Impact of Global Ocean Surface Flux Product, J-OFURO3

Japanese Ocean Flux data sets with Use of Remote Sensing Observations

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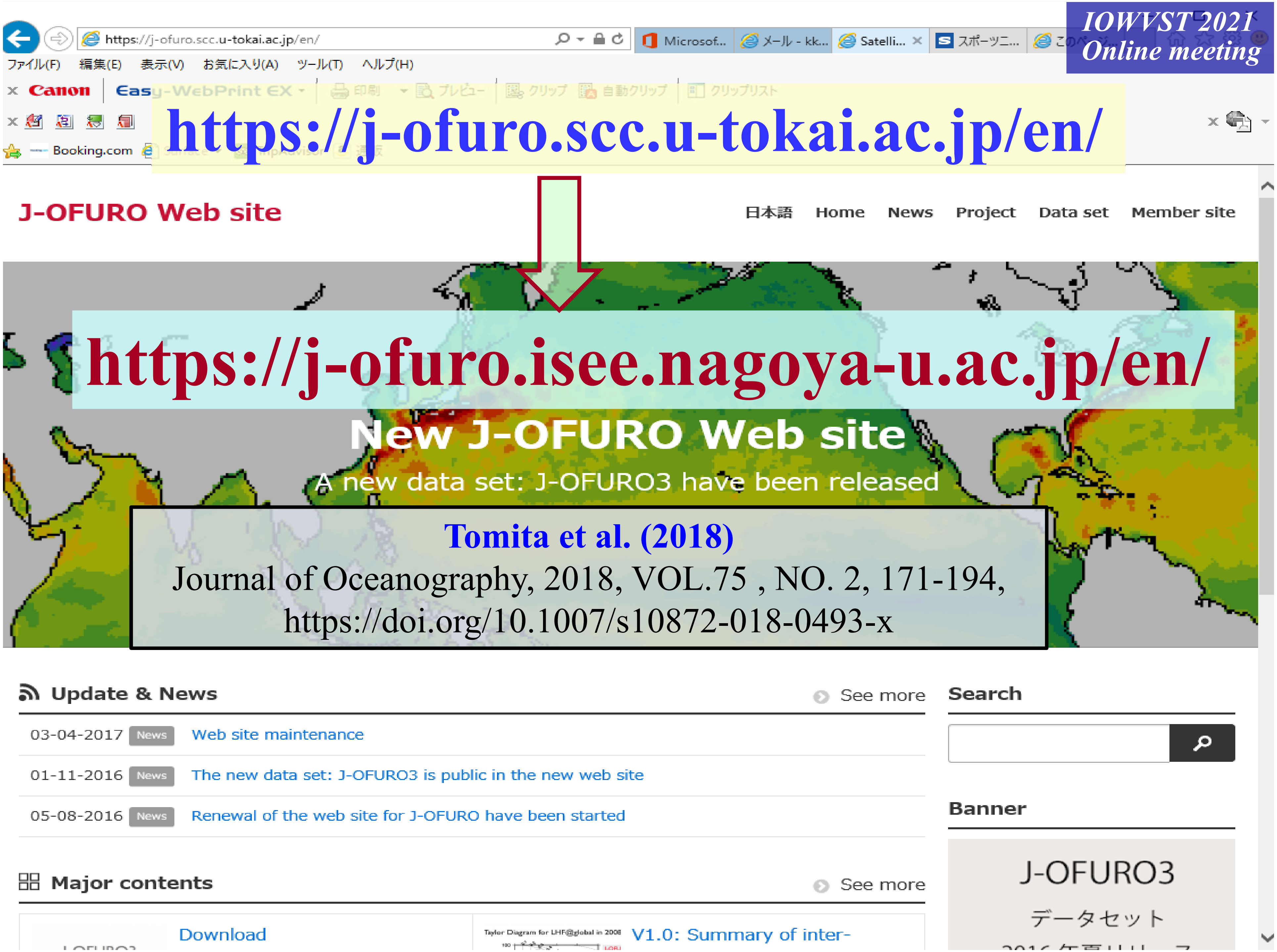

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New J-OFURO Web site
A new data set: J-OFURO3 have been released
Tomita et al. (2018)
Journal of Oceanography, 2018, VOL.75 , NO. 2, 171-194,
https://doi.org/10.1007/s10872-018-0493-x
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データセット

J-OFURO3

Japanese Ocean Flux data sets with Use of Remote Sensing Observations

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J-OFURO1 → J-OFURO2 → J-OFURO3

2000 **2008** **2016**

Available fluxes and parameters

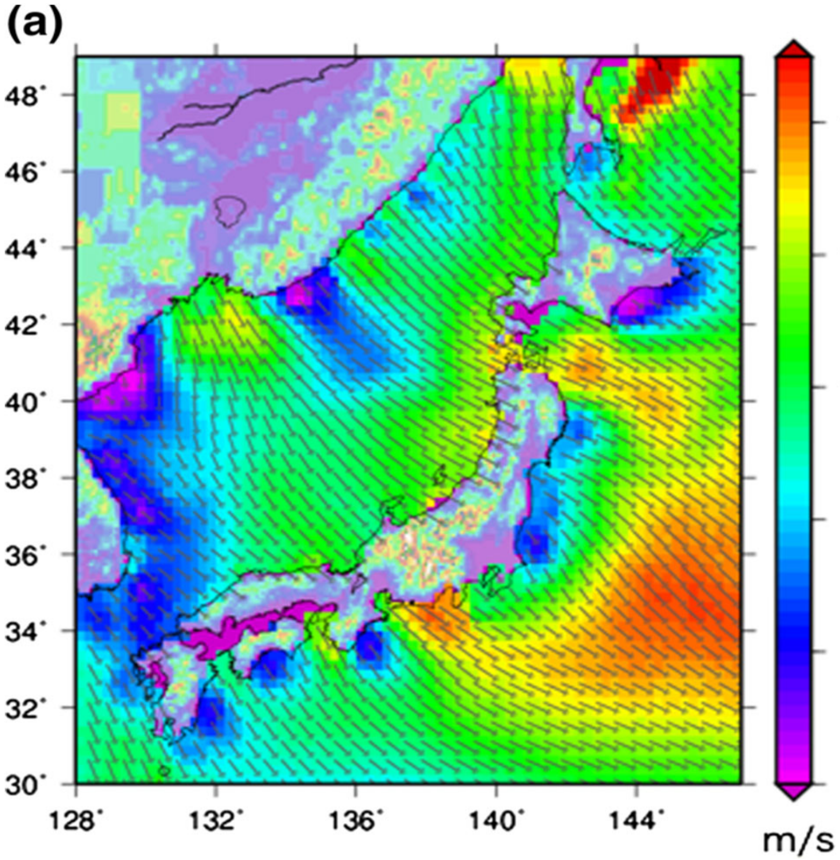
LHF, SHF: Latent and Sensible Heat Fluxes
SWR, LWR: Short and Longwave Radiation
NHF: Net Heat Flux
TAUX, TAUY: Zonal & Meridional Momentum Fluxes
WND, UWND, VWND: Wind-speed, Zonal & Meridional Winds
FWF: Fresh Water Flux, EVAP: Evaporation, RAIN
SST: Sea Surf. Temp.
QA: Specific Humidity, QS: Saturated Surface Specific Humidity
TA10: Air Temp.(10m), DT: Temperature Difference

