New Release of Oceanic Scatterometer and Radiometer Turbulent Air-Sea Fluxes

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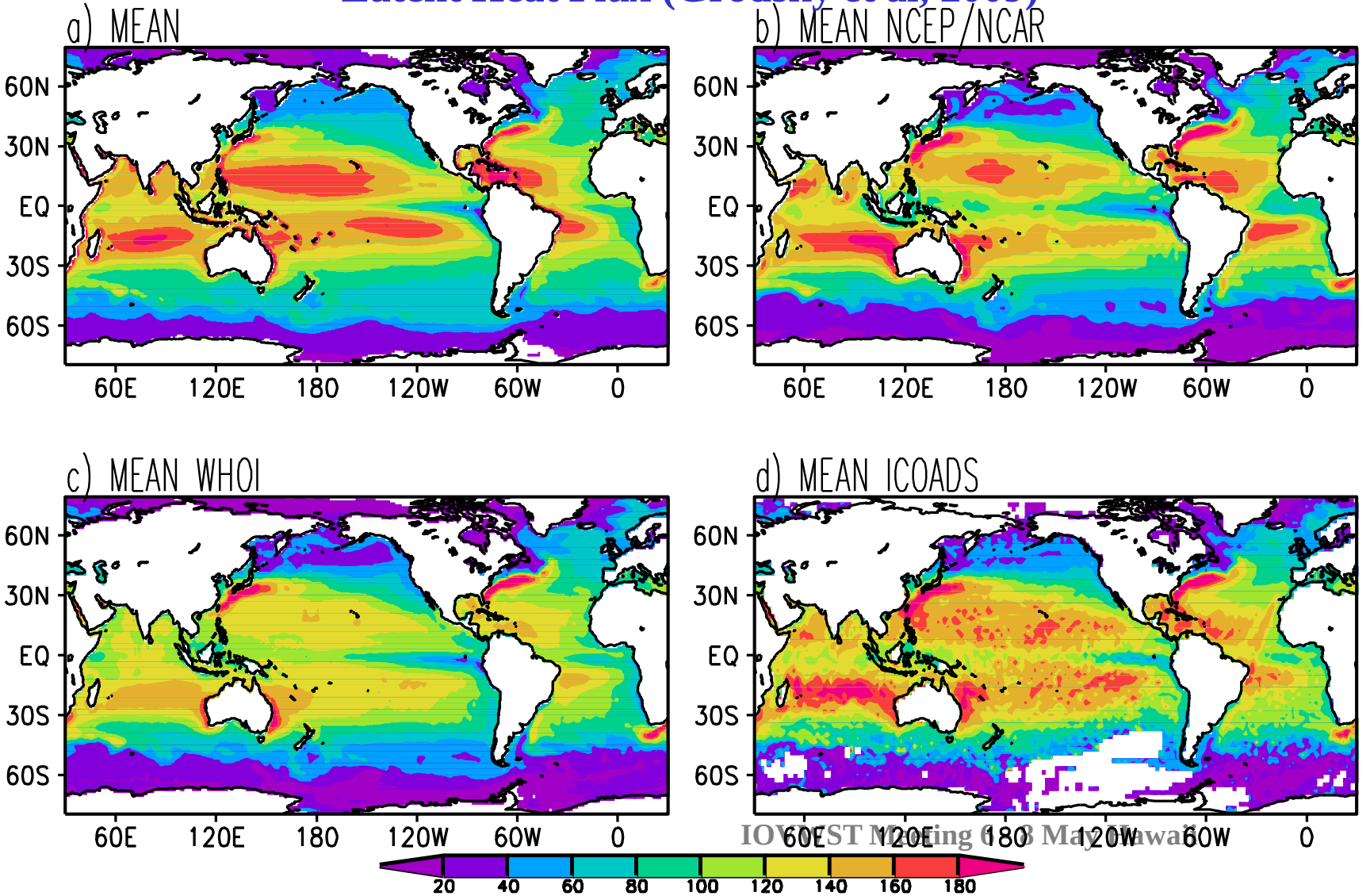
Background

