

Monitoring the Indonesian Throughflow in Makassar Strait
MITF

KR Baruna Jaya VIII

Terkait Cruise Selat Makassar 2015

10 August to 17 August 2015

Jakarta to Makassar, Indonesia

I Introduction and Cruise Objectives:

The archipelago between Southeast Asia and Australia, the only tropical interocean pathway, offering a maze through which warm Pacific water spreads into the Indian Ocean, the Indonesian Throughflow (ITF), influencing large-scale oceanic heat and freshwater inventories. As the ITF region is at the nexus of ENSO (El Niño/La Niña) and the Asian monsoon phenomena, it is highly likely, as indicated by model studies, that the ITF impact on SST patterns affect ENSO and monsoon behavior. Within the Indonesian seas the ITF shapes the marine ecosystem and biochemistry, and is a factor in governing the environmental conditions, particularly of the coastal waters of Indonesia. Recording the ITF is a cost effective way to monitor a core element of the ocean and climate system, with the goal to enable improved climate predictive capability and the regional oceanographic condition of the Indonesian region. As Makassar Strait is the pathway for 80-85% of the total ITF, it is the obvious focus of an ITF monitoring array.

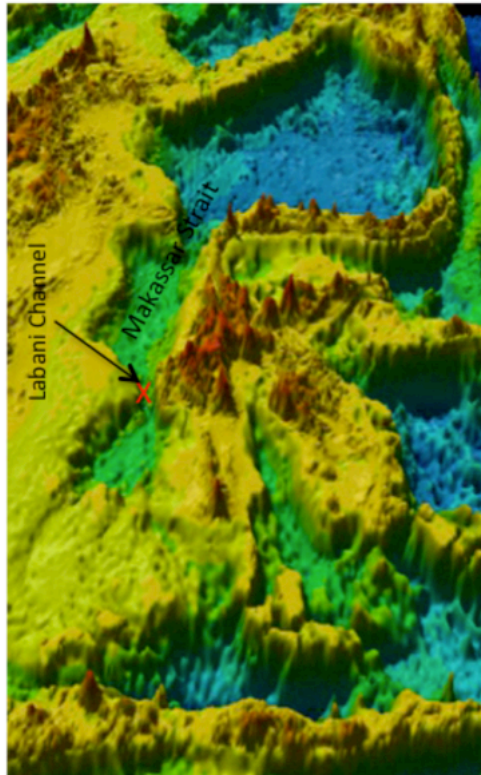


Figure 1 Position (Red X) of the Makassar ITF mooring within Labani Channel.

The Makassar Strait throughflow time series, at 2°51' S; 118°28' E; 2147 m (Figure 1), in the Labani Channel 45 km wide constriction of Makassar Strait, began with the Arlindo program in 1996-1998, and continued with INSTANT January 2004 to December 2006 and continued as the MITF program as part of the NOAA OCO program in December 2006. The most recent recovery was in August 2011, but it was not re-deployed due to logistical complications.

In August 2013 the Makassar mooring was deployed at 2° 51.785' S and 118° 27.772' E from the Baruna Jaya VII. The objective of the Baruna Jaya VIII August 2015 cruise is to recovery that mooring, download the data and redeploy the mooring for another two years. The 2013-2015 mooring configuration and the 2015–2017 mooring configuration is shown in Figure 2.

The activity is covered by an agreement between The Research and Development Centre for Marine and Fisheries Technology (RDCMFT) of The Agency for Marine and Fisheries Research and Development (AMAFRAD), Ministry of Marine Affairs and Fisheries of Republic of Indonesia and The Lamont-Doherty Earth Observatory (LDEO) of Columbia University, USA, signed in May 2015.

It is noted that the Makassar Strait throughflow (MITF) carries ~80-85% of the total ITF and >90% of the total ITF within the thermocline, making it an ideal site for tracking the changing nature of the ITF. The time series since 1996, with gaps as noted above, has revealed some startling changes in the ITF, which has large scale significance to the ocean and climate system, with possible improvement in long term (interannual) predictions, as well as marine ecosystems within Indonesian waters.

II Cruise Schedule and Participants

The BJ8 Terkait Cruise Selat Makassar 2015, left Jakarta at 1530 on Monday, 10 August 2015 and ended Monday morning, 17 August, in Makassar. The cruise time was devoted to recovery of the 2013-2015 Makassar mooring, downloading the recorded data, and redeploying a modified version of the mooring for the 2015-2017 period and gathering of an array of CTD stations, with water samples for biology, plus plankton net tows.

