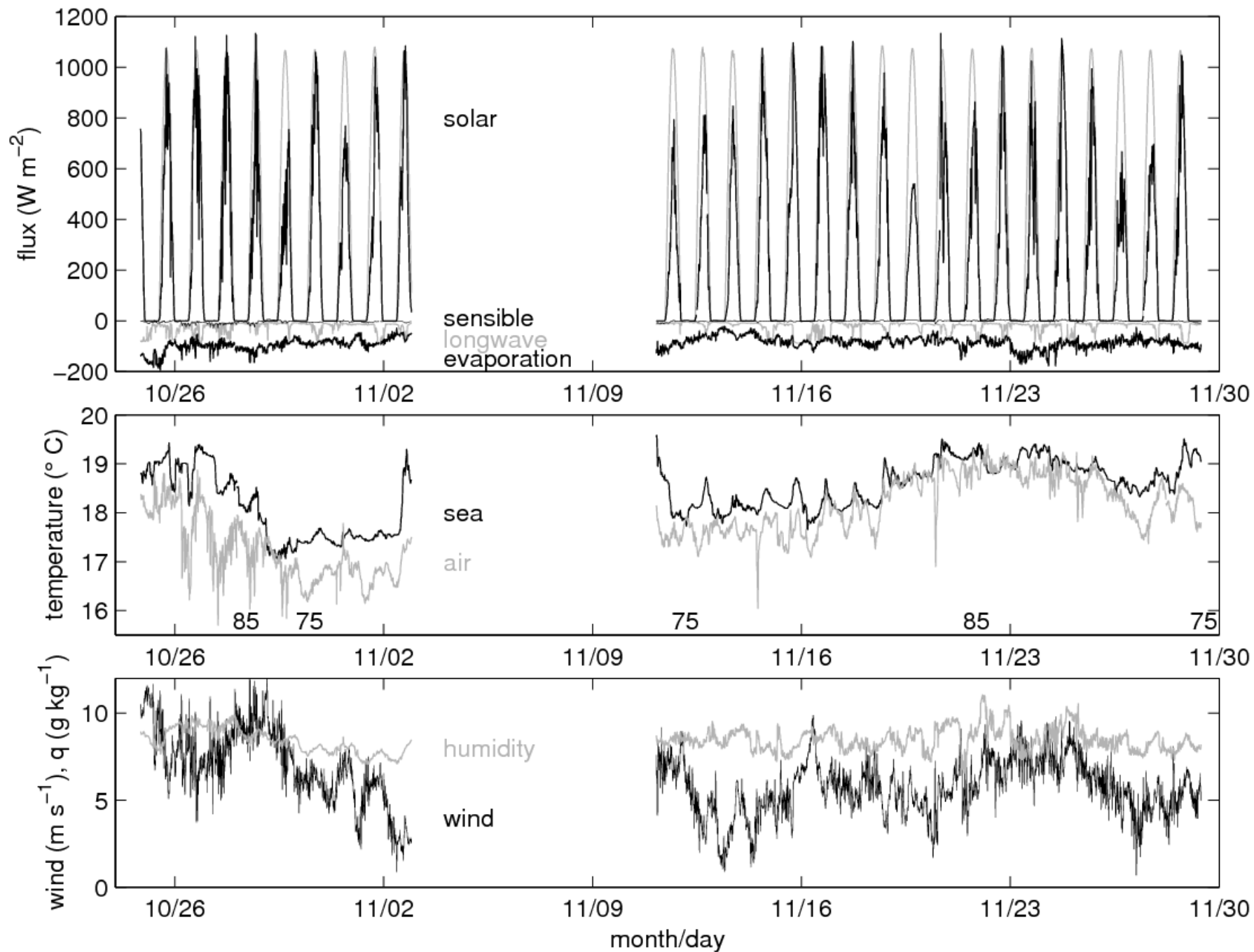
2006 Oct 20		Oct 22
2007 Oct 26		Oct 24
2008 Oct 27		Oct 30
2008 Nov 20		Nov 11 Nov 28

