Development and initial analysis of the DEEP-C surface energy flux product

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Contents

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- Paper on net surface fluxes published in JGR
- Data for both TOA and surface fluxes are updated
- Current work
  - Comparison of surface flux products
  - Investigation on discrepancies between different products
- Summary

Data updated

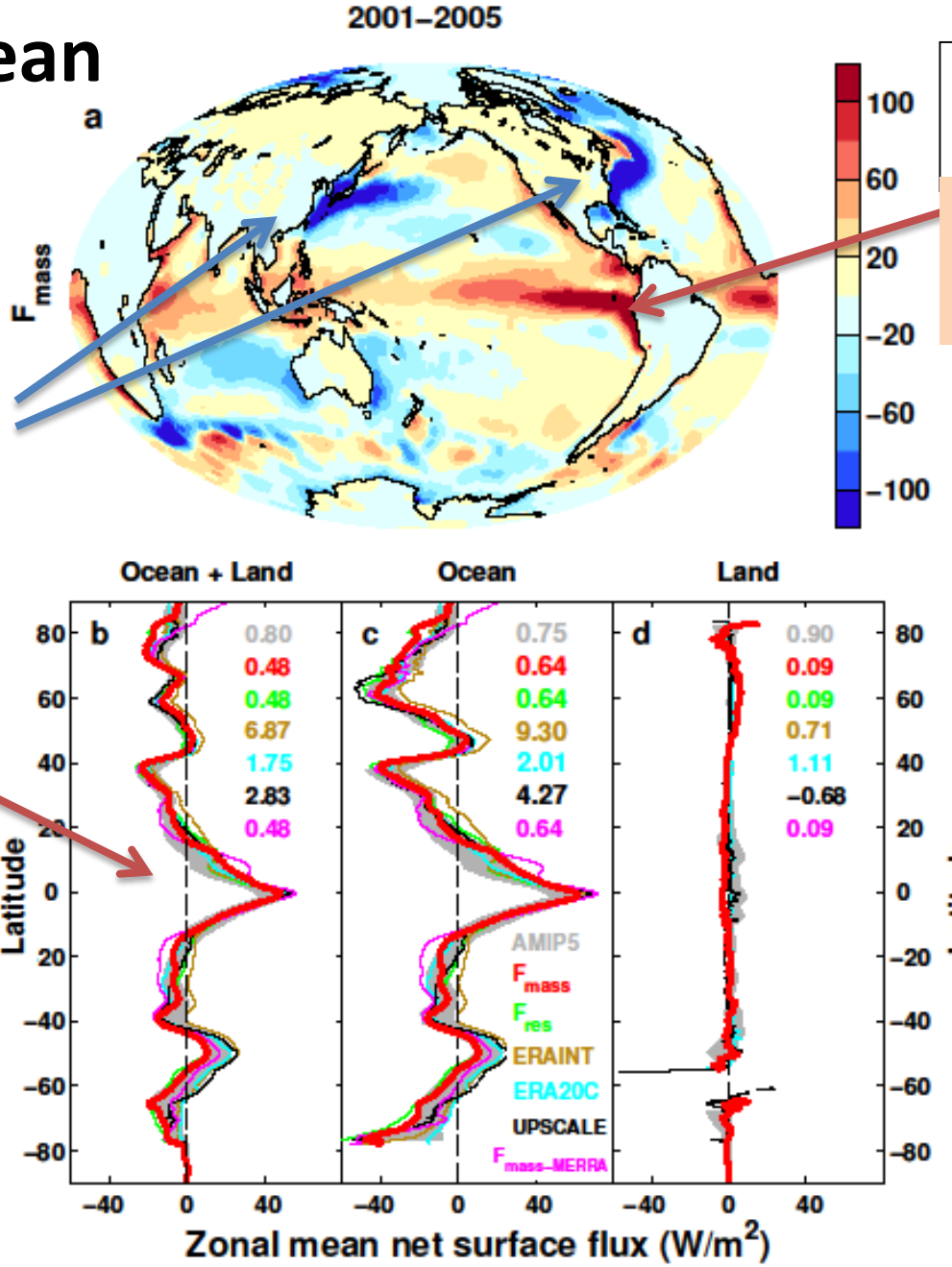
- Liu, C., Allan, R. P., Berrisford, P., Mayer, M. , Hyder , P. , Loeb, N. , Smith, D. , Vidale, P. L. and Edwards, J. M. (2015) ***Combining satellite observations and reanalysis energy transports to estimate global net surface energy fluxes 1985-2012.*** *Journal of Geophysical Research*: Atmospheres. ISSN 2169-8996 doi: **10.1002/2015JD023264.**

