Development of an Inter-Basin Pacific-Indian Ocean Model (PIOM):

ITF and the Circulation in the Banda Sea

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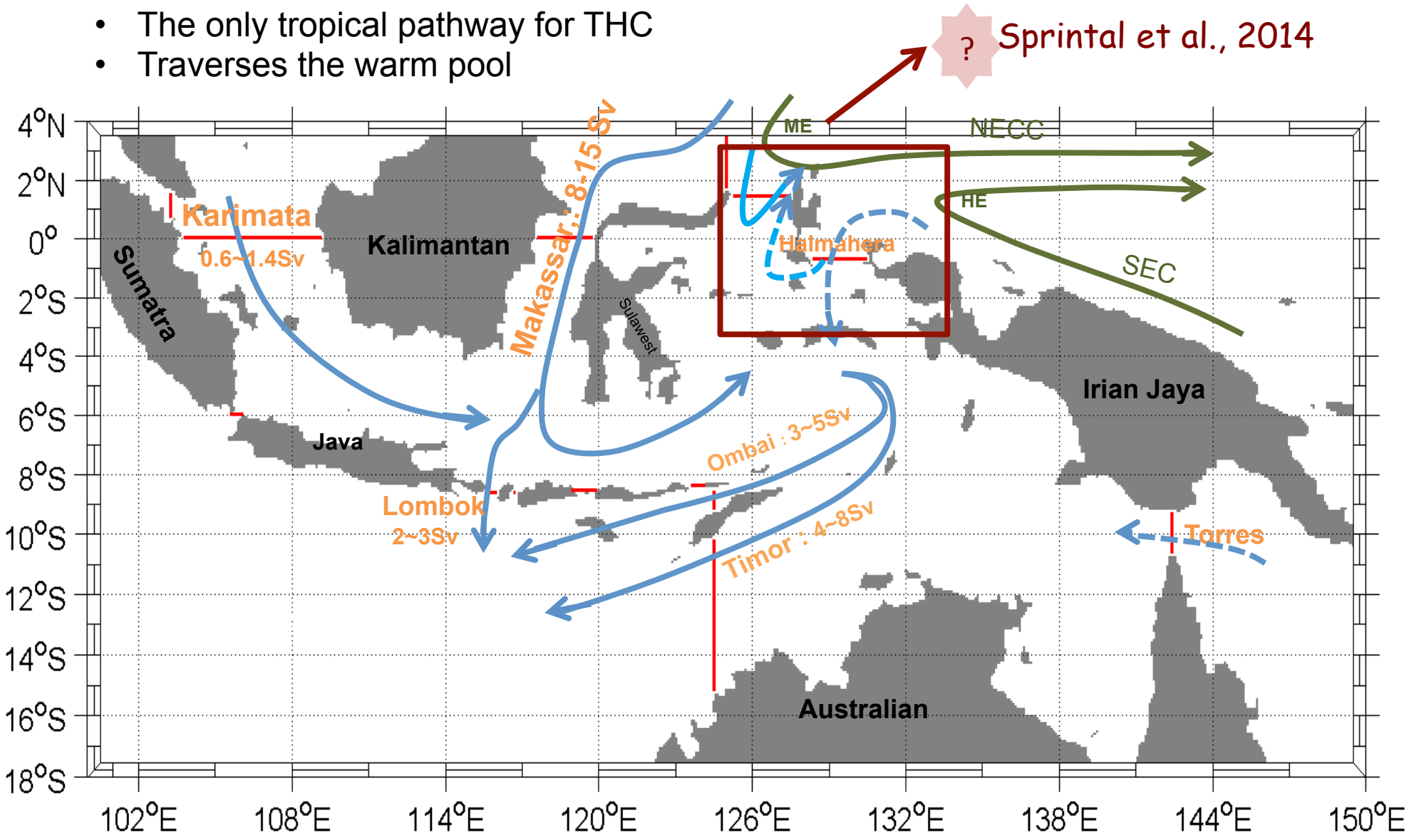
The ITF plays an important role in the climate system!

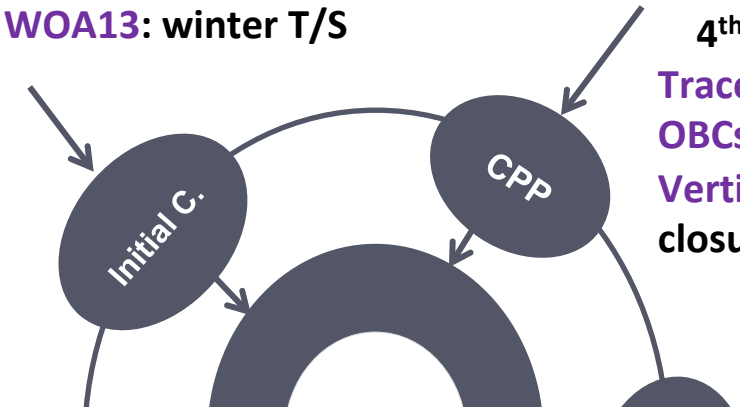
- The only tropical pathway for THC
- Traverses the warm pool



ITF with transports (Sv). The contributions to the ITF from North Pacific/South Pacific are shown by the solid/dashed blue lines.

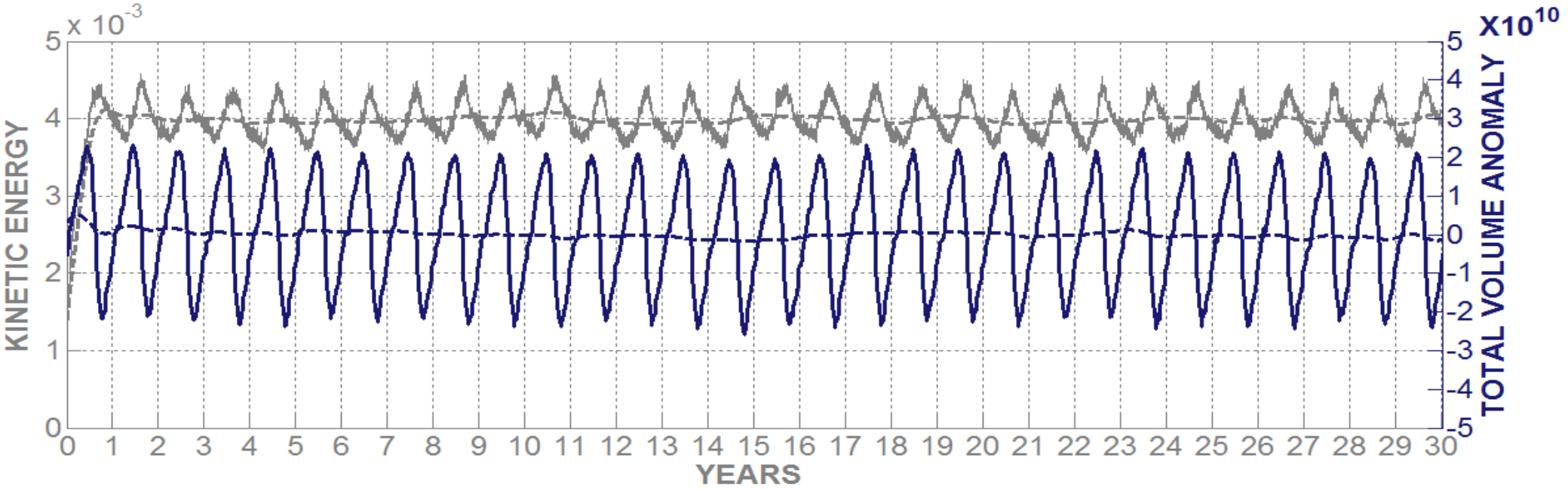
PIOM Set Up

WOA13: winter T/S

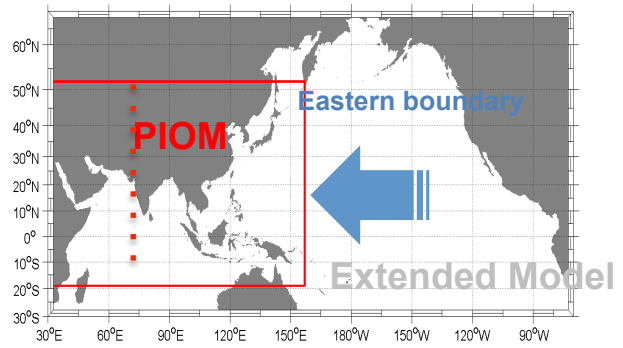


Momentums:
3rd order upstream for 3D eqs.
4th-order center for 2D eqs.
Tracers: 4th-order center
OBCs: modified radiation
Vertical mixing: MY level-2.5 closure

Climatological Exp:
- **Domain**
- O. B. Forcing
- Wind
- **Topography**
- **Tide**

