

Analysis of Long Time Series of Turbulent

t fluxes estimated from remotely sensed observations

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*Analysis of Long Time Series of Turbulent fluxes estimated
from remotely sensed observations*

- **Investigation of Error Sources.**
- **Analysis of the Spatial and Temporal Patterns**



New Release: 1992 - 2008

➤ Wind :

- *QuikSCAT new release (2008)*
- *Better consistency: ERS-1; ERS-2; NSCAT; QuikSCAT*

➤ HR SST V2 (Nov.

2

0

➤ Air Temperature:

08) (<http://www.ncdc.noaa.gov/oa/climate/research/sst/griddata.php>)

Iterative Procedure (Konda et al, 2003).

First Guess : NCEP2 2-m Air Temp.

➤ Objective Method

Improvement of spatial and temporal structure functions

Error Sources



Accuracy

Limitation of Fluxes only from Satellite retrievals

Limitation of Fluxes only from Satellite retrievals



Error =

F(Error

or_{Obs}, Error_{model}, Error_{Sampling}, Error_{Ol}, Error_{Param}, ...)

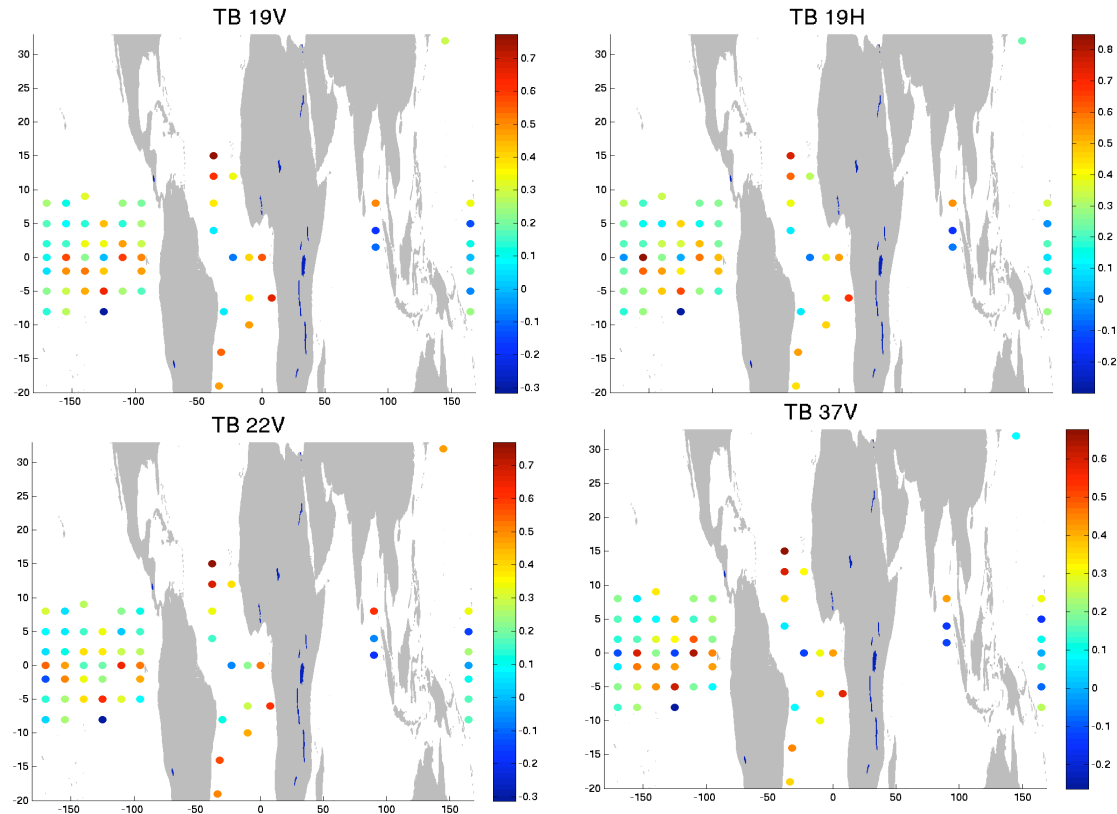
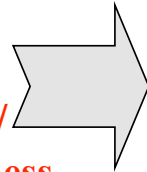


Error Source : Observations / Empirical models

➤ $Qa = a0 + a1*Tb19v + a2*Tb19h + a3*Tb22v + a4*Tb37v$

Correlation of
Collocated High
Resolution

Buoy Humidity /
Satellite Brightness
Temp. Data



● Existing empirical models may exhibit good results at global scale, but poorer at some locations.

● Better results are obtained based on the ‘empirical model tuning’ using buoy data

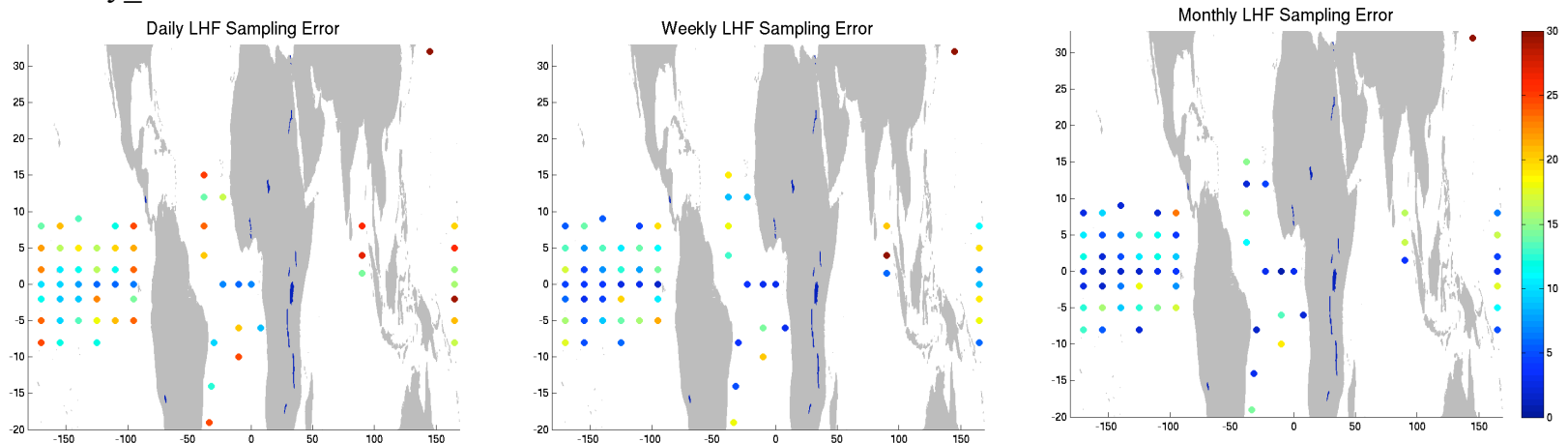


Error Source : Sampling Scheme

$$\text{Rms Difference} = V_{\text{buoy}} - V_{\text{buoy_sat}}$$

V_{buoy} = Hourly Buoy Data

$V_{\text{buoy_Sat}}$ = Hourly Buoy Data at Satellite local Time (QuikSCAT; SSM/I)