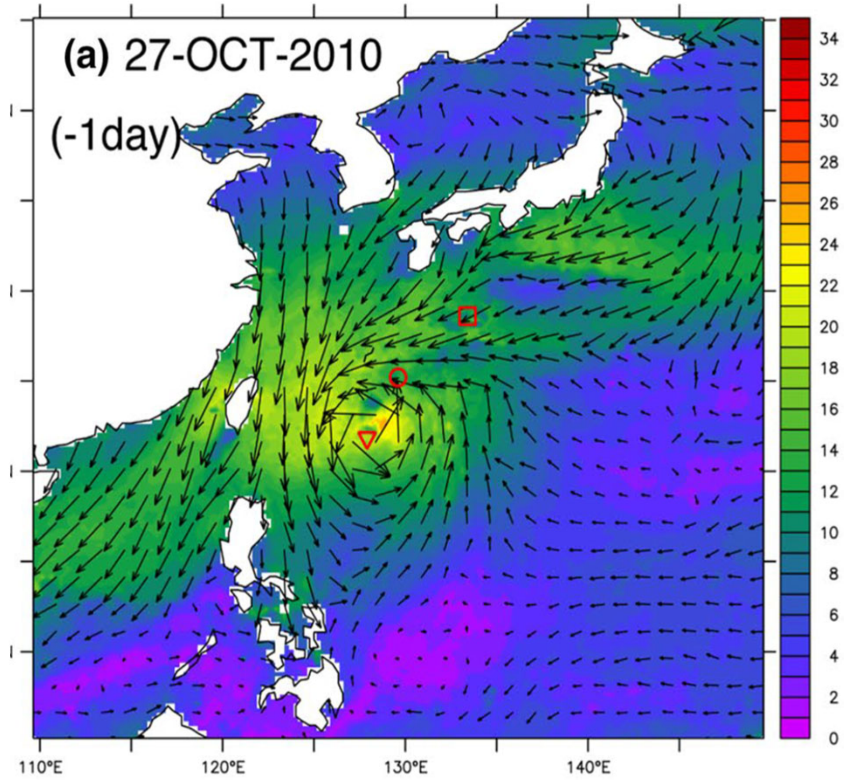
Overview across J-OFURO data sets including J-OFURO3

	J-OFURO1	J-OFURO2	J-OFURO3
Period	1992-1993	1988-2008	1988-2013 Data set for **1988-2017** will be available
Temporal average	monthly	daily	daily
Spatial grid size	1.0deg.	1.0deg.	0.25deg.
SST	Reynolds SST	MGDSST	Ensemble median of various products
Humidity	Schlussel et al. 1995 SSMI	Schlussel et al. 1995 SSMIs	New algorithm SSMIs, SSMIS, AMSR-E, TMI, AMSR2
Wind	SSMI	SSMIs, AMSR-E, TMI ERS-1/2, QuikSCAT	SSMIs, SSMISs, AMSR-E, AMSR2, TMI, WindSat, ERS-1/2, QuikSCAT, ASCAT-A/B, OSCAT

Tomita et al. (2018)

Examples of Wind Field by J-OFURO3





clearer understanding of more fine-scale ocean–atmosphere features such as mesoscale eddies and geographic features

International Journal of Remote Sensing2020, VOL. 41, NO. 15, 6022–6049
https://doi.org/10.1080/01431161.2020.1714784

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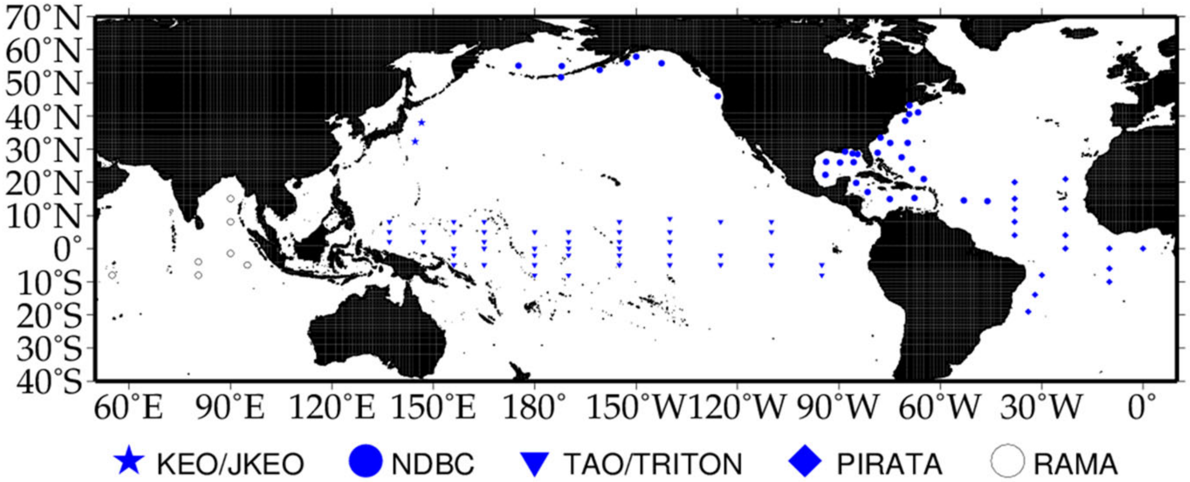
Validation of different global data sets for sea surface wind-stress

by **Masafumi Yagi and Kunio Kutsuwada**

Global surface wind stress product used in this study

Name	Spatial Resolution	Temporal Resolution	
QSCAT/J-OFURO2	1.00 deg	daily	Satellite
J-OFURO3	0.25 deg	daily	Satellite
IFREMER	0.25 deg	daily	Satellite
CCMP V2	0.25 deg	daily	Hybrid
NCEP/NCAR	2.00 deg	daily	Reanalysis
NCEP/CFSR	0.50 deg	daily	Reanalysis
JRA55	1.25 deg	daily	Reanalysis
JRA55-do	0.5625 deg	daily	Reanalysis
ERA-Interim	0.75 deg	daily	Reanalysis

Yagi & Kutsuwada (2020)



Wind Stress （from 1 January 2008 to 31 December 2008）

Product name	Low-latitudes 15°S-15°N (17625)			Low-latitudes 15°S-15°N (17625)		
	Bias	RMSE	*r*	Bias	RMSE	*r*
J-OFURO2	0.0058	0.0170	0.939	0.0028	0.0123	0.941
J-OFURO3	-0.0008	0.0173	0.931	0.0029	0.0132	0.935
IFREMER	-0.0022	0.0156	0.944	0.0023	0.0112	0.951
CCMP v2.0	0.0006	0.0063	0.978	0.0003	0.0078	0.978
NCEP/NCAR1	0.0121	0.0223	0.881	-0.0003	0.0199	0.839
NCEP/CFSR	0.0073	0.0117	0.949	0.0045	0.0095	0.950
JRA55	0.0056	0.0138	0.885	0.0020	0.0665	0.851
JRA55-do	0.0077	0.0171	0.932	0.0020	0.0146	0.914
ERA-Interim	0.0038	0.0201	0.900	0.0018	0.0174	0.875

This statistical values shows the best reliability for CCMP product
with lowest mean and RMS differences and highest correlation.

