Activities and Plans along GO-SHIP Repeat Hydrography in Japan

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- Establishment of Japan Repeat Hydrography Implementation Group
- Japan's contribution to GO-SHIP from 2003 to 2013
- Efforts towards hydrographic data synthesis

Masao Fukasawa

Co-chair: JRIG (Japan Repeat Hydrography Implementation Group)

1.Establishment of Japan Repeat hydrography Implementation Group (JRIG)

- **JRIG** was established as Japanese domestic body to deal with GO-SHIP activities in Japan.
- **JRIG** coordinates implementation plans of repeat hydrography in Japan along GO-SHIP vision and provides technical review.
- **JRIG** consists of members from organizations planing and implementing "Repeat Hydrography " and the direct data users.
- **JRIG** aims to be endorsed by JIOC sub-com and IOC/IOCCP as the access point in Japan for possible “International Repeat Hydrography Program".

Japan Repeat hydrography Implementation Group (JRIG)

Co-Chair: Yoshiteru KITAMURA（Japan Meteorological Agency)
Masao FUKASAWA (JAMSTEC, GO-SHIP）

Member : Masaki KAWABE (Ocean Research Institute/The University of Tokyo)
Toshitaka GAMO(ORI/UT, GEOTRACES)
Ichiro YASUDA (ORI/UT)
Hiroshi OGAWA (ORI/UT, IMBER)
Toshio SUGA (Tohoku University, CLIVAR/OOPC, JARGO)
Masao ISHII (Meteorological Research Institute/JMA, GO-SHIP, PACIFICA)
Michio AOYAMA (MRI/JMA, SGONS)
Akihiko MURATA (JAMSTEC, SGONS)
Takeshi KAWANO (JAMSTEC)
Tomowo Watanabe(JFRI, JFA)

PO CO BGC Fish.

2. Contribution to GO-SHIP from 2010 to 2013

Cruises for the past 10 years

GO-SHIP LINE	year	Chief Scientist/ Organization	Performance	Data
P01	2007	Kawano (JAMSTEC)	*1	CCHDO, CDIAC, JAMSTEC
P03	2005	Kawano/Kaneko/Murata (JAMSTEC)	*1	CCHDO, CDIAC, JAMSTEC
P06	2003	Fukasawa/Watanabe (JAMSTEC)	*1	CCHDO, CDIAC, JAMSTEC
P10	2005	Kawano (JAMSTEC)	*1	CCHDO, CDIAC, JAMSTEC
P14	2007	Kawano/Murata (JAMSTEC)	*1	CCHDO, CDIAC, JAMSTEC
P17N	2001	Fukasawa (JAMSTEC)	*1	CCHDO, CDIAC, JAMSTEC
P21	2009	Murata/Uchida (JAMSTEC)	*1	Under QC
A10	2003	Yoshikawa (JA<STEC)	*1	CCHDO, CDIAC, JAMSTEC
I03+I04	2003	Fukasawa (JAMSTEC)	*1	CCHDO, CDIAC, JAMSTEC

*1 Every Station : CTDO+LADCP, Dissolved Oxygen, Salinity, Nutrients, CFC-11,-12, -113 (Selected layers)

Every other station : DIC/TA, pH

Selected stations : C-13, C-14, Chl-a, Radio Nuclides, etc (Selected layers)

Underway : Thermp-Salino, pCO2、ADCP

Cruises for coming 3 years (implementation phase)

GO-SHIP line	Period	Duration	Station	Chief Scientist/ Organization	Performance
P09	Jul-Sep 2010	52days	124	Nakano/JMA	*1
P13	Jun-Sep 2011	90days	174	TBD/JMA	*1
I02*[a] + I10	Dec. 2011 – Jan 2012	55days	217	Murata/JAMSTEC	*2
A part of (S04P + S04I)	Jan-Mar 2013	65 days	Ca. 150	Kawano/JAMSTEC	*2

*1. Every Station (30nm) : CTDO+LADCP, Nutrients
Every other station (60nm) : DIC/TA, pH, Dissolved Oxygen, Salinity
CFC-11,-12 (<2,500m+3 layer), Chlorophyll-a (<200m)