- Geodetic weighting and days in a month are considered in CERES satellite data

- Updated data are at the site **http://www.met.reading.ac.uk/~sgs01cll/asym/as.html**

- Effect is minor in general, but large for cross-equator energy transport

Multi-annual mean



Cold tongue + Tropical Instability Wave

Willett et al **(2006 Prog in Oceanog)**

Warm surface over Gulf Stream and Kuroshio current

Kwon et al **(2010 J Clim)**

Good variation agreement between data sets

Reconstructed TOA radiation fluxes

(Allan et al 2014, GRL)

\+

mass corrected atmospheric energy divergence of ERA-Interim

Liu et al **(2015 JGR)**

Uncertainty

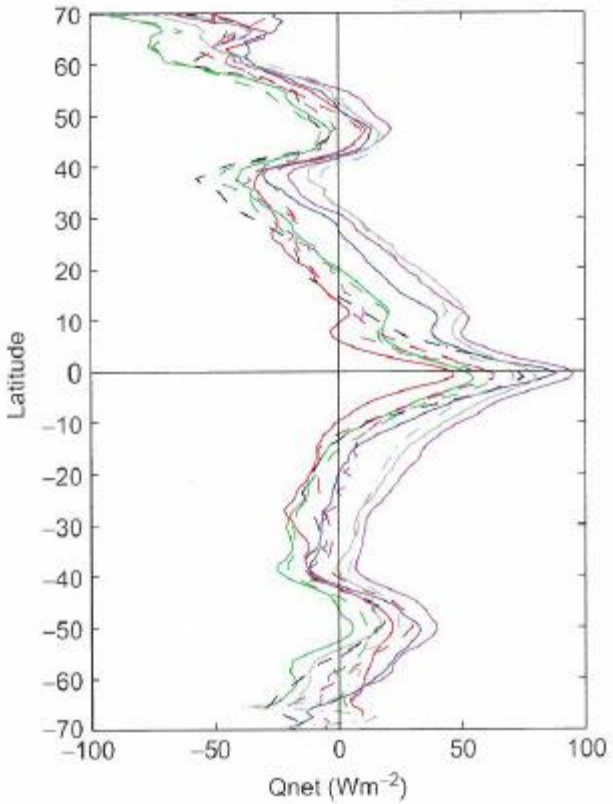
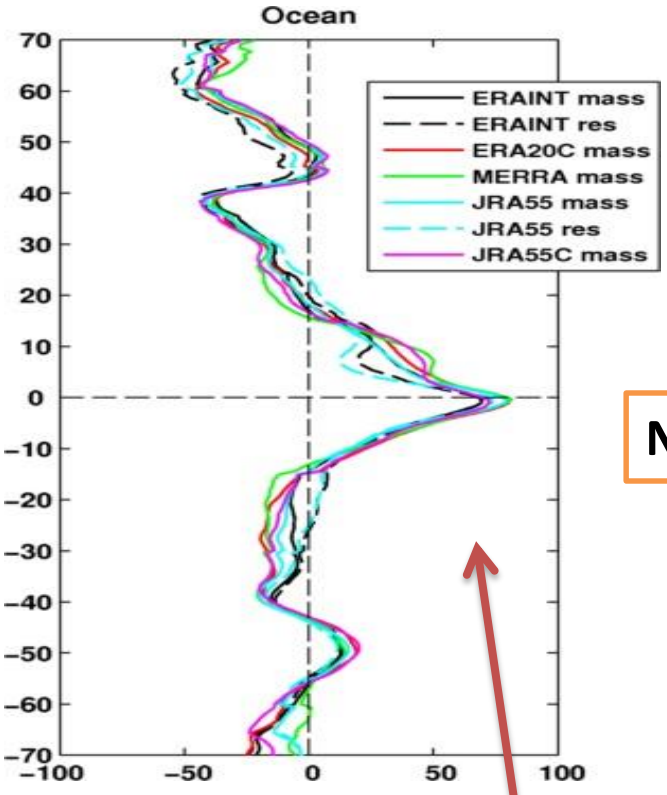