Stratus synthesis of NOAA ship observations

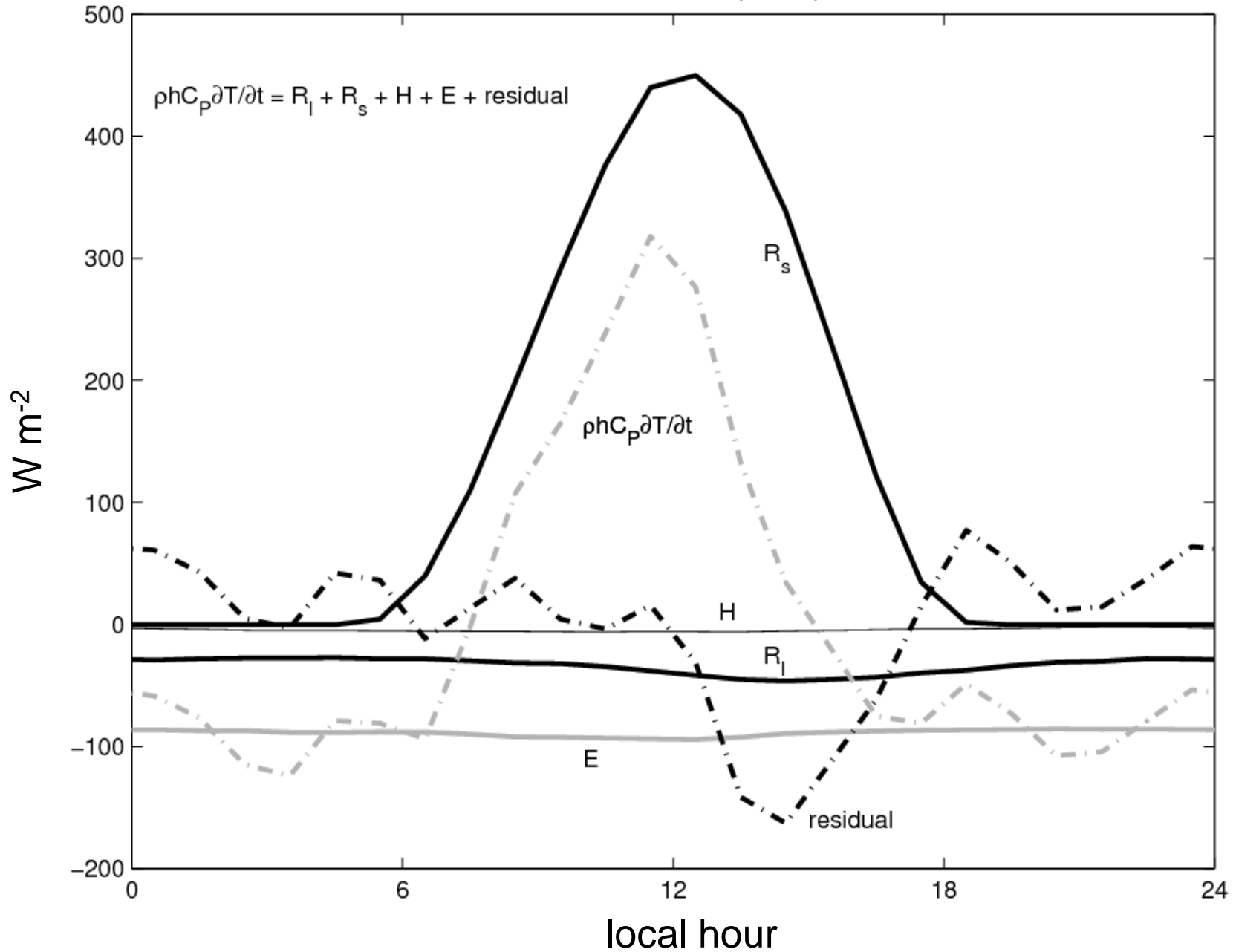
<http://www.esrl.noaa.gov/psd/psd3/synthesis>