The general cruise track is shown in Figure 2. The latitude/longitude of the mooring and CTD stations are given in Table I. The cruise participants are listed in Table II placed at the end of this cruise report.

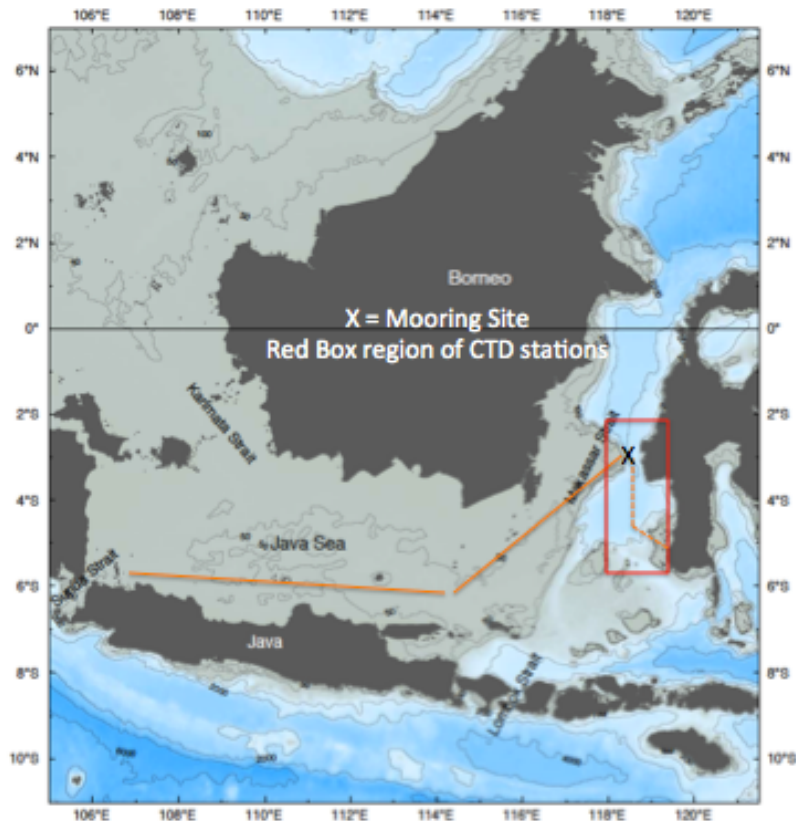


Figure 2 General cruise track. The Mooring and CTD station positions (within the red box) is given in Table I