Correlation of LHF / Bulk Variable Rms Errors

Wind speed	Spec. Hum. (Qa)	Air Temperature	Sst
<u>0.91</u>	0.65	0.69	0.60

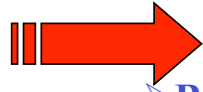
● **Poor Accuracy Results are Expected for Satellite Daily Estimates.**

● **Merging Satellite / In-situ / Numerical Models Reduces Temporal Sampling Error**

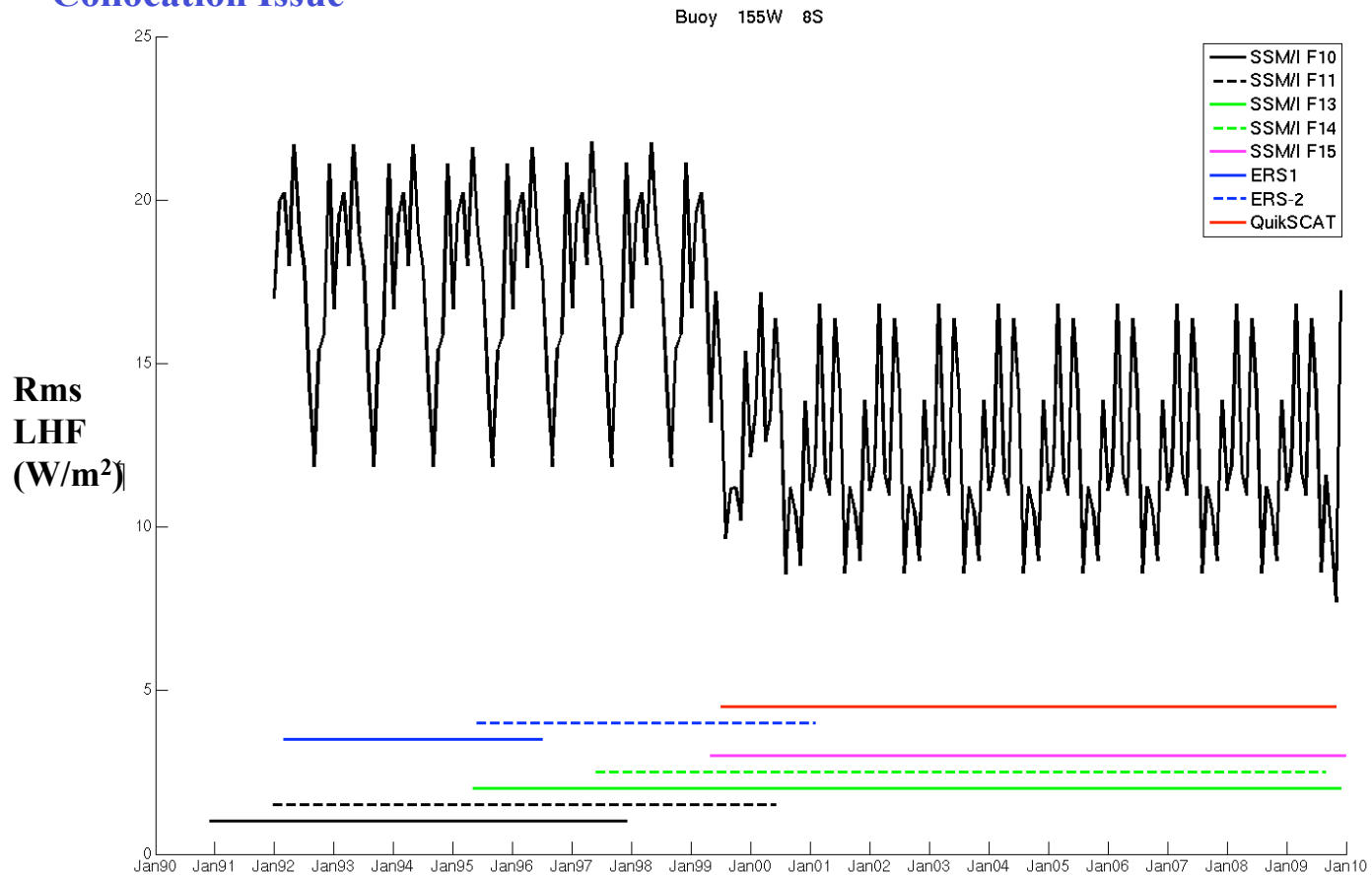


Error Source : Sampling Scheme

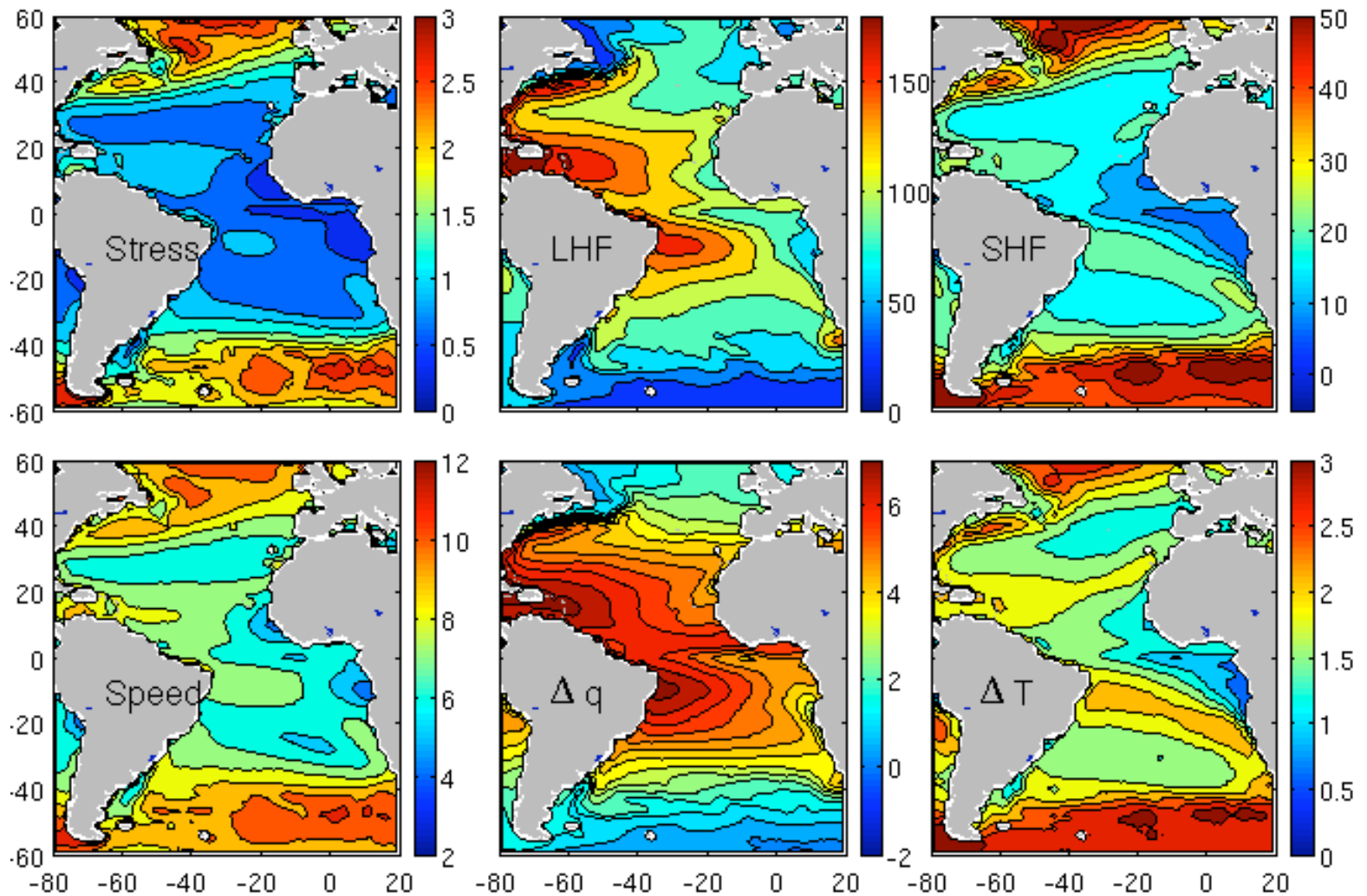
Impact on Long Time Series Analysis



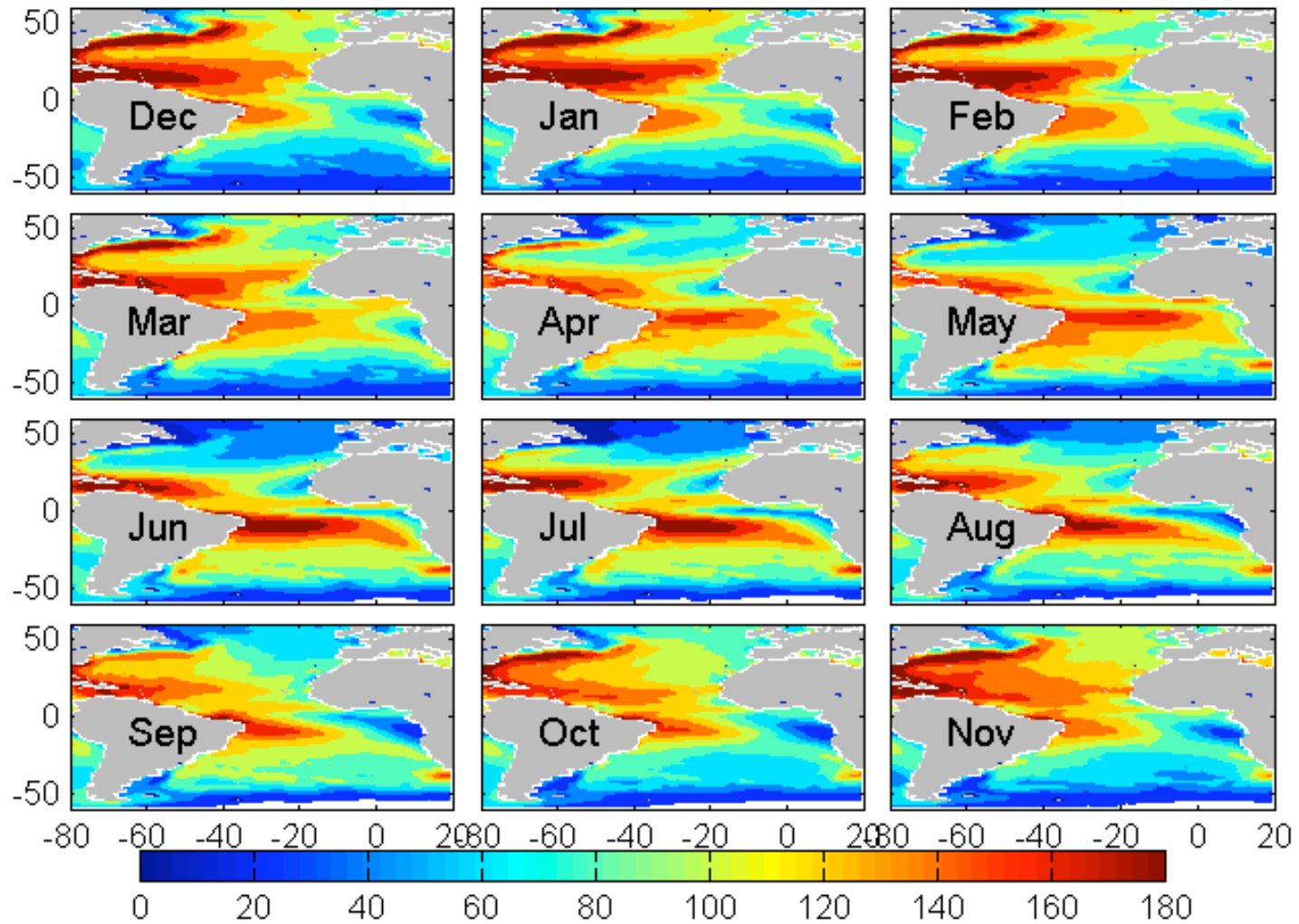
- Buoy Configuration during 1992 through 2009: Buoy Configuration of 2006
- Instrumental Characteristics (Swath, WVC, Orbit) are Considered for Collocation Issue