Yagi & Kutsuwada (2020)

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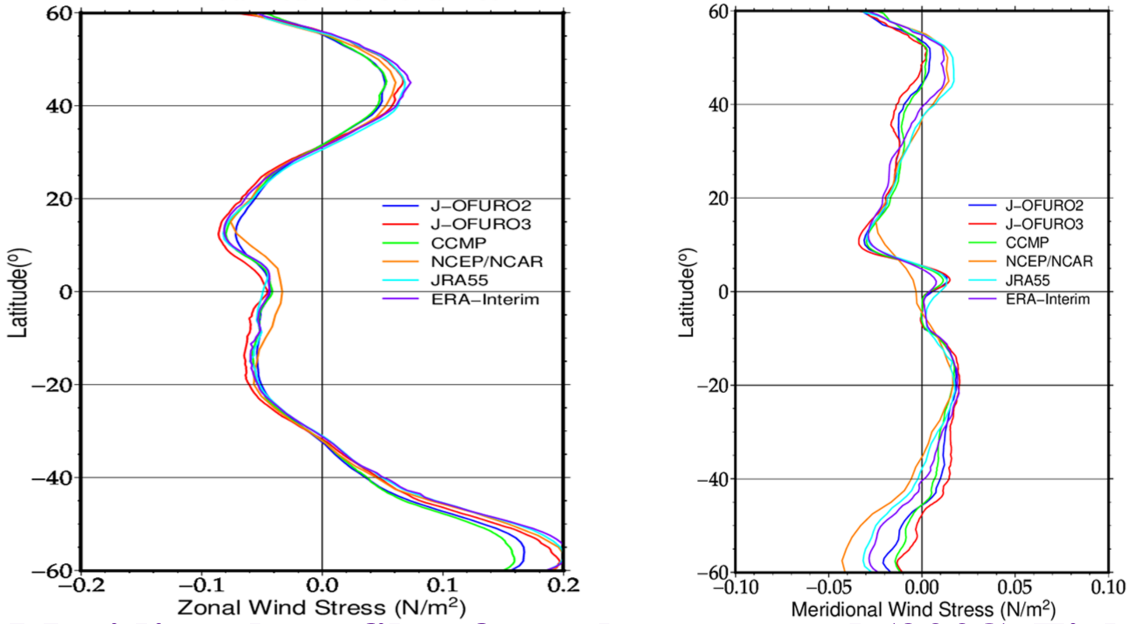
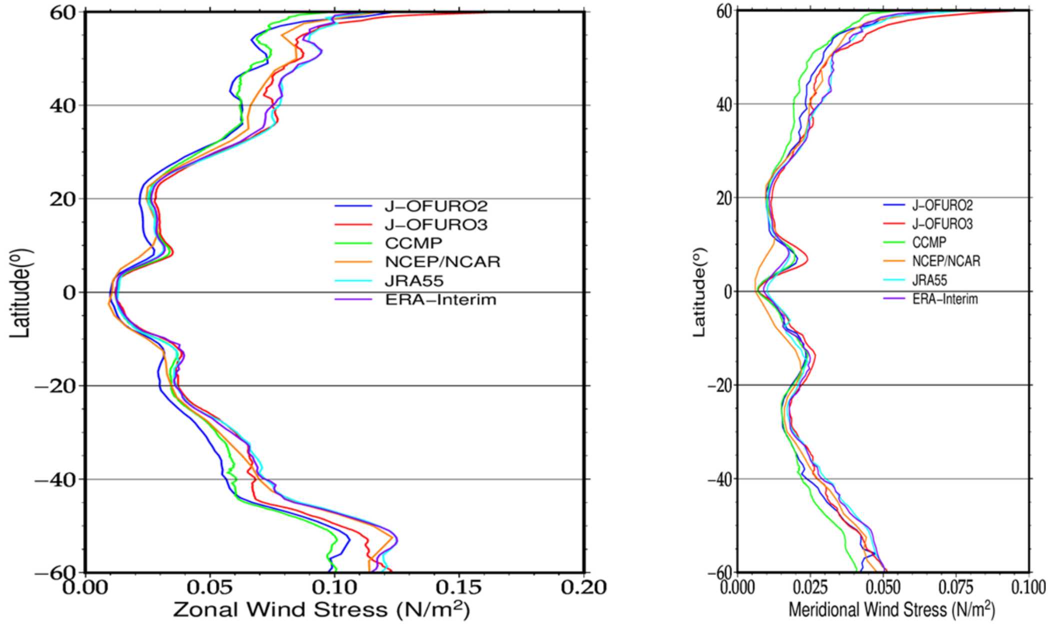


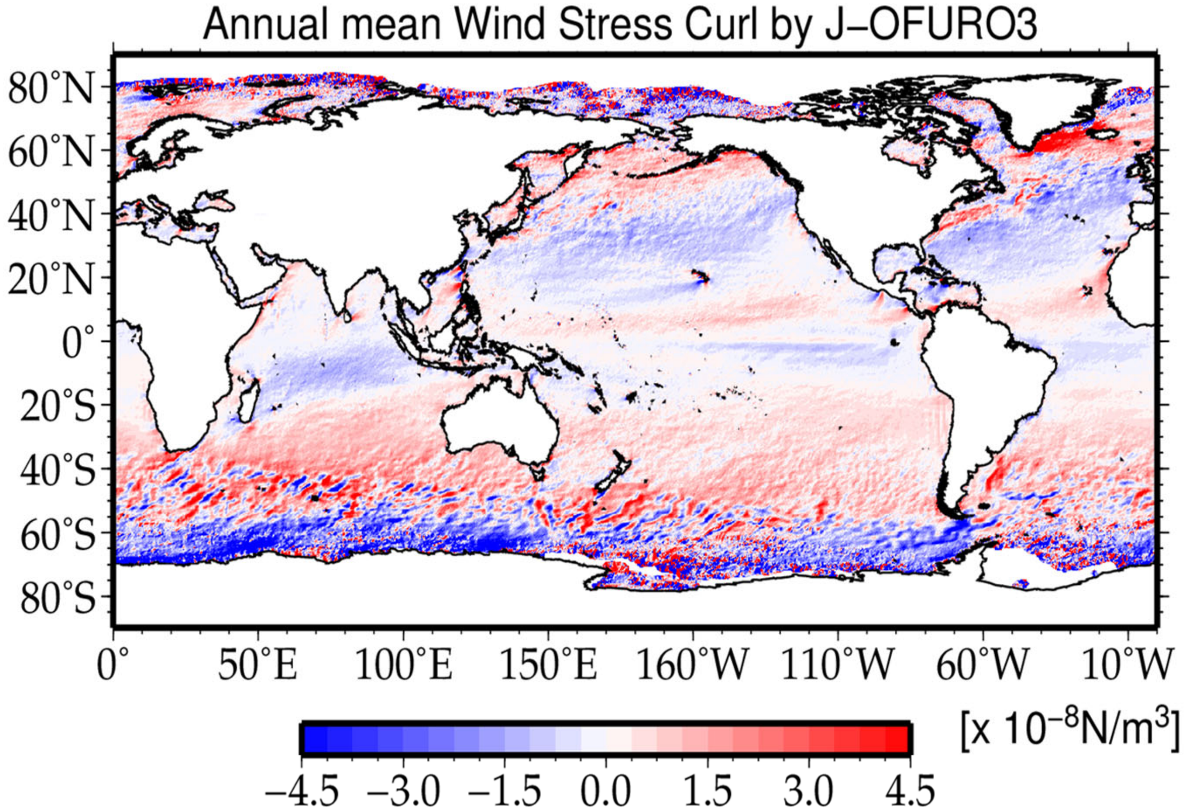
Meridional profile of yearly-averaged (2008) Field