- Fall 2001, 2003-2008 (7 years) 20°S, 75-85°W.
- Integrate measurements of
 - Surface meteorology
 - Turbulent and radiative fluxes
 - Cloud vertical structure: top, base, and LCL.
 - Drizzle-sensitive Doppler radar (VOCALS 2008)
 - Column water vapor and liquid water path
 - Rawinsonde profiles
 - Aerosols
- Assess model and analysis fluxes from observations.

VOCALS 2008 20° S time series

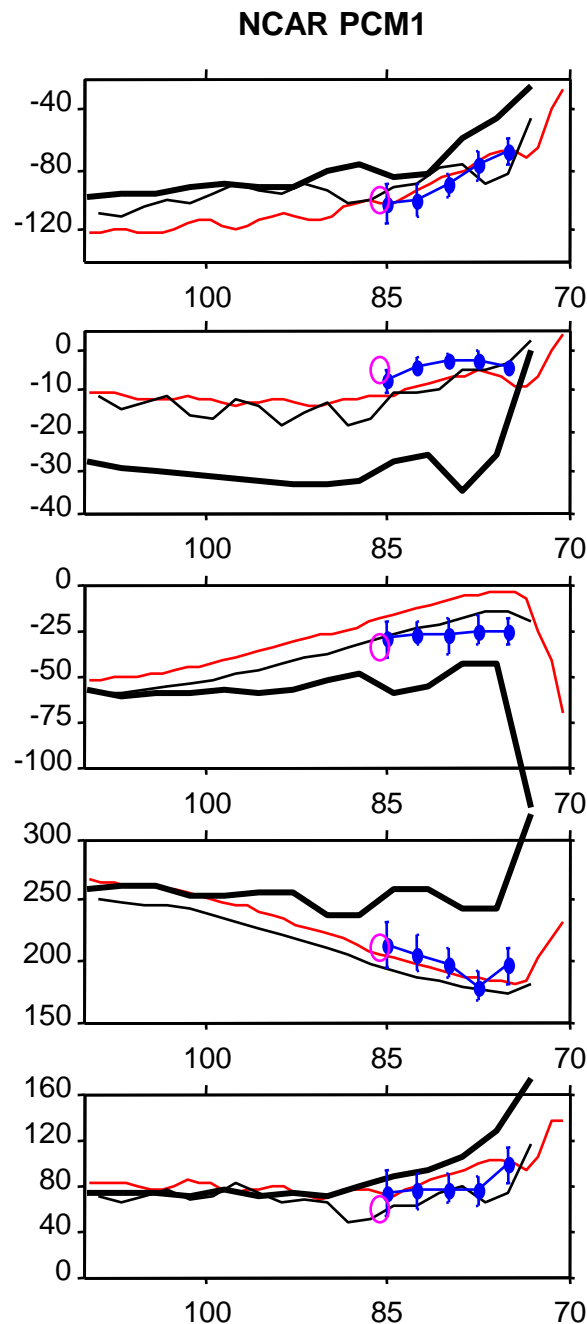
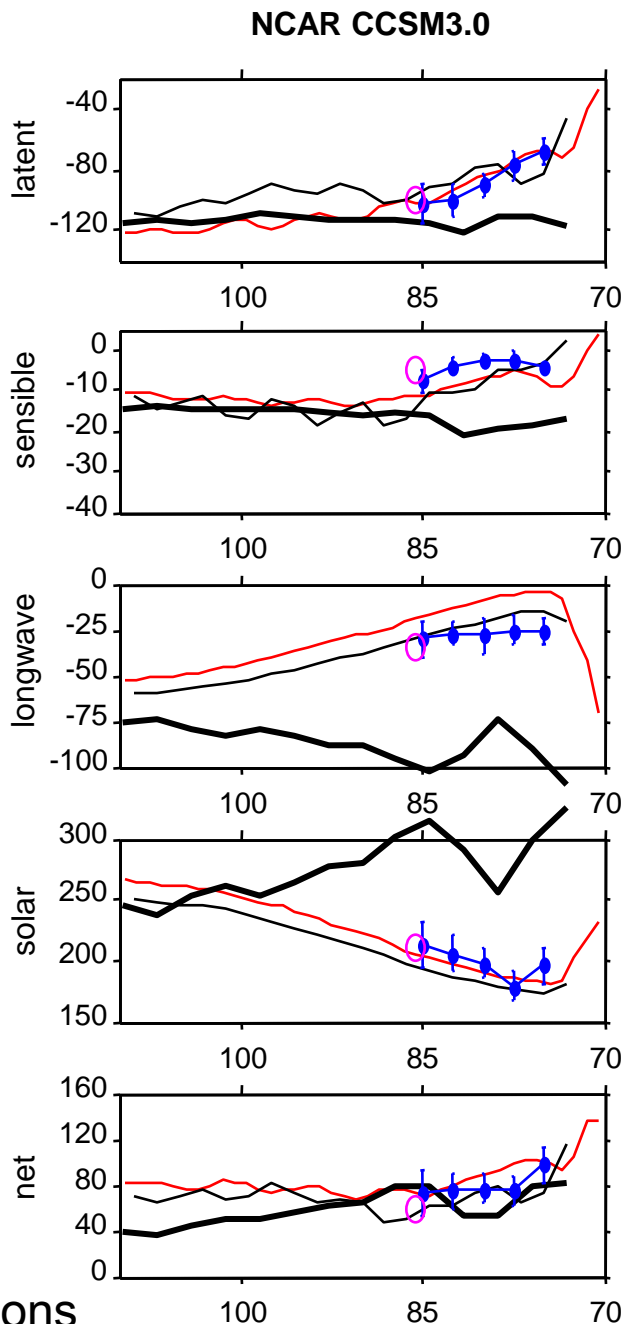
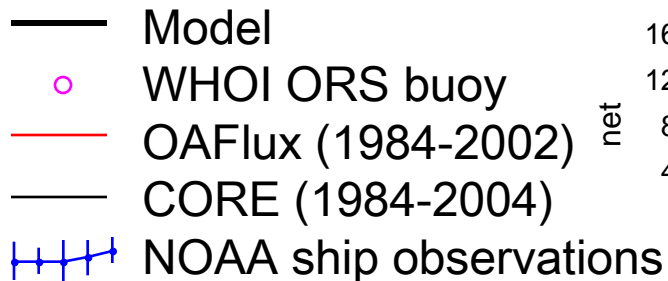