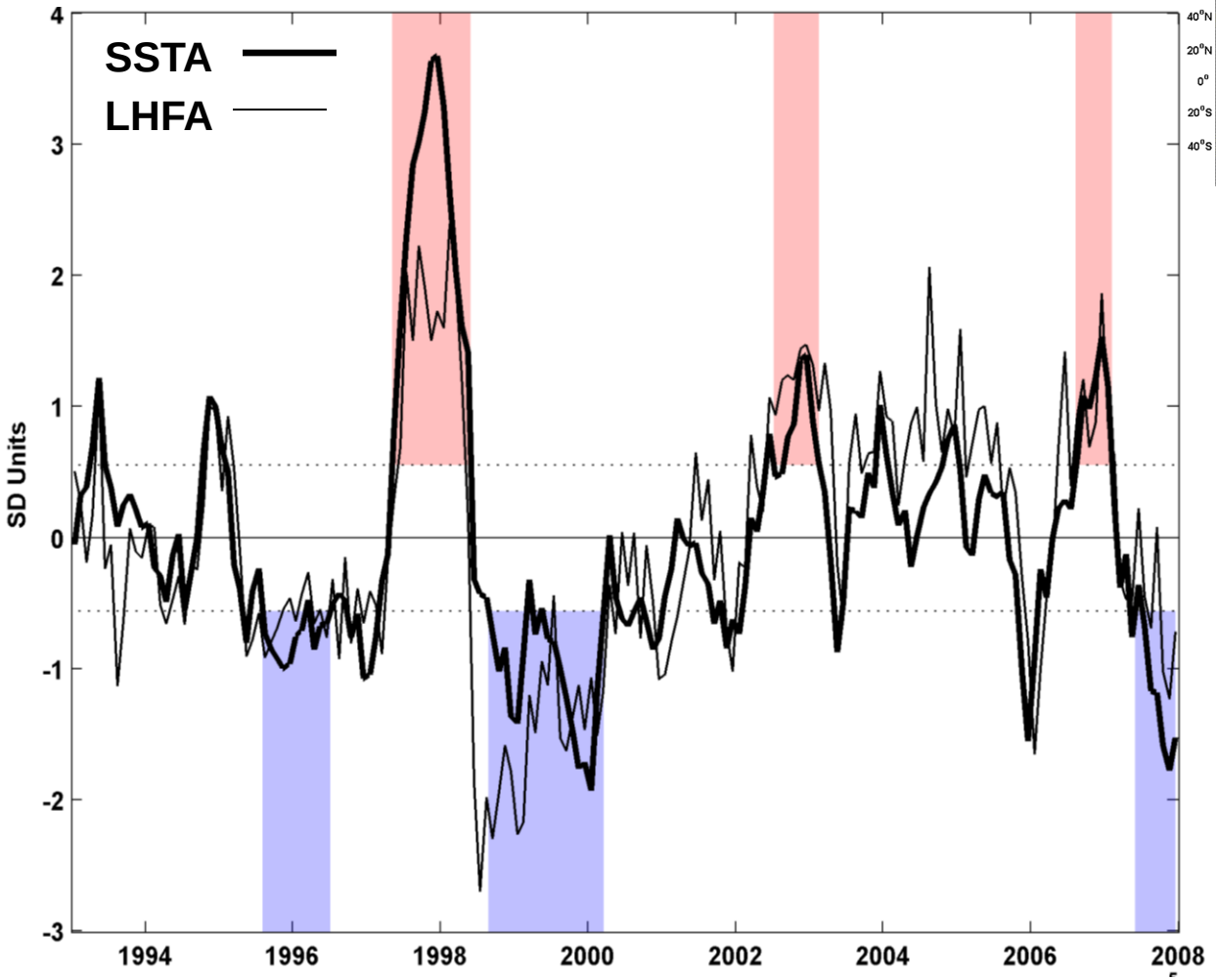
- **17 years of Satellite Fluxes over Global Ocean (Weekly / Monthly / 1°x1°)**

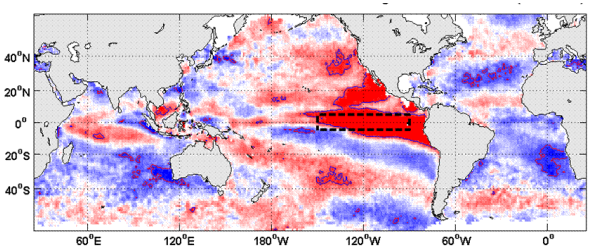
Latent Heat Flux (Grodsky et al, 2009)



ENSO Signal in LHF (Mestas *et al*, 2013)

Definition: El Niño and La Niña periods occur when the smoothed (5-month running) Niño-3 SSTAs remain warmer than 0.5°C or colder than -0.5°C for at least six consecutive months (*Trenberth* ,1997)





- **3 El Niño (red)**
- **3 La Niña (blue)**

ENSO events calculated using Niño-3 index (Trenberth 1997)

Turbulent Flux Accuracy Requirements

Grodsky S. A., A. Bentamy, J. A. Carton, R. T. Pinker , 2009: Intraseasonal latent heat flux based on satellite observations *Journal of Climate* 2009 early online release, posted April 2009 DOI: 10.1175/2009JCLI2901.1