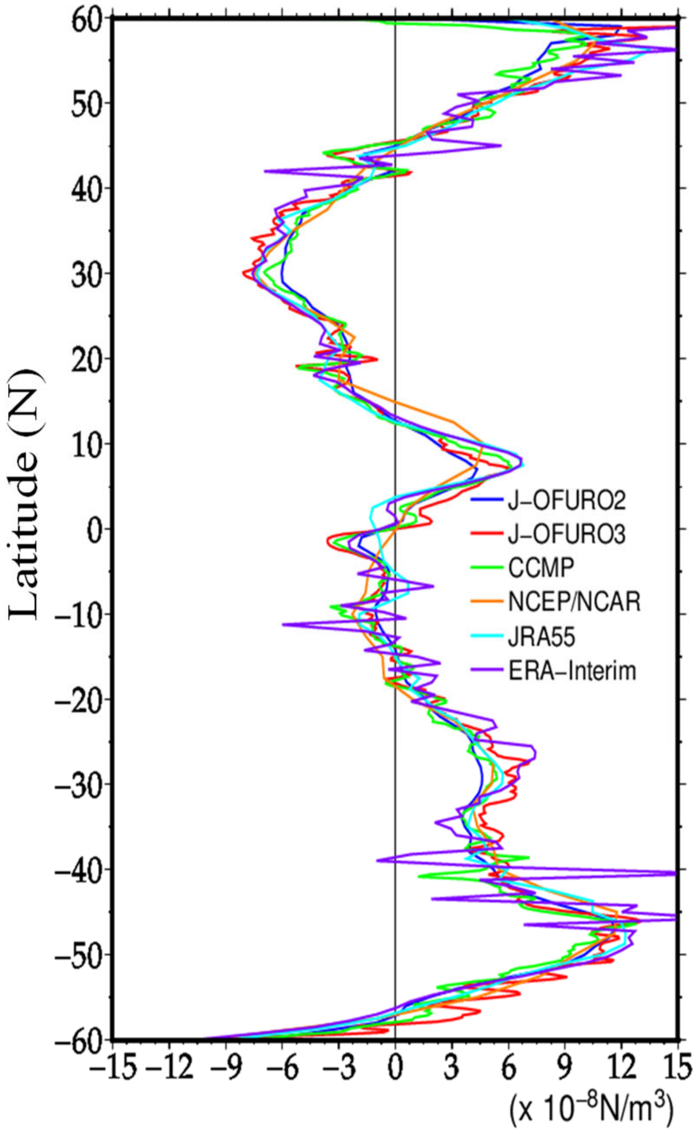


Meridional profile standard deviation in 2008

There are large differences in mid- and high latitudes in yearly-average and standard deviation fields.

Yagi & Kutsuwada (2020)





Yearly-averaged wind-stress curl in 2008

Yagi & Kutsuwada (2020)

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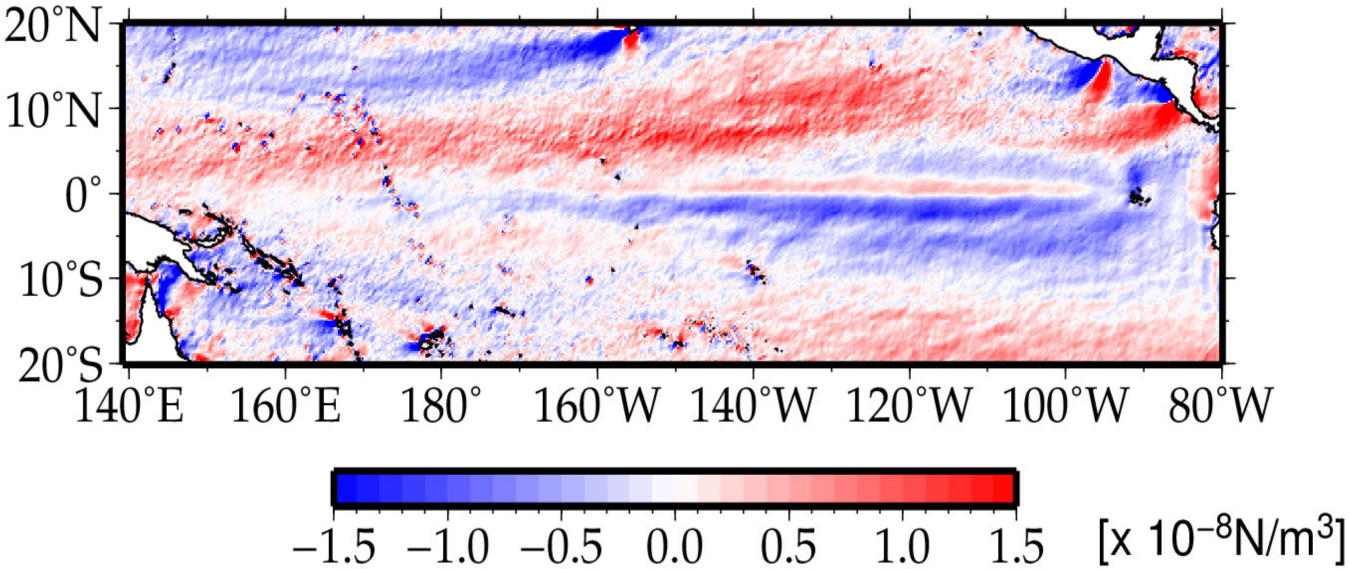
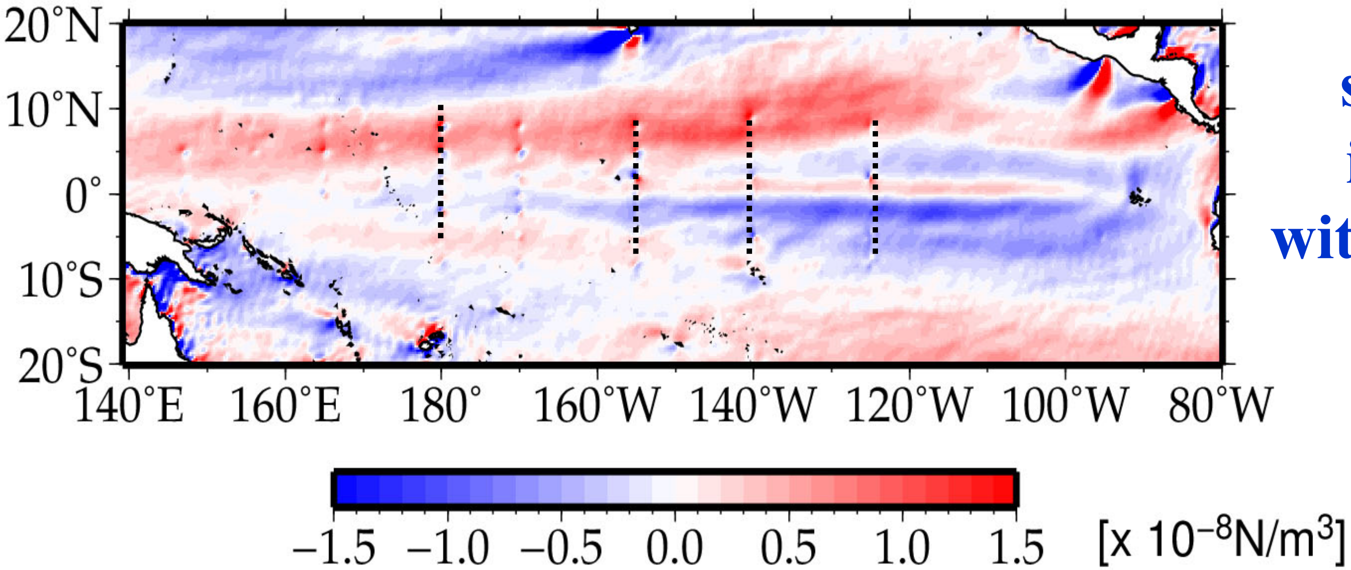
Annual mean Wind Stress Curl by J-OFURO3