diurnal cycle: 7-year surface heat budget, 20°S



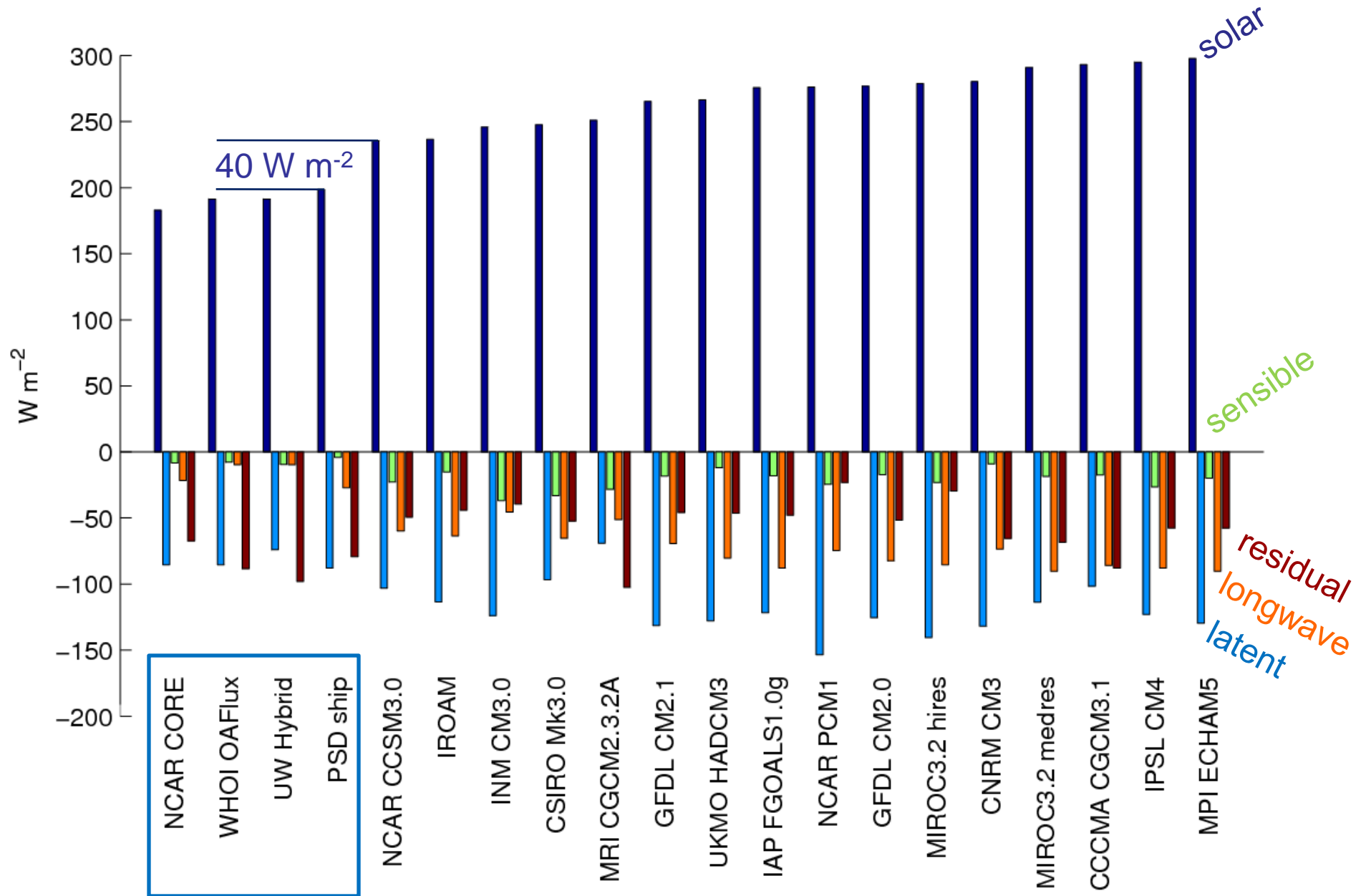
Heat fluxes at 20°S

5 October ship sections

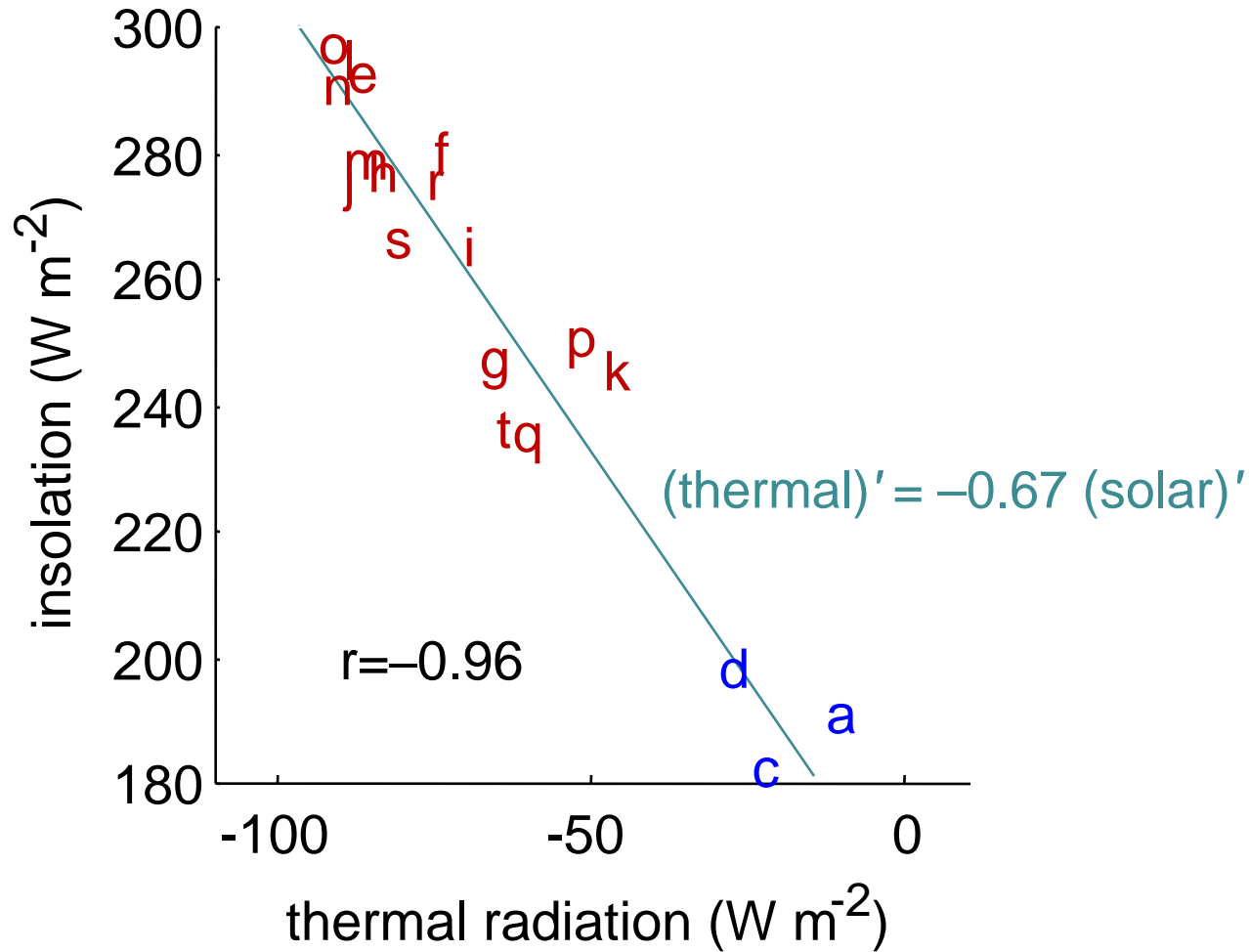


west longitude