*2. Every Station : CTDO, Dissolved Oxygen, Salinity, Nutrients,
CFC-11,-12, -113, SF6 (Selected layers)
Every other station : DIC/TA, pH
Selected stations : C-13, C-14 (Selected layers), Chlorophyll-a (<200m)
Underway : Thermp-Salino, pCO2、ADCP

*a. Observation line could be changed due to Vandalism

Precision

Precision in Repeat Hydrography by MIRAI in 2007

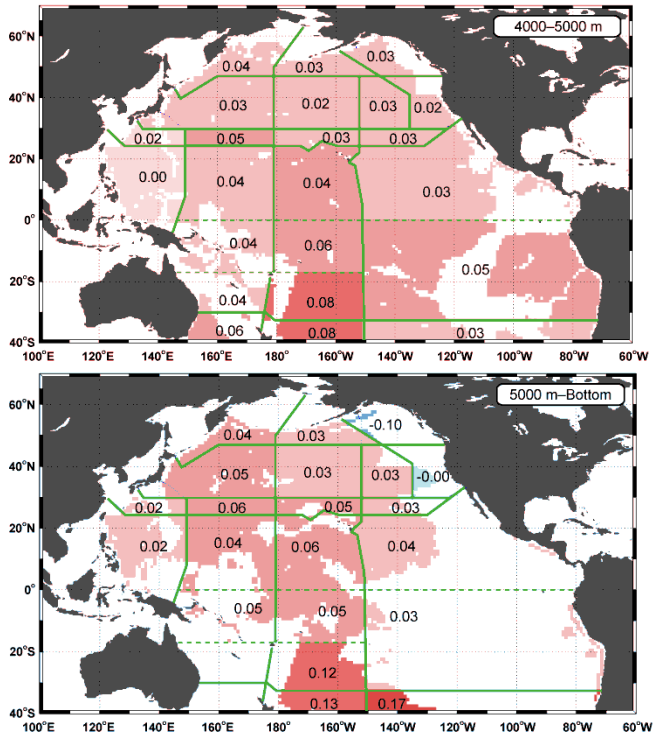
Property	Repeatability	Remark
Salinity	0.0018±0.00019, n = 482	Abs. diff. ± std
DO	0.09 μmol kg^{-1}, n = 975	Std
Nitrate	0.07%, n = 266	CV, mean
Phosphate	0.10%, n = 266	CV, mean
Silicate	0.07%, n = 266	CV, mean
DIC	1.2±1.1 μmol kg^{-1}, n = 440	Abs. diff. ± std
Ta	0.5 ±0.5 μmol kg^{-1}, n = 407	Abs. diff. ± std
pH	0.0005 ± 0.0006, n = 565	Abs. diff. ± std
CFC-11	0.010 pmol kg^{-1}, n = 233	
CFC-12	0.008 pmol kg^{-1}, n = 234	
CFC-113	0.008 pmol kg^{-1}, n = 217	

JMA will be similar because the instruments and the methods are same.

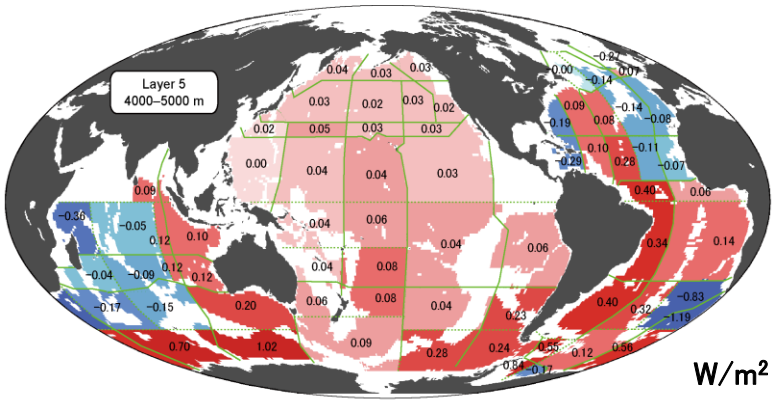
3. Efforts toward hydrographiuc data synthesis

- **PACIFICA** (PACIFic ocean Interior Carbon) : will be presented by Dr. Masao Ishii

- Bottom/Deep water property change related to MOC variability



Kawano et al.(2010)