Annual mean Wind Stress Curl by CCMP



spatial feature in relationship with buoy locations

Yagi & Kutsuwada (2020)

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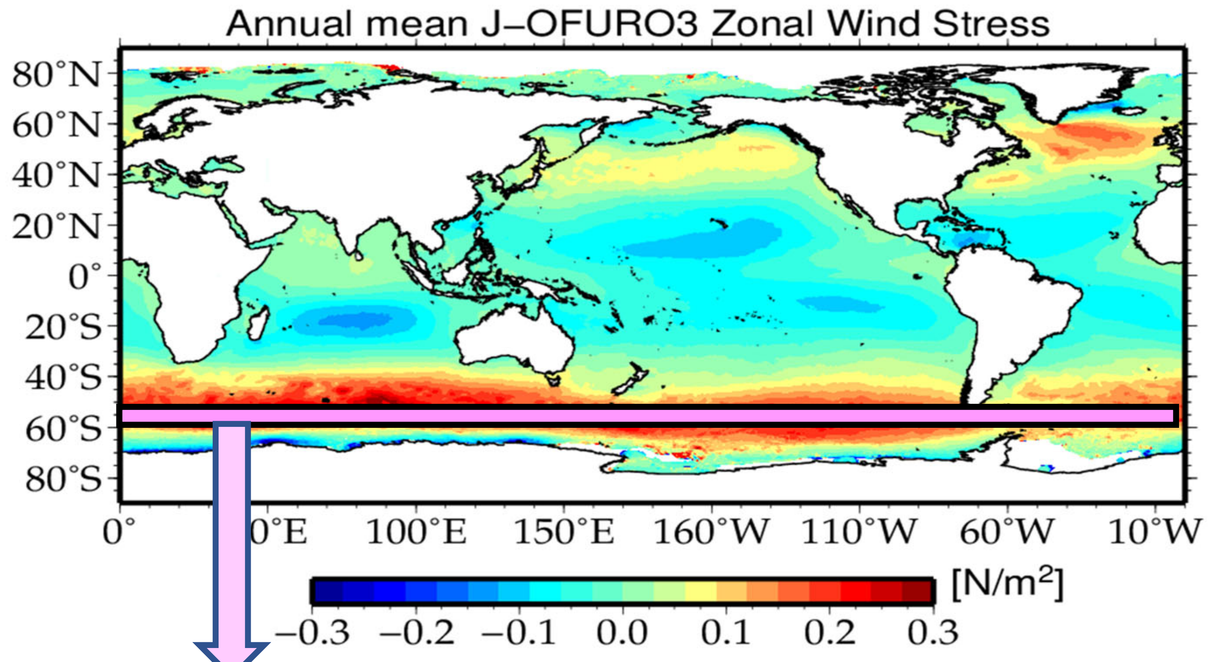

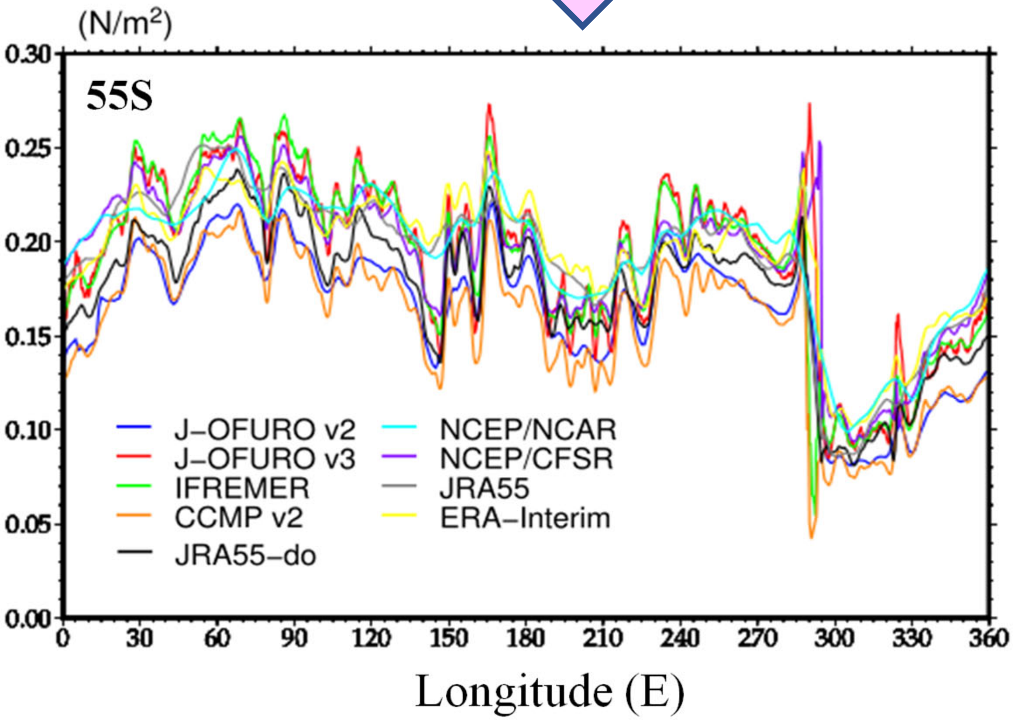

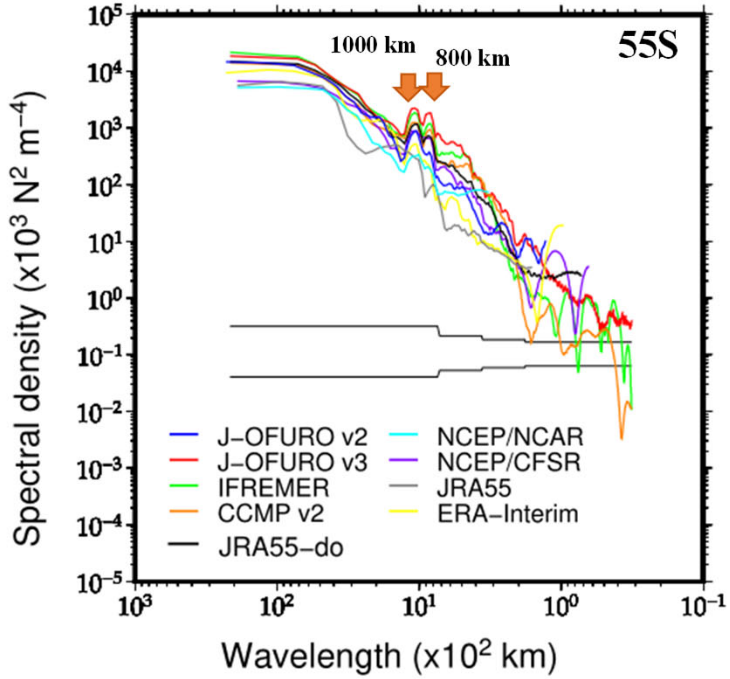

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Validation of different global data sets for sea surface wind-stress

by **Masafumi Yagi and Kunio Kutsuwada**

Summary

Validations reveal that the J-OFURO3 has relatively higher reliability than other satellite and reanalysis ones except the hybrid one (CCMP), especially in the tropical Pacific region.

Intercomparisons among the curl fields exhibit that the CCMP has its spatial feature in relationship with buoy locations, possibly due to spatial no-uniformity arising from data assimilation

In spatial spectra, the J-OFURO3 has its spectral feature in some regions with energy level higher than those by other products in scales shorter than about 100km, suggesting the possibility of detecting small-scale features.

