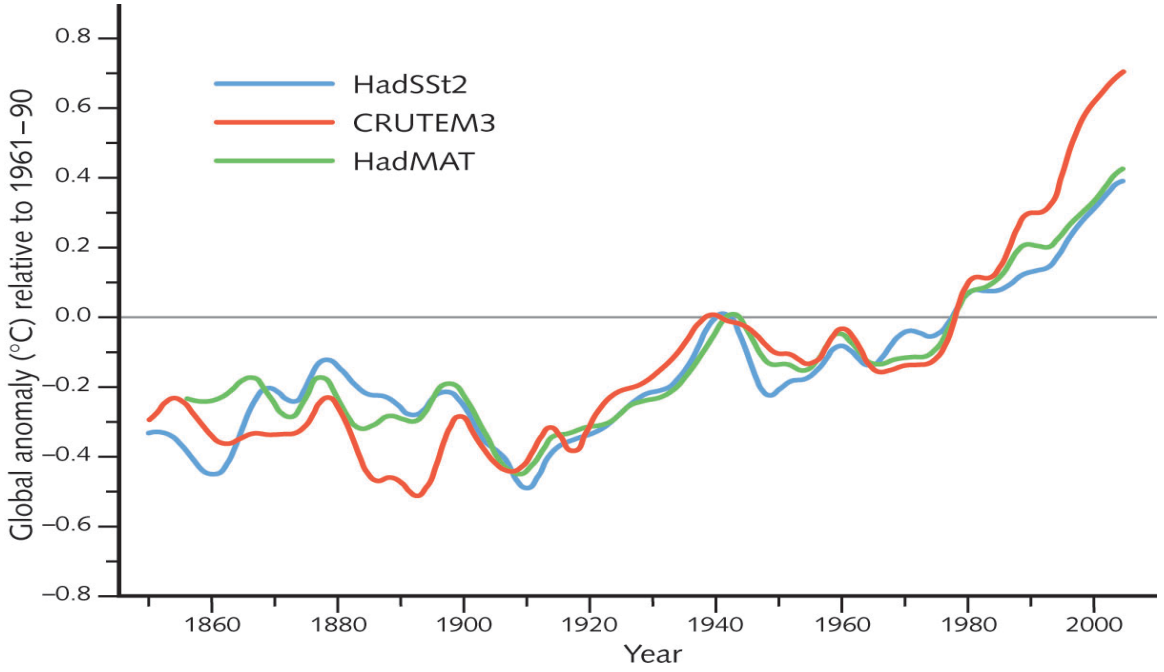
Trends in 15 years (1993-2007) of Satellite Derived Oceanic Evaporation

Frank Kelly

Texas A&M University – Corpus Christi

Collaborators: A. Mestas-Nunez, A. Bentamy, K. Katsaros, R. Pinker, W. Drennan, J. Carton

Motivation



- Long term trend in surface temperature
- Rapid warming past 20-30 years
- Trends in latent heat flux (LHF) ?
- Associations with sea surface temperature (SST) & other LHF state variables ?