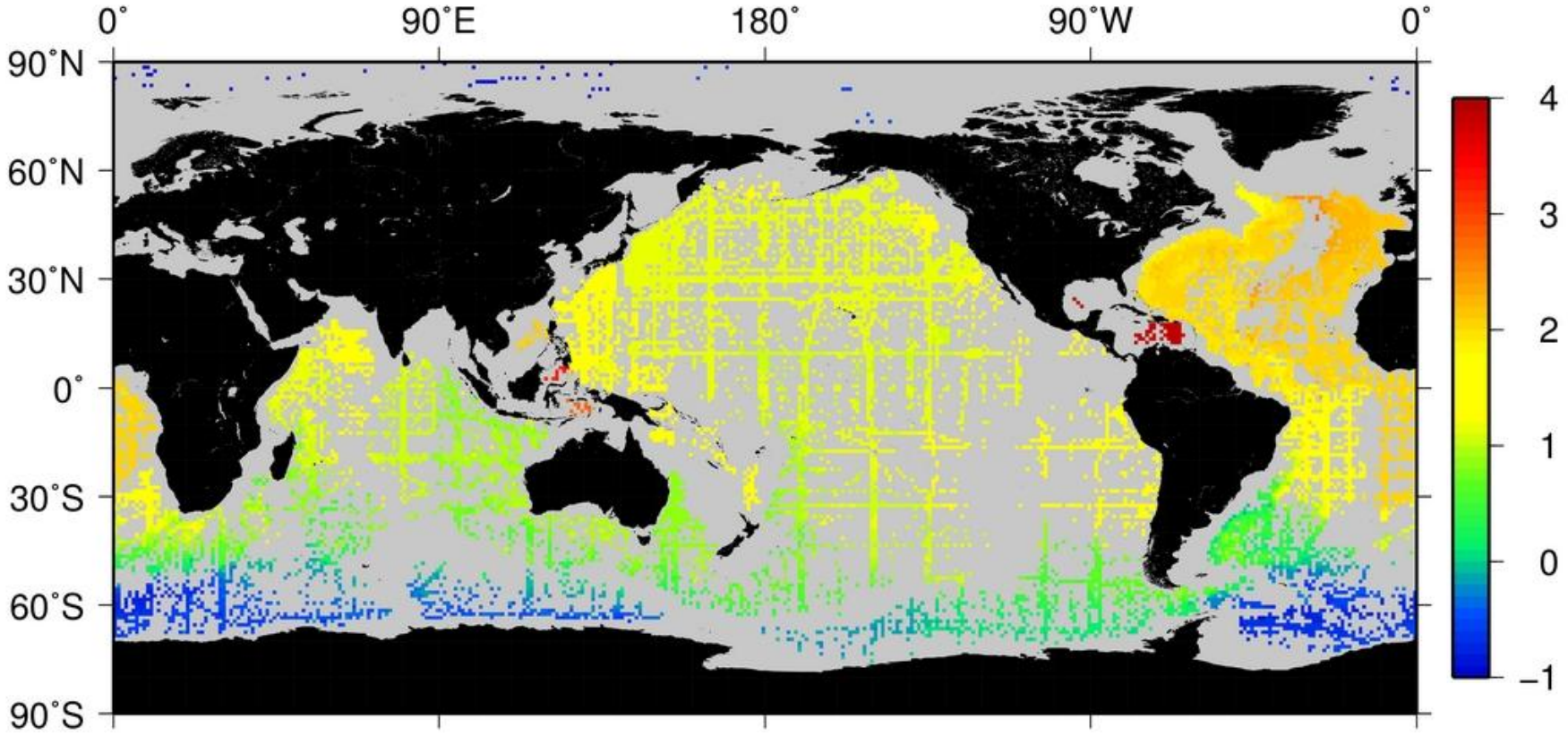


Koketsu et al. (This OSM)

Full depth 4DVAR data set :

Ocean Climate Program, Data Research Center (JAMSTEC) and Kyoto Univ.