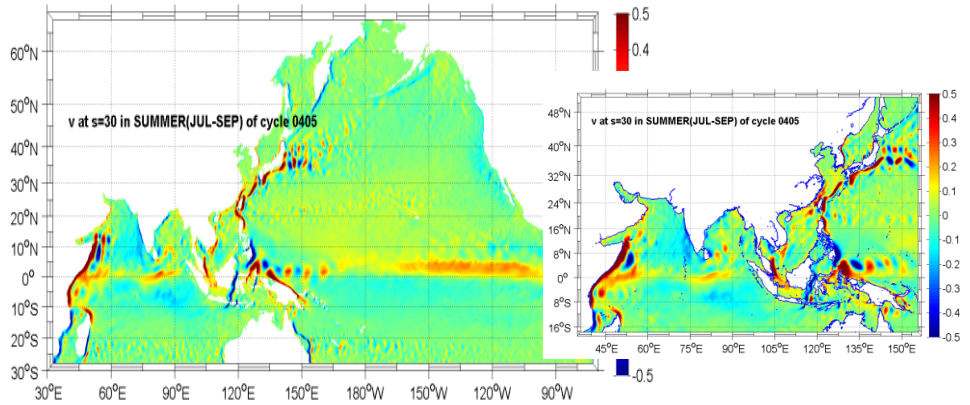


PIOM: Domain & Open Boundary

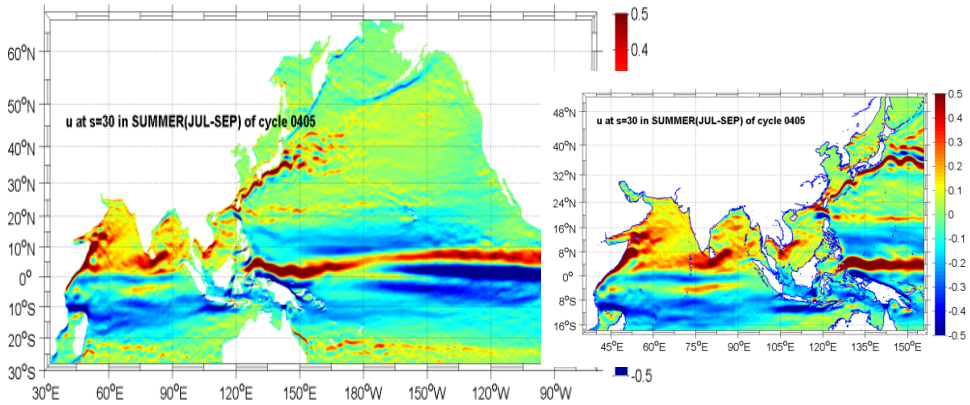


Summer

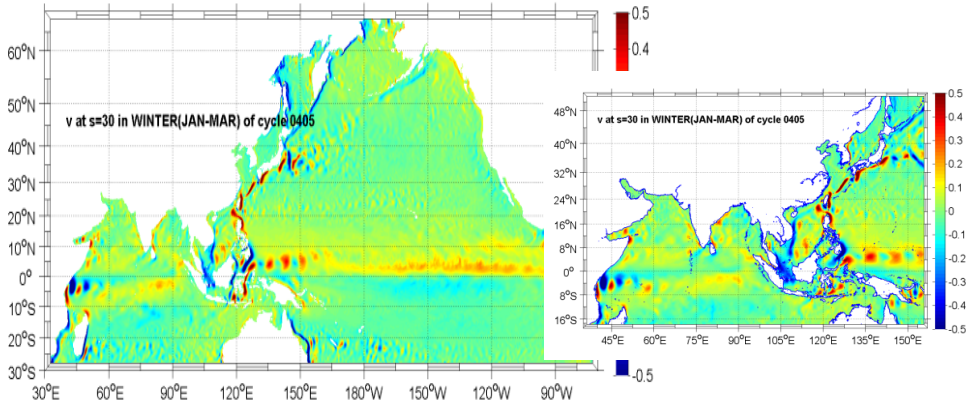
Surface V

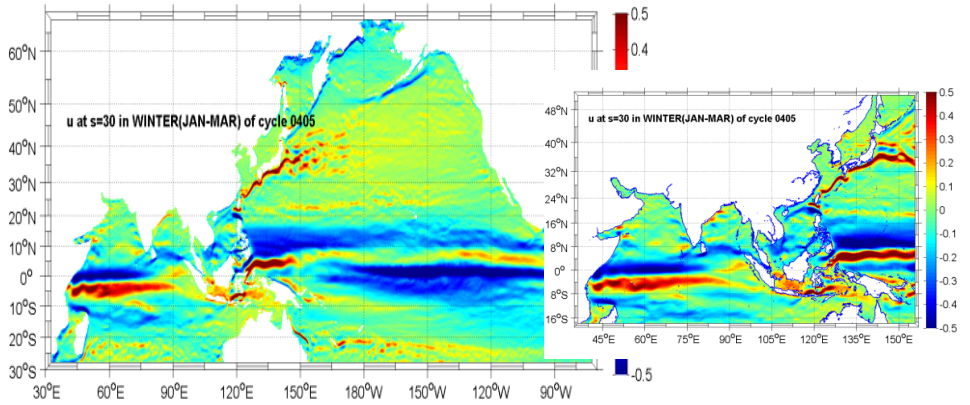


Surface U



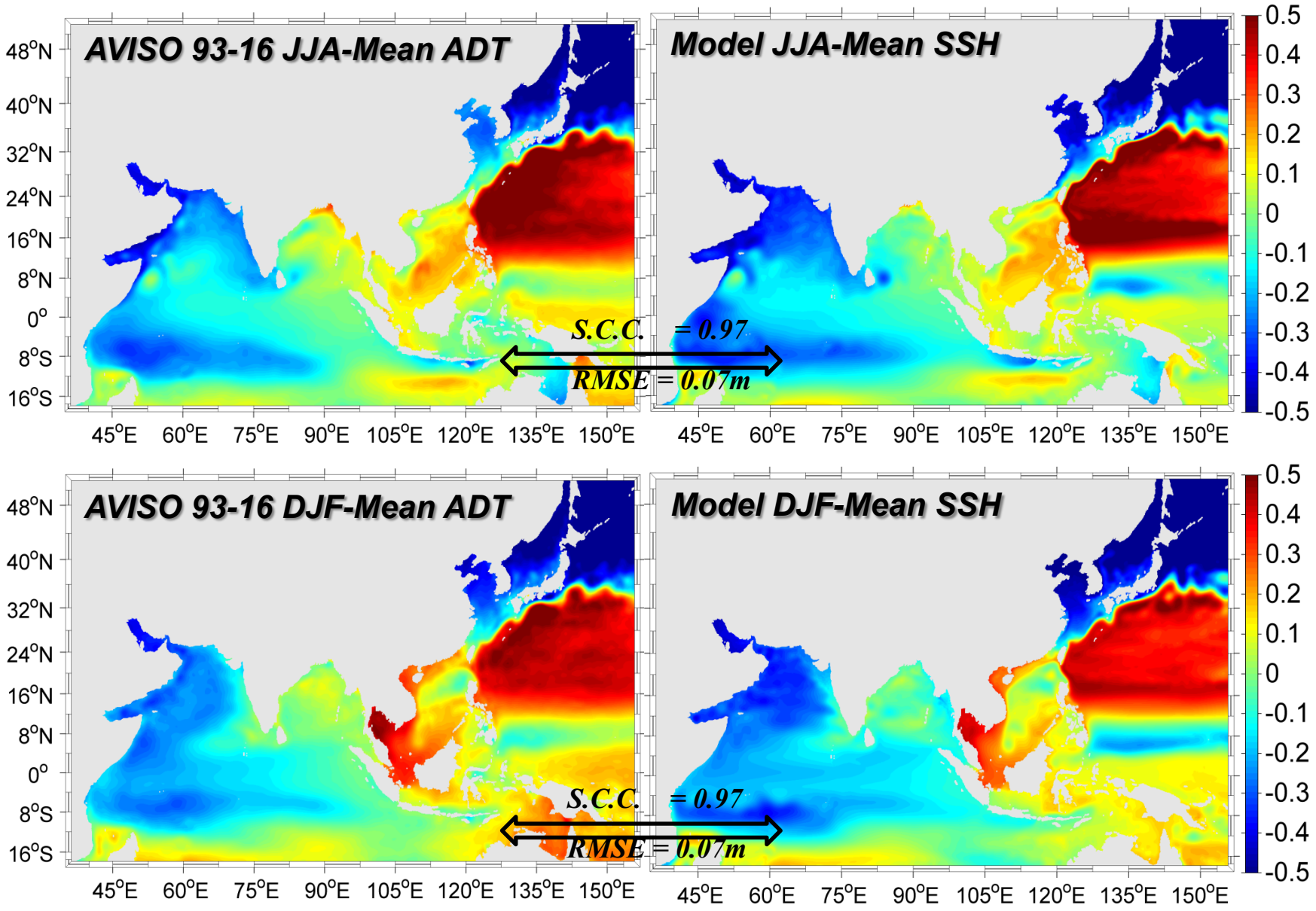
Winter



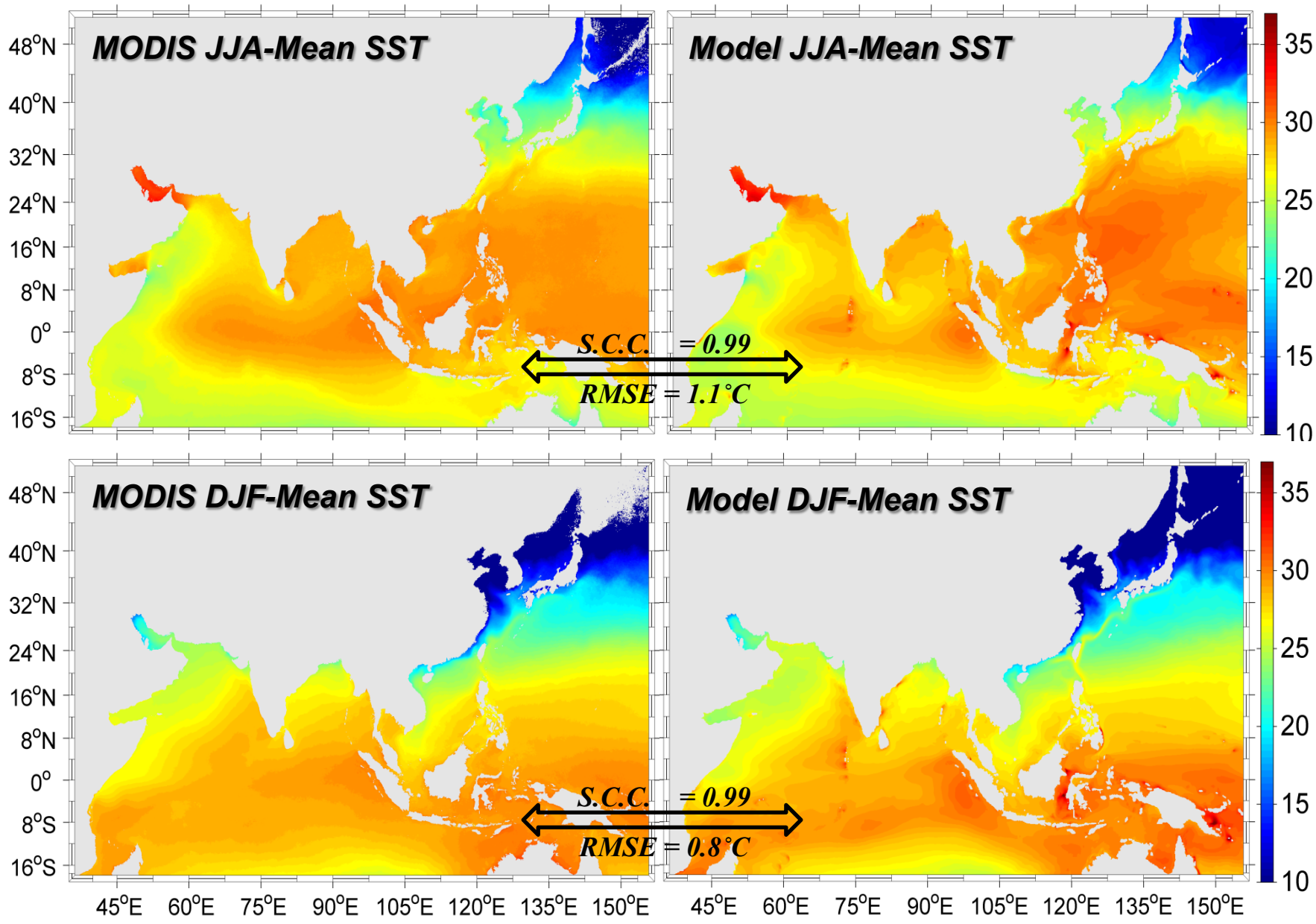


Comparing PIOM with the extended model suggests that the EB & SB of PIOM perform well!

