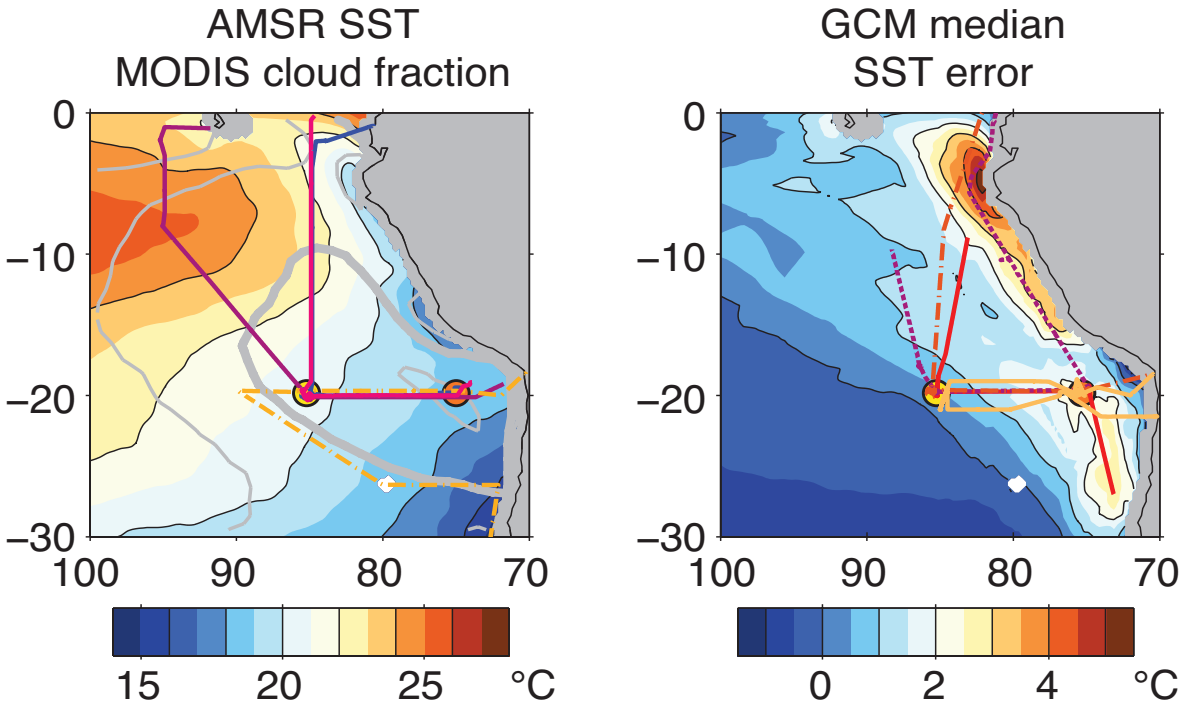
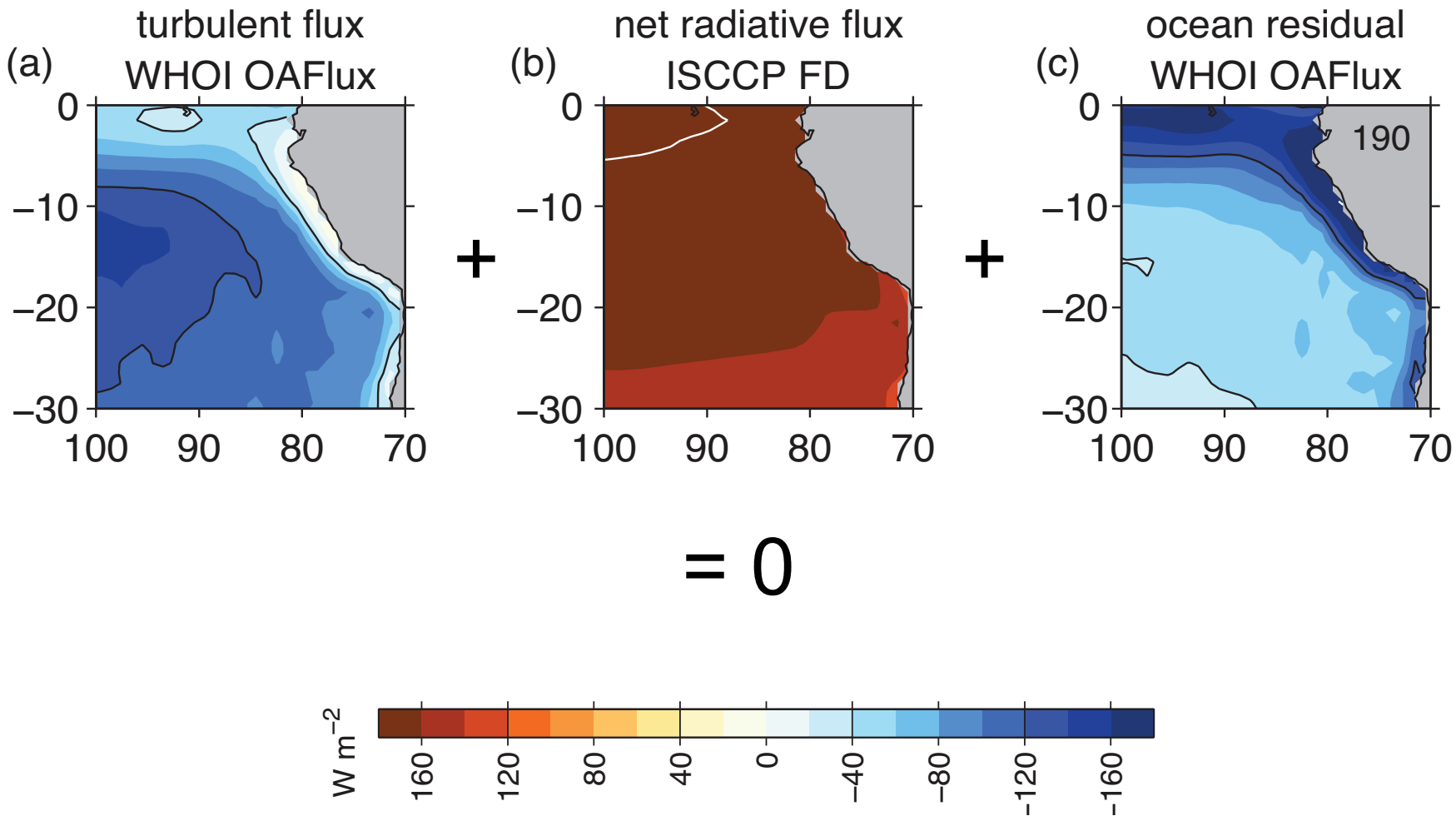
Eastern Pacific surface fluxes observed and simulated by coupled GCMs