Satellite Turbulent Fluxes : 1992 - 2008

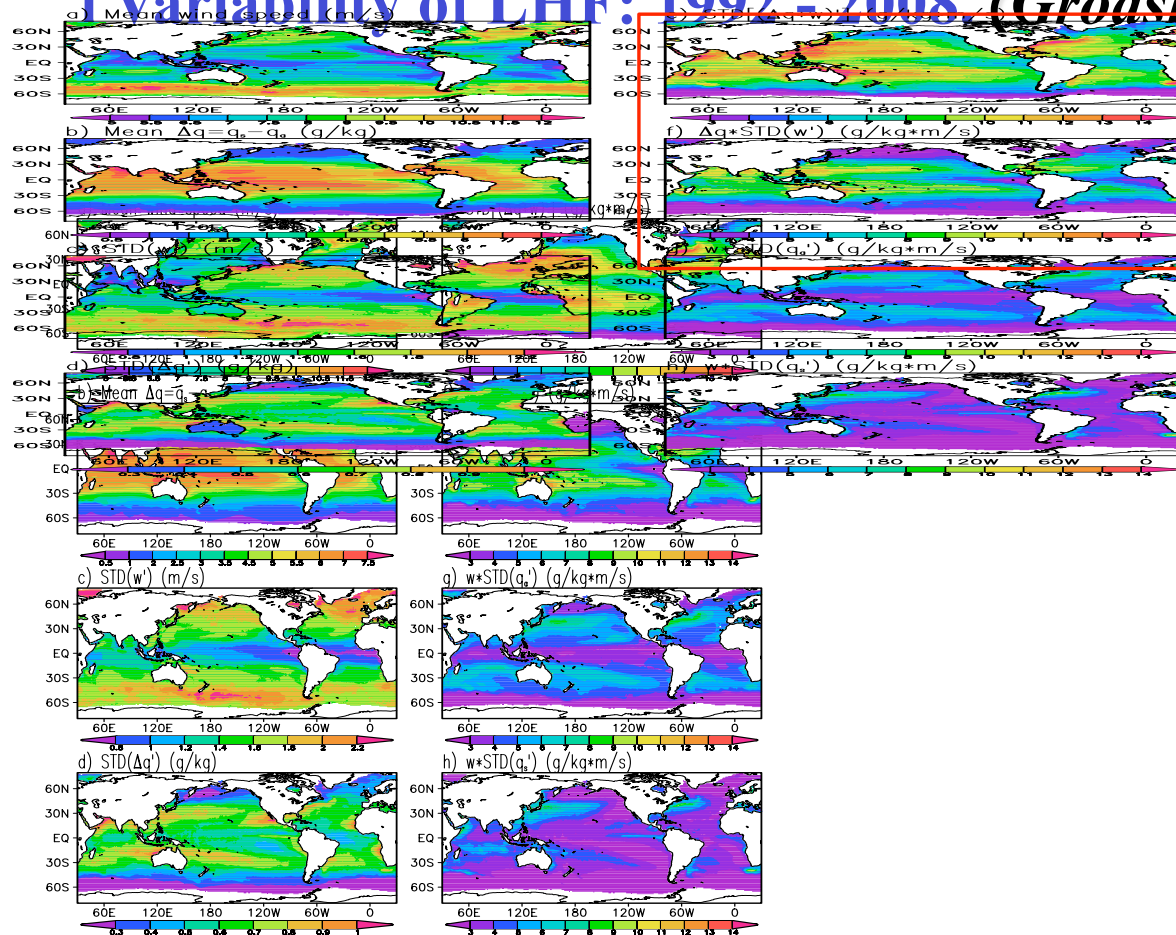


Monthly Mean of Latent Heat Flux: 1992 - 2008



a

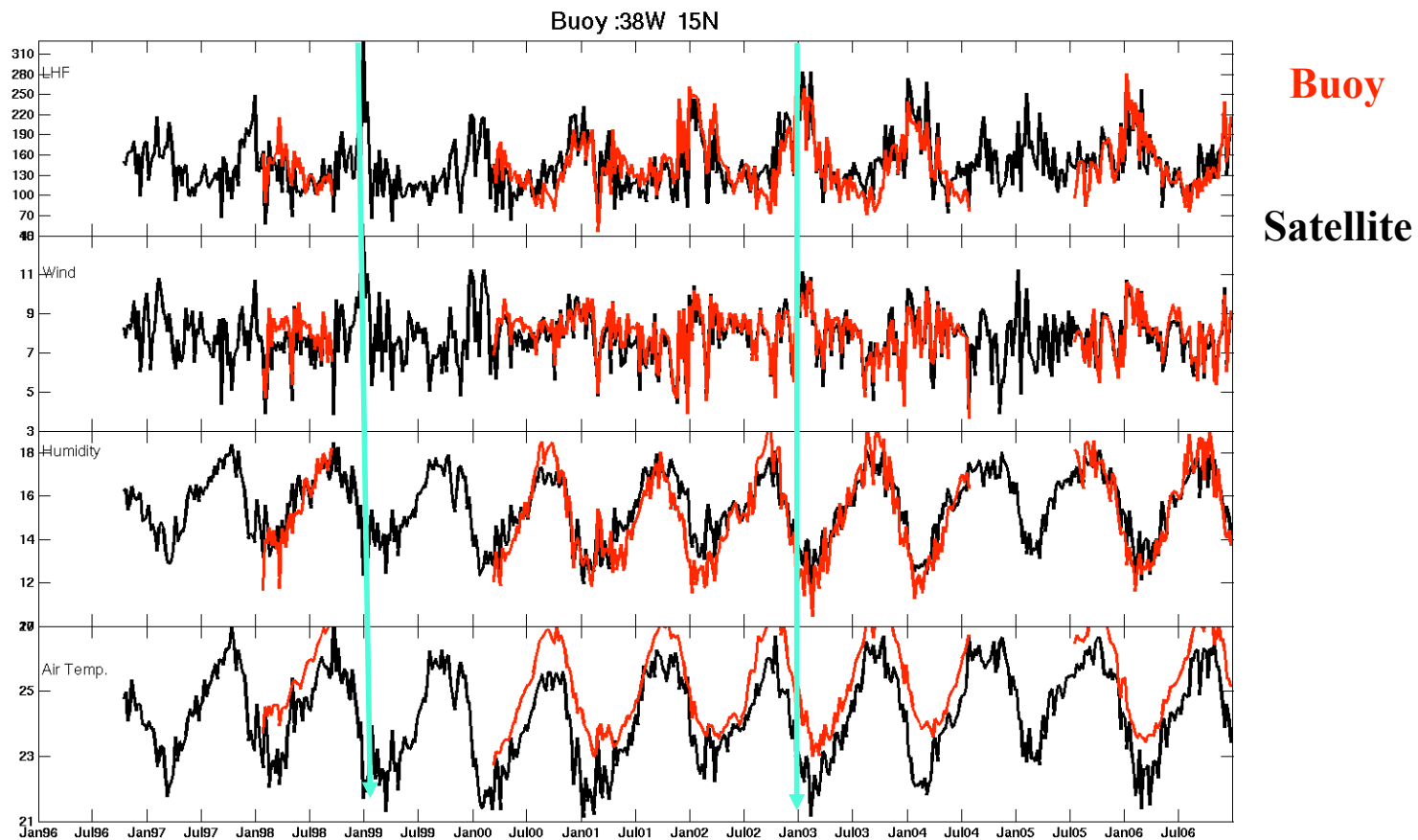
Variability of LHF: 1992 - 2008 (Grotsky et al, 2009)