Santorelli A. , R. T. Pinker, A. Bentamy, K. B. Katsaros, W. M. Drennan, A. M. Mestas-Nuñez, J. A. Carton, 2011 : Differences between two estimates of air-sea turbulent heat fluxes over the Atlantic Ocean. *JGR*., VOL. 116, C09028, 19 PP., doi:10.1029/2010JC006927

- Improvements of:
  - Specific air humidity
  - Surface wind speed
  - Air Temperature
- Improvement of spatial and temporal resolutions

New Release of Turbulent Fluxes (Bentamy *et al*, 2013) Main Changes

- **Wind :**
  - QuikScat retrievals (V3 (Fore *et al*, 2011)) including (Bentamy *et al*, 2012) results
- **Specific Air Humidity :**

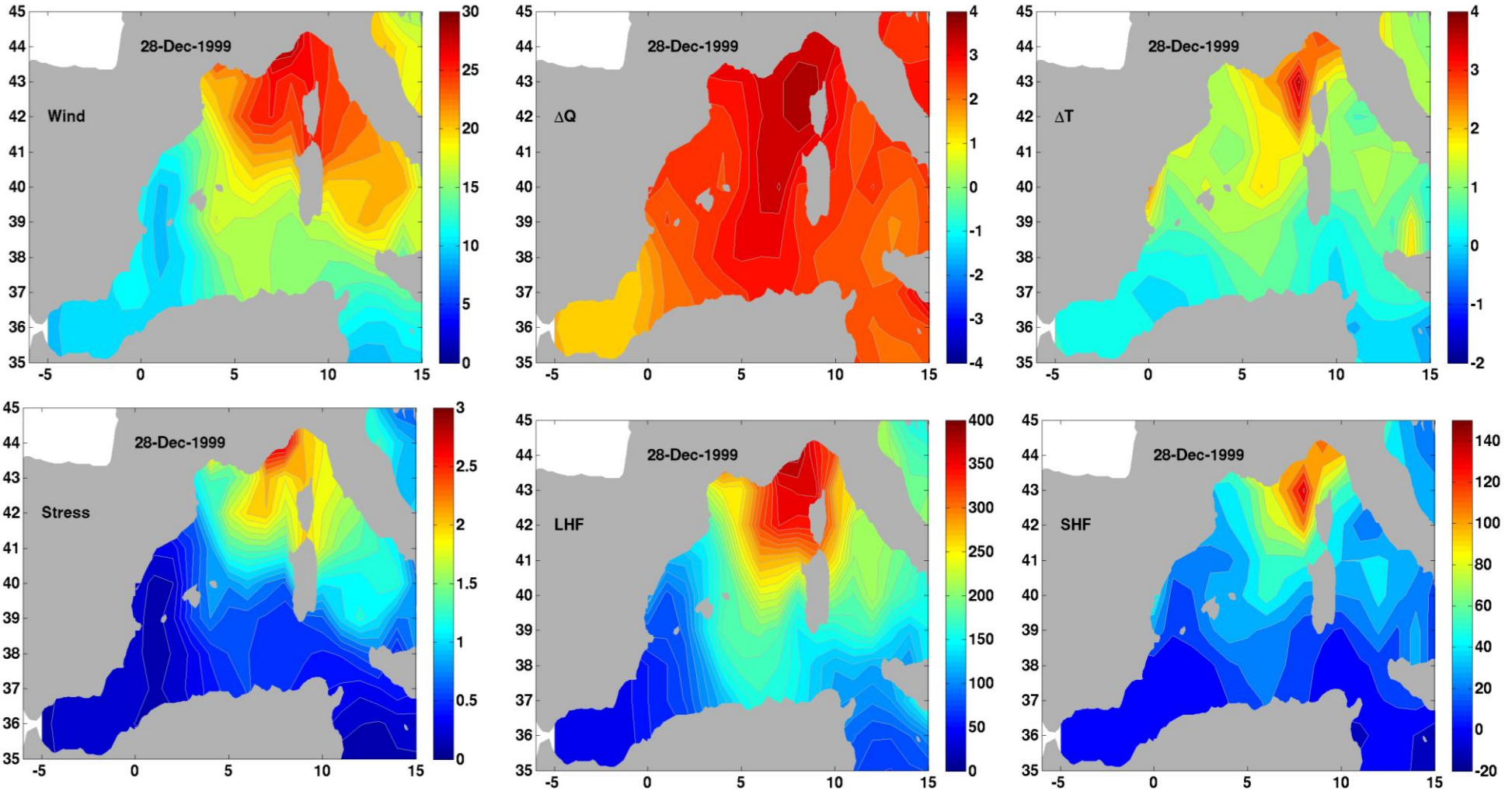
$$qa_{10} = f_1(\mathrm{Tb}_{19V}) + f_2(\mathrm{Tb}_{19H}) + f_3(\mathrm{Tb}_{22V}) + f_4(\mathrm{Tb}_{37V}) + g(\mathrm{SST}) + h(\Delta T)$$