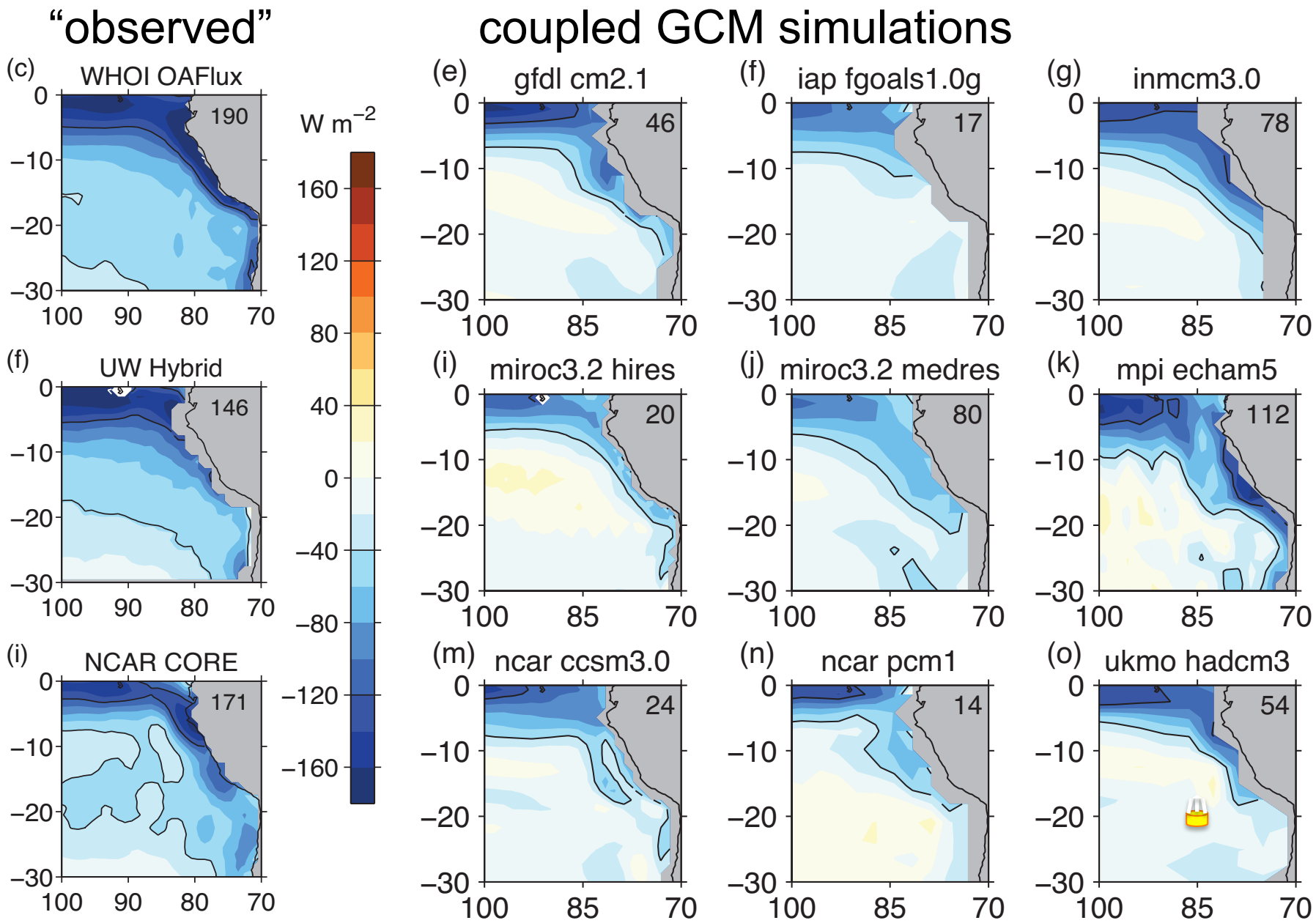
Simon de Szoeke & Chris Fairall

de Szoeke et al. 2010: Surface Flux Observations on the Southeastern Tropical Pacific Ocean and Attribution of SST Errors in Coupled Ocean–Atmosphere Models, *J. Climate.*