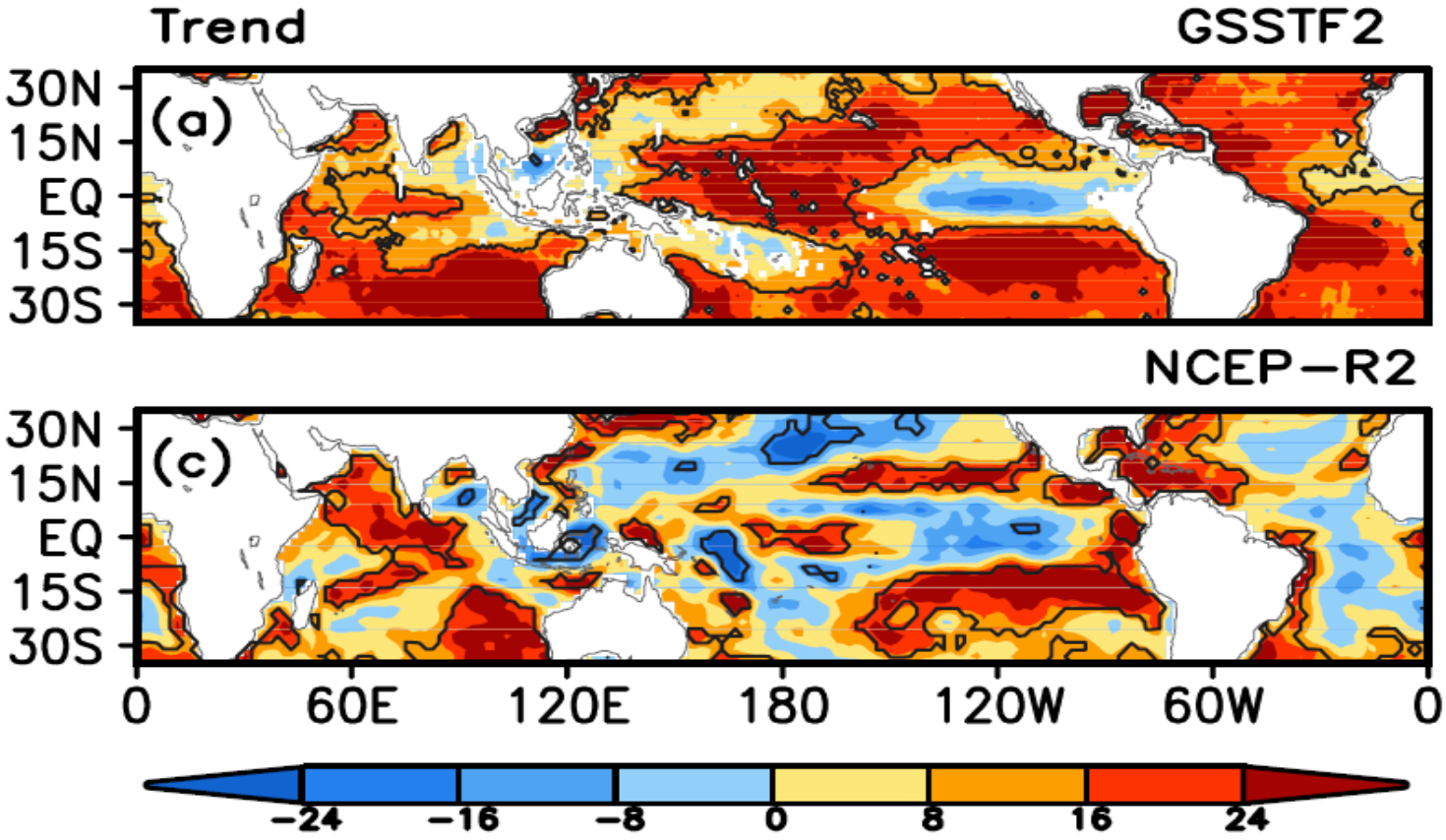
Trends in LHF – Previous Results

- Liu and Curry (2006) investigated trend in LHF for tropical & subtropical oceans using four products: 2 Reanalyses & 2 Satellite-based datasets
- LHF Trend in W/(m^2*decade)

Satellite		Reanalysis	
GSSTF2	HOAPS2	NCEP R-2	ERA-40
16.8	8.37	8.93	1.64

- Positive trends in LHF primarily associated with positive trend in wind

Spatial Distribution of LHF Trend from Liu & Curry (2006)