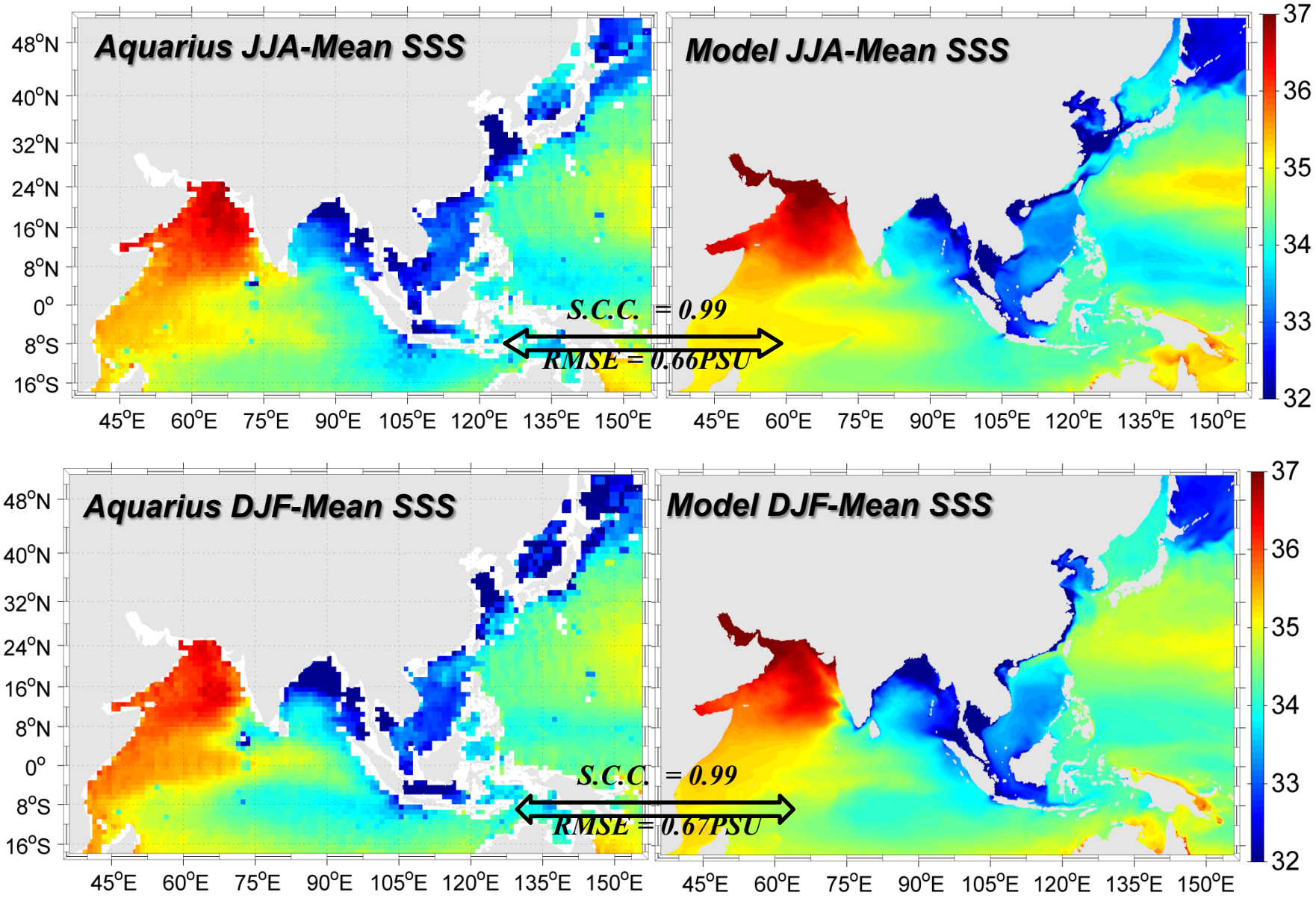
Comparison with Observations



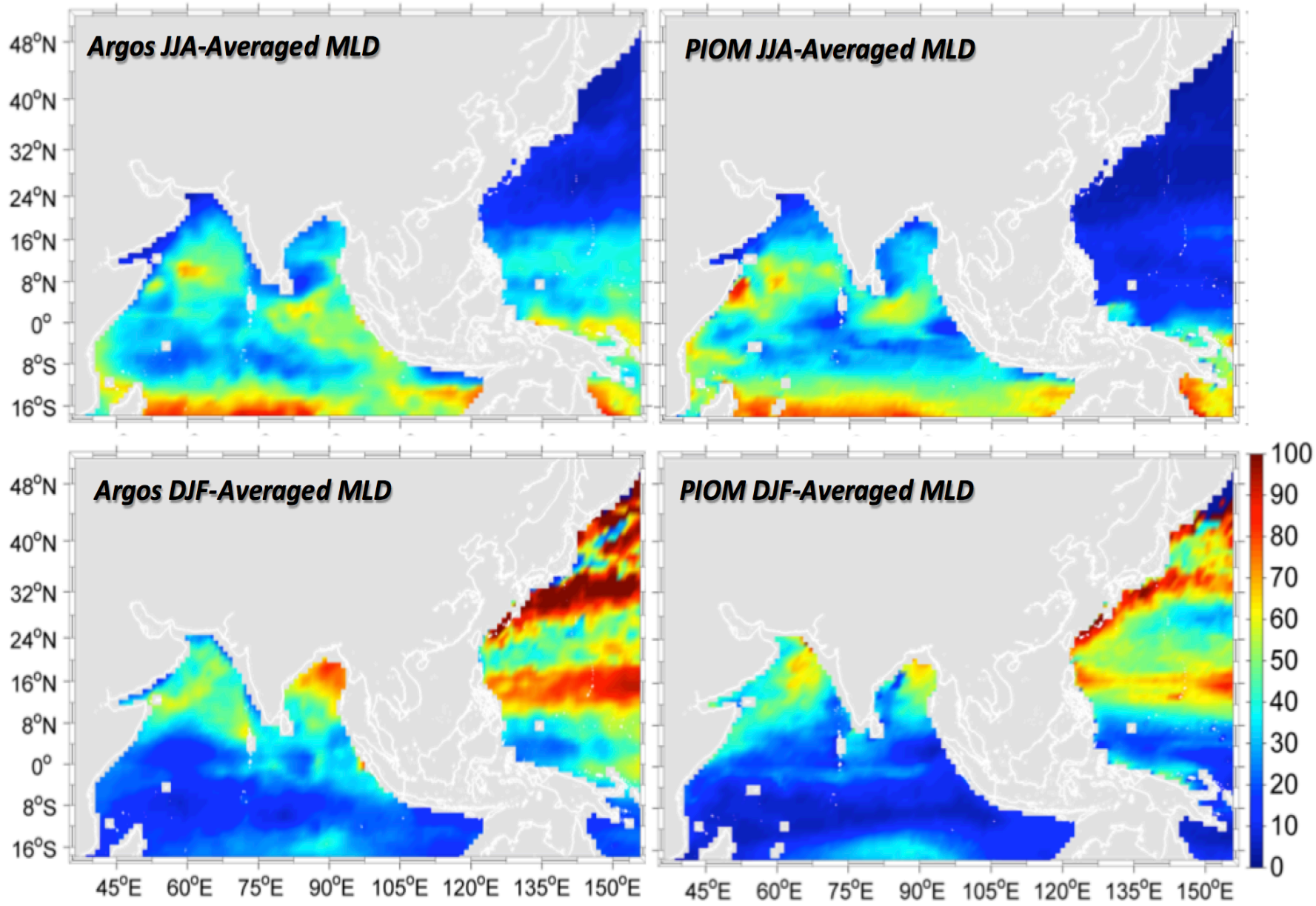
Comparison with Observations



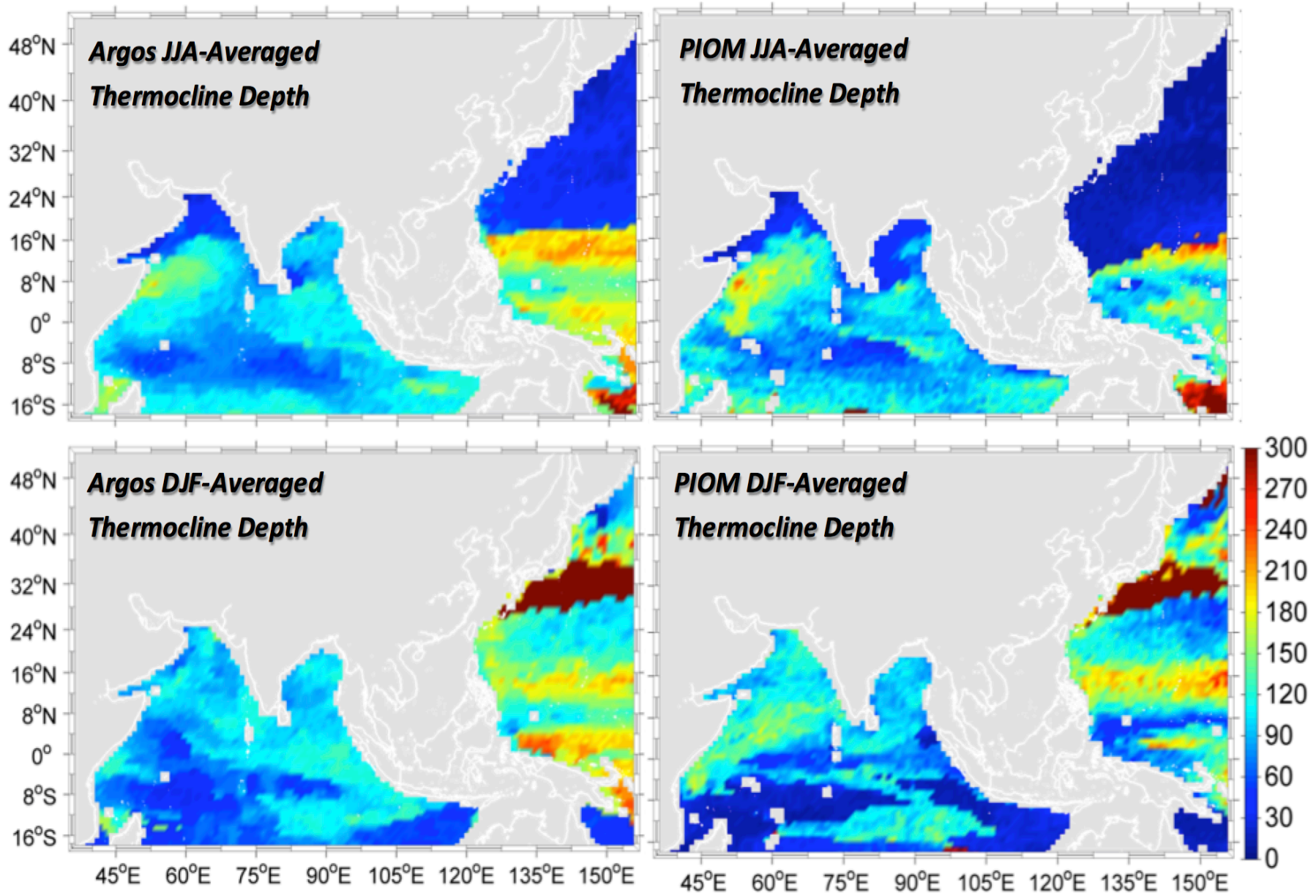
Comparison with Observations



Comparison with Observations



Comparison with Observations

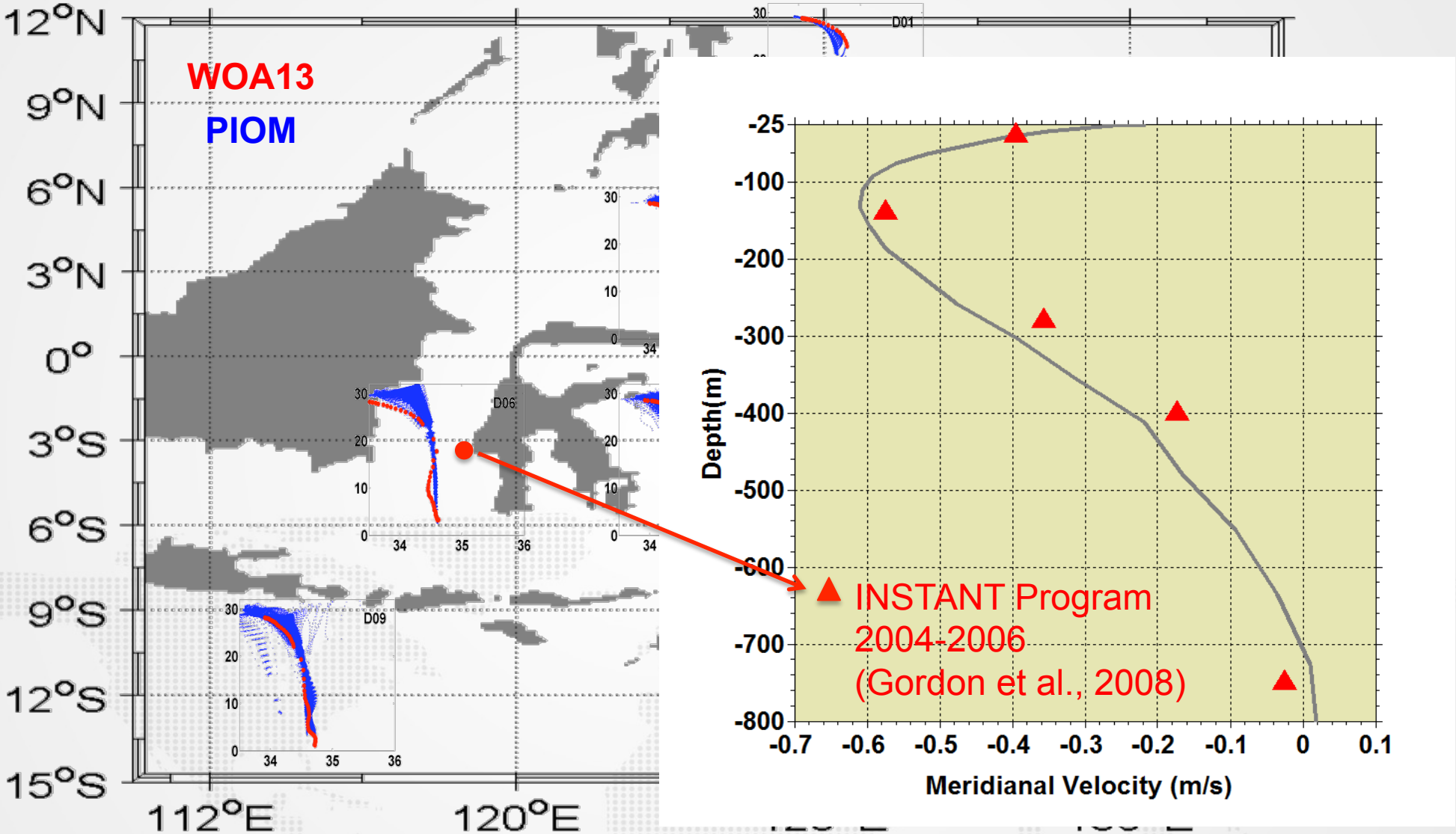


Comparison with Observations

Variables \ Season		Spring	Summer	Fall	Winter
SSH	Spatial Correlation: OFES and AVISO	0.9297	0.9240	0.9234	0.9325
	Spatial Correlation: PIOM and AVISO	0.9648	0.9691	0.9715	0.9702
	RMSE: OFES and AVISO	0.1161	0.1266	0.1265	0.1168
	RMSE: PIOM and AVISO	0.0875	0.0759	0.0711	0.0775
SST	Spatial Correlation: OFES and MODIS	0.9992	0.9989	0.9992	0.9991
	Spatial Correlation: PIOM and MODIS	0.9984	0.9984	0.9990	0.9991
	RMSE: OFES and MODIS	1.2976	1.2327	1.3473	1.2235
	RMSE: PIOM and MODIS	1.1749	1.0696	0.8281	0.81
SSS	Spatial Correlation: OFES and Aquarius	0.9998	0.9998	0.9998	0.9998
	Spatial Correlation: PIOM and Aquarius	0.9998	0.9998	0.9998	0.9998
	RMSE: OFES and Aquarius	0.5242	0.4876	0.5582	0.6236
	RMSE: PIOM and Aquarius	0.5926	0.6384	0.6011	0.6293
MLD	Spatial Correlation: OFES and Argos	0.8739	0.9596	0.9277	0.9260
	Spatial Correlation: PIOM and Argos	0.8764	0.9204	0.7729	0.9253
	RMSE: OFES and Argos	16.3862	13.3769	13.7636	18.0013
	RMSE: PIOM and Argos	13.0255	13.6884	18.5479	15.8392
Thermocline Depth	Spatial Correlation: OFES and Argos	0.7677	0.8673	0.8848	0.8155
	Spatial Correlation: PIOM and Argos	0.4453	0.8681	0.8867	0.8737
	RMSE: OFES and Argos	102.2577	44.4831	90.1475	90.1475
	RMSE: PIOM and Argos	137.9973	48.9442	49.3472	67.6698