Tb are from SSM/I F11 – F15

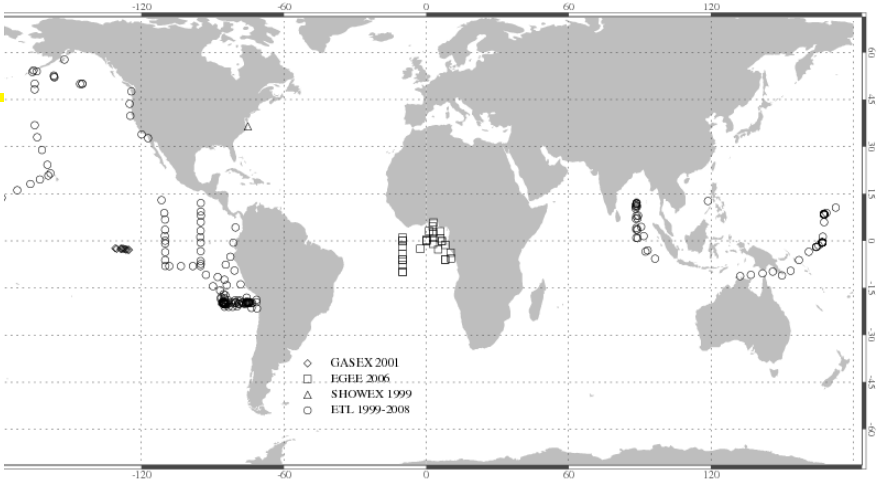
- **Air Temperature:**
  - Corrected Era Interim
- **Sea Surface Temperature**
  - HR SST V2 (Reynolds et al, 2007)

Objective Method (Bentamy *et al* , 2011)
Calculations of Global Daily and Monthly 0.25°x0.25° Flux Analyses.