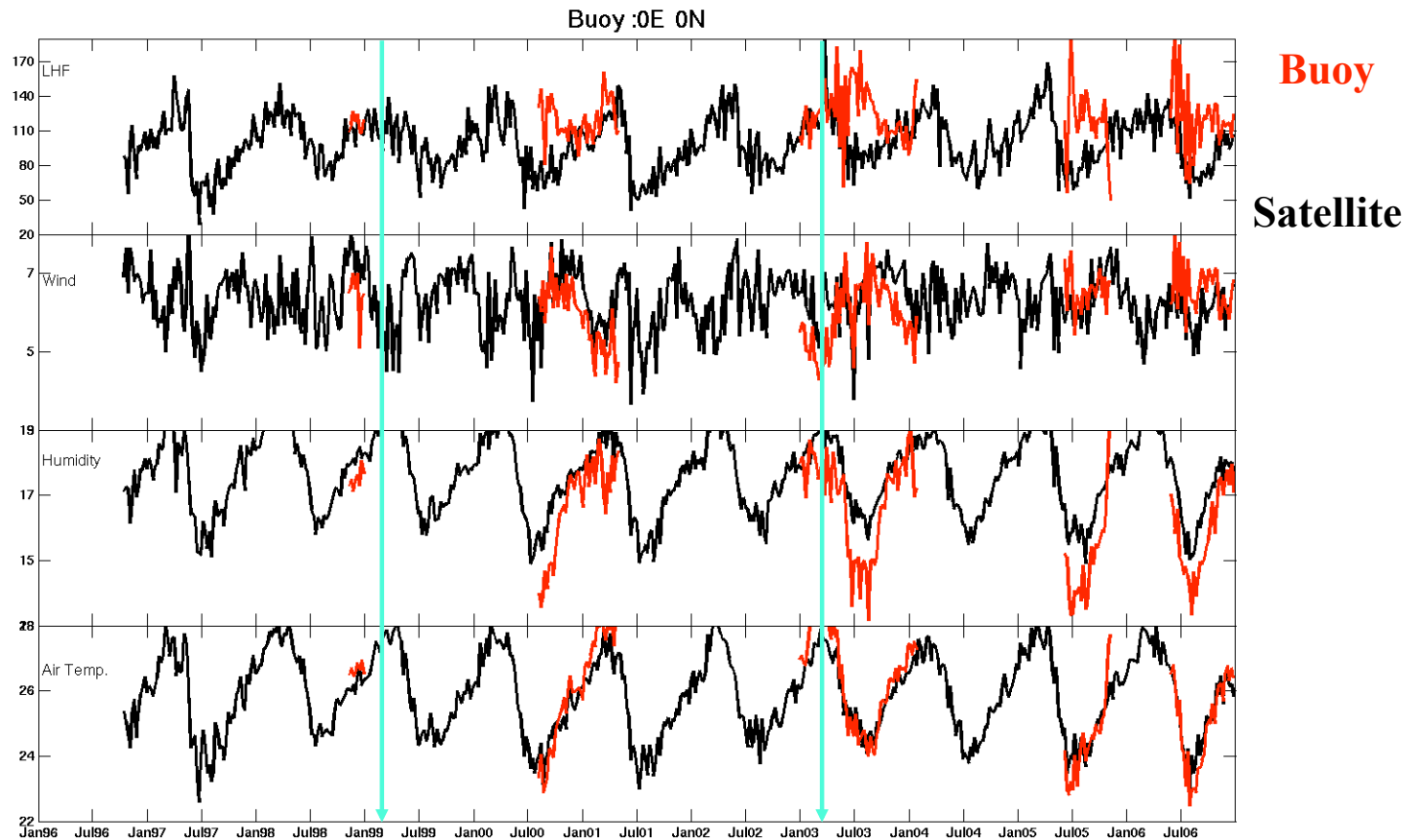
✓ At each grid point the anomalous LHTFL is calculated by removing the seasonal cycle (sum of the three first annual harmonics).

✓ Intraseasonal LHTFL is calculated by removing variations with periods exceeding 3 months from the anomalous LHTFL.

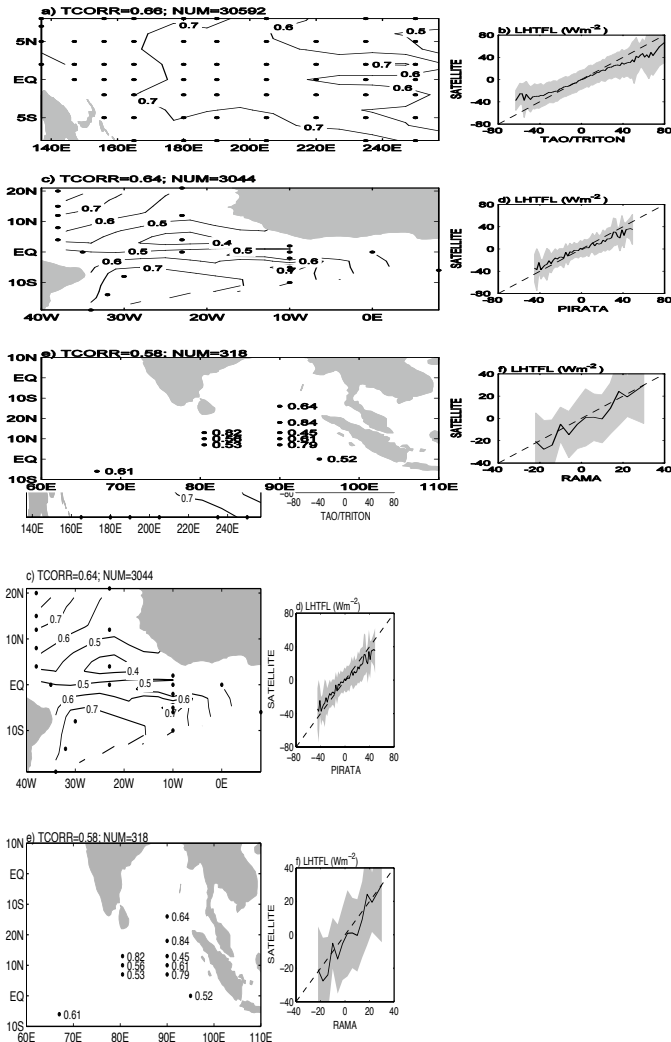
Time Series of Latent Heat Flux and of Bulk Variables