Black (Cambridge blue): the results of PIOM are better (worse) than OFES

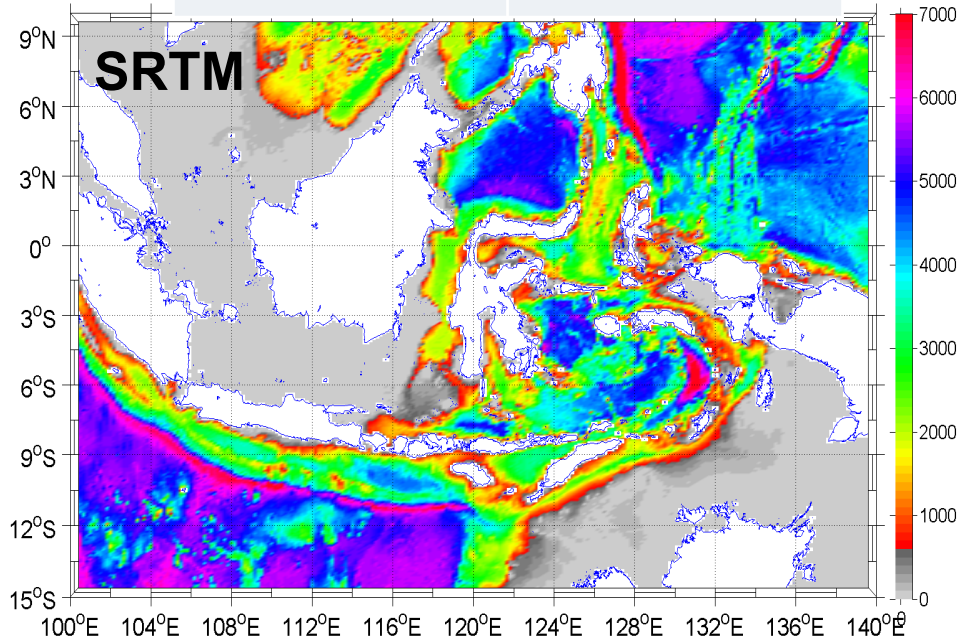
Comparison with Observations

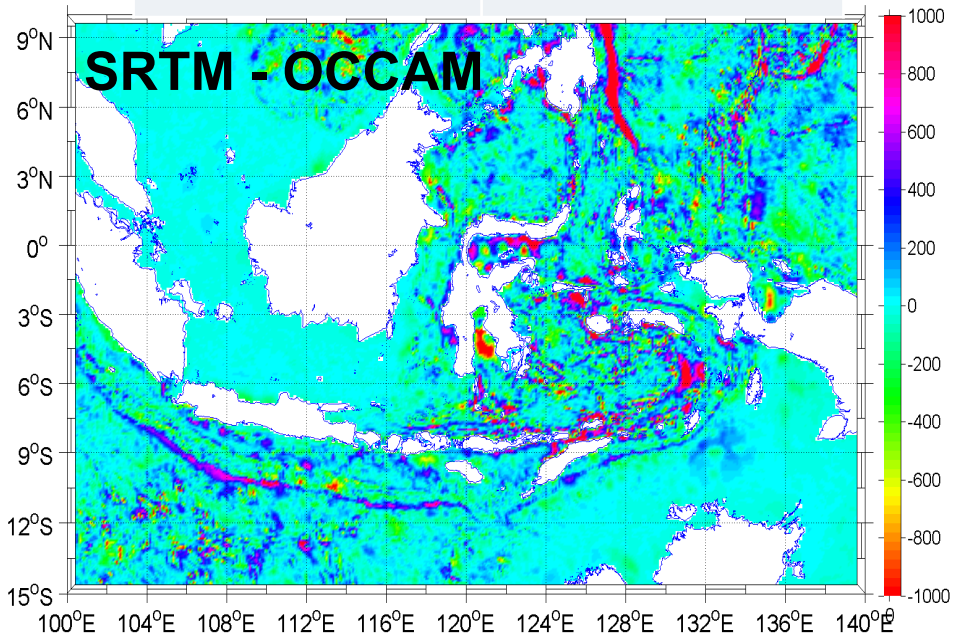


Different Topographic Products

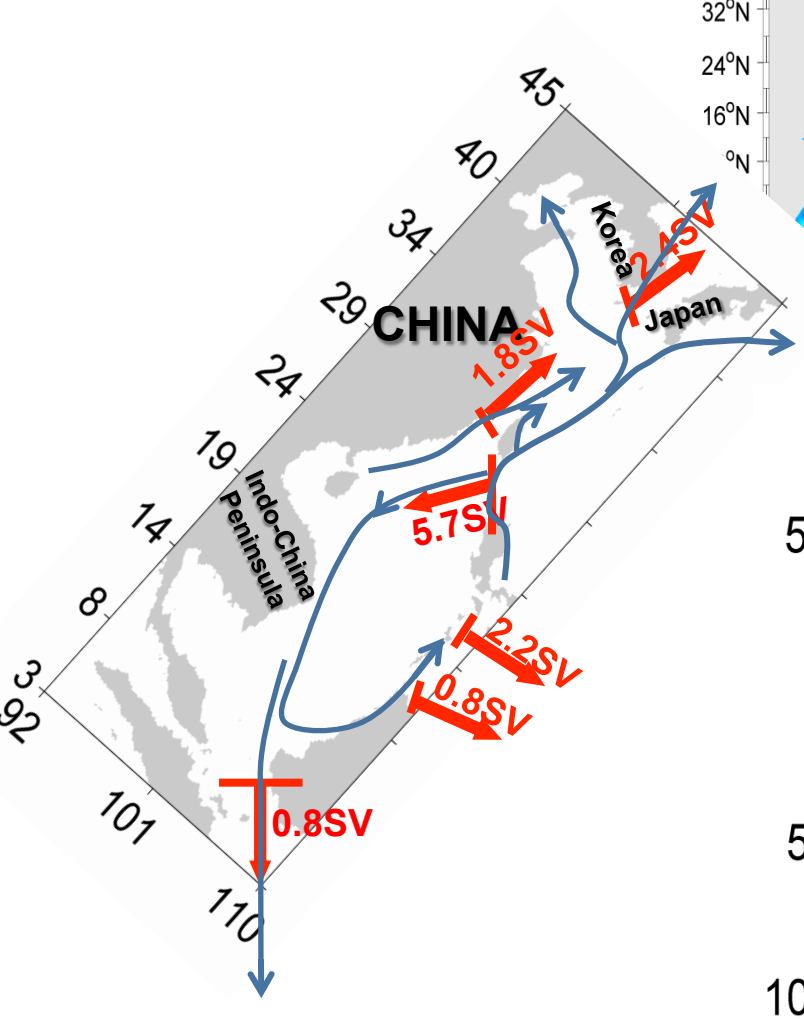
Topo: SRTM	Transport(SV)
Makassar	-6 Sv
Maluku	7 Sv
Halmahera	-6.2 Sv
Lombok	-3.5 Sv
Timor	1 Sv
Ombai	-2.6 Sv

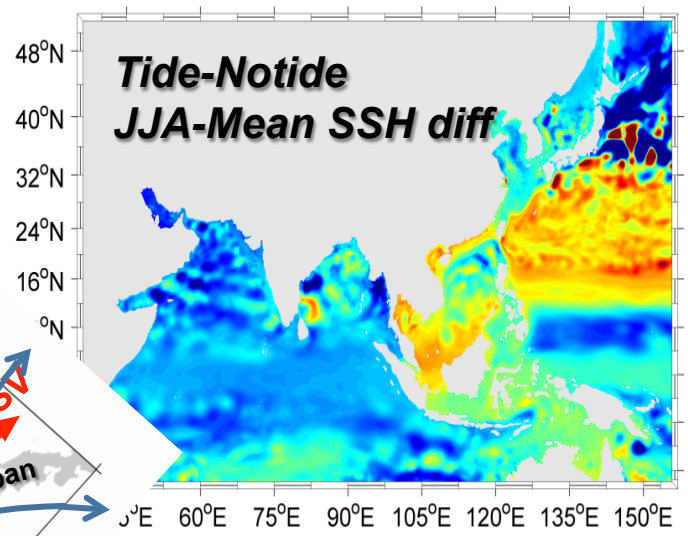
Topo: OCCAM	Transport(SV)
Makassar	-9 Sv
Maluku	2.7 Sv
Halmahera	-3.6 Sv
Lombok	-2.7 Sv
Timor	-5.7 Sv
Ombai	-1.7 Sv