Surface heat balances



20°S, 75-85°W October average

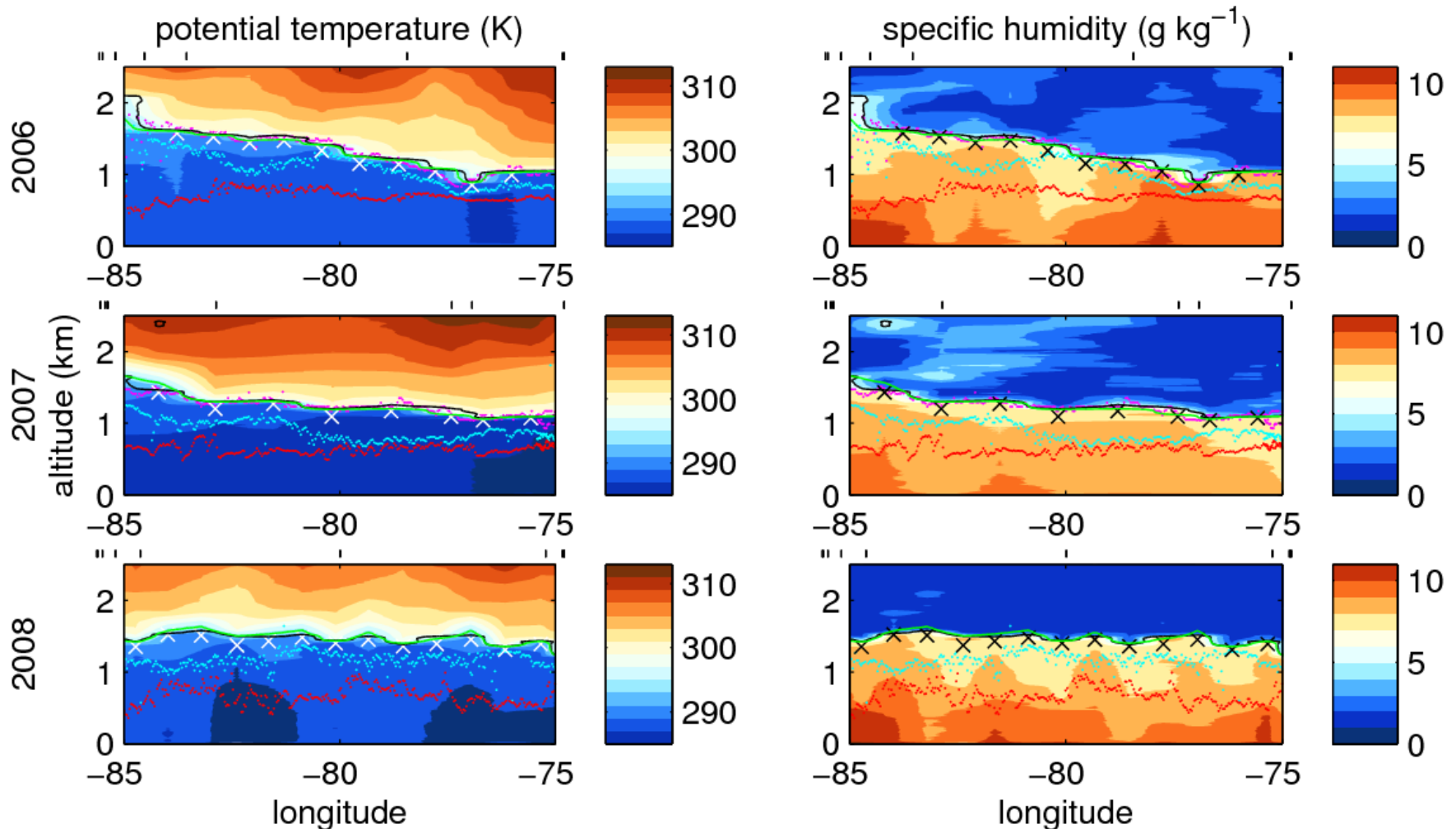


Cloud observations from the stratus region

- Rawinsondes: atmospheric profiles
- Lidar ceilometer: cloud base
- W-band radar: cloud and hydrometeors
- Boundary layer and cloud top
- Aerosols
- Surface meteorology

How do these measurable quantities regulate radiatively important clouds?