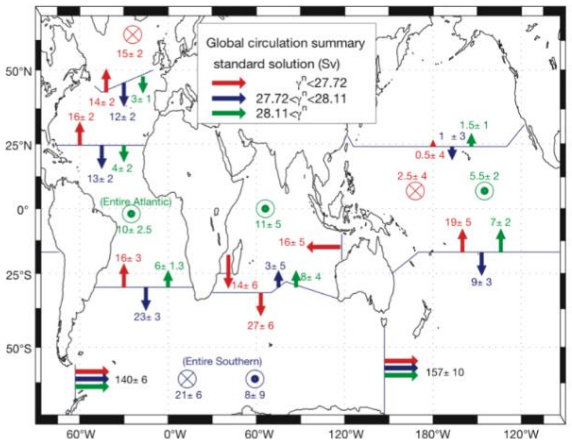
EN3 (NODC, BMO)	**1951～**	**2692748**	**profiles**
WOCE revisit data	**1996～**	**4008**	
CTD/XCTD data JAMSTEC original	**1998～**	**846**	
NCEP (flux data)			



Data distribution for the layer deeper than 4000m(1951-2006)

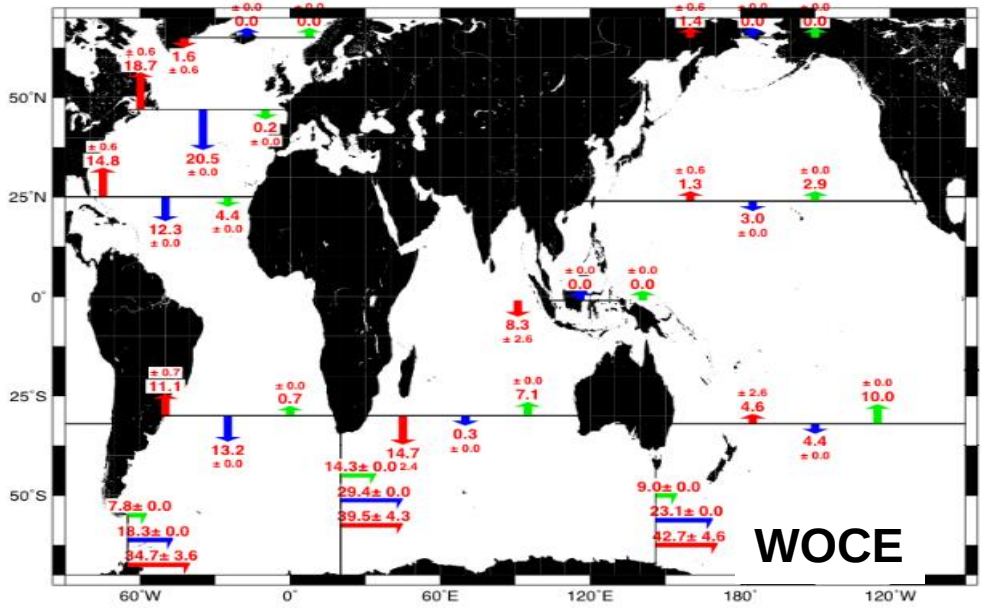