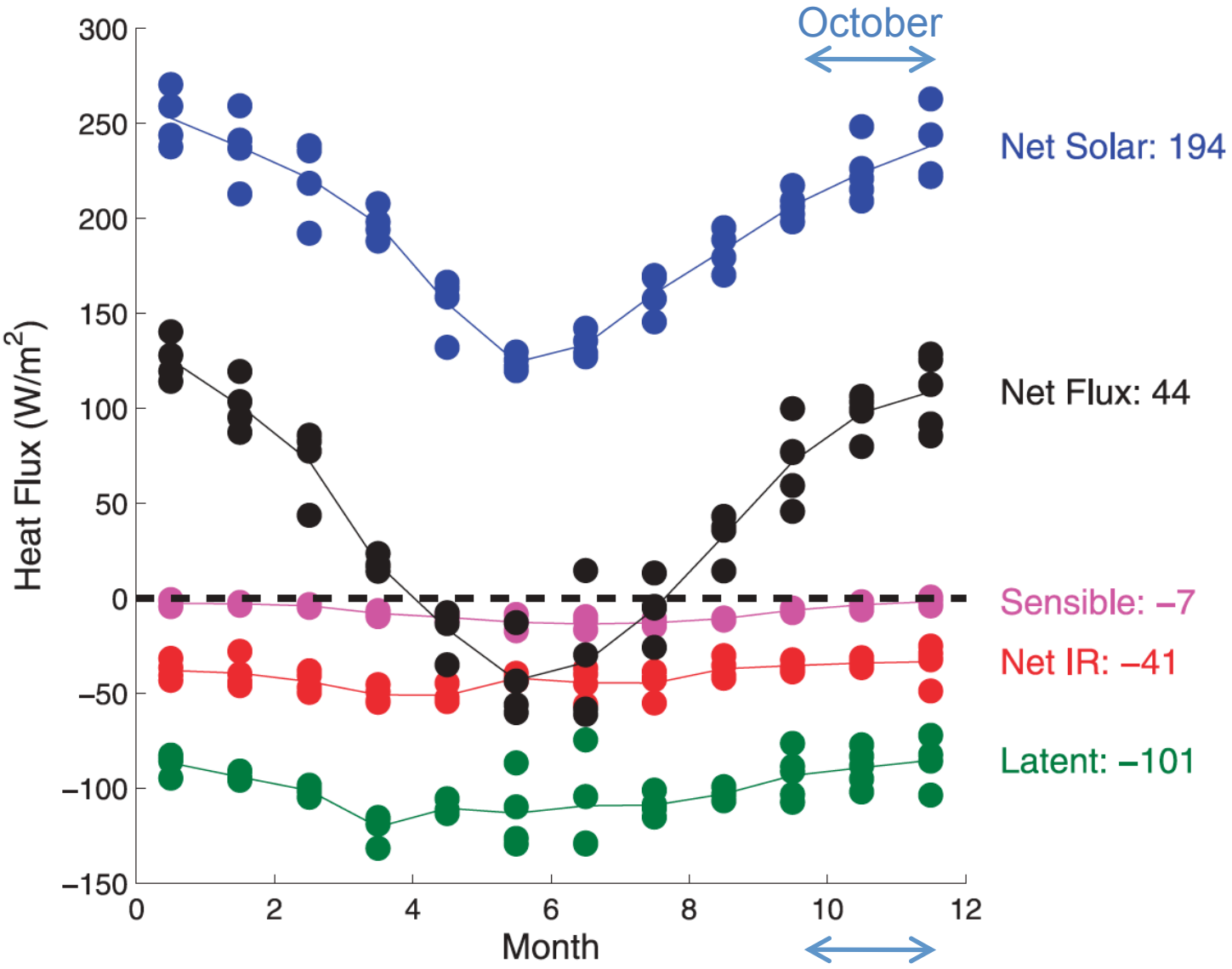
annual average heat budget



Ocean residual flux



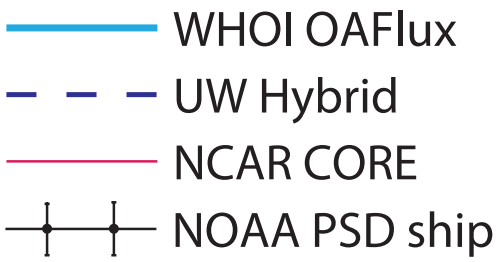
surface ocean heat budget

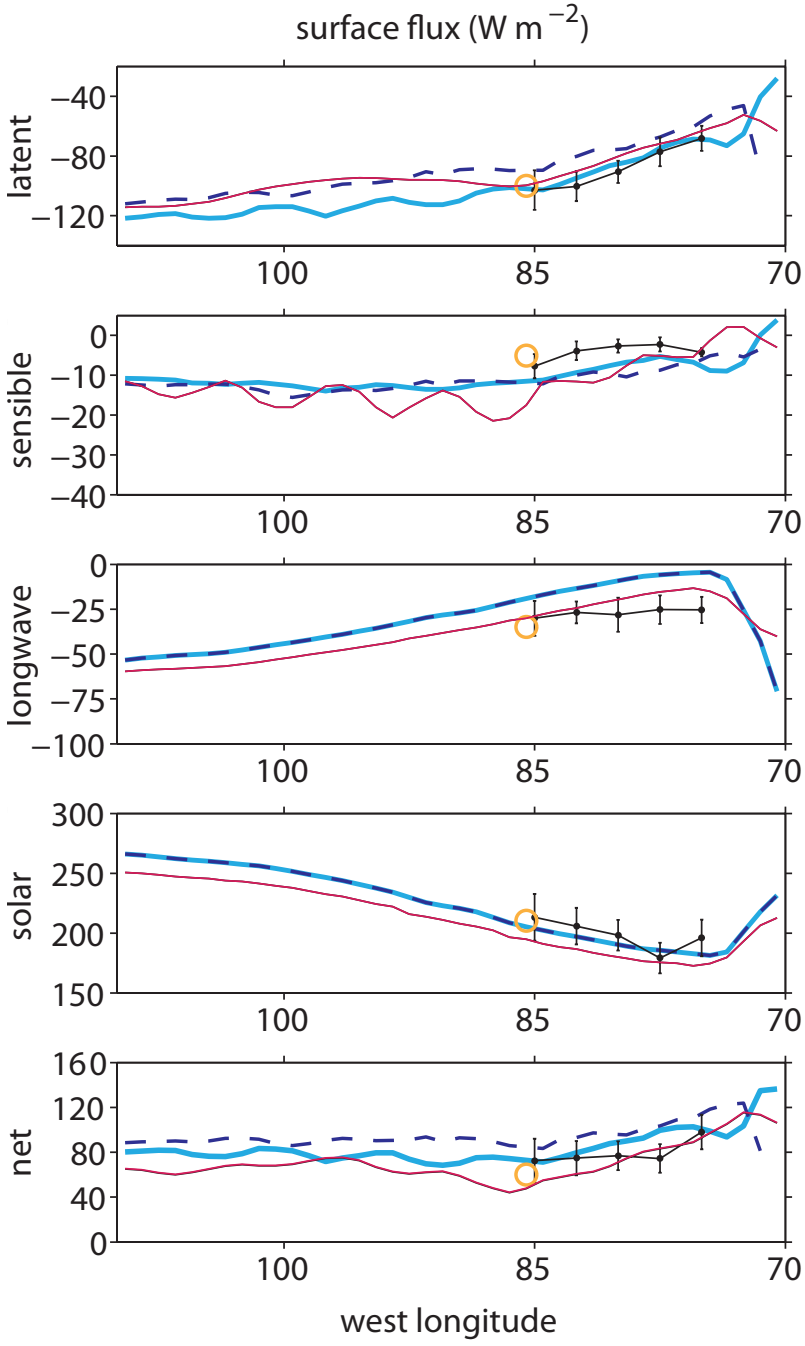


Colbo and Weller 2007

ship-observed heat fluxes

20°S, October





surface heat budget