Daily Fluxes from Remotely Sensed Data

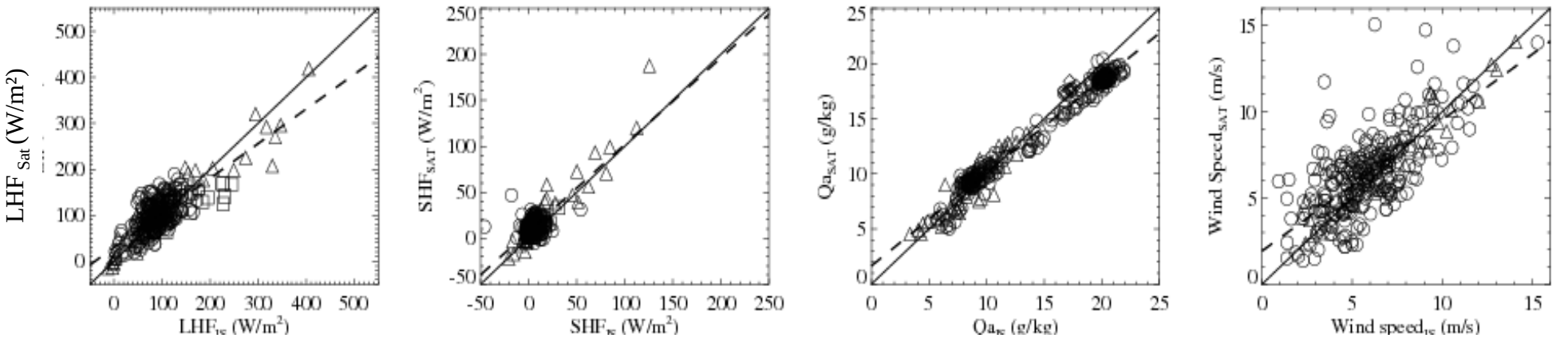


Assessment of the Turbulent Flux Accuracy

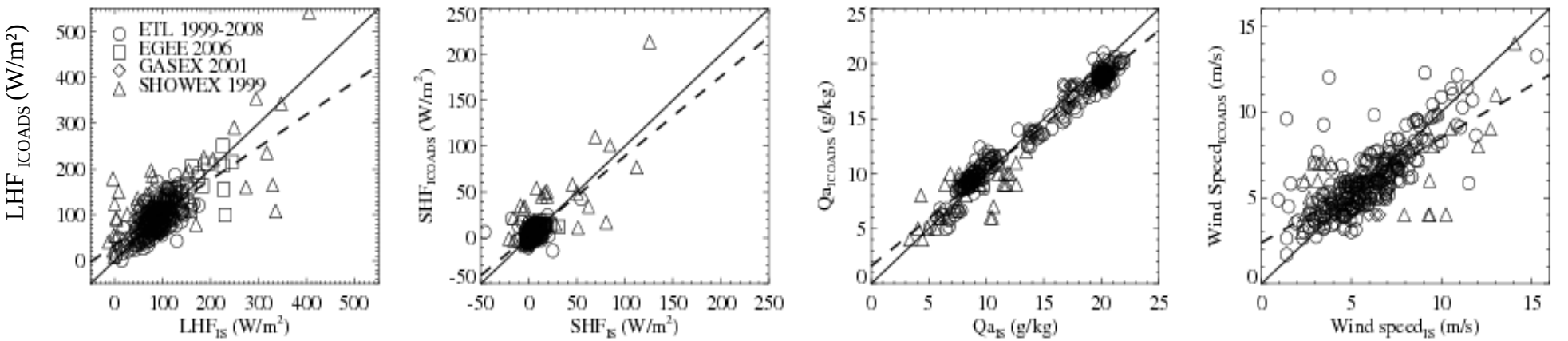


- Spatial and temporal Collocation of Daily Estimates

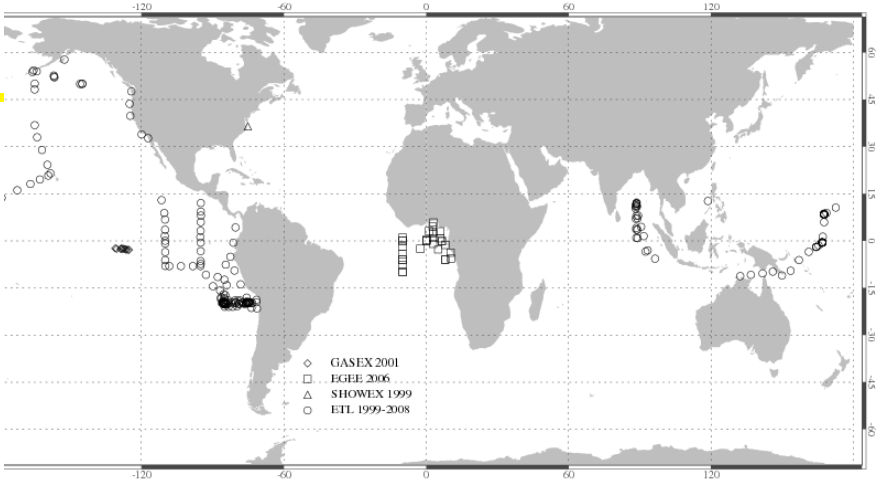
In-Situ / Satellite



In-Situ / ICOADS(Berry et al, 2011)



Assessment of the Turbulent Flux Accuracy



- Spatial and temporal Collocation of Daily Estimates
- Outliers are excluded

		LHF (W/m²)		SHF(W/m²)		Stress(10^{-3}N/m²)	
		Bias	SDE	Bias	SDE	Bias	SDE
	Ifremer	-6.0	31.5	-1.9	11.9	-7.5	23.3
Brunke *et al*, 2011	ERA-I	17.6	34.7	2.7	14.2	-2.3	43.3
	CFSR	19.3	44.8	-0.3	22.6	4.8	89.1
	HOAPS	1.7	50.3	-1.4	18.1		
	OAFLUX	11.6	41.0	2.2	18.1		

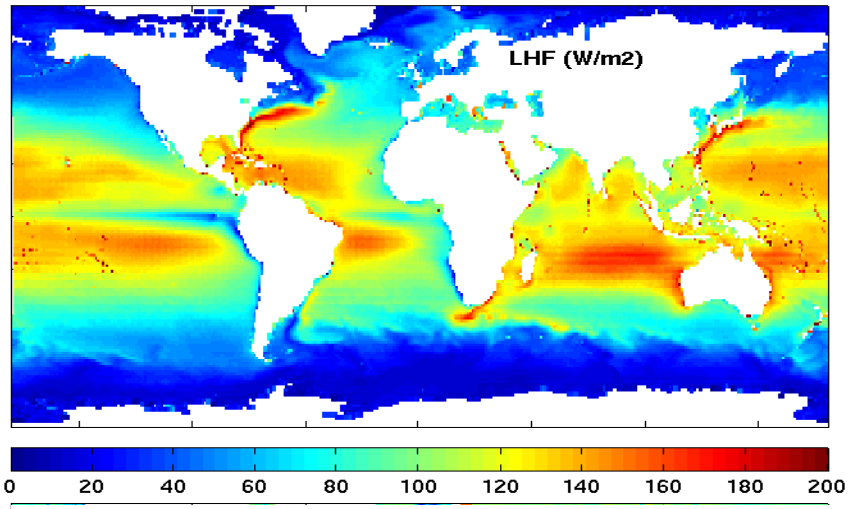
ICOADS / Satellite Comparisons
Impact of Basic Variables