FIGURE 5.10 Zonal mean net air–sea heat flux from NCEP-1 (red dashed), ERA-40 (red solid), NCEP CFSR (blue solid), Trenberth residual (black dashed), NOC1.1a (green solid), NOC1.1 (gray solid), NOC2 (gray dash-dot), UWM/COADS (green dashed), OAFlux/ISCCP (purple solid), and COREv2 (purple dashed).

Josey et al. 2013
Ocean Circulation & Climate

2001-2008



NOC data?

Our method
Thanks to Michael Mayer

Comparison of flux changes

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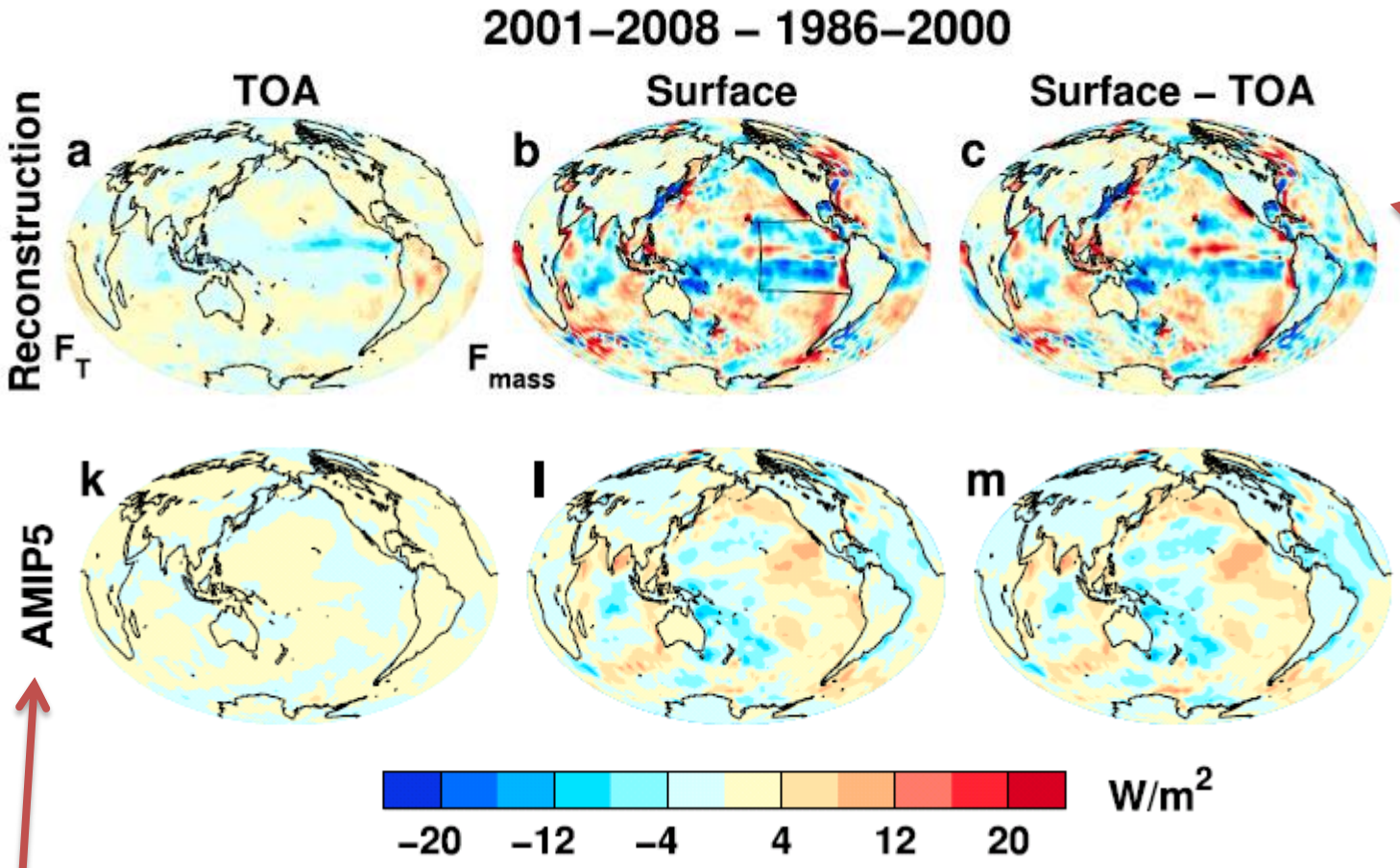