0 =

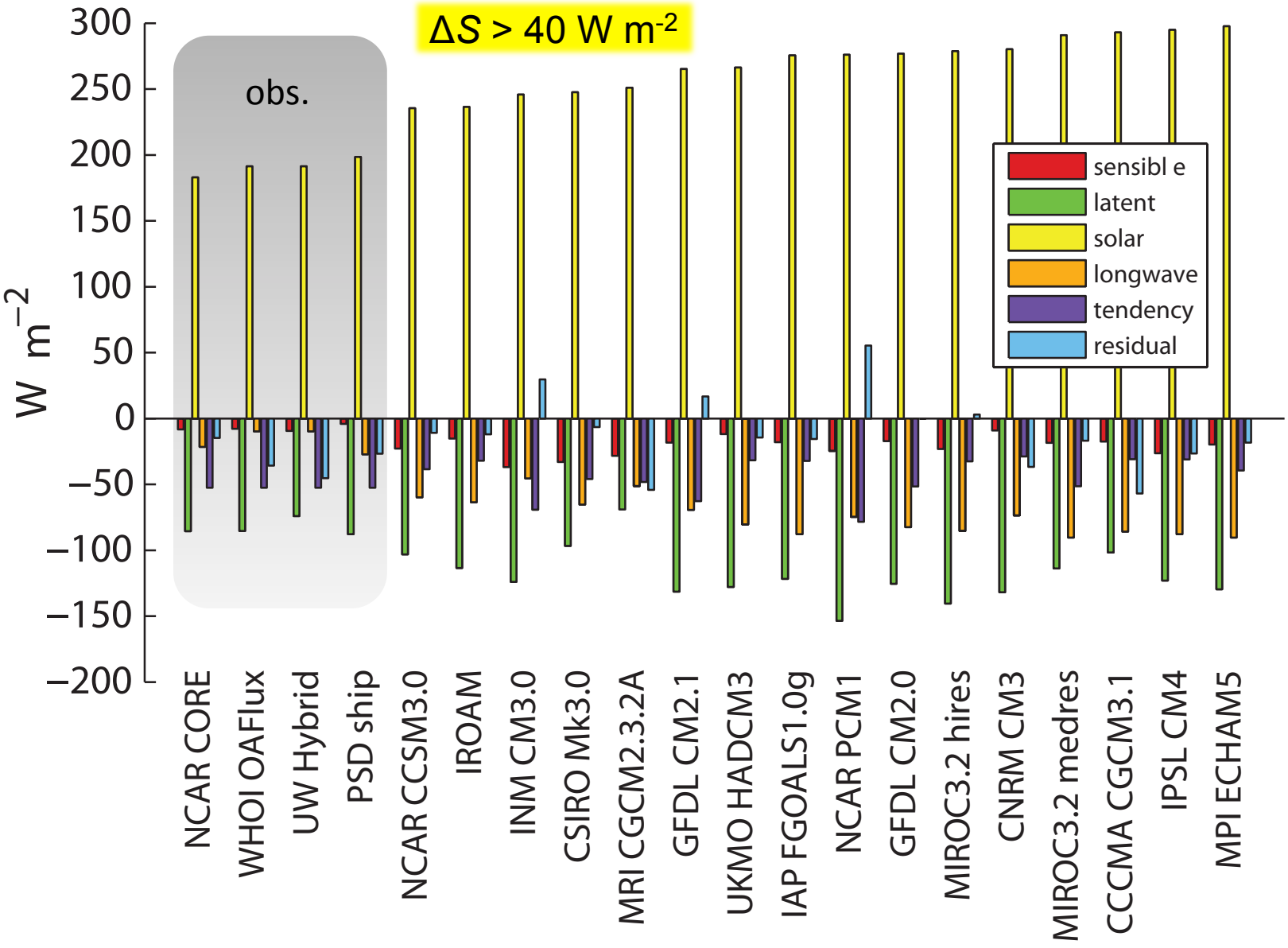
$-\partial/\partial t$ SST

turbulent evaporation and sensible flux

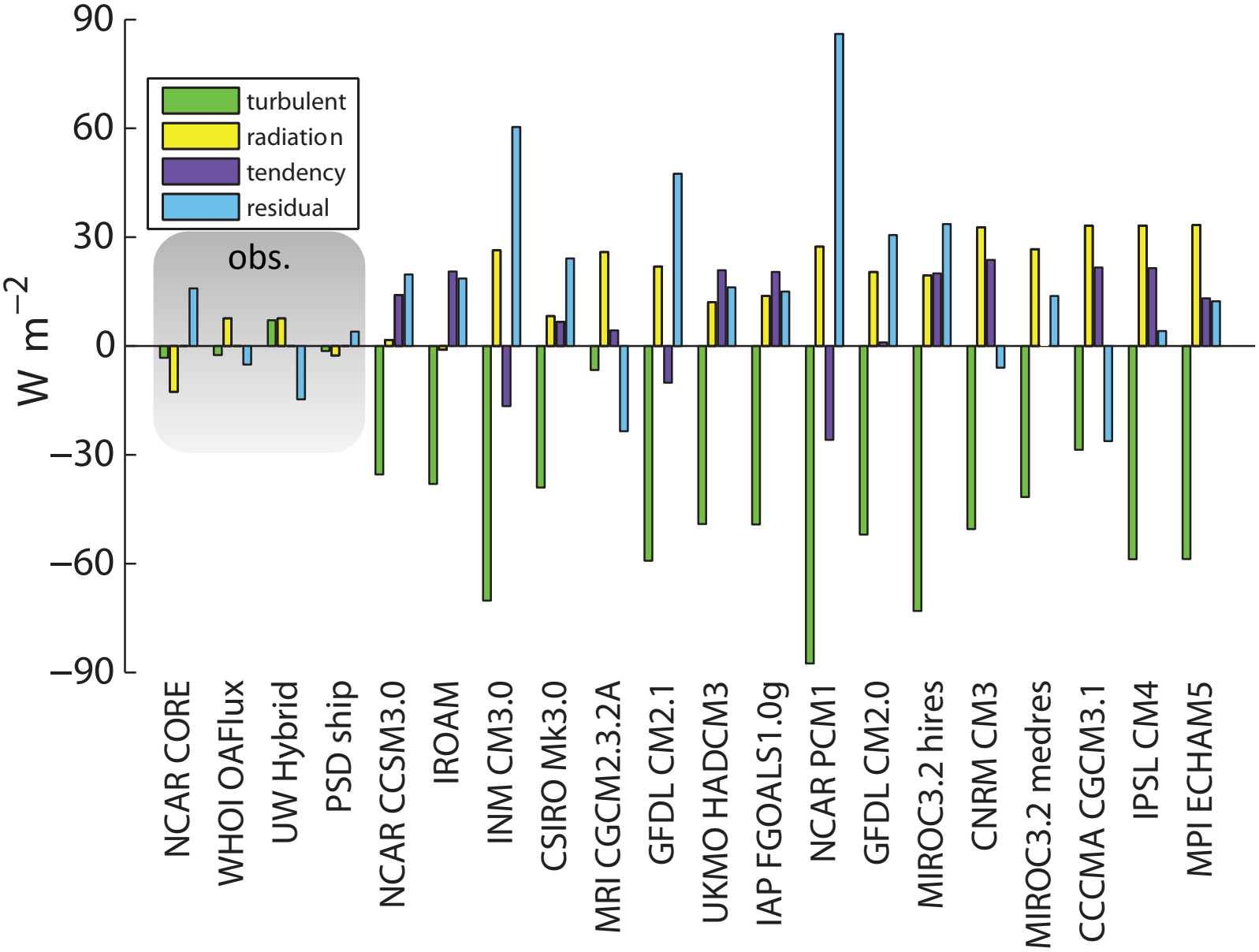
net radiation

ocean residual

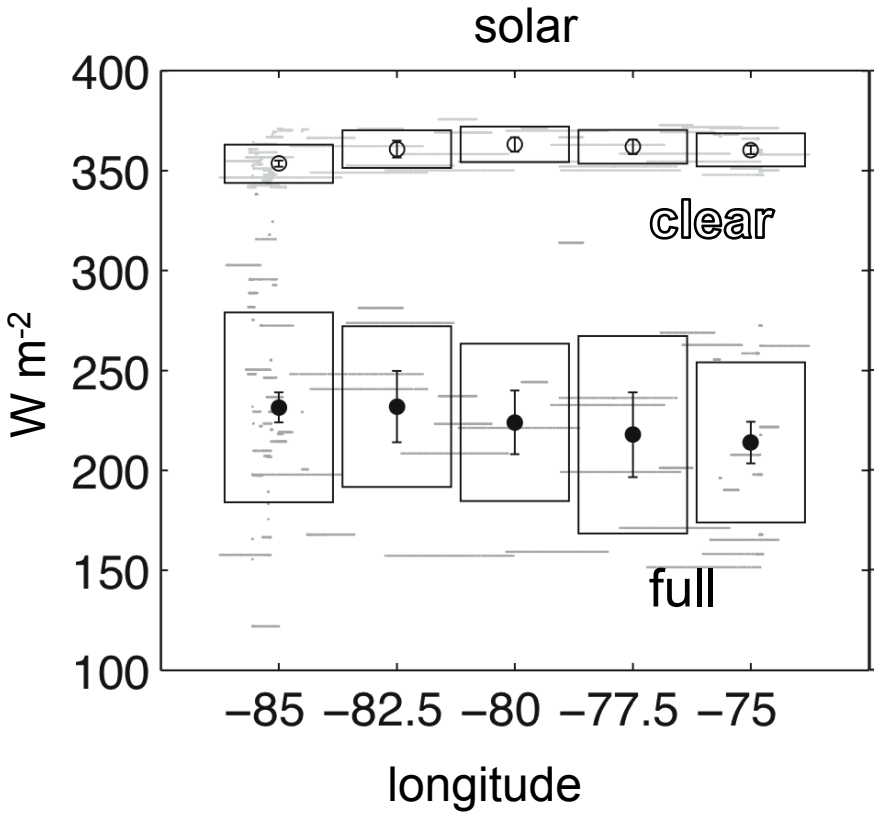
surface heat budget

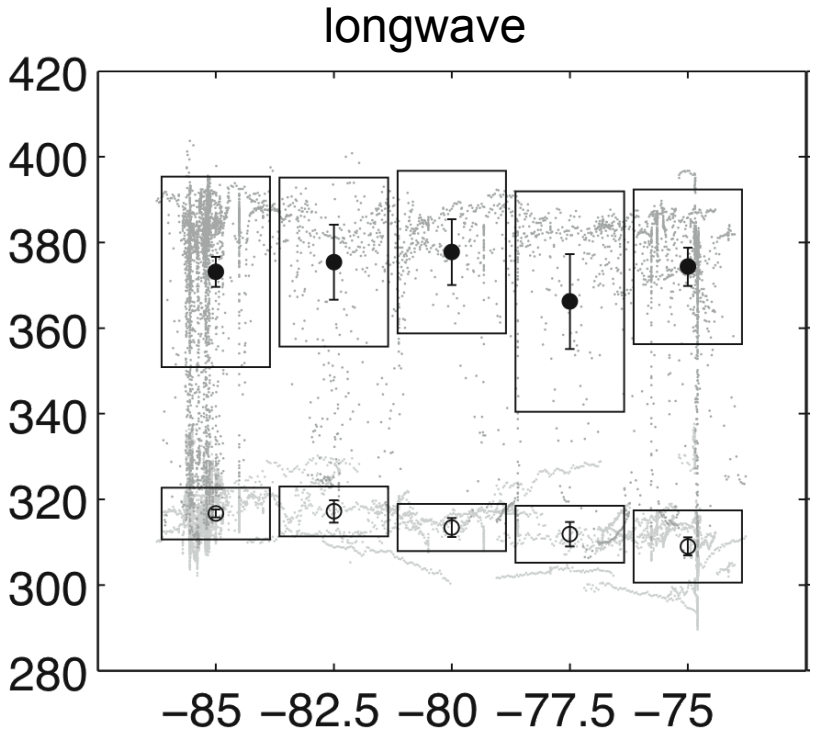