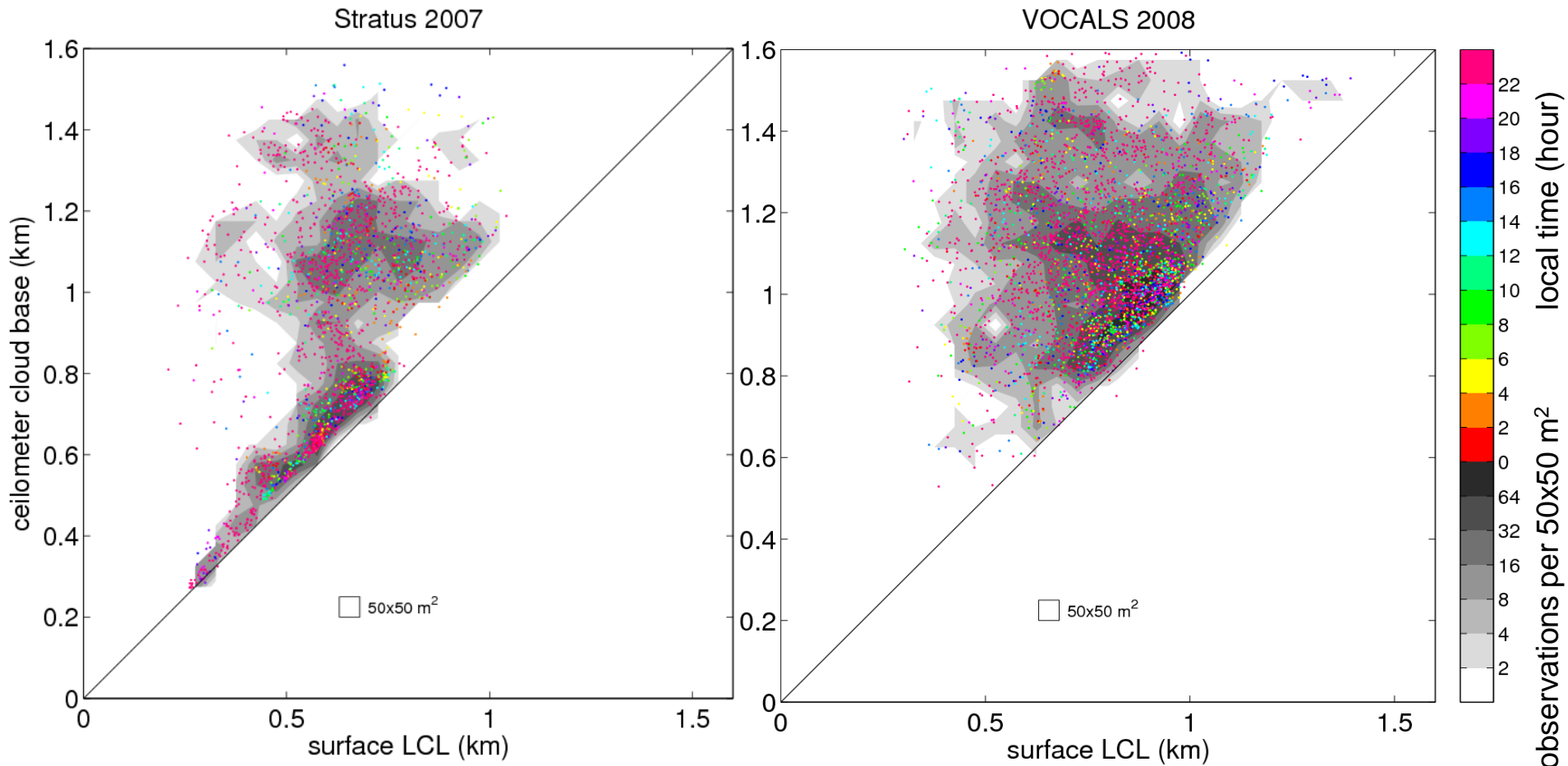
Radiosonde profiles along 20°S



PBL height tilted west in 2001, 2005, 2006, 2007;
no tilt in 2003, 2004, 2008 (leg 1).

C-130 85° W sections can identify if this is synoptic variability.

Decoupling observed from the ship



- Lowest cloud base is 10% higher than lifting condensation level (LCL).
- Cloud base above 900 m decouples from surface layer.
- Cloud bases were higher and more decoupled in 2008.