- GSSTF2 shows wider distribution of positive LHF trend

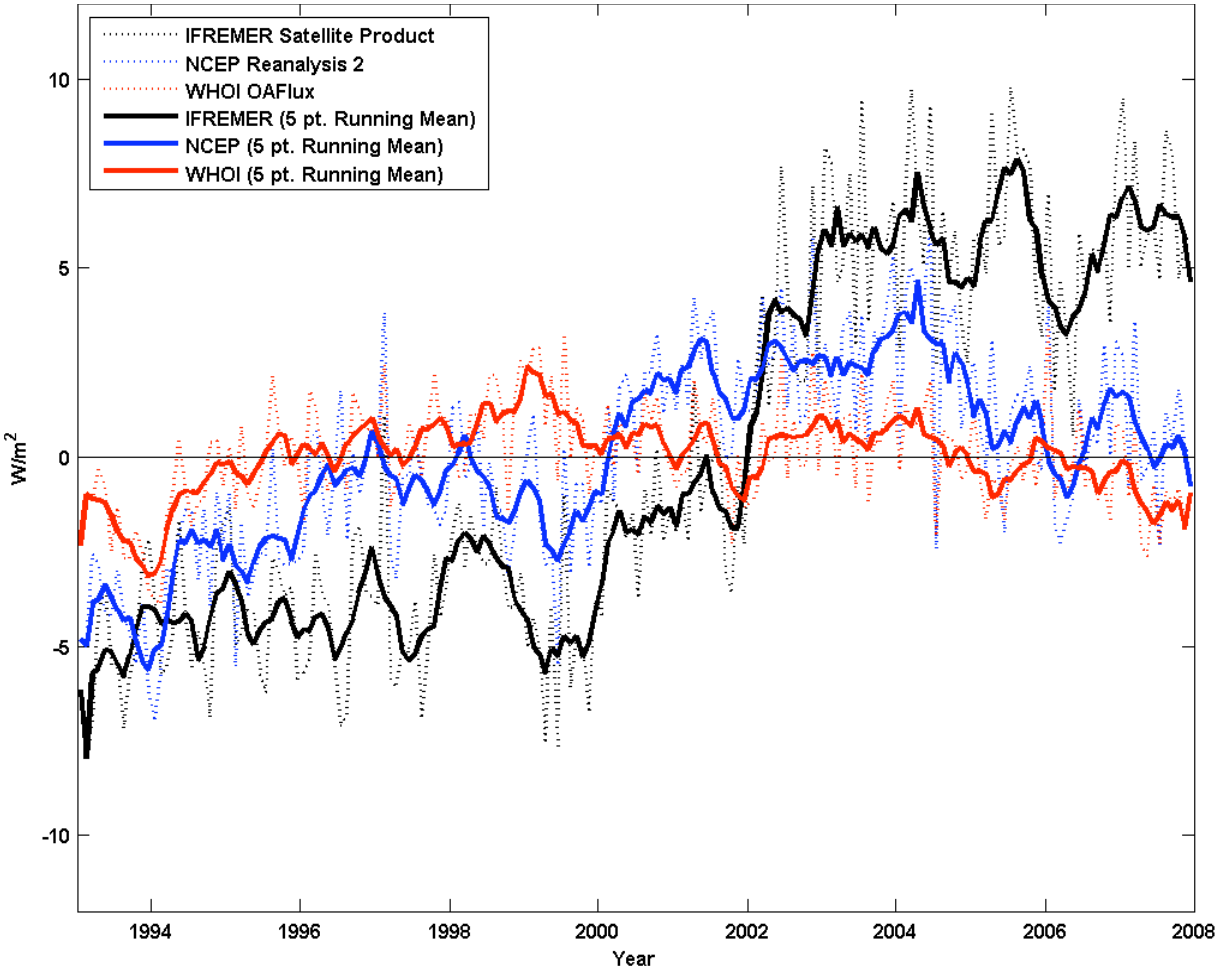
Objectives of Current Analysis

- Compare trends in LHF over 15 year period (1993-2007) between following datasets:
  1. IFREMER Satellite-Based Flux
  2. NCEP Reanalysis II
  3. WHOI OAFlux
- Clarify differences in trend of each dataset in global ocean and in low to high latitude oceans
- Investigate potential trends in state variables used in calculating IFREMER bulk flux

Sources of LHF parameters

Parameter	Source for IFREMER	Source for WHOI
Air temperature	Estimated from specific air humidity, wind speed and sea surface temperature using the *Konda et al.* (1996) model	NCEP, ECMWF reanalyses
Sea surface temperature	*Reynolds et al.* (2007)	NCEP, ECMWF reanalyses, *Reynolds et al.* (2007)
Surface wind speed	ERS-1, ERS-2, QuickSCAT scatterometers	NCEP, ECMWF reanalyses, SSM/I and AMSR-E radiometers, QuickSCAT scatterometer
Specific air humidity	Estimated from Reynolds SST using the *Schulz* (1993, 1997) model	NCEP, ECMWF reanalyses, product from *Chou et al.* (2001) using SSM/I column water vapor retrievals

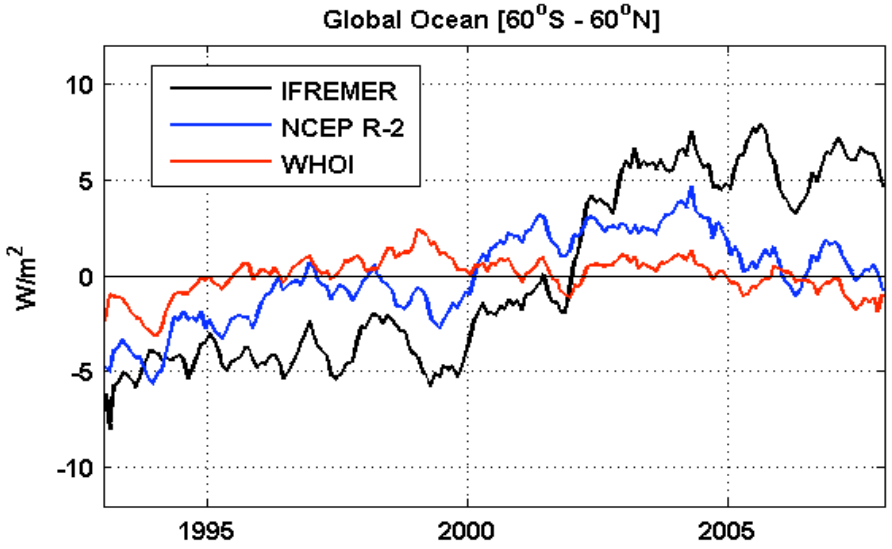
Global anomaly of monthly averaged LHF [60°S – 60°N]