surface heat budget *errors*

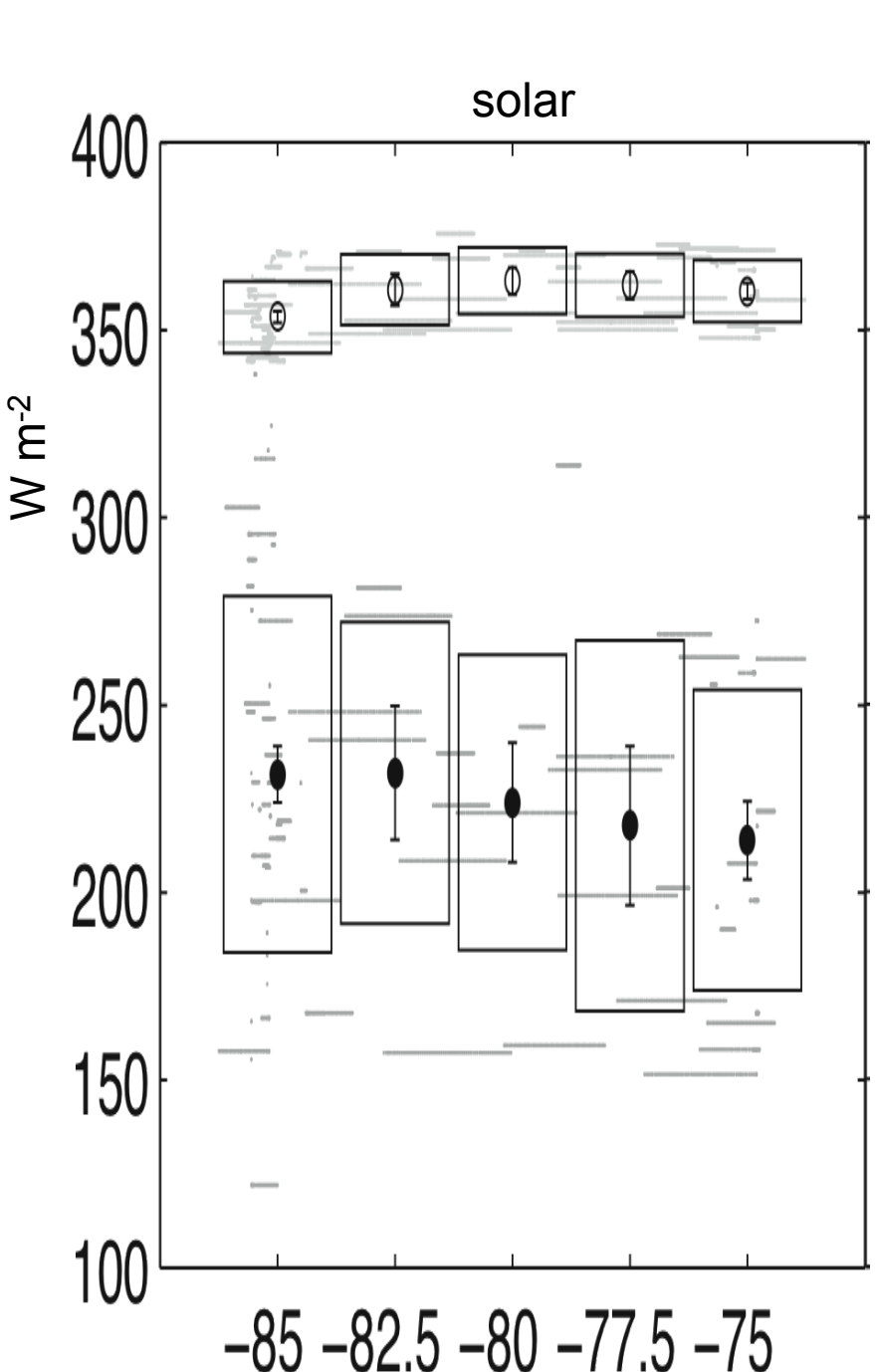


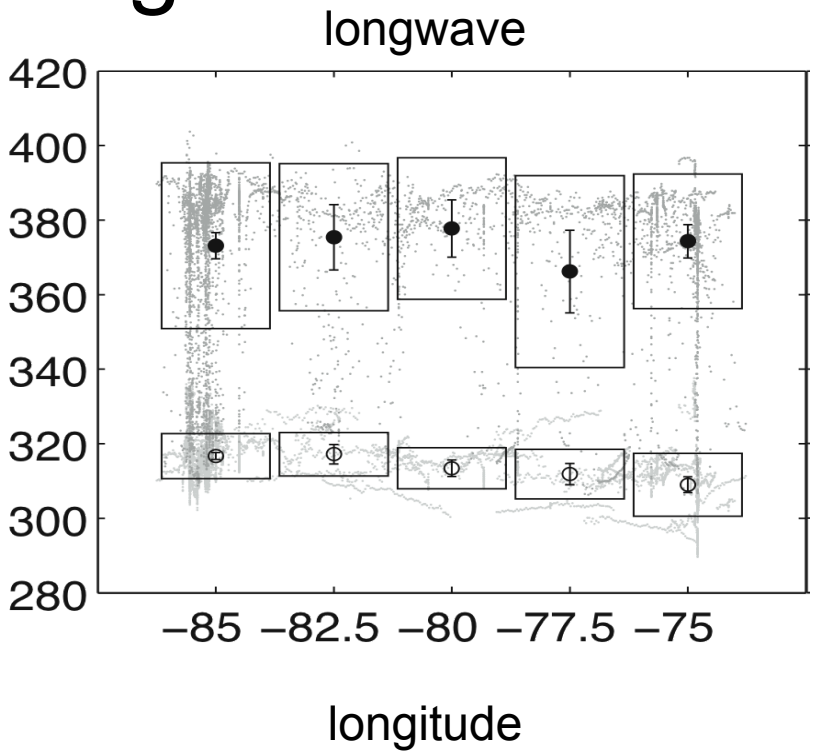
surface downwelling radiation



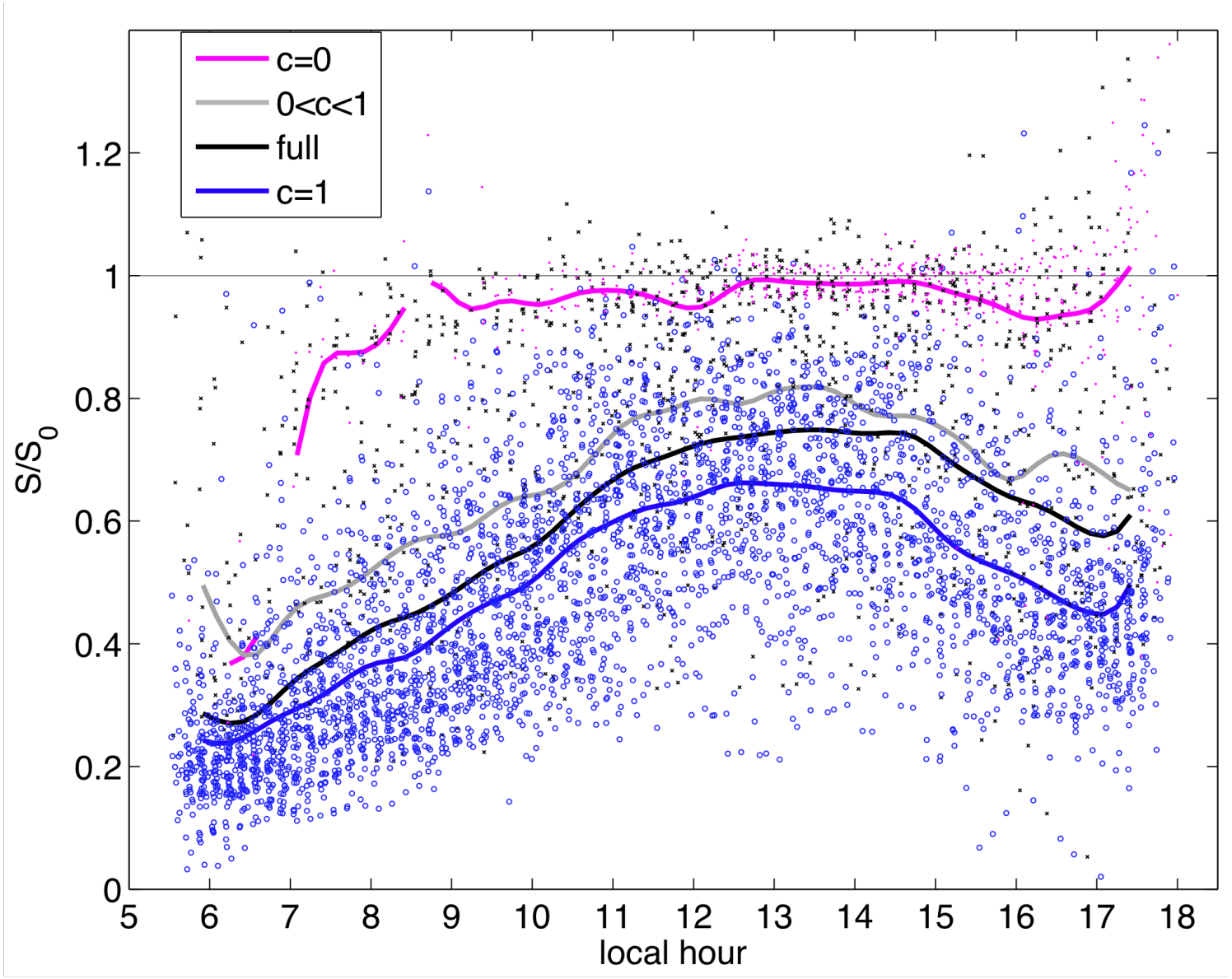


surface downwelling radiation





solar transmission

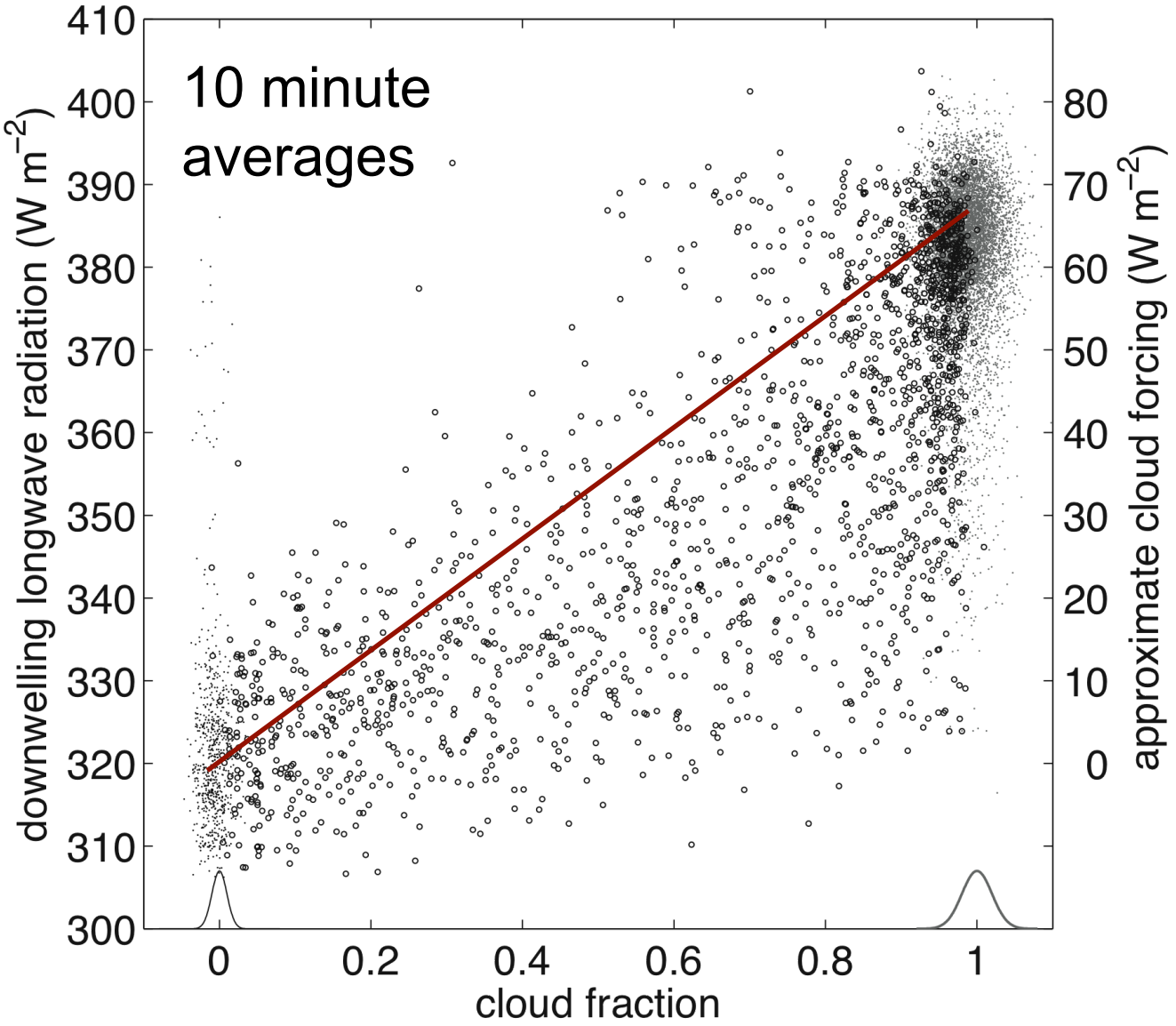