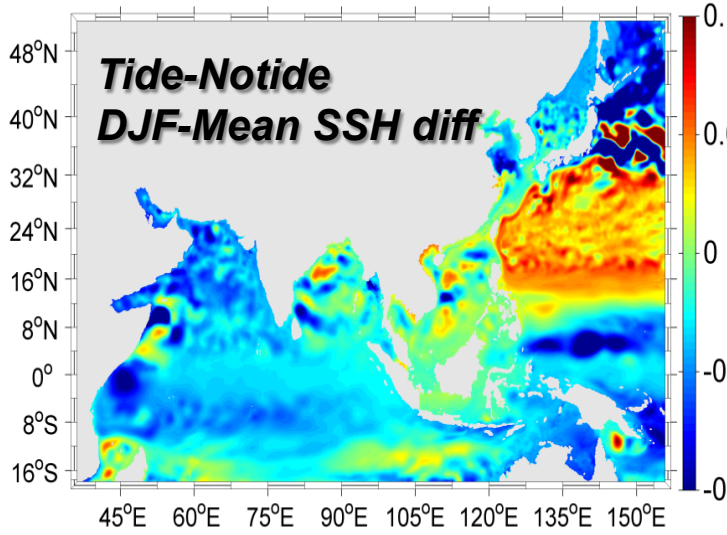


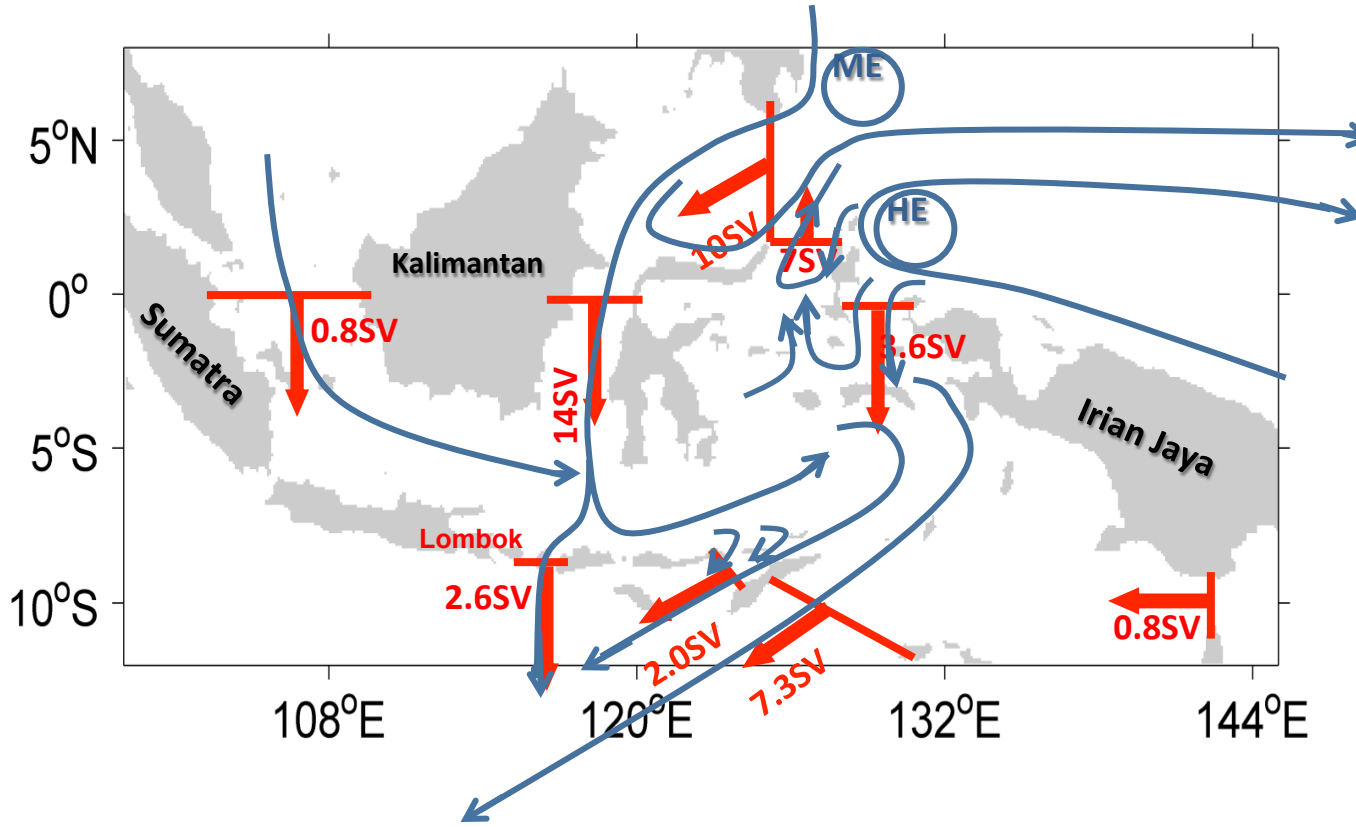


PIOM with Tides



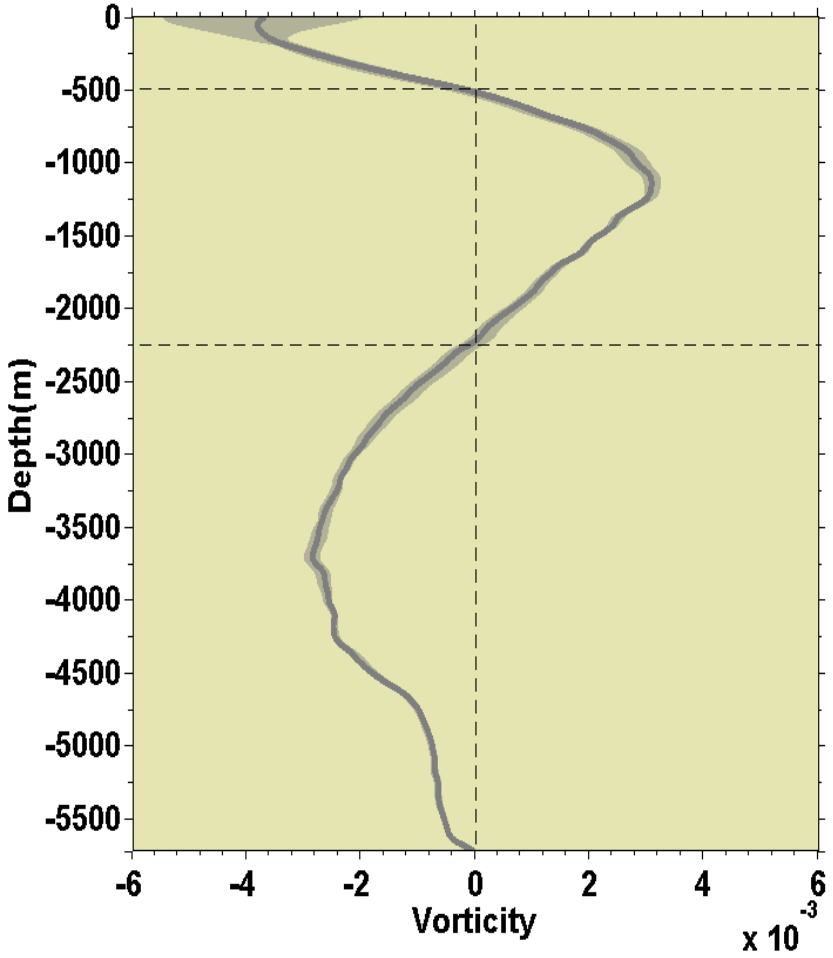


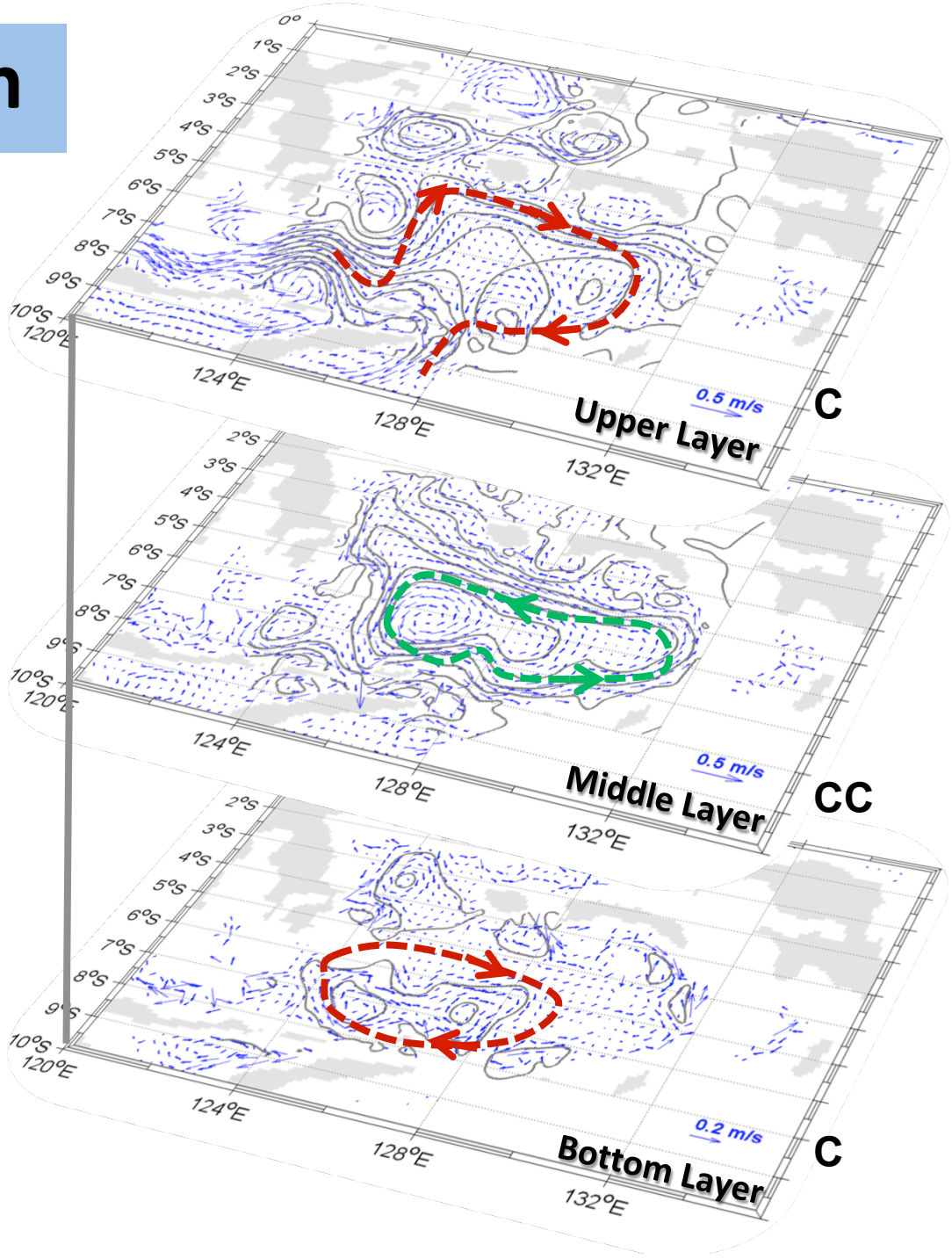




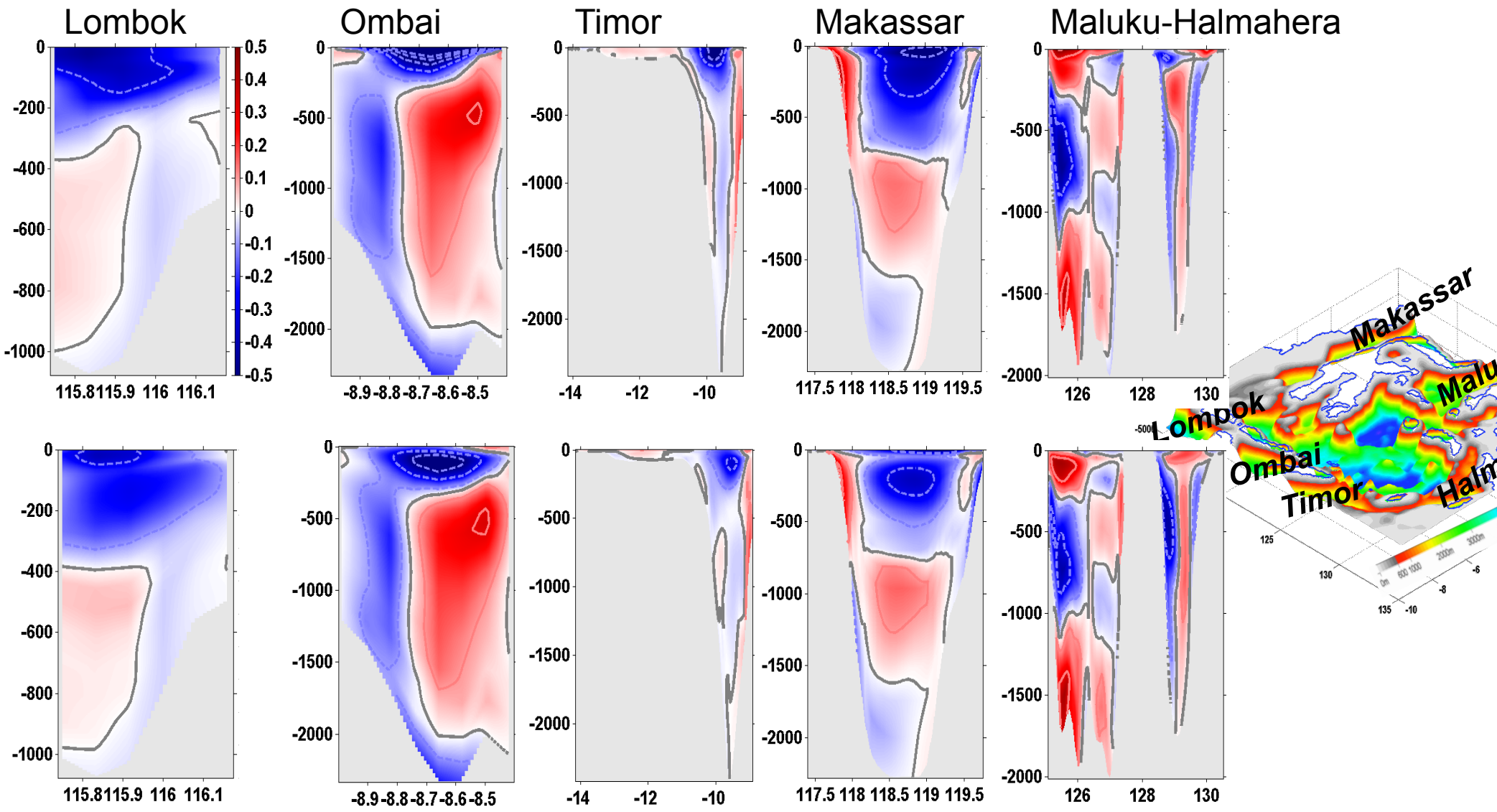
The Banda Sea Circulation

$$C = \iint_{\epsilon} (\mathrm{rot}V)\,dA$$

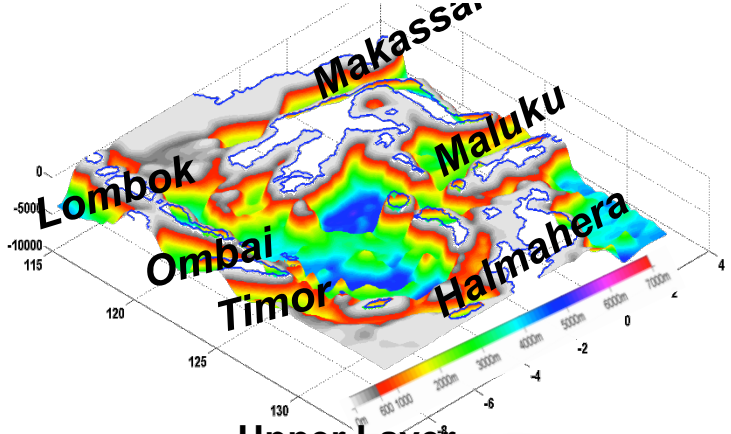


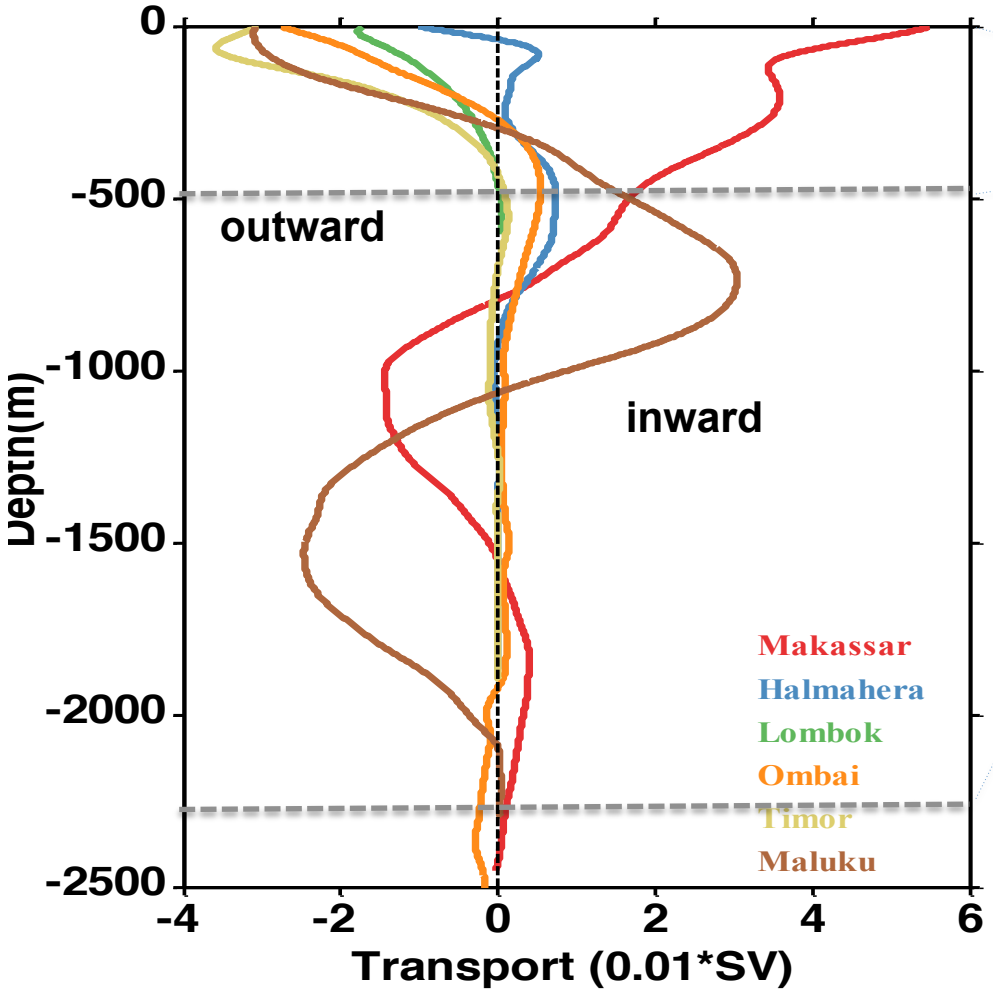