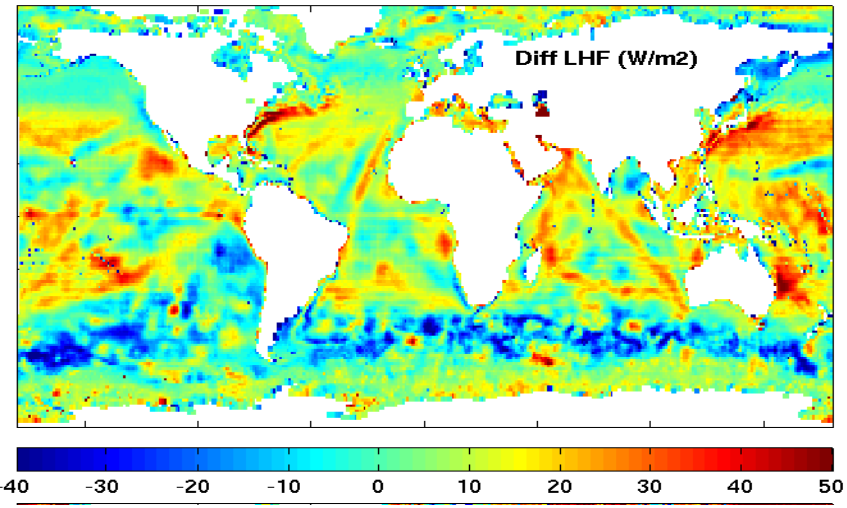
$$dLhf = (\partial Lhf/\partial U)dU + (\partial Lhf/\partial Ce)dCE + (\partial Lhf/\partial Qa)dQa + (\partial Lhf/\partial Qs)dQs$$

$$= dLHF_U + dLHF_{Ce} + dLHF_{Qa} + dLHF_{Qs}$$

$$Lhf = \rho \times Lv \times U \times (Qs-Qa)$$

$$dU = U_{nocs} - U_{satellite;}\ dCe = Ce_{nocs} - Ce_{satellite};\ dQa = Qa_{nocs} - Qa_{satellite};\ dQs = Qs_{nocs} - Qs_{satellite}$$





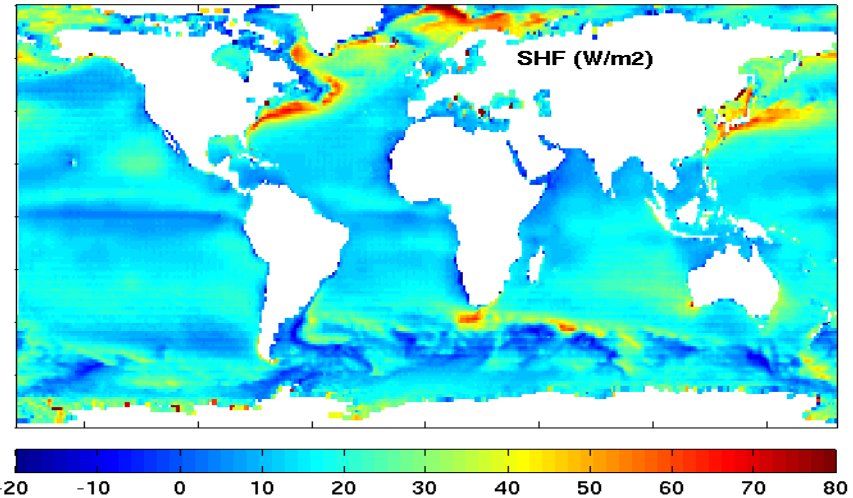
ICOADS / Satellite Comparisons
Impact of Basic Variables

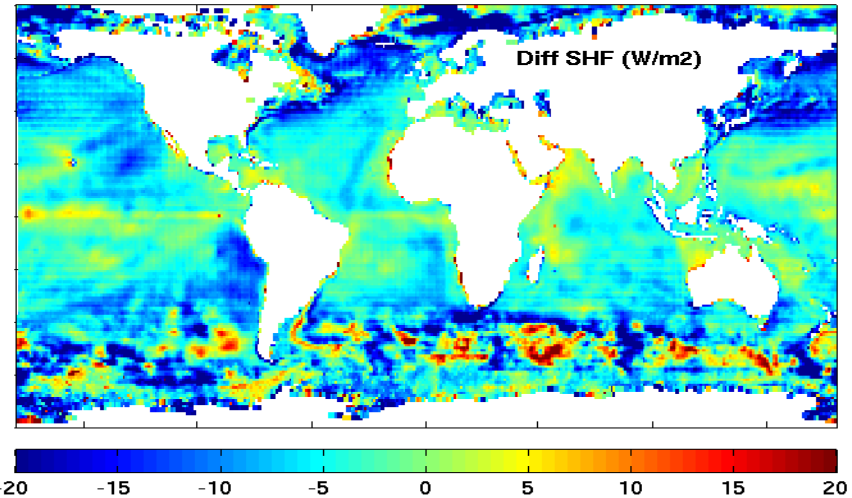
$$dShf = (\partial Lhf/\partial U)dU + (\partial Lhf/\partial Ch)dCH + (\partial Lhf/\partial Ta)dTa + (\partial Lhf/\partial Sst)dSst$$