clear

full

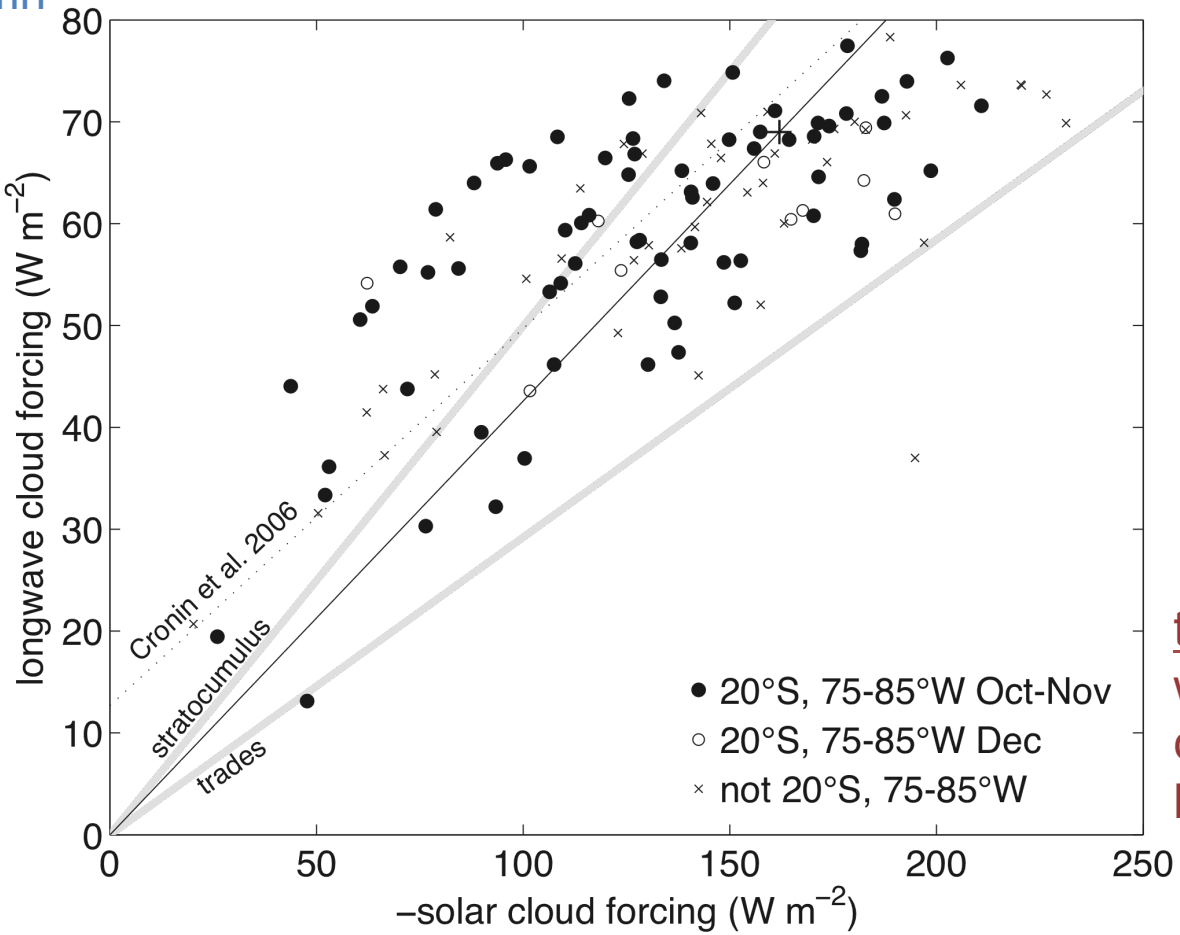
cloudy

longwave cloud effect



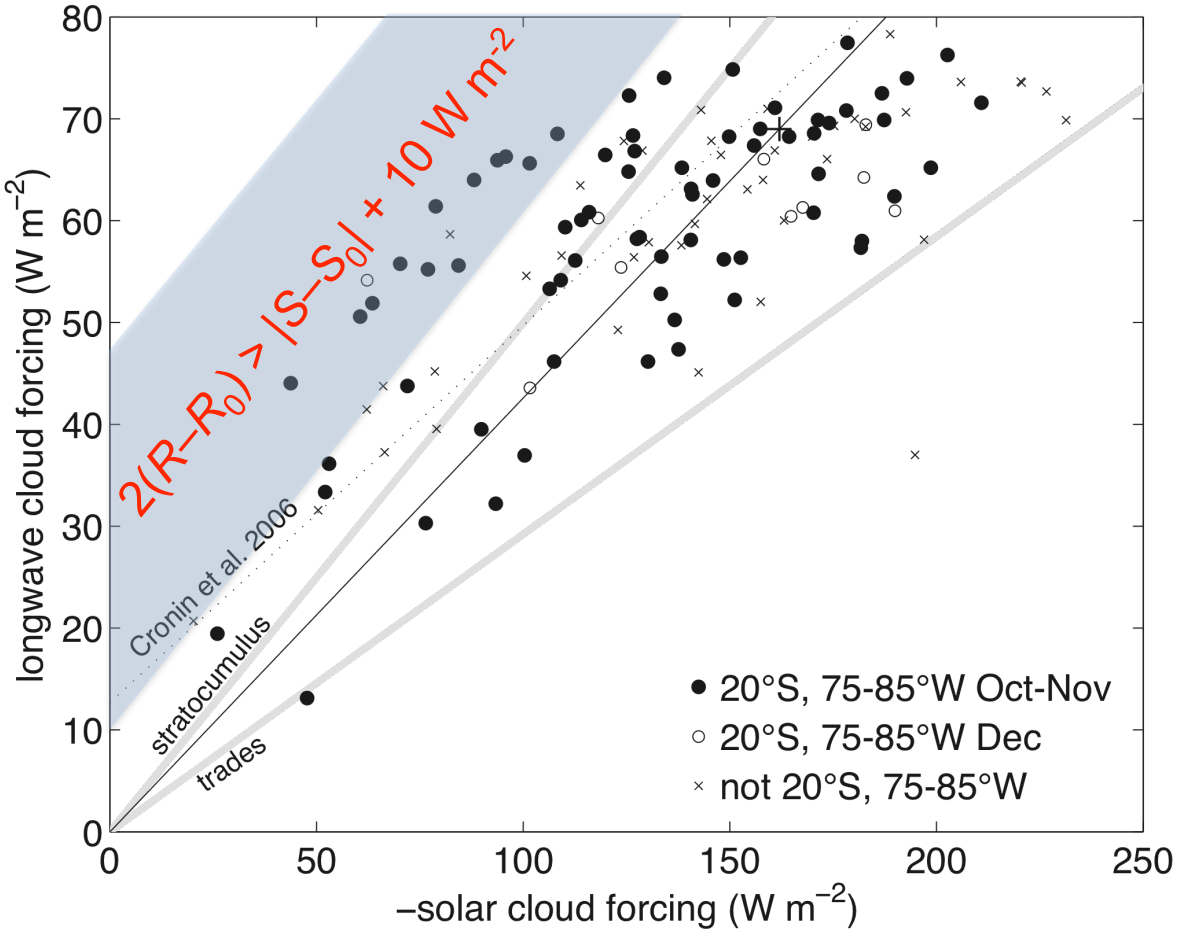
Cloud forcing phase diagram

polar
cold dry column
low sun ←

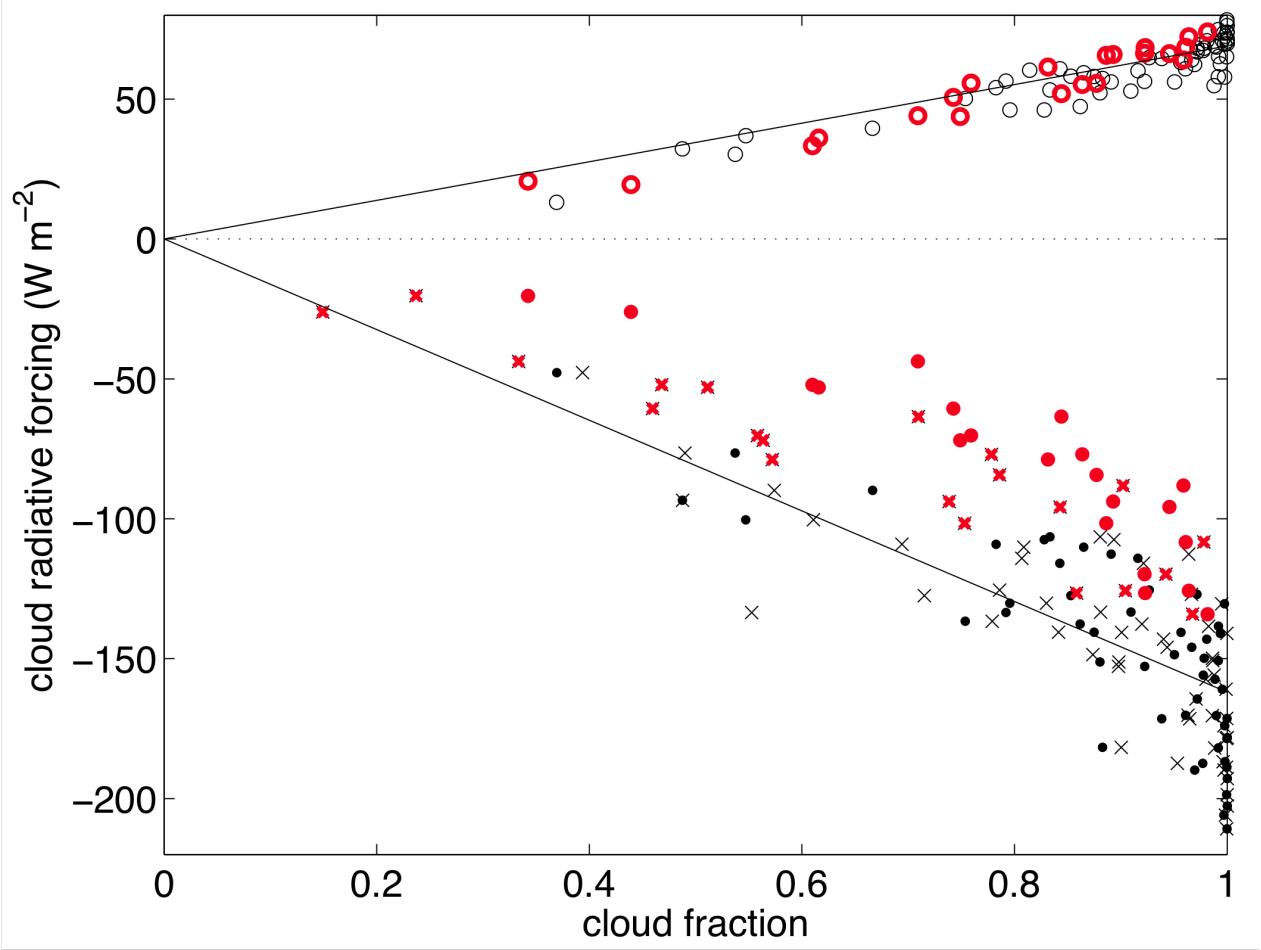


tropical
warm moist
column,
high sun →

Cloud forcing phase diagram