Different in AMIP simulations

16 member

- **Is SST the driver?**
- **Is the wind the driver? (England et al. 2014)**

Latent Heat Flux Trend

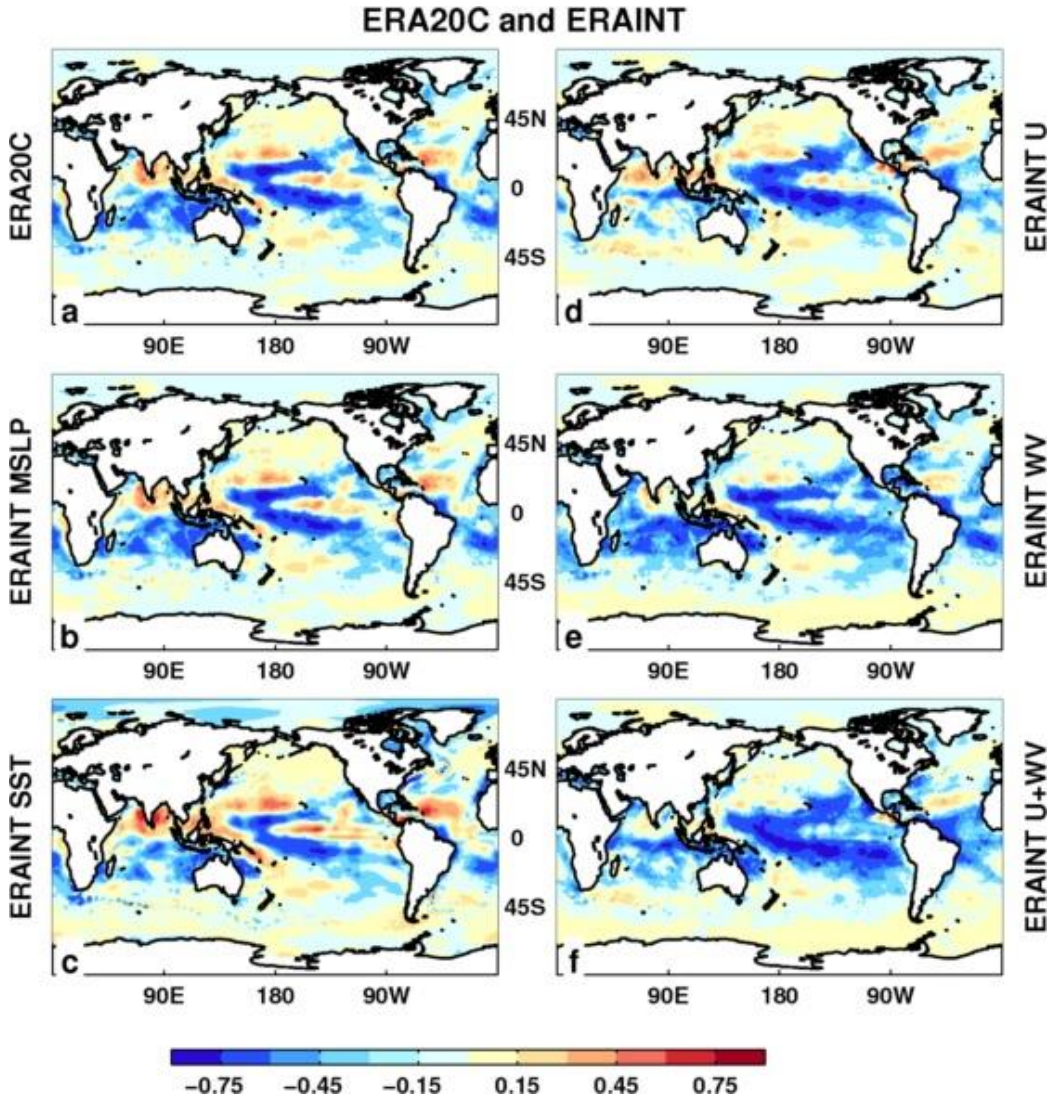
$$\mathrm{LHF} = \rho L C_E U (Q_s - Q_a) \quad (1)$$