Table I

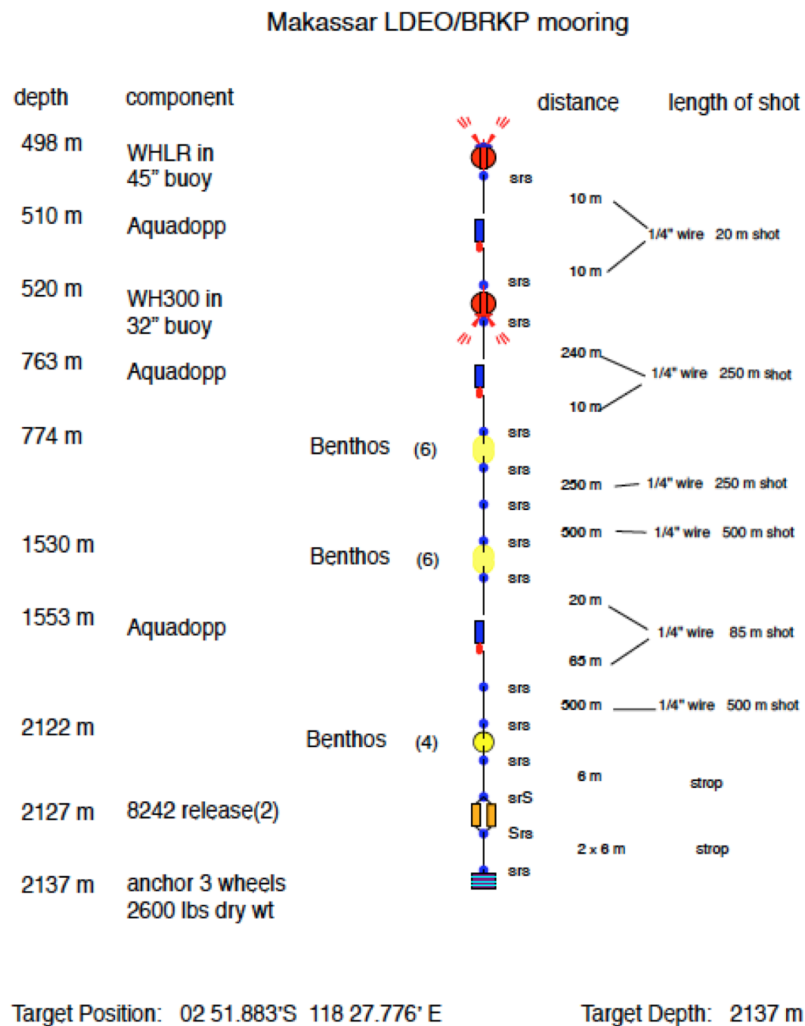
Mooring and CTD Stations

Latitude	Longitude	CTD #	
2° 48' S	118° 43.2' E	1	same site as 93/94
2° 48' S	118° 36.0' E	2	same site as 93/95
2° 48' S	118° 24.0' E	3	same site as 93/96
2° 48' S	118° 18.3' E	4	same site as 93/97
2° 51.785' S	118° 27.772' E	Mooring Recovery	
2° 30'S	118° 15'E	5	
2° 30'S	118° 36'E	6	
2° 51.785' S	118° 27.772' E	7, 8	labeled mooring 1 and 2
2° 51.785' S	118° 27.772' E	Mooring Deployment	
3° 30'S	118° 30'E	9	
4° 00'S	118° 00'E	10	dropped, bad winds/waves
4° 00'S	118° 30'E	11	
4° 00'S	119° 00'E	12	
4° 30'S	118° 00'E	13	Done after #14
4° 30'S	118° 45'E	14	
5° 00'S	118° 45'E	15	

Note- with dropping of station 10, there were 14 stations in total, including the two at the mooring site; station numbers differ from those assigned by CTD crew.

III Mooring activity

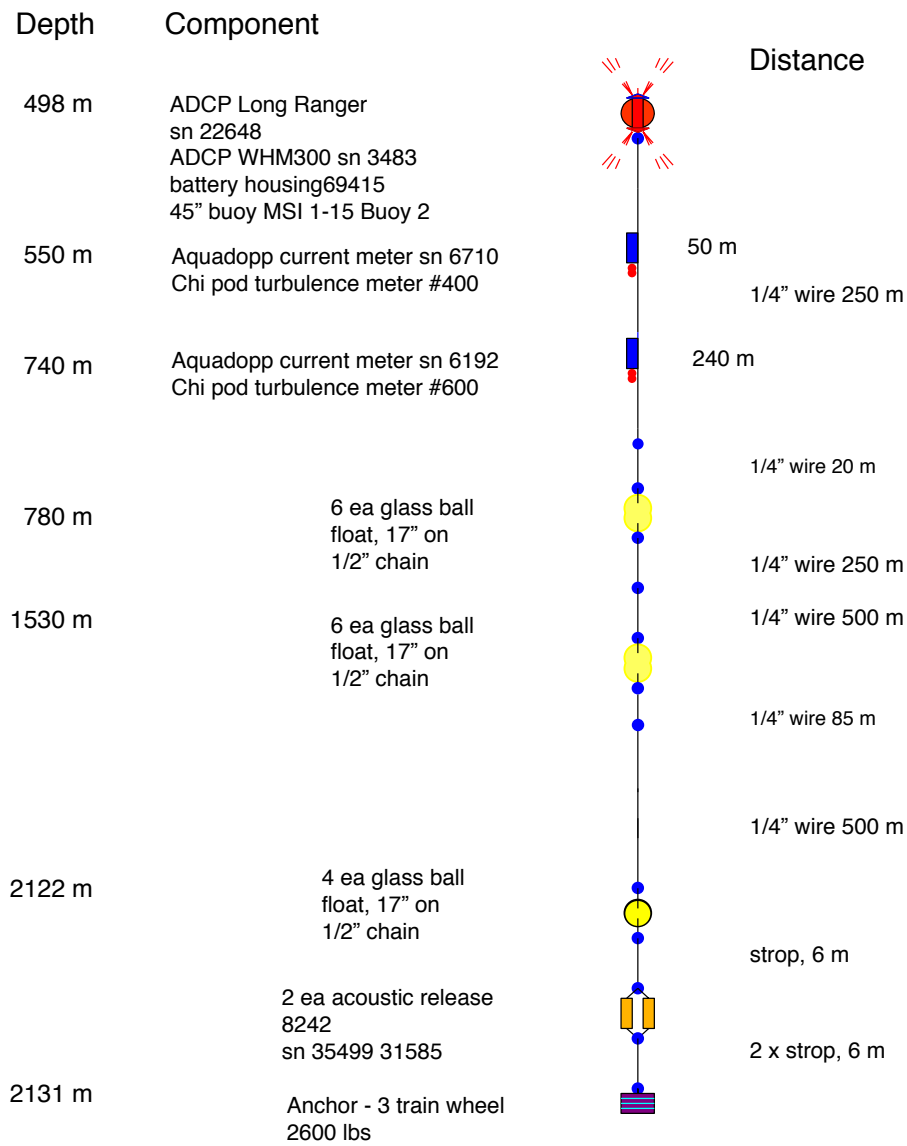
The configuration of the mooring in the 2013-2015 period is shown in Figure 4a. The recovery of that mooring on 14 August 2015 is shown as Figure 5. The release mechanism was tricked at 8:25 AM Makassar time. The new mooring was deployed on 15 August 2015 (anchor released at 12:50 pm) for a 2-year period is shown in Figure 4b.