Assimilated data result and analysis

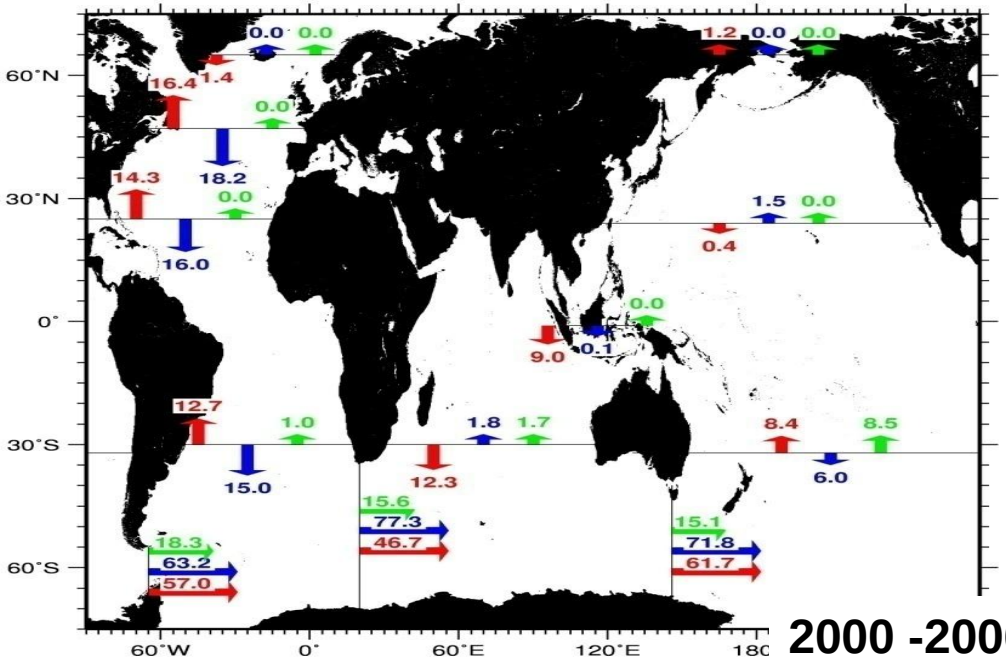
Global Mass Transport



Ganachaud and Wunsch

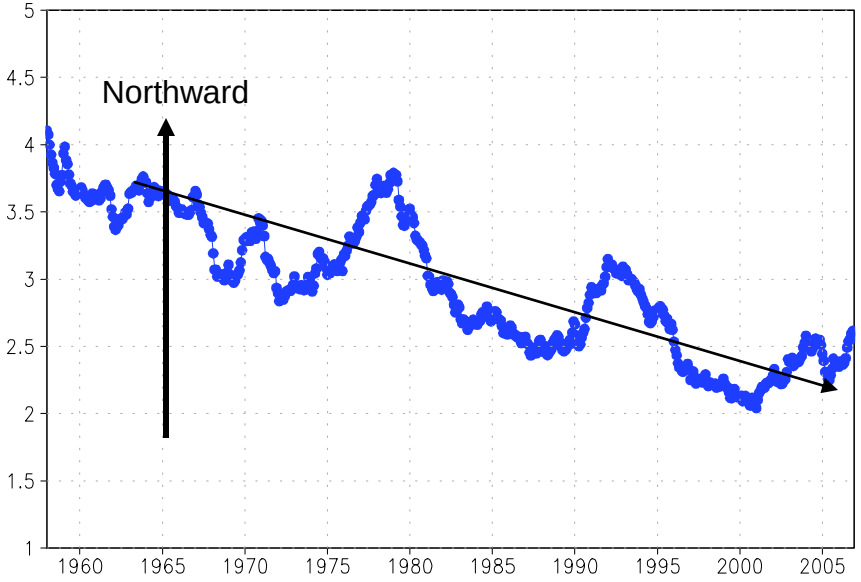
4DVAR assimilated



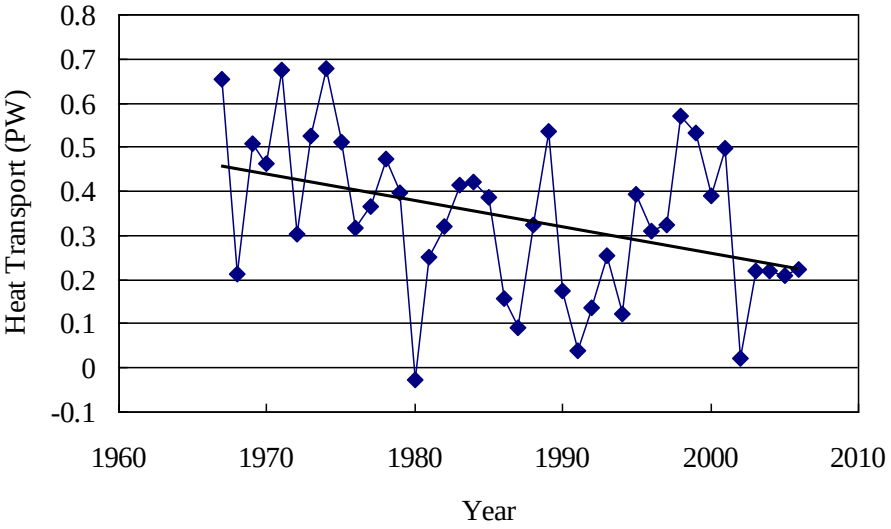


Transports of Bottom Water