Time Series of Latent Heat Flux and of Bulk Variables



Intraseasonal LHTFL validation against the tropical ocean moorings

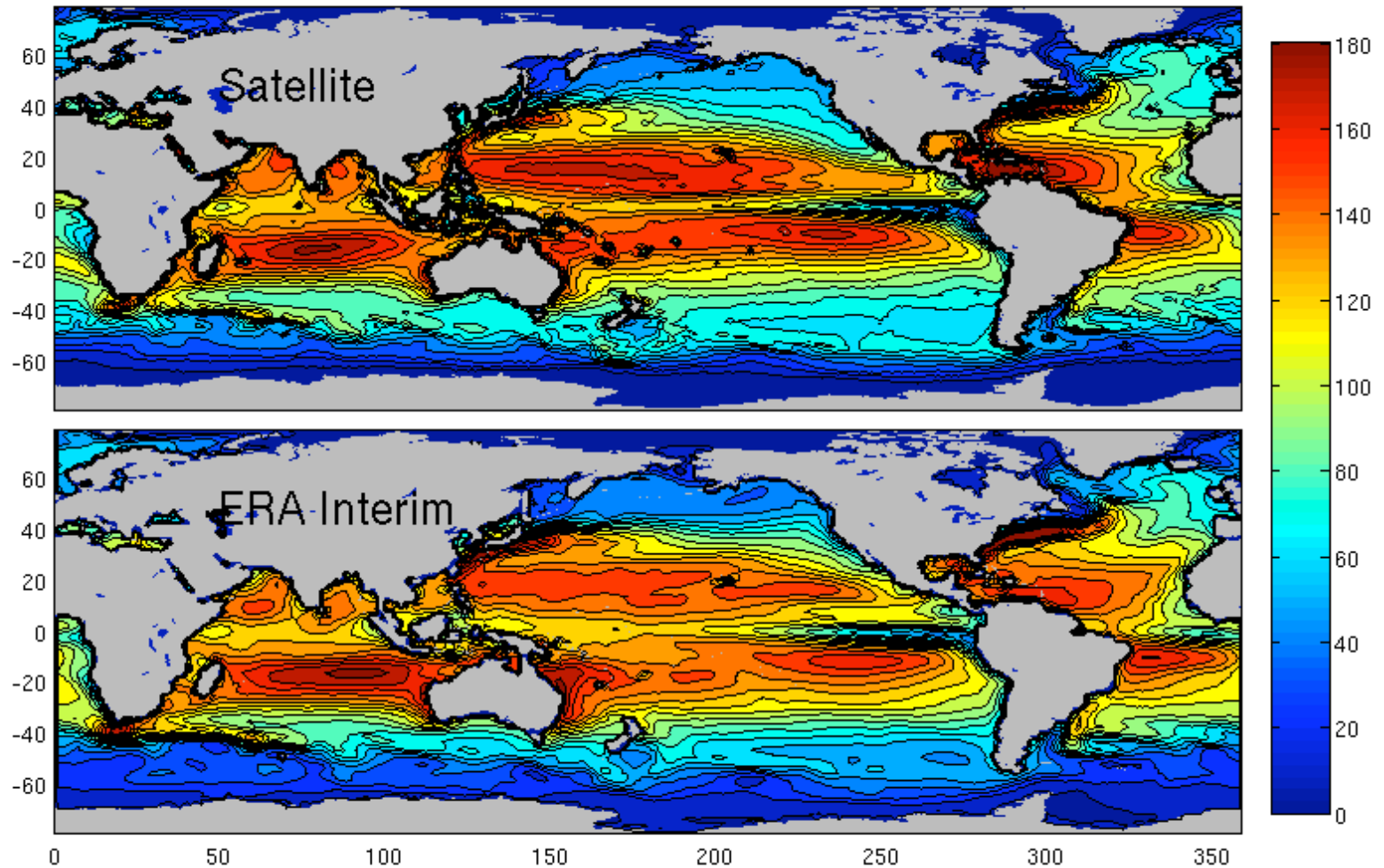


Satellite and buoy intraseasonal LHTFL are in good correspondence. But satellite LHTFL underestimates magnitudes of 'strong' events. Are some strong events missing by twice-a-day observations?

Time correlation (TCORR) of satellite and buoy intraseasonal LHTFL is well above the 99% confidence level. But TCORR is weaker in the ITCZ region.