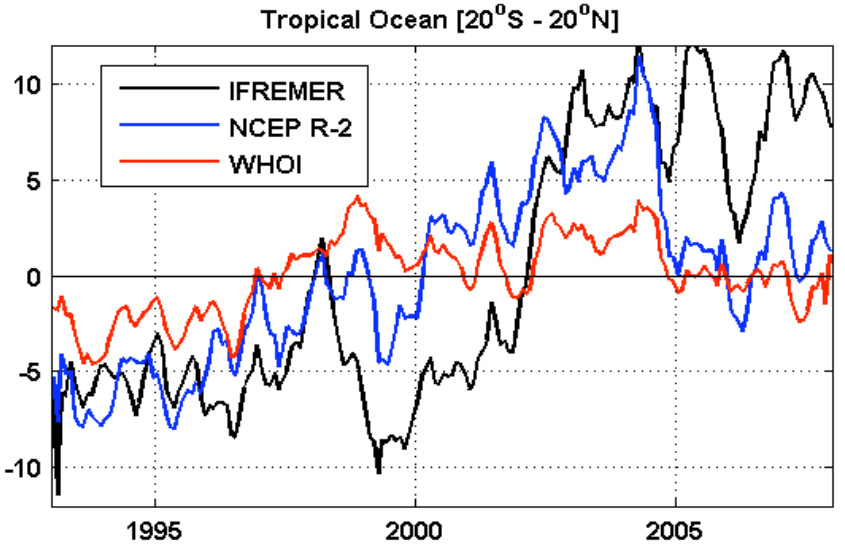


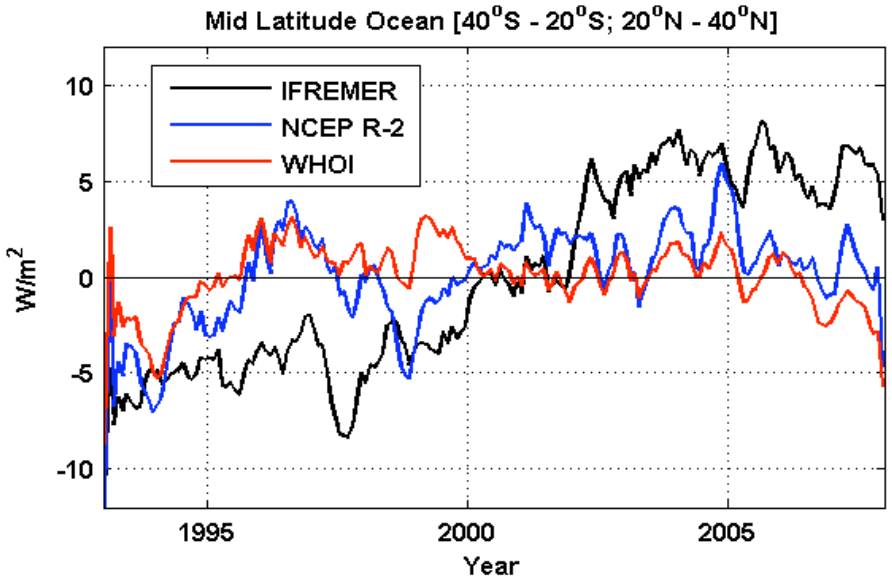
LHF Trend in W/ (m^2*decade)