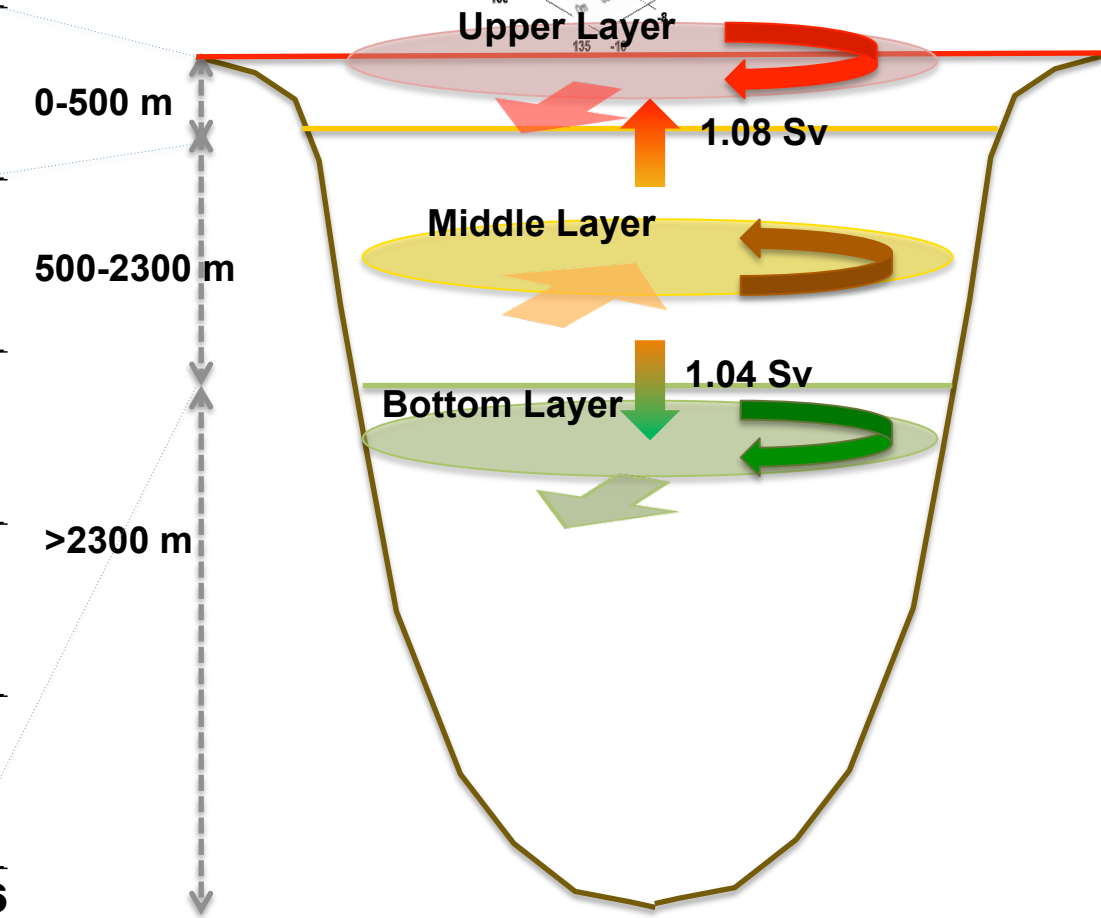
In- and outflows to the Banda Sea



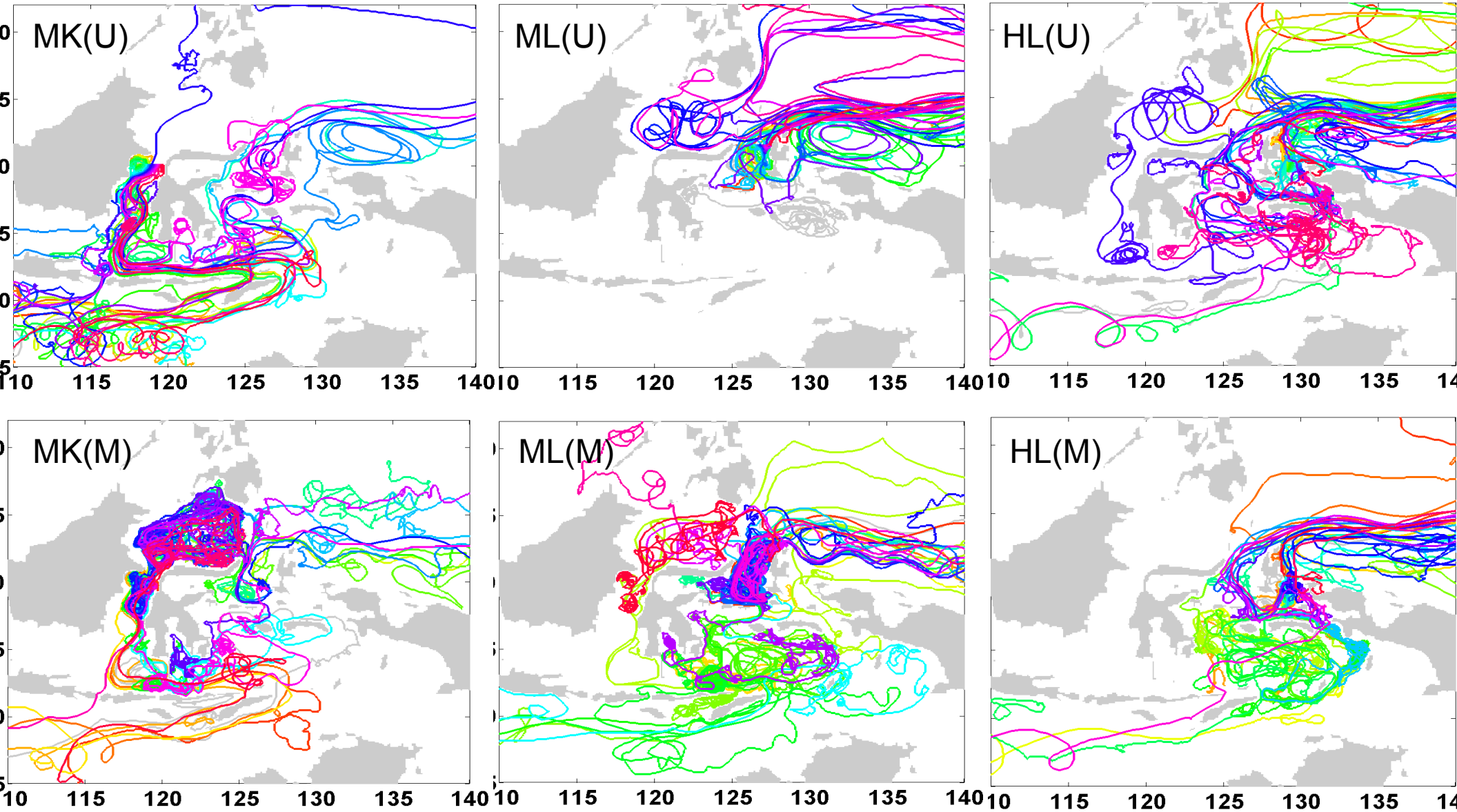
In/Outflows & the Banda Sea Circulation



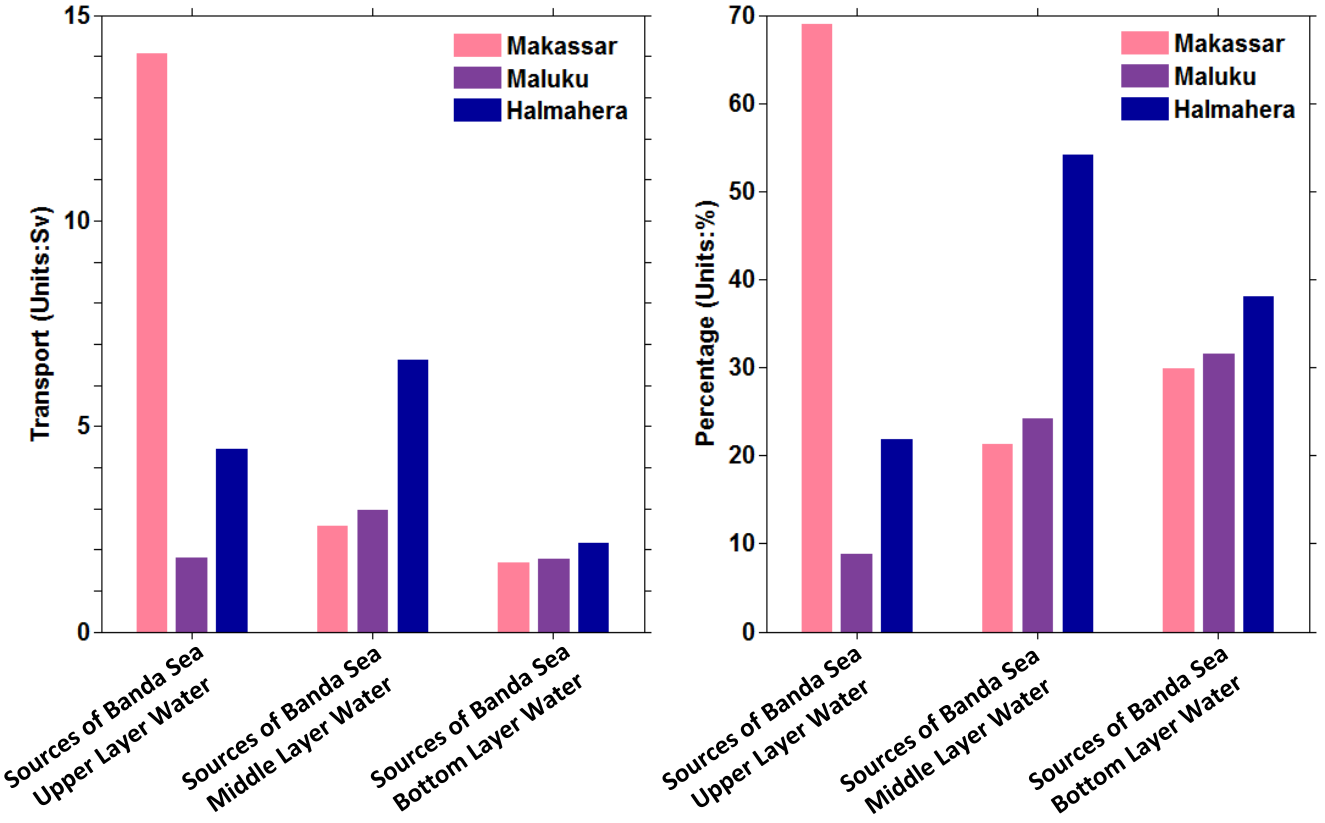




The Banda Sea Waters



The Banda Sea Waters



Summary

- Comparison with observations demonstrates the reliability of the PIOM result.
- The ITF transport derived from PIOM is within a reasonable range, but the transport is sensitive to both local and regional topography.
- The inclusion of tide in the model tends to increase the ITF transport by changing the inter-basin sea level differences.
- There are three layers of circulation in the Banda Sea: clockwise in the upper and bottom but counterclockwise in the middle. Inflows of Makassar, Maluku, and Halmahera origins are mixed in the Banda Sea, and all contribute to the ITF.