$$Q_s = 0.98(0.622 e_s / P). \quad (2)$$

$$10^3 C_E = a \exp[b(U + c)] + d/U + 1 \quad (3)$$

$$Q_a = \frac{a}{W + b}\left[cW\mathrm{SST} + dW + \frac{e\mathrm{SST}}{fW - 7.55} - 9.74\right] + 8.94.$$

U: wind speed
W: water vapour content
SST
P: mean sea level pressure



Singh et al. 2005 MWR

Trends of SST, MSLP, wind and WV

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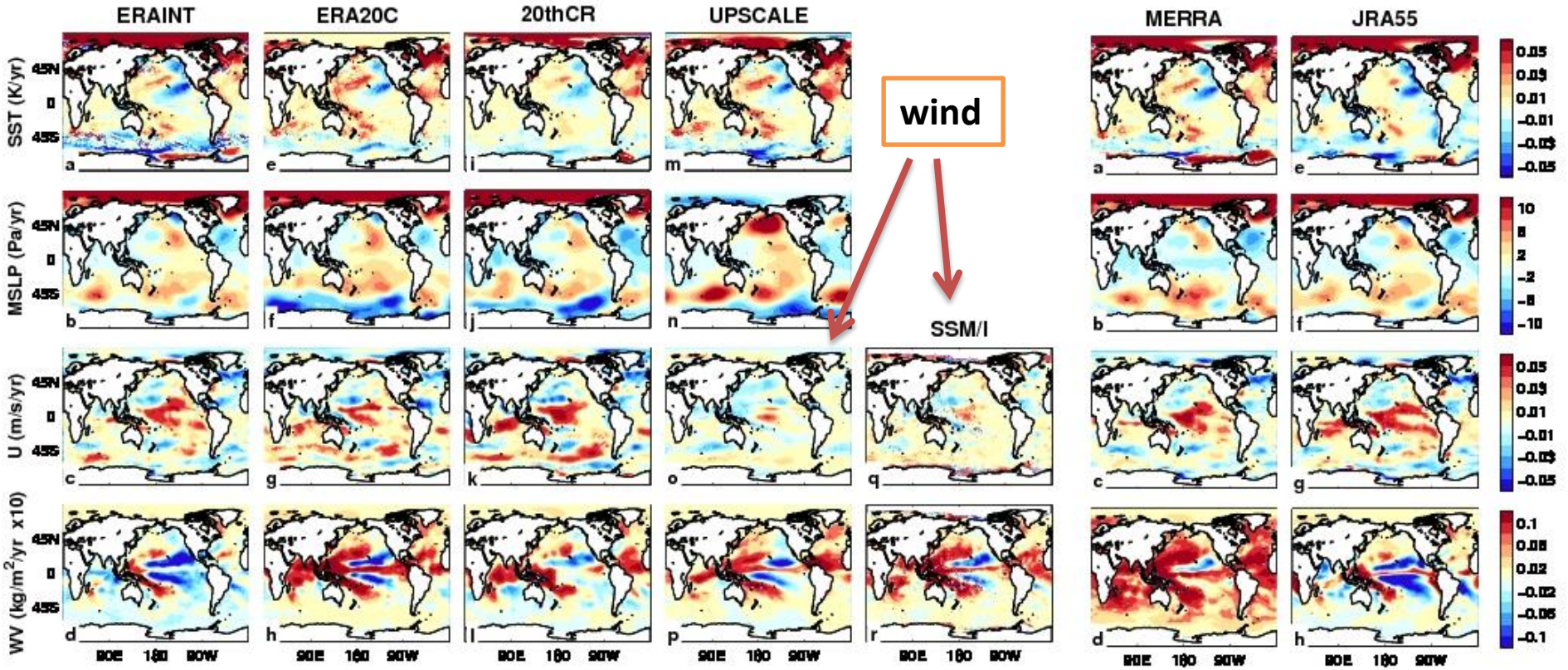