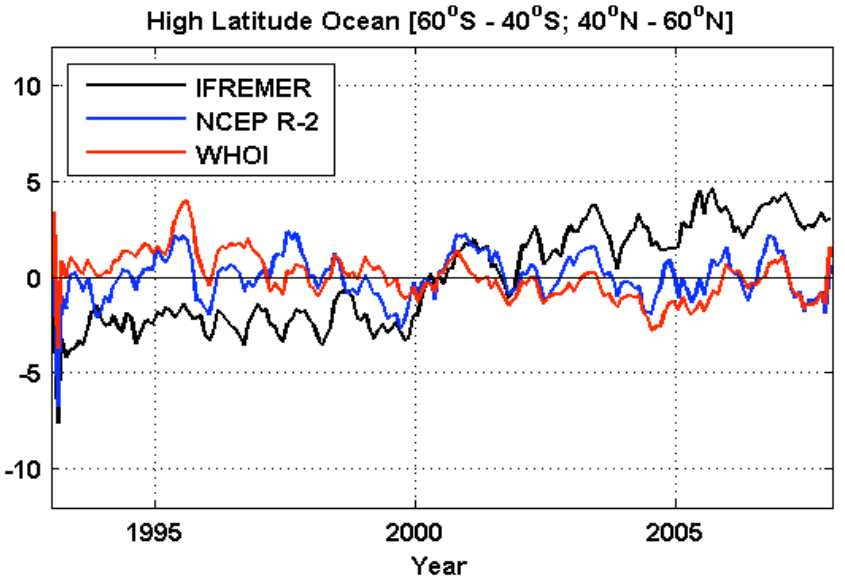
IFREMER	9.7
NCEP R-2	3.7
WHOI	0.3

LHF anomalies for specific ocean regions

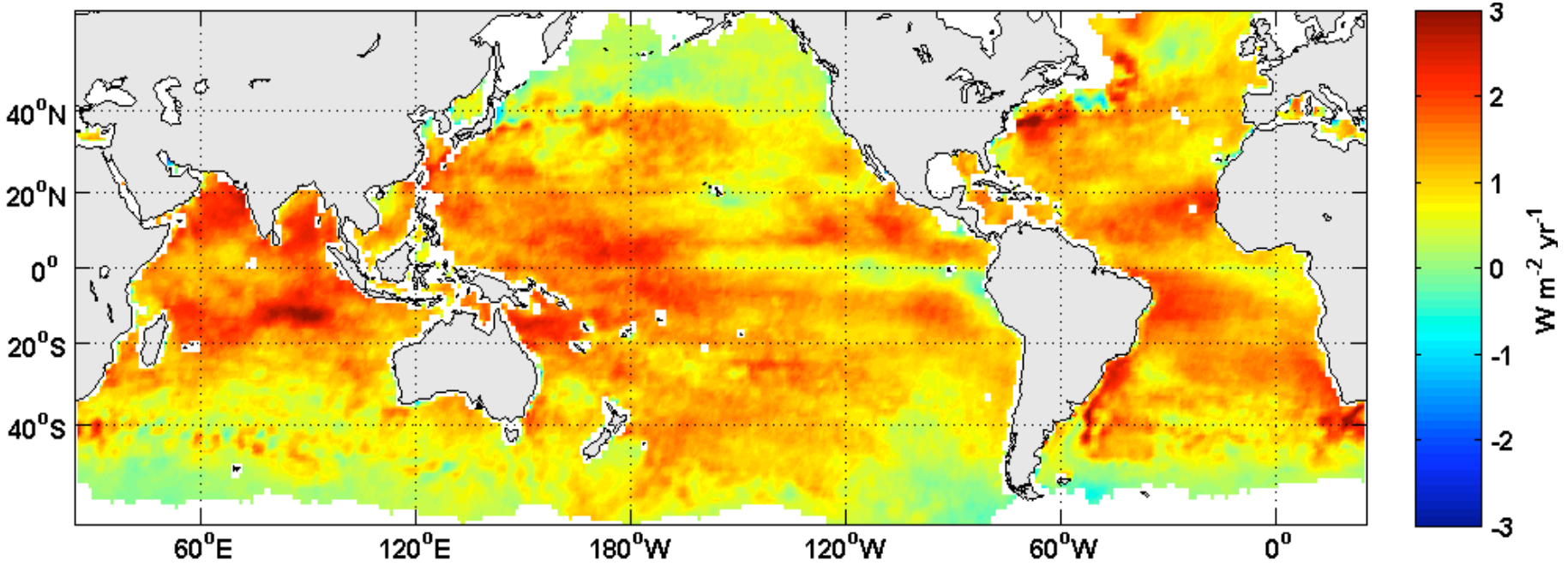




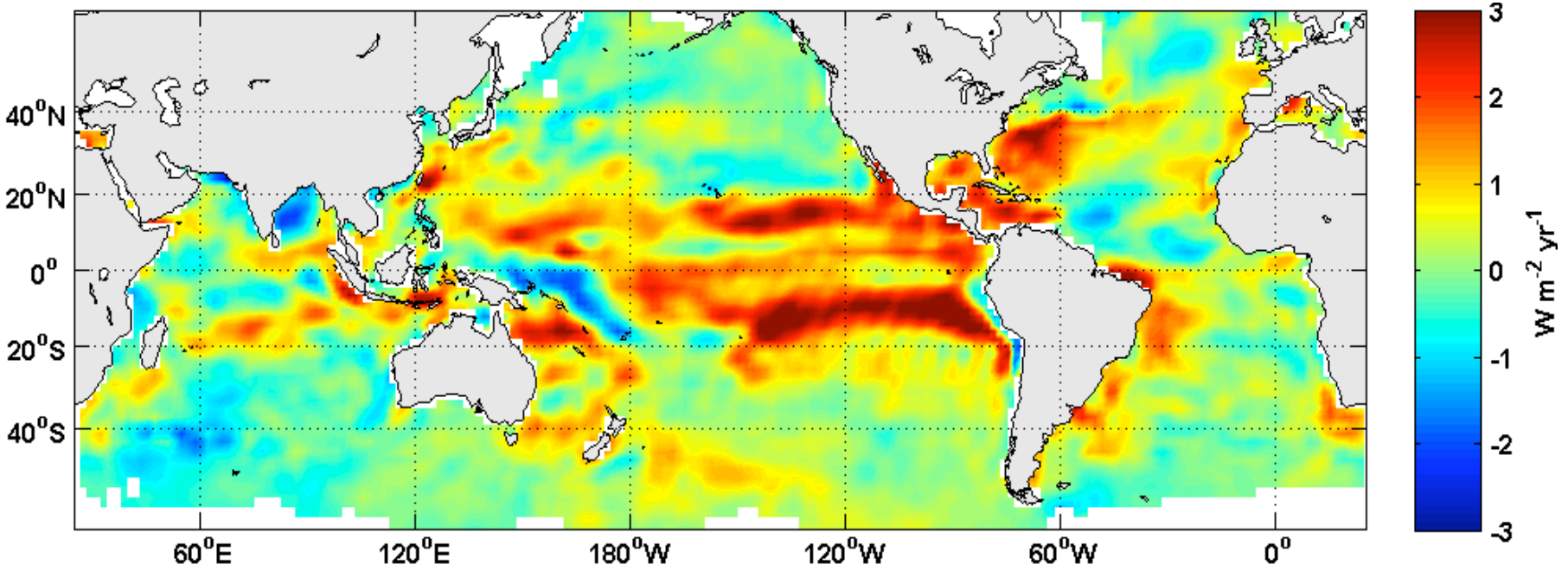