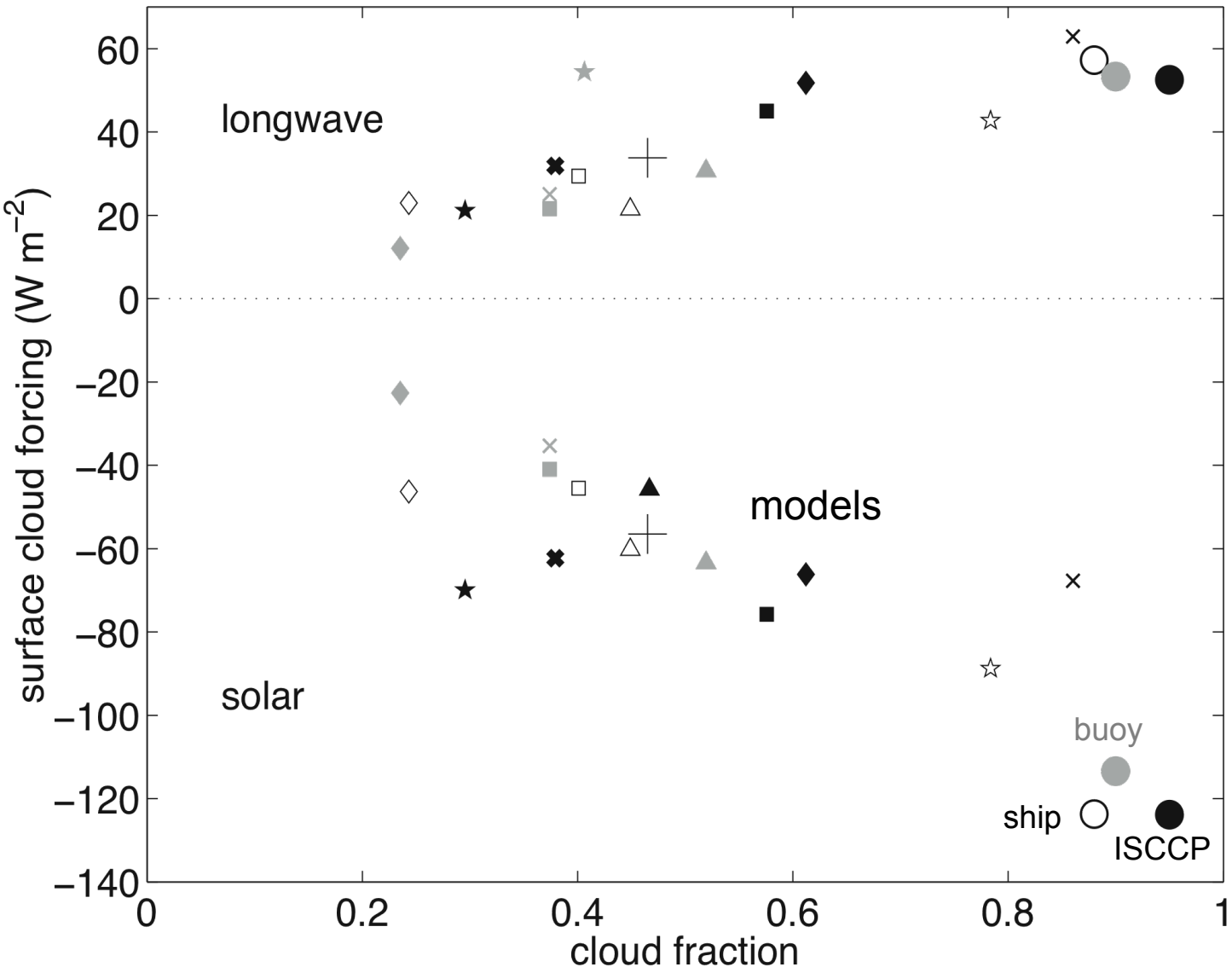
Daily average cloud radiative forcing



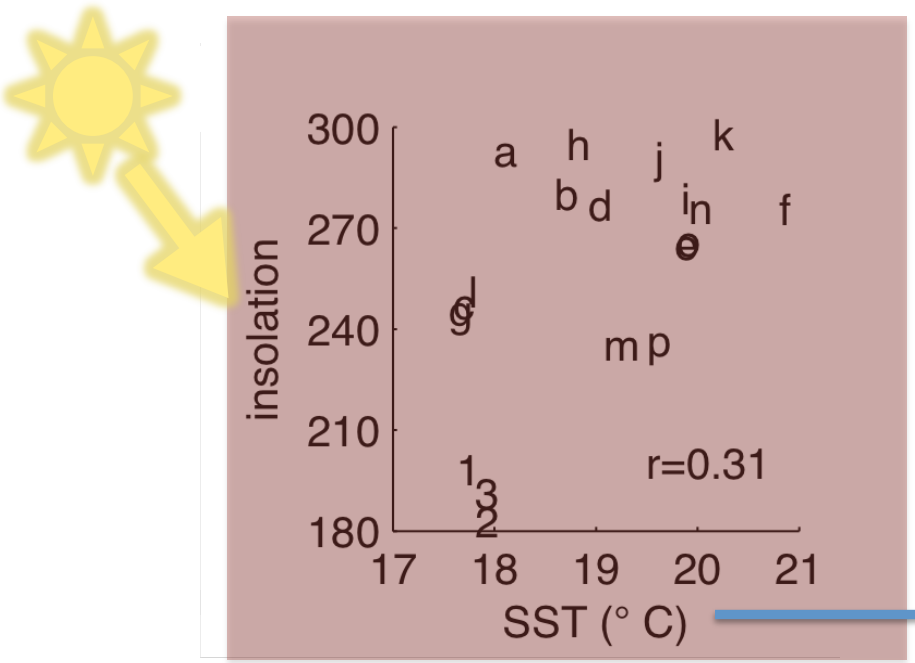
xx: solar-weighted cloud fraction

red: $2(R–R_0) > |S–S_0| + 10$ W m^{-2}

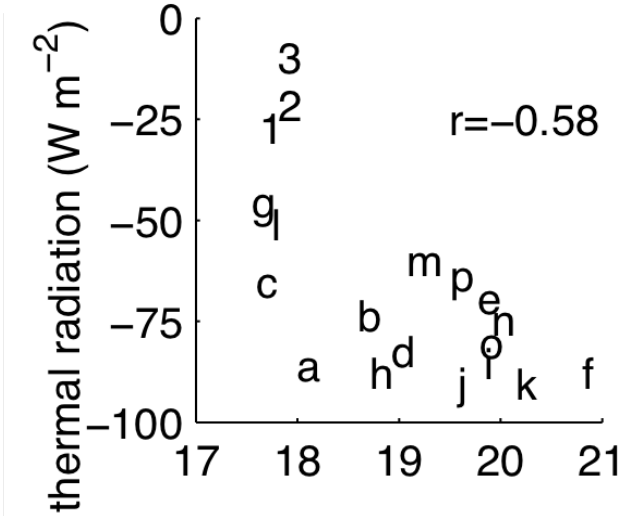
model surface cloud forcing