Frontiers in Marine Science published: 05 February 2021 doi: 10.3389/fmars.2021.612361

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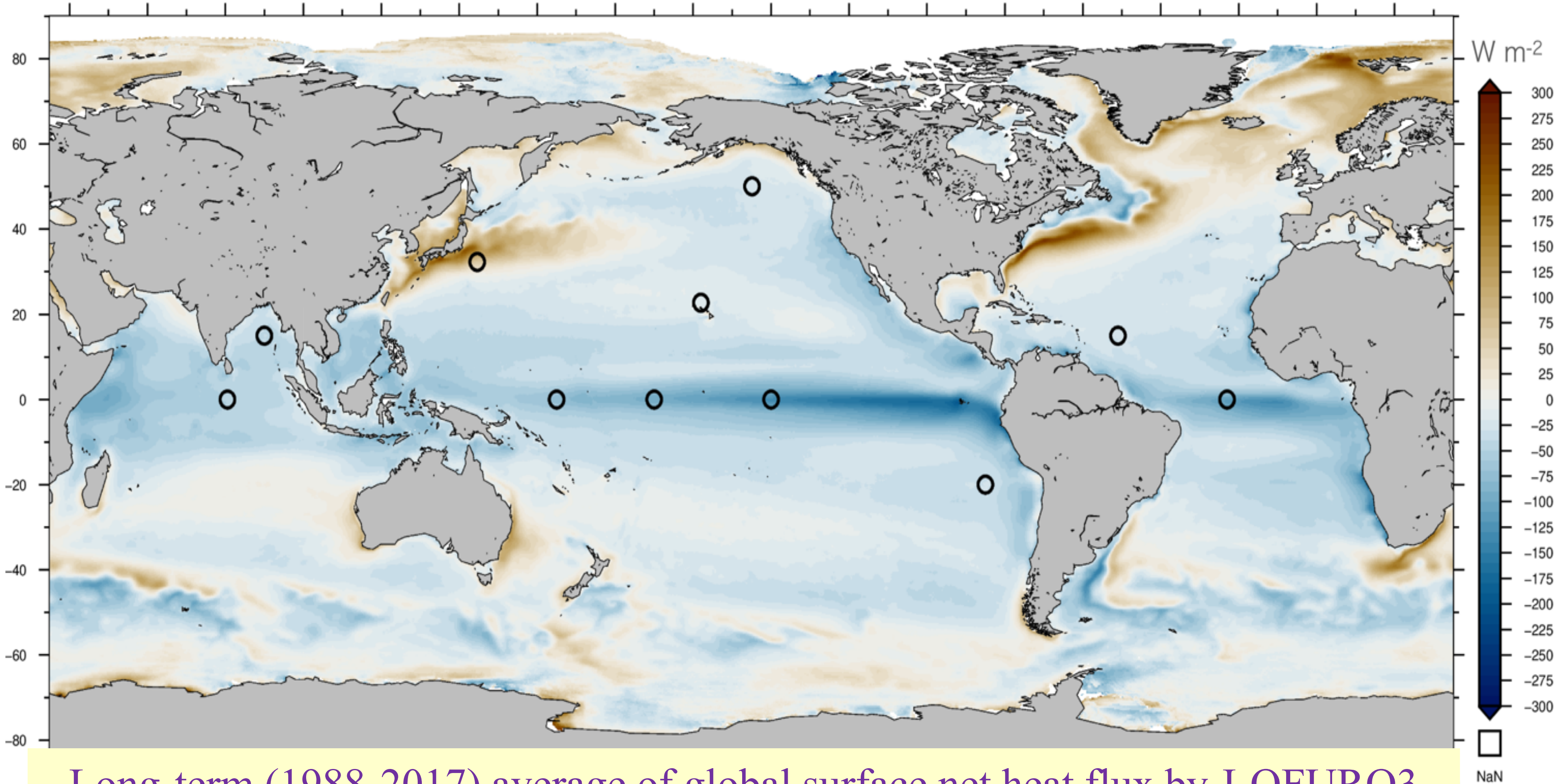
Advances in the estimation of global surface net heat flux based on satellite observation

by Hiroyuki Tomita, Kunio Kutsuwada, Masahisa Kubota and Tsutomu Hihara



Long-term (1988-2017) average of global surface net heat flux by J-OFURO3 monthly means for 1988-2017. Positive values are upward heat flux. Locations of 11 buoys used in comparison are indicated as black circles.

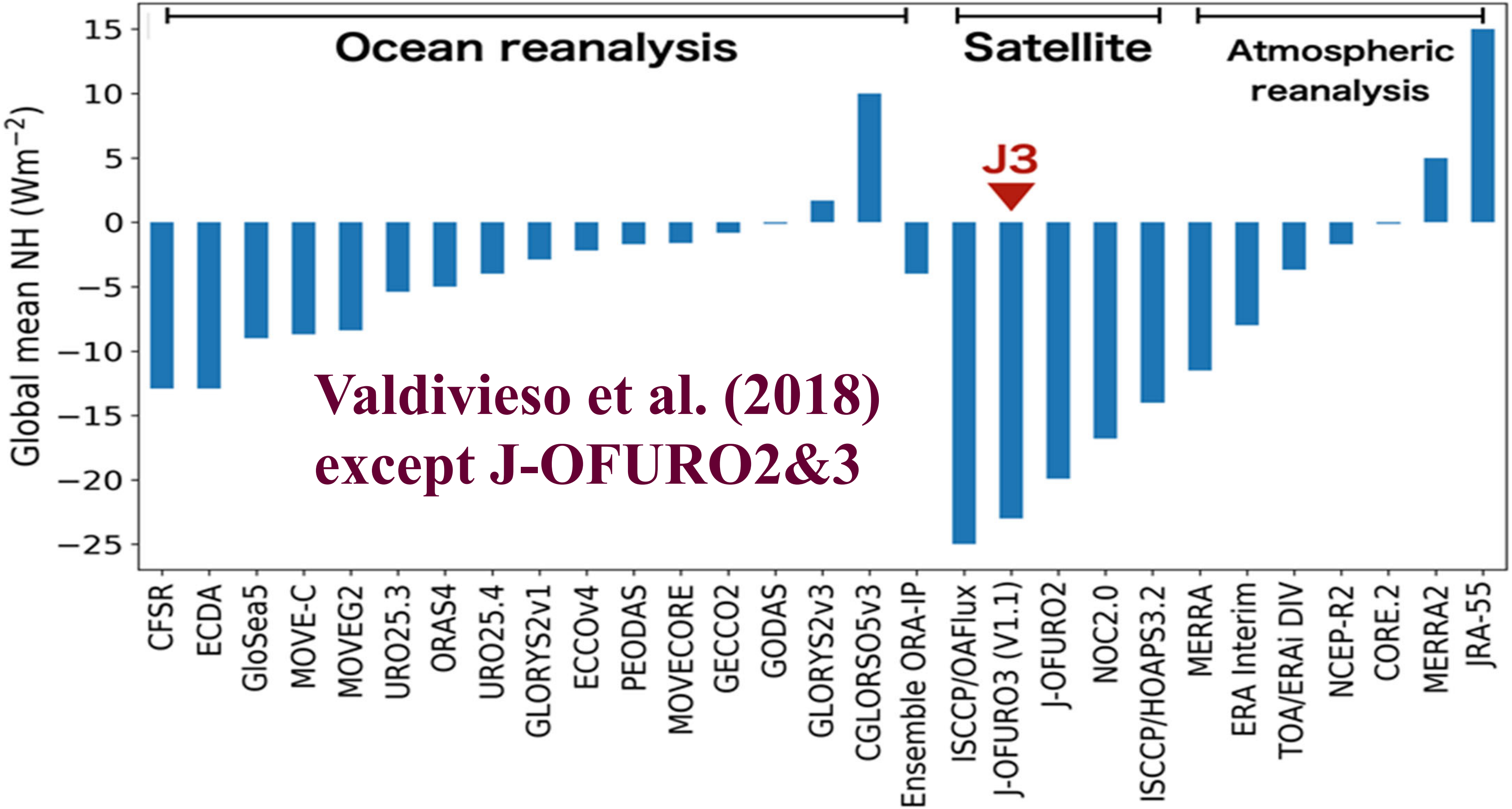
Tomita et al. (2021)

Buoy Stations used in comparison with J-OFURO3. N means number of valid monthly means.