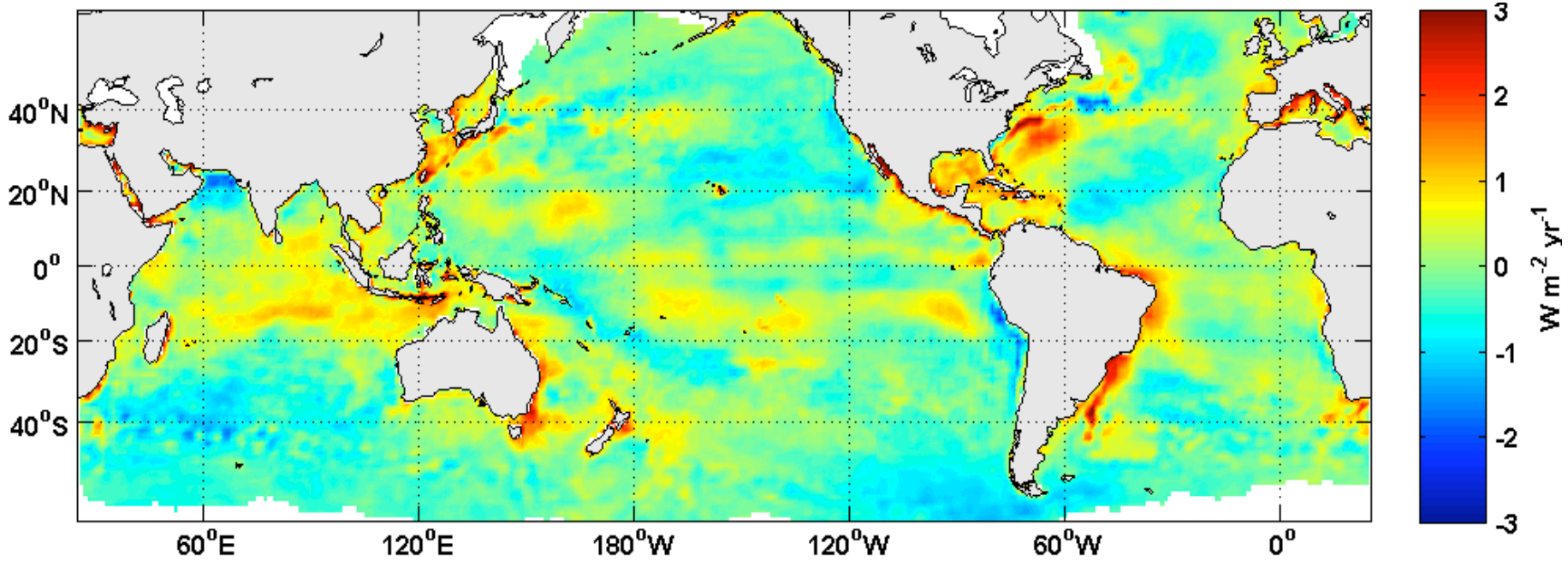
Spatial distribution of LHF trend - IFREMER



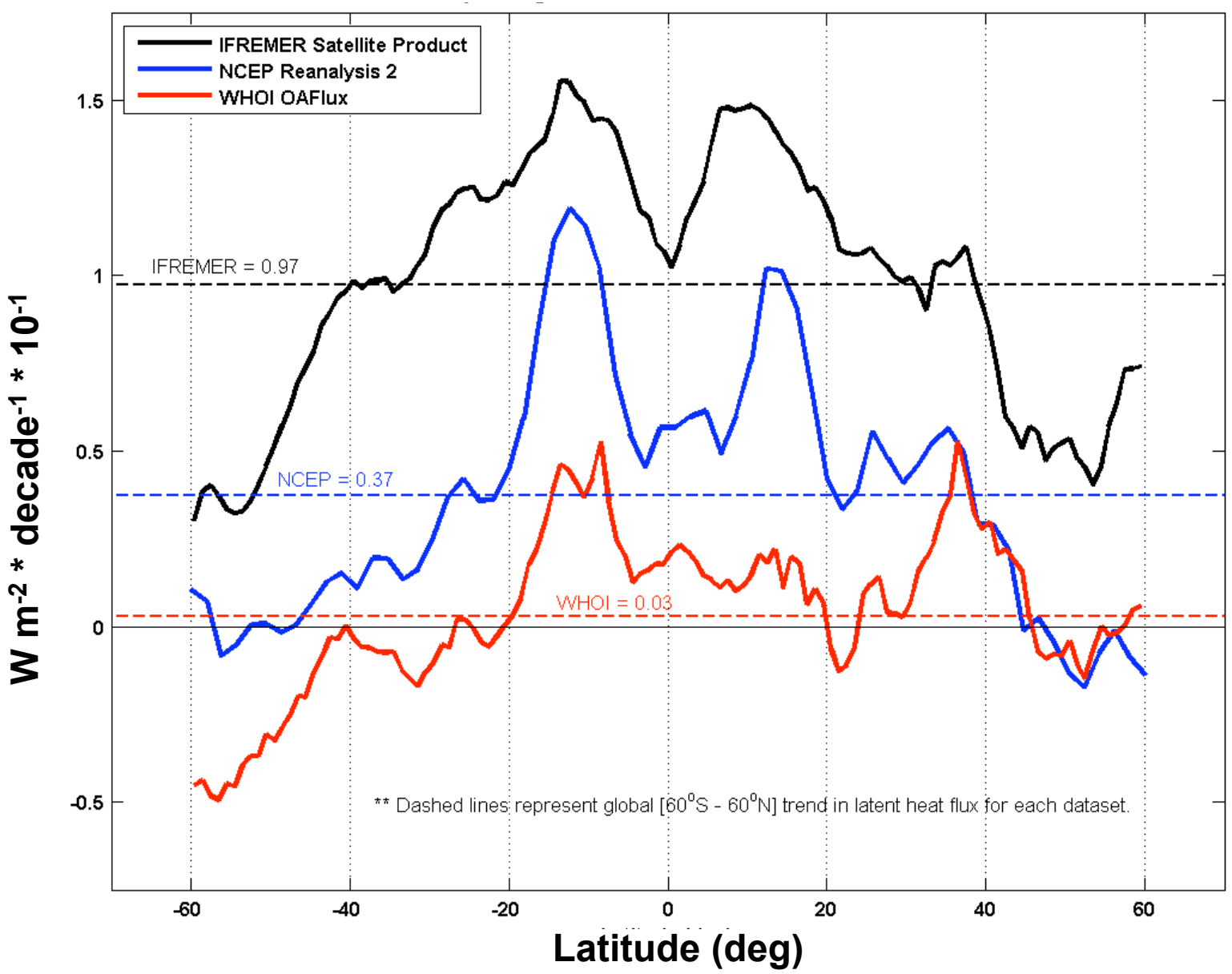
Spatial distribution of LHF trend - NCEP R-2