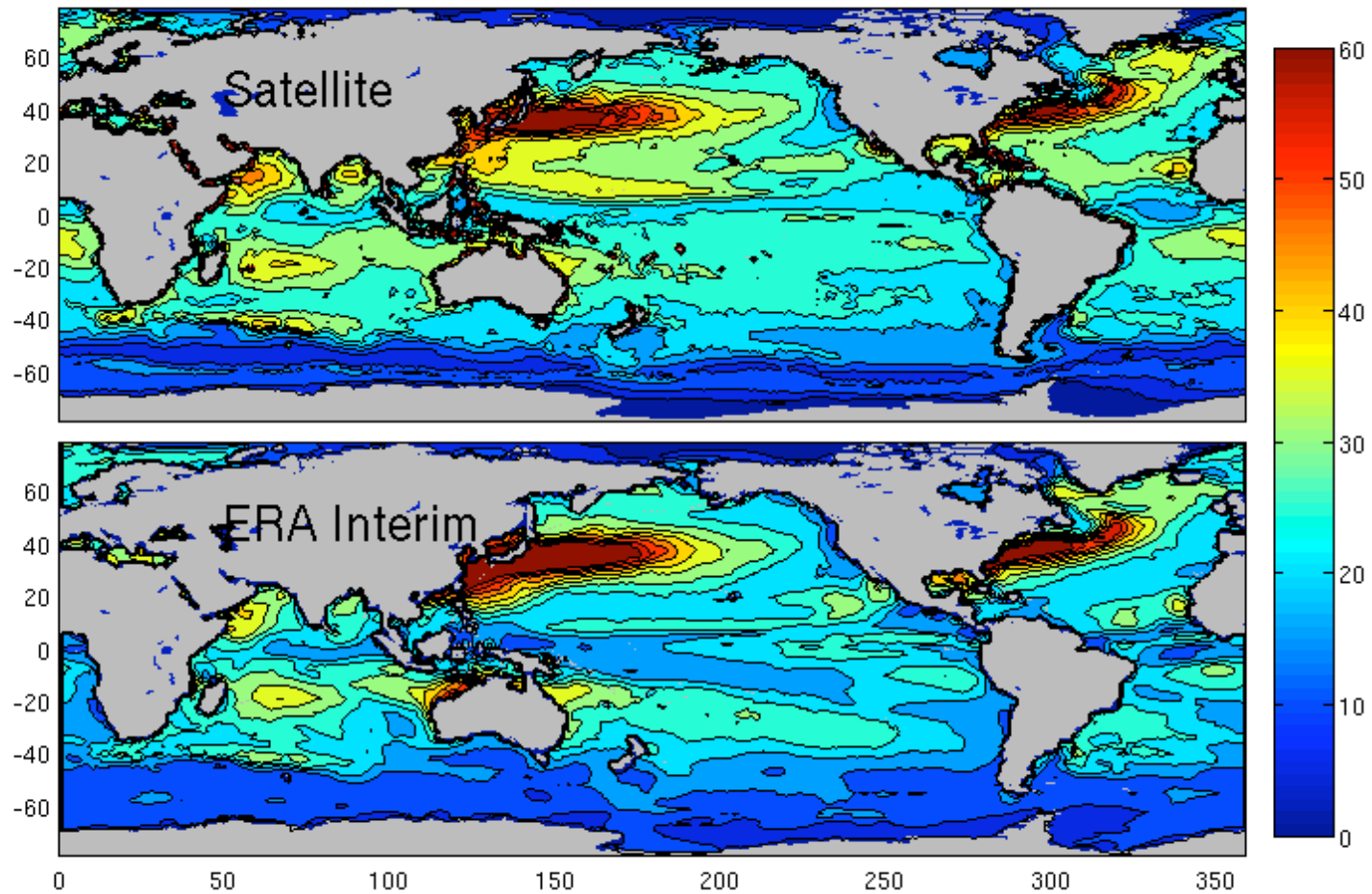
Annual Mean of Latent Heat Flux

LHF Mean: 1992 - 2008

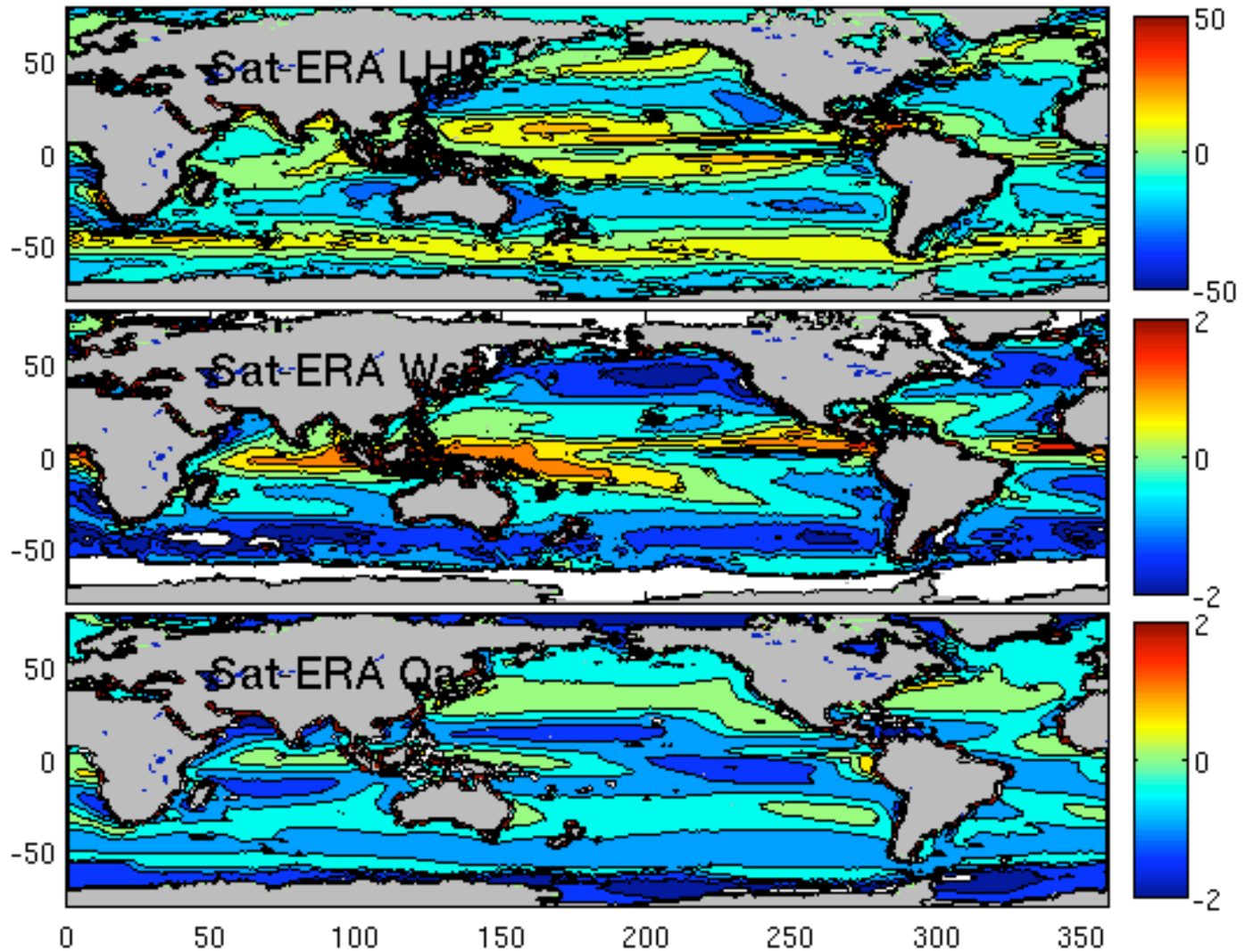


Variability of Latent Heat Flux

LHF Std: 1992 - 2008

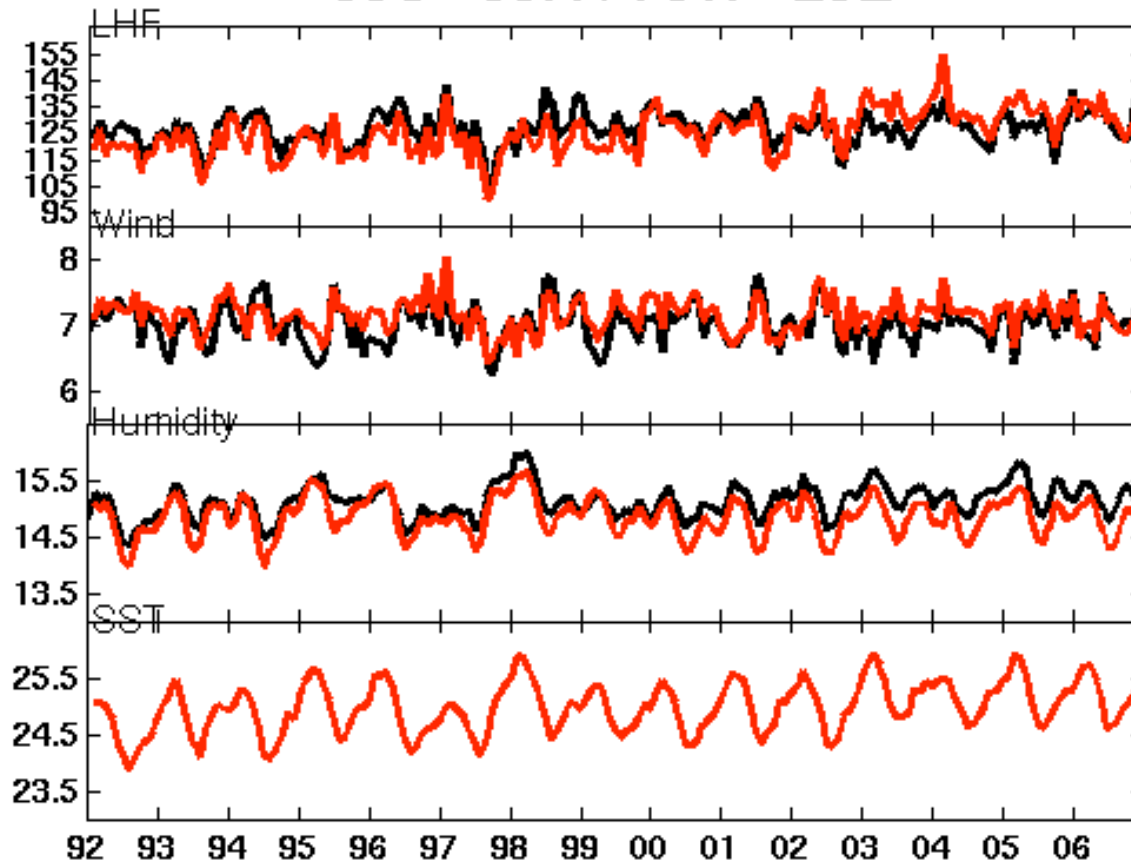


Mean of Satellite and Era Interim Differences : 1992 - 2008.



Time Series of Monthly-Averaged LHF and Bulk Variables Inter-Tropical Atlantic Ocean

30S - 30N / 70W - 20E



Satellite

Era Interim

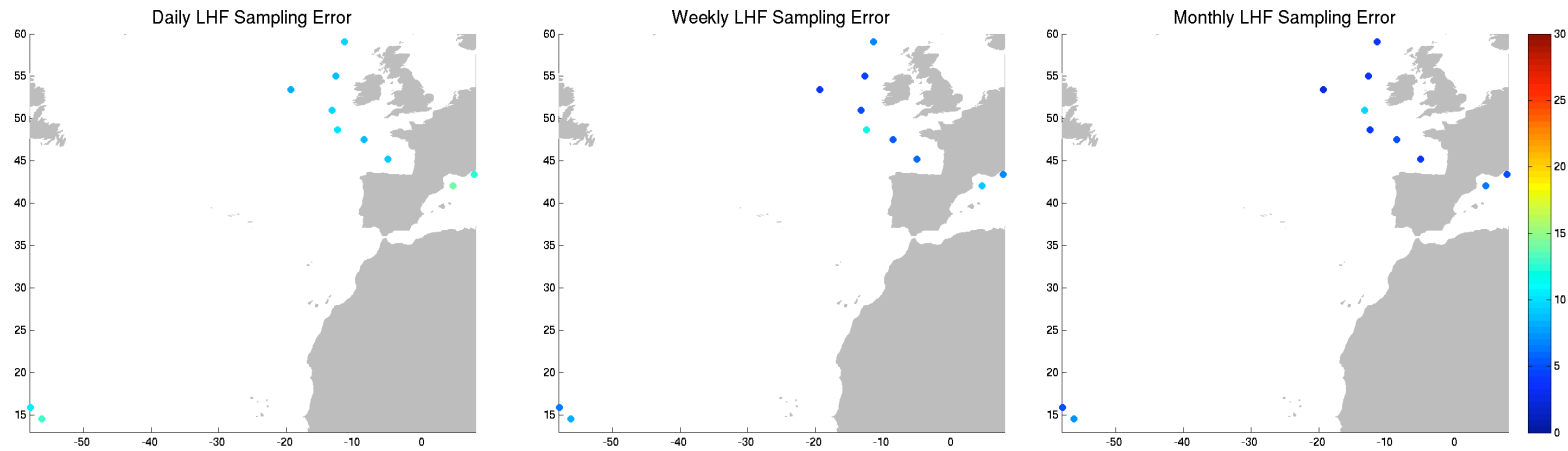


Summary / Perspectives

- **17 years of satellite fluxes are available**
<ftp://ftp.ifremer.fr/ifremer/cersat/products/gridded/flux-merged/flux/data/>
- **LHF variability compare well with Buoy and model**
- **LHF variability is not only associated to surface wind**
- **Further improvements are needed in the equatorial areas.**
- **Using ASCAT wind retrievals and AMSR-E**



Error Source : Sampling Scheme



● Poor Results are Expected for Satellite Daily Estimates.

● Merging Satellite / In-situ / Numerical Models Reduces Temporal Sampling Error



Correlation of SST and LHF : 1992 - 2008