Wind speed

LH

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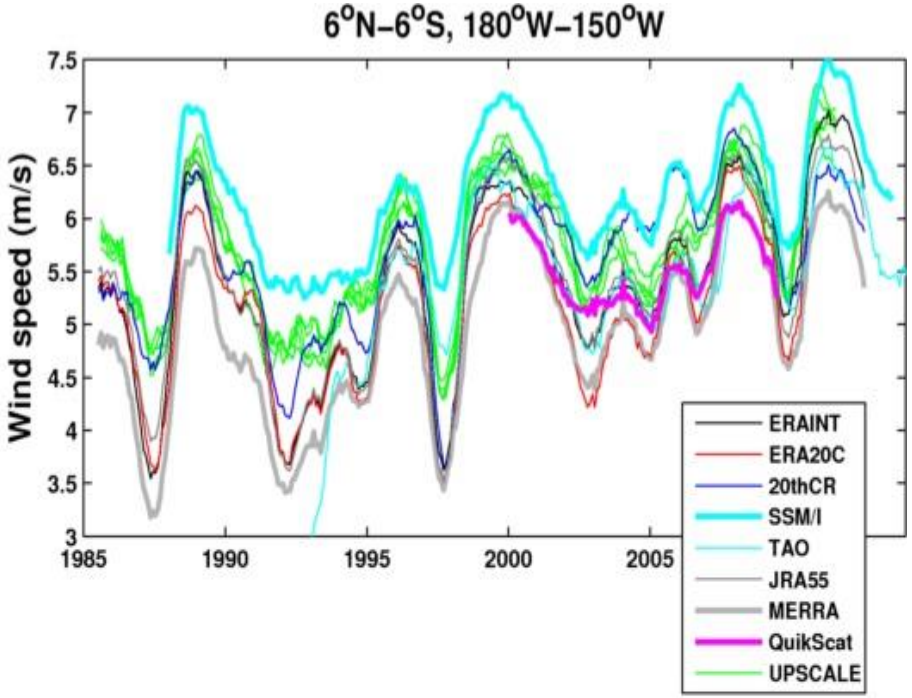