	Site name	Location	Sart date	Final date	N	Framework	Provider
1	KEO	32.3N, 144.6E	2004/6/17	2018/12/31	105	OCS	NOAA/PMEL
2	PAPA	50.1N, 144.9W	2007/6/9	2018/12/31	108		
3	TAO/TRITON	0N, 165E	2006/7/13	2017/9/8	63	GTMBA	
4		0N, 170W	2006/6/25	2018/10/29	49		
5		0N, 140W	2006/9/16	2018/12/31	76		
6	PIRATA	0N, 23W	2007/5/26	2014/7/6	46	GTMBA	
7	RAMA	0N, 80.5E	2008/8/10	2014/8/17	35		
8		15N, 90E	2008/10/20	2016/5/21	50		
9	WHOTS	22.75N, 158W	2008/8/14	2018/9/24	152	ORS	WHOI
10	STRATUS	20S, 85W	2000/10/8	2018/4/7	192		
11	NTAS	15N, 51W	2001/3/31	2018/6/11	187		

Tomita et al. (2021)

Long-term average of global mean NHF



Valdivieso et al. (2018)
except J-OFURO2&3

Almost all estimates are showing ocean heating.

Tomita et al. (2021)

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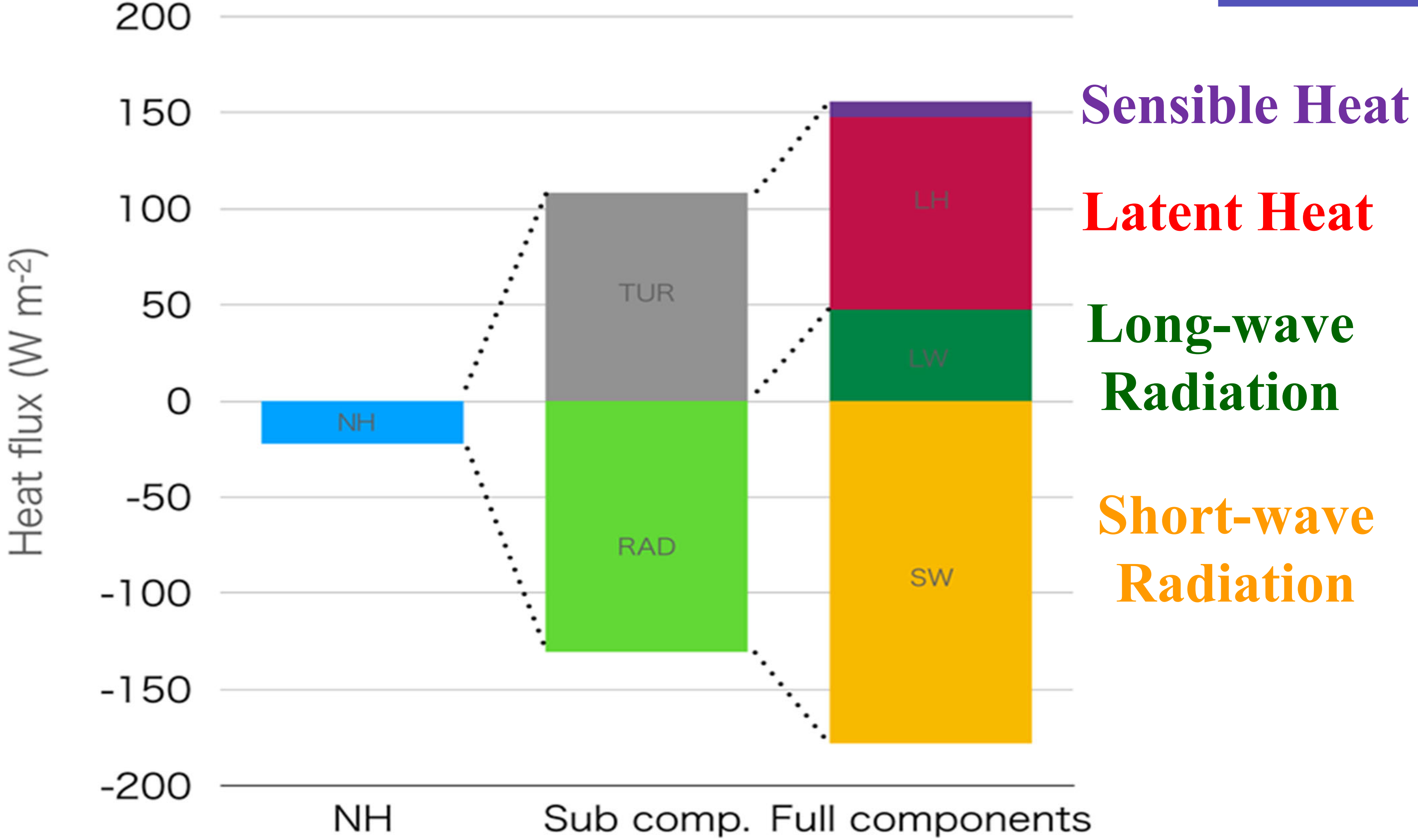

Balance of each component of global long-term average of J-OFURO3 surface net heat flux (NH). The balance of turbulent heat flux (TUR) and net surface radiation (RAD), and the full components: net shortwave radiation (SW), net longwave radiation (LW), latent heat flux (LH), and sensible heat flux (SH) are shown.

Biases (J-OFURO3 minus buoys)

1,063 monthly means from 11 sites

Tomita et al. (2021)