Time series of the northward transport of bottom water across 52S

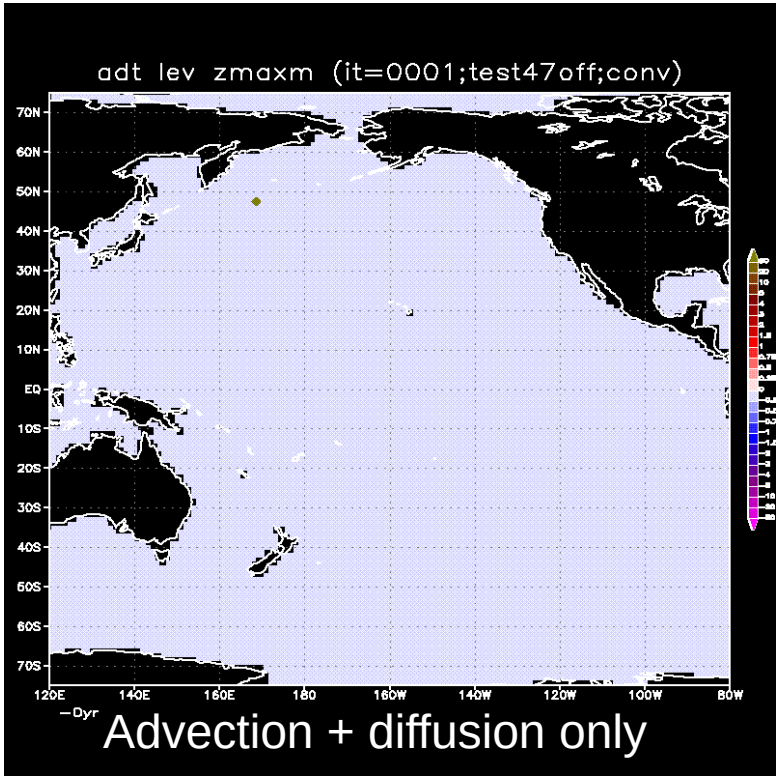


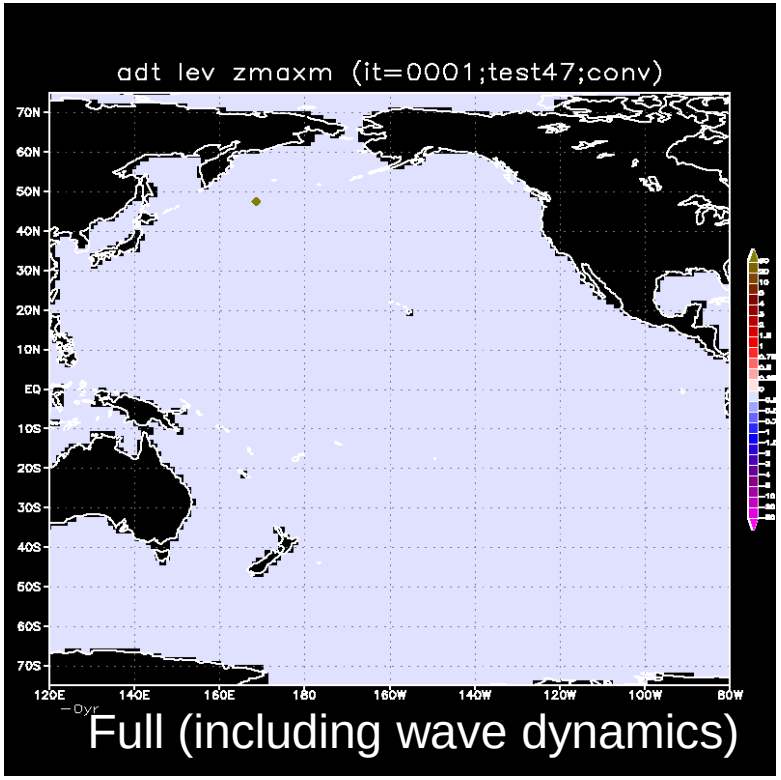
Time series of southward pseudo heat trasnport (0℃reference) across 32S



Both results are consistent with observational results of the abrupt warming in the bottom warming