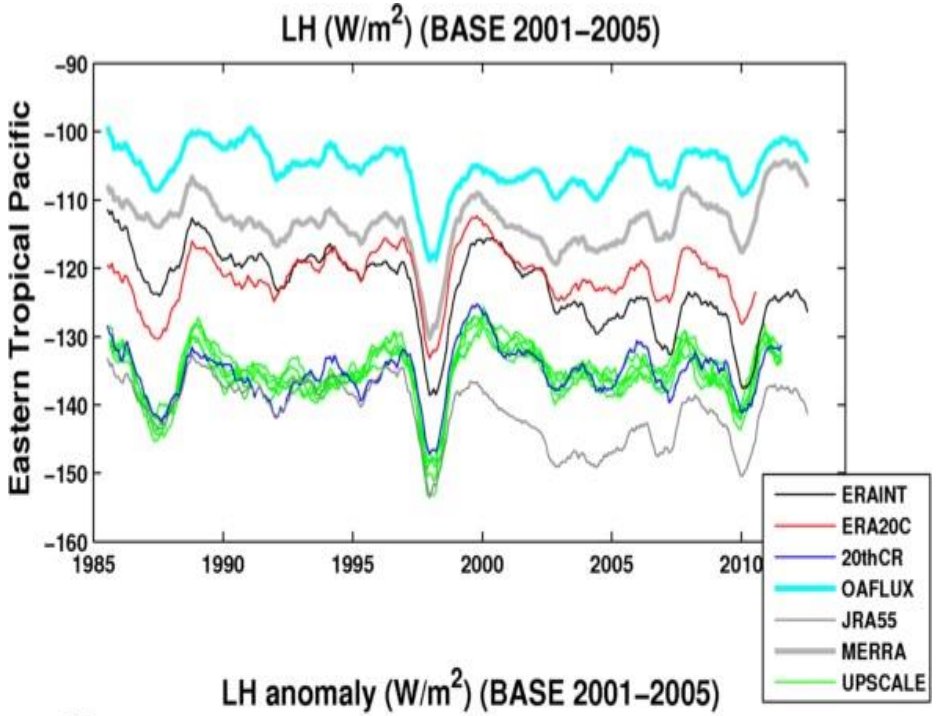

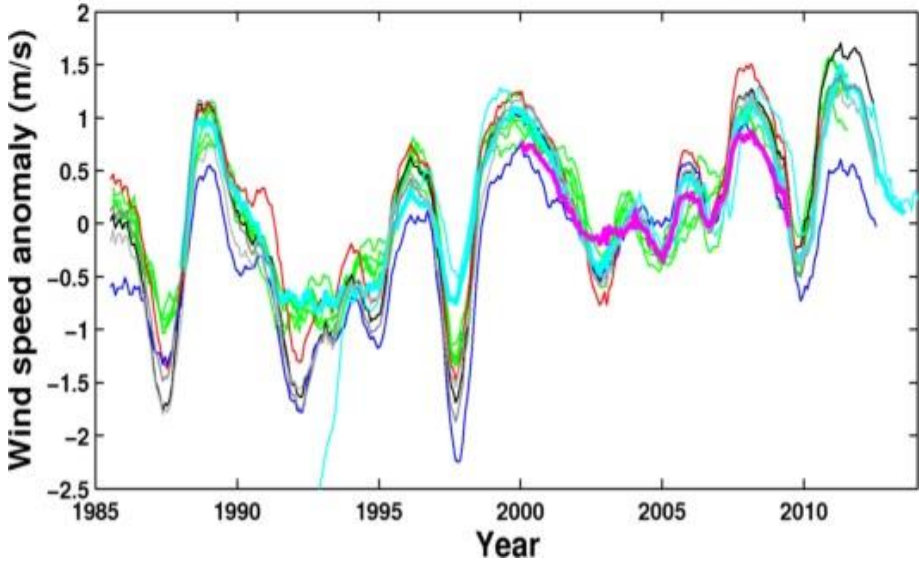

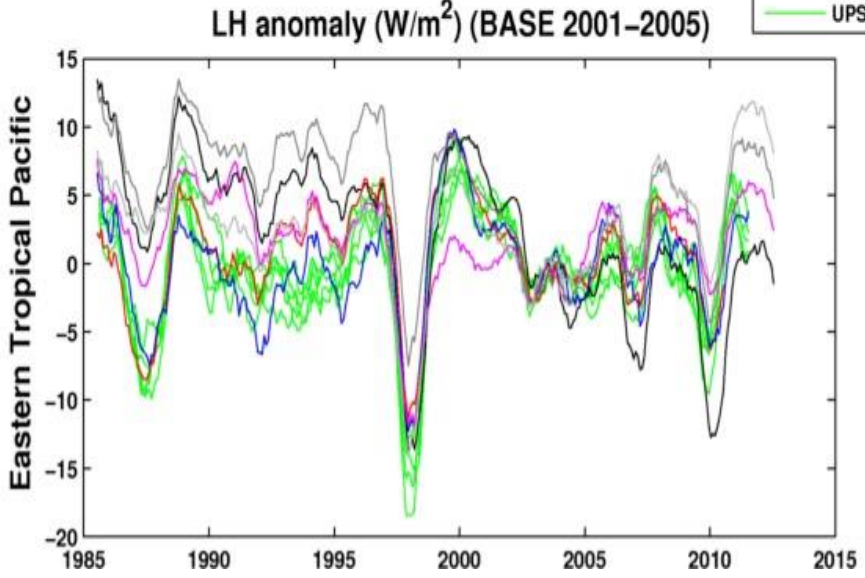

Wind speed and LH flux trends

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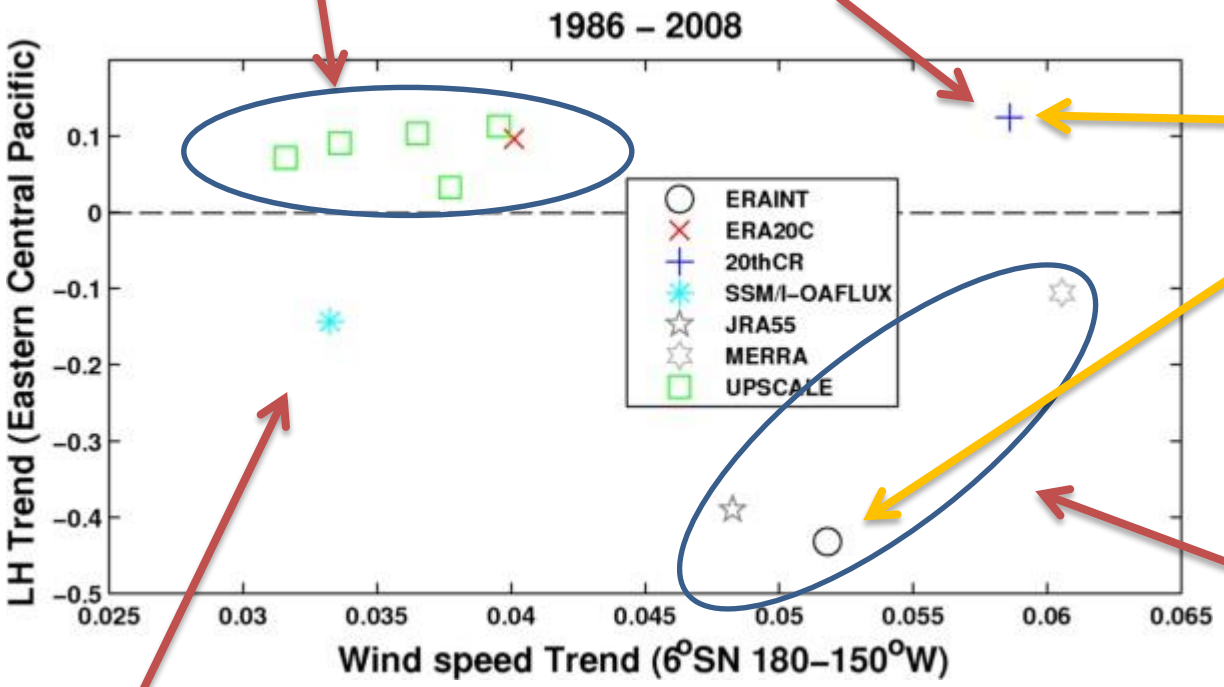

Prescribed SST or Surface data assimilated

Used by England et al (2014)

3D data assimilated

Observed

Summary

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- TOA and surface flux data are updated and can be downloaded from website **http://www.met.reading.ac.uk/~sgs01cll/asym/as.html**

- The zonal mean spread of surface fluxes is reduced using our method.

- Discrepancies exist over eastern Pacific, under investigation.

- Collaborate with Met Office for the product validation (Pat).

- Comparison with NOC data (Damien)