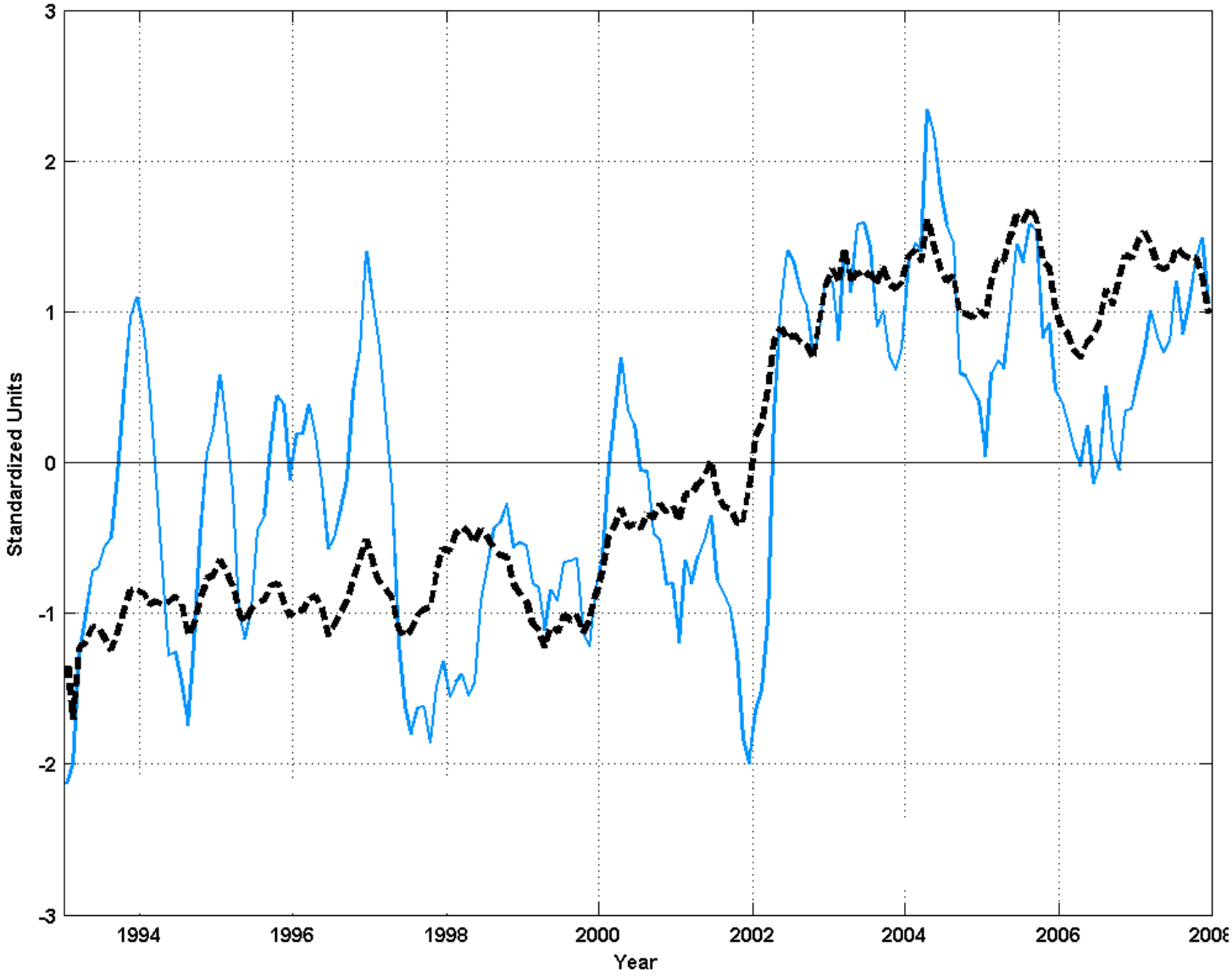
Spatial distribution of LHF trend - WHOI