$$= dLHF_U + dLHF_{Ch} + dLHF_{Ta} + dLHF_{Sst}$$

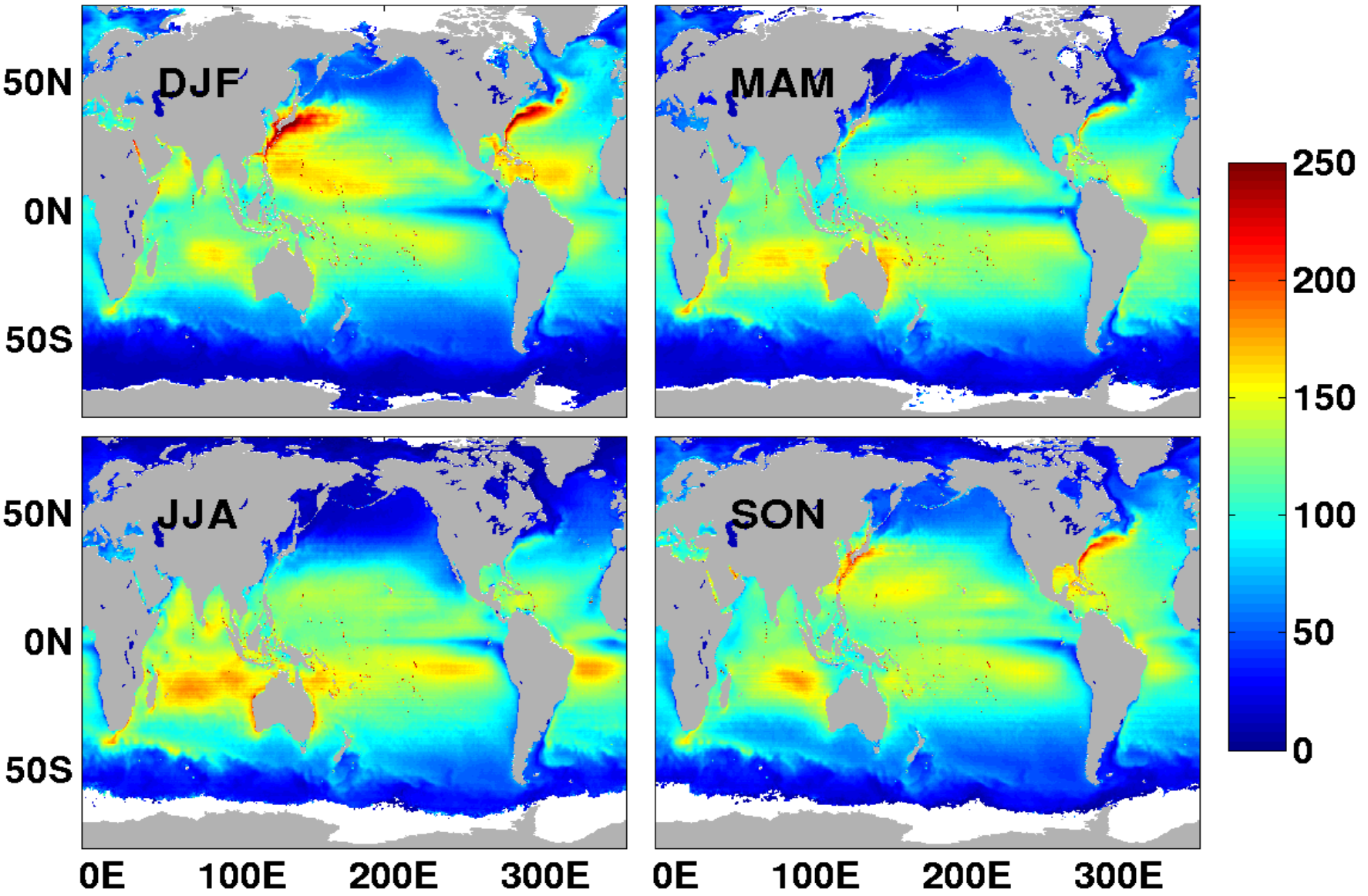
$$Shf = \rho \times CP \times U \times (Sst - Ta)$$

$$dU = U_{buoy} - U_{satellite};\ dCh = Ch_{buoy} - Ch_{satellite};\ dTa = Ta_{buoy} - Ta_{satellite};\ dSst = Qsst_{buoy} - Qsst_{satellite}$$