ADCP buoys are Flotec syntactic foam with stainless steel frames
Aquadopp = Nortek aquadopp current meter with wire clamps
Benthos = 17" Benthos glass ball floats in hard hats, shackled to 1/2" long-link galvanized chain
srs = 1/2" galv safety pin shackle-5/8" galv pear link - shackle (S = 5/8" shackle)
mooring wire is 1/4" nil spin jacketed wire rope with swaged terminations

Figure 4a Makassar mooring 2013-2015

Makassar Strait Mooring Deployed Aug 2015 BJ VIII



● shackle-ring-shackle

Triangulated position and depth:
02° 51.683'S 118° 27.912'E depth 2115 m
Anchor dropped 0453 GMT 15 August 2015

Figure 4b Makassar mooring 2015-2017, modified from the plan to accommodate dropping the 1500 m aquadopp, reposition of the remaining 2, and the addition of the χ pods (measurement of ocean turbulence) at the 2 aquadopp instruments.

The equipment deployed on 15 August 2015: new Long Ranger ADCP, WHM300 Workhorse ADCP, a single syntactic foam buoy and frame that accommodates Long Ranger and WHM300 plus battery case. The LADCP recovered is operational, and turned over to RDCMFT for further ITF measurements. Also deployed were two Acoustic current meter, Nortek Aquadopp (a third aquadopp recovered on 15 August malfunctioned and could not be re-deployed in the 2015-2017 mooring). Acoustic release, ORE/Edgetech, 2 units; 10-glass ball flotation from the 2013-2015 mooring plus 6 new glass ball flotation. Two χ pods (measurement of ocean turbulence) were positioned at the aquadopp instruments.



Figure 5a Recovery of the 2013-2015 Makassar mooring, 14 August 2015 @ 2° 51.785' S and 118° 27.772' E



Figure 5b Deployment of the 2015-2017 Makassar mooring, 15 August 2015. Top sphere @ 11:30 am Makassar time; Anchor away at 12:52 am. Coordinate: 2° 51.683' S and 118° 27.912' E (only 312 m from the 2013-2015 position).

The recovered Makassar mooring had a full load of data from the upward looking Long Ranger ADCP, the most important component of the data collection, as it provides ocean current information from the surface to ~500m, the primary layer of the ITF. The downward looking workhorse ADCP failed. Two of the aquadopps had a full data set and were downloaded; the deepest ~1500 m, had a full load of data, but software issues did not allow it to be downloaded. It was not redeployed; its data will be downloaded in the lab. Triangulation of the anchored 2015-2017 mooring reveals its coordinates as: 2° 51.683' S and 118° 27.912' E, about 312 m from the site of the 2013-2015 mooring.

IV CTD Stations

There were 12 CTD stations with 12-bottle rosette water sampler down to a depth of 1000 m. Two CTD to 750 m were obtained at the mooring site to gain a sense of the time variability. Water samples were obtained for water chemistry. The CTD were followed (except at the two at the mooring site (7 and 8) by a vertical plankton tow (Figure 7). Table I lists the stations latitude/longitude; two were dropped due to bad weather.