Zonal Averaged Trends in LHF



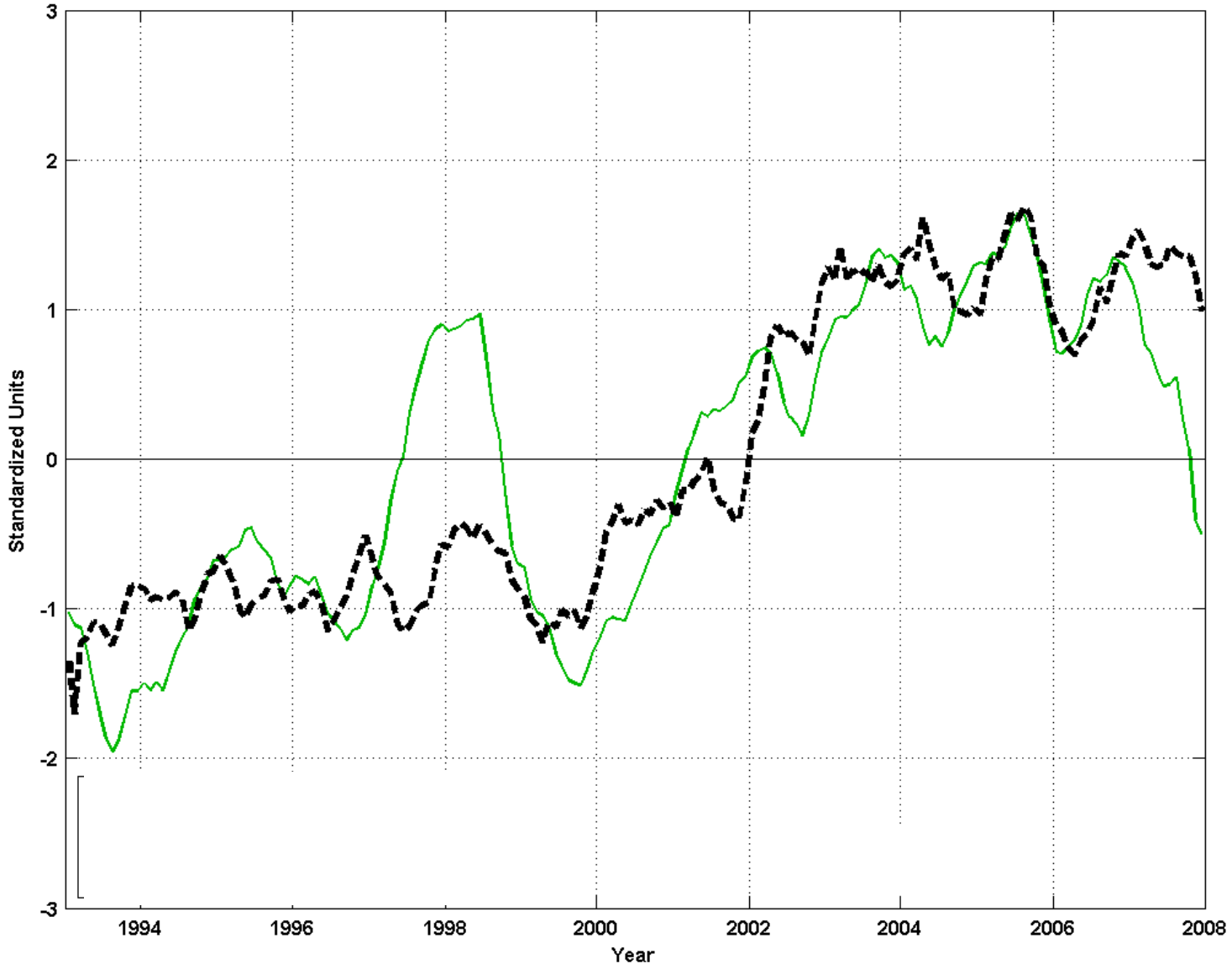
IFREMER - LHF (black) & WSP (blue) [SD Units]



SD of LHF = $4.7\,W/m^2$

SD of WSP = 0.093 m/s

IFREMER - LHF (black) & SST (green) [SD Units]



SD of LHF = $4.7\,W/m^2$

SD of SST = $0.11\,^{\circ}C$

Summary

- Of 3 datasets, IFREMER shows largest positive trend in LHF over 15 year period
- Trends in NCEP R-2 & WHOI are mostly tropical
- IFREMER trends are more global (includes mid & high latitudes)
- Qualitatively, positive trends in LHF of IFREMER are associated with positive trends in wind speed & SST

Further Work

- Perform statistical analysis on trends in LHF for each dataset to test for significance
- Quantify contribution of LHF parameters to overall, positive LHF trend
- Extend analysis to Climate Models

Questions ? ? ?