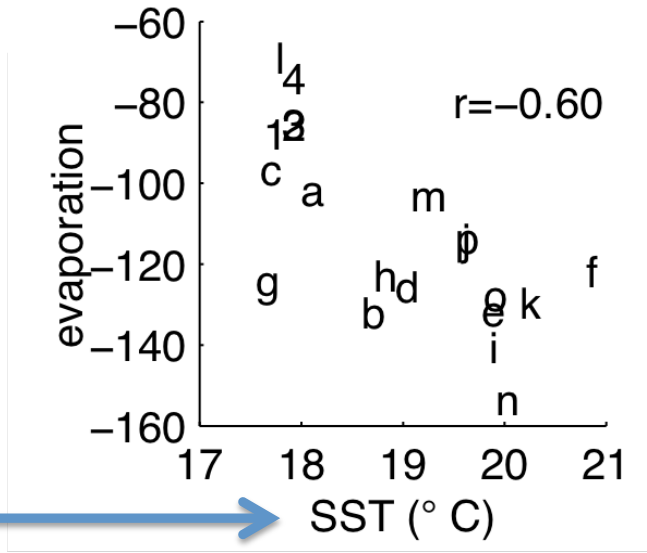


Does insolation explain SST?



no





surface heat budget

0 =

$-\partial/\partial t$ SST

turbulent evaporation and sensible flux

net radiation

} damp SST

ocean residual =

Ekman transport

geostrophic transport

upwelling

eddy flux divergence

the end