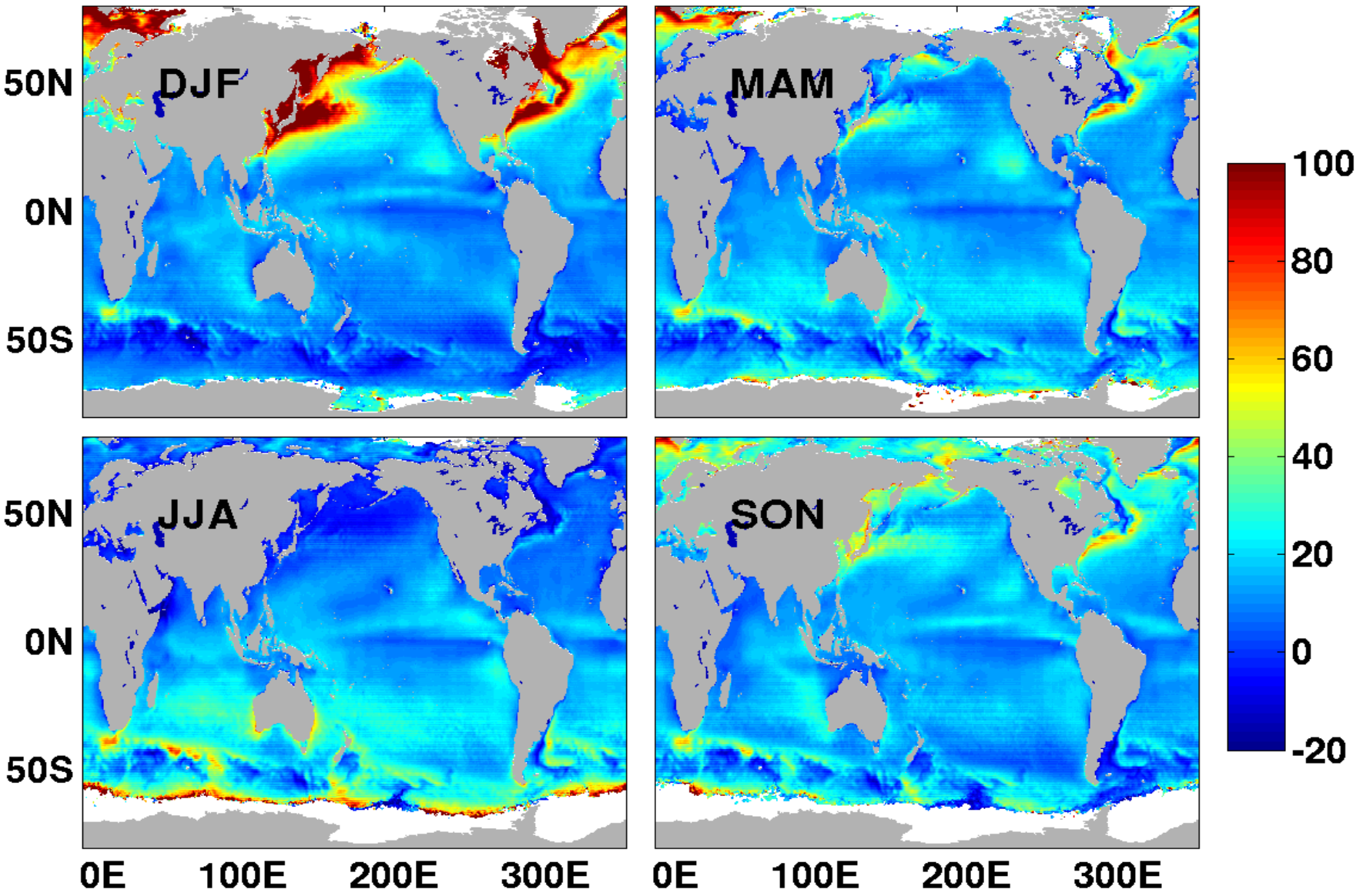




LHF Seasonal Patterns



SHF Seasonal Patterns



Summary / Perspectives

- Flux Improvements are achieved
- Better Results at global scale
- Good Agreement with In-situ Estimates
- Long Time Series: 1999 - 2009
- Further Validations
- Spatial and Temporal Resolutions Issues
- Forcing Impact : exp. Upwelling systems
- Extended Time Period: 1992 - 2012