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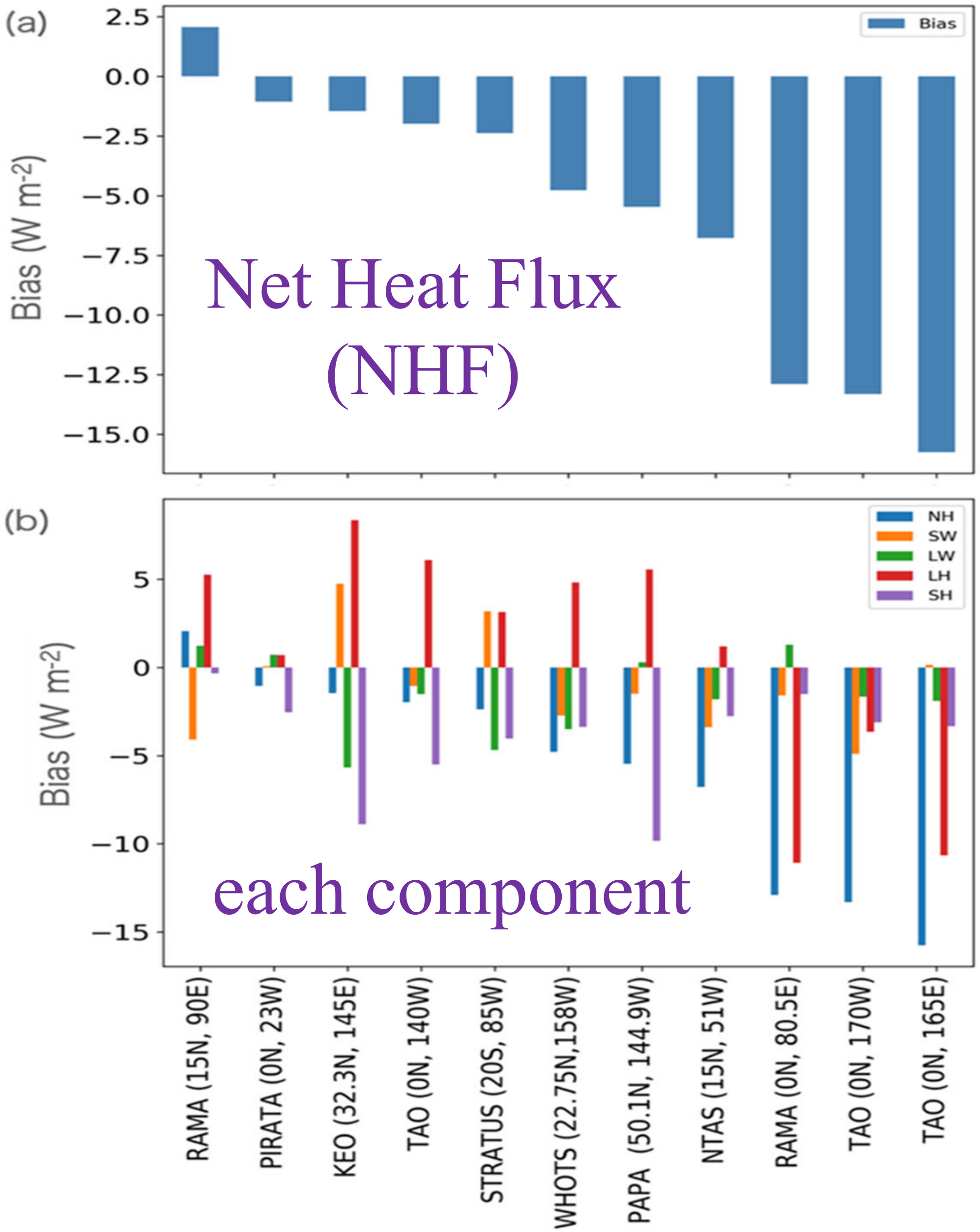
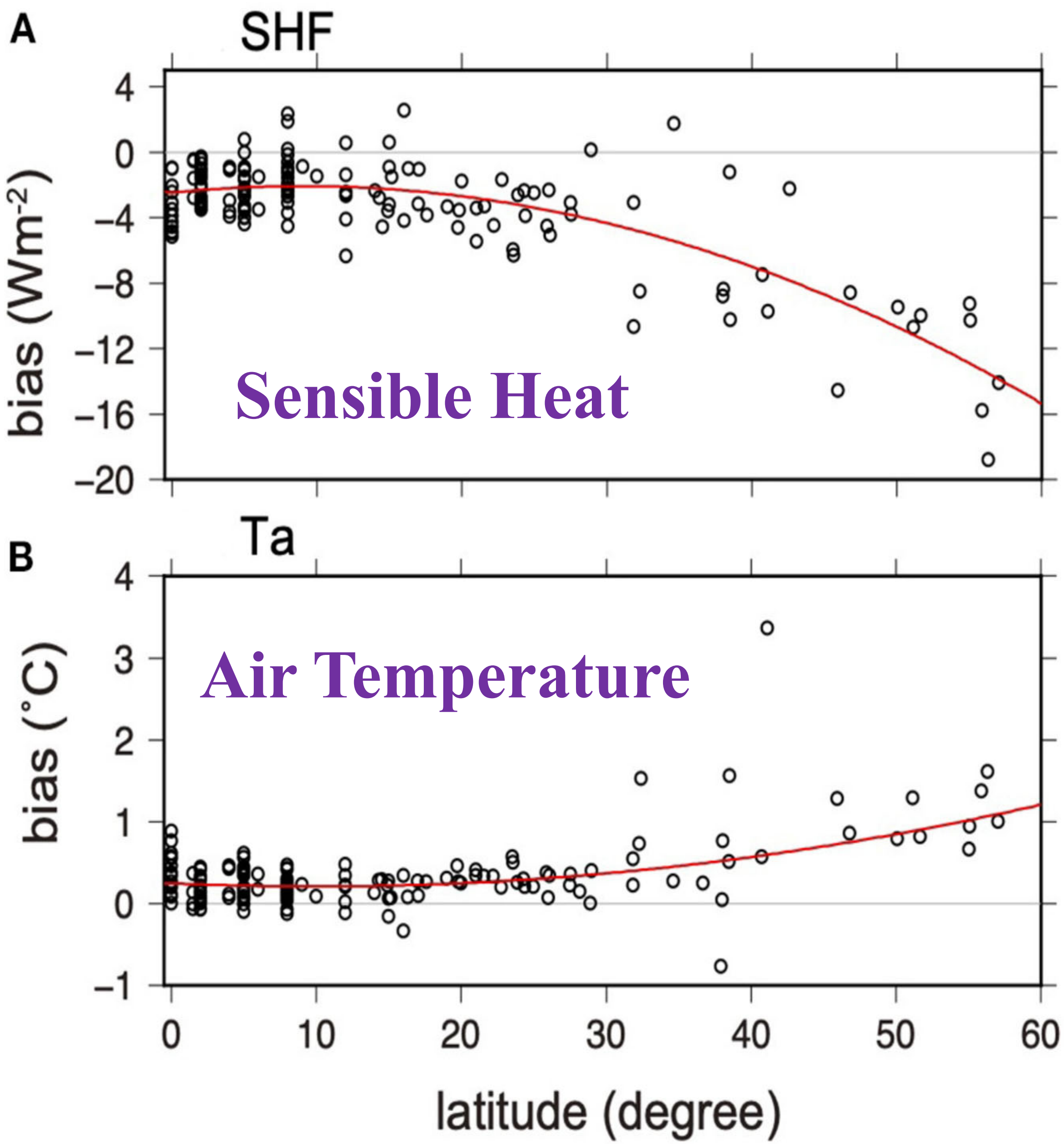


The NHF by J-OFURO3 has negative bias (ocean heating) for almost all stations.

The SHF by J-OFURO3 has negative bias for all the stations.

Latitudinal dependency of Biases

Tomita et al. (2021)



The SHF by J-OFURO3 has latitudinally-dependent bias, possibly due to air temperature.

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Summary

Global averages of surface net heat flux are estimated from the J-OFURO3 product to verify the balance/imbalance in the heat budget through ocean surface. The value for the 30-year mean is **about 22 W m^{-2} meaning the imbalance to heat the ocean surface**. Validation for the heat flux components exhibits that there are systematic biases in sensible heat flux. Correction of these biases gives the imbalance of about 11 W m^{-2} which is approximately half the original one.

Tomita et al. (2018)

Journal of Oceanography, 2018, VOL.75 , NO. 2, 171-194,
https://doi.org/10.1007/s10872-018-0493-x

An introduction to J-OFURO3, a third-generation Japanese ocean flux data set using remote-sensing observations

Yagi and Kutsuwada (2020)

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