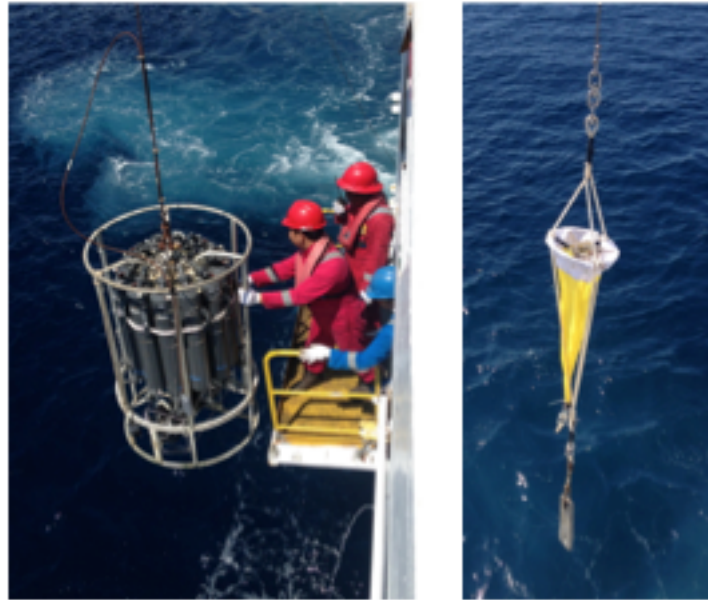


Figure 7: Launching CTD, left photo; lowering Plankton net, right photo.

Acknowledgements

I am most pleased to report that the cruise was highly successful and that this was due to the excellent offices and crew of KR Baruna Jaya VIII and of the technical support staff. I offer sincere thanks to Agus Setiawan, R&D Centre for Marine & Fisheries Tech, who arranged for the cruise. I acknowledge with pleasure the fine work of Capt. M Afandi Juluhun. His ship handling skills made for a smooth mooring deployment, despite the 1.5 m/sec surface current. Teguh Agustiadi, who was in charge of the group handling the mooring activity, did a superb job of organizing the support staff, carrying out a complex series of activities. His booming voice provided the spirit to bring everyone together. The very experienced Muhadjirin, who was in charge of the CTD operation, oversaw the collection of a fine, well-calibrated data set, which with the water samples and plankton tows, provide great insight to the oceanography and biochemistry of Makassar Strait.

The Indonesian students who joined the cruise were such a delightful bunch, so cheerful, wonderful sense of humors. I am so happy to meet with them, and convey the excitement of learning about the oceanography of their seas. My graduate student at Columbia University, Asmi Napitu, was so important in coordinating the activities between the US and Indonesian groups. She was central to making the cruise a success. Bruce Huber effectively conveyed his knowledge to the group, which will serve them well in their careers. I also thank Kandaga Pujiana, a past graduate student of mine, who led the Baruna Jaya VII cruise in the deployment of the Makassar mooring in August 2013. The success in the deployment led to the treasure trove of Makassar throughflow data for the 2013-2015 period.

I appreciate the opportunity to bring my 16-year-old son, Charles Gordon, on the cruise. Not only might he have learned about what his father does, but he has been introduced to the Indonesian culture.

The praise I offer above reflects the wonderful experience I had in working with my Indonesian colleagues over the last 3 decades.

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17 August 2015

Table II Participants

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23	Nanda Syahni	Pramu Kapal III	Calon Pegawai Negeri	

			Sipil	

Science Team

No	N A M A	JABATAN	NEGARA/ INSTANSI
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2	Arnold Gordon	Peneliti / Researcher	LDEO USA
3	Mukti Trenggono	Peneliti / Researcher	Indonesia/ BPOL KKP
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5	Charles Bemard Ffield Gordon	Peneliti / Researcher	LDEO USA
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11	Bayu Priyono	Peneliti / Researcher	Indonesia/ BPOL KKP
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13	Fitriastuti Nagari	Student	Indonesia/ UNSOED
14	Dwi Asvarita	Student	Indonesia/ UB
15	Reskyani Fajri Rahmawati	Student	Indonesia/ UB

16	Muhammad Arief Wibowo	Student	Indonesia/ ITB
17	Irvan Wira Trihadi Geofary	Student	Indonesia/ UB
18	Ahmad Didin Khoiruddin	Student	Indonesia/ UB
19	Annisa Shafira Kinasih	Student	Indonesia/ UB
20	Raut Wahyuning Paluphi	Student	Indonesia/ UB
21	Kolonel laut (P) Hasnan	Security Officer	Indonesia/ Ditwilhan
22	Muhadjirin	Operator	Indonesia/ P2O LIPI
23	Nuradmojo	Operator	Indonesia/ P2O LIPI