Pathway and origin of bottom water warming signal

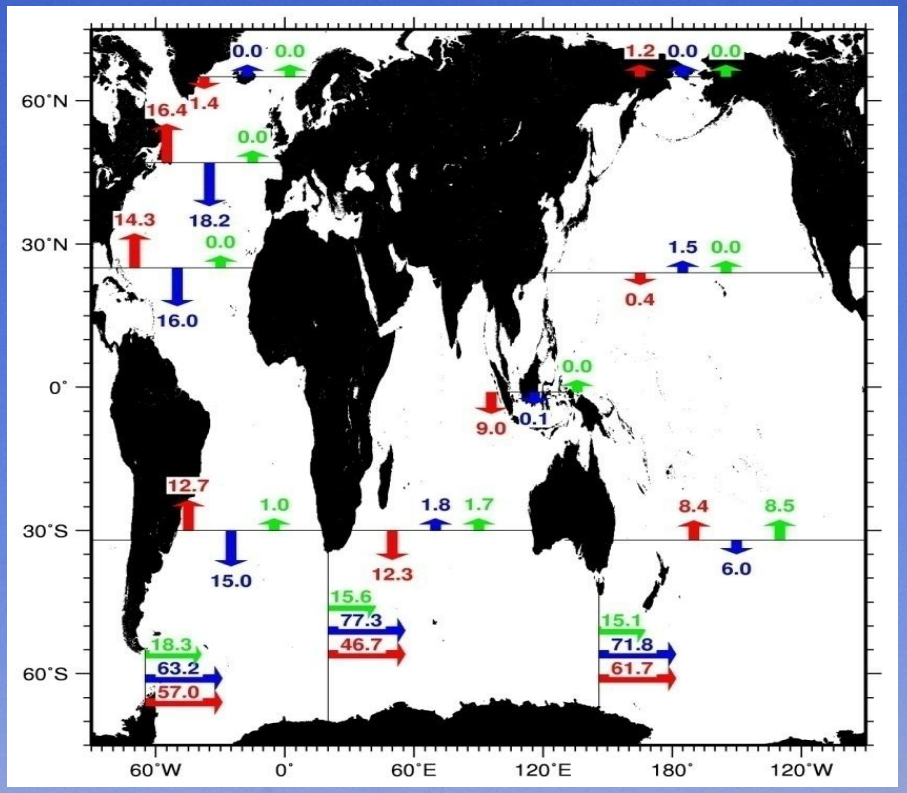


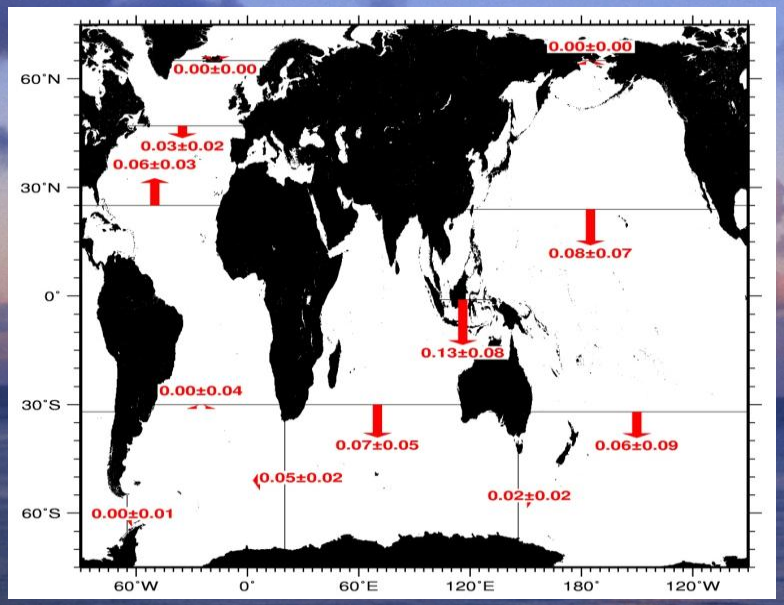


Adjoint variable of T in the case of an `artificial cost' input at a location where deep ocean (47ºN, 170ºE, 5500m-depth) corresponds to the finding of Fukasawa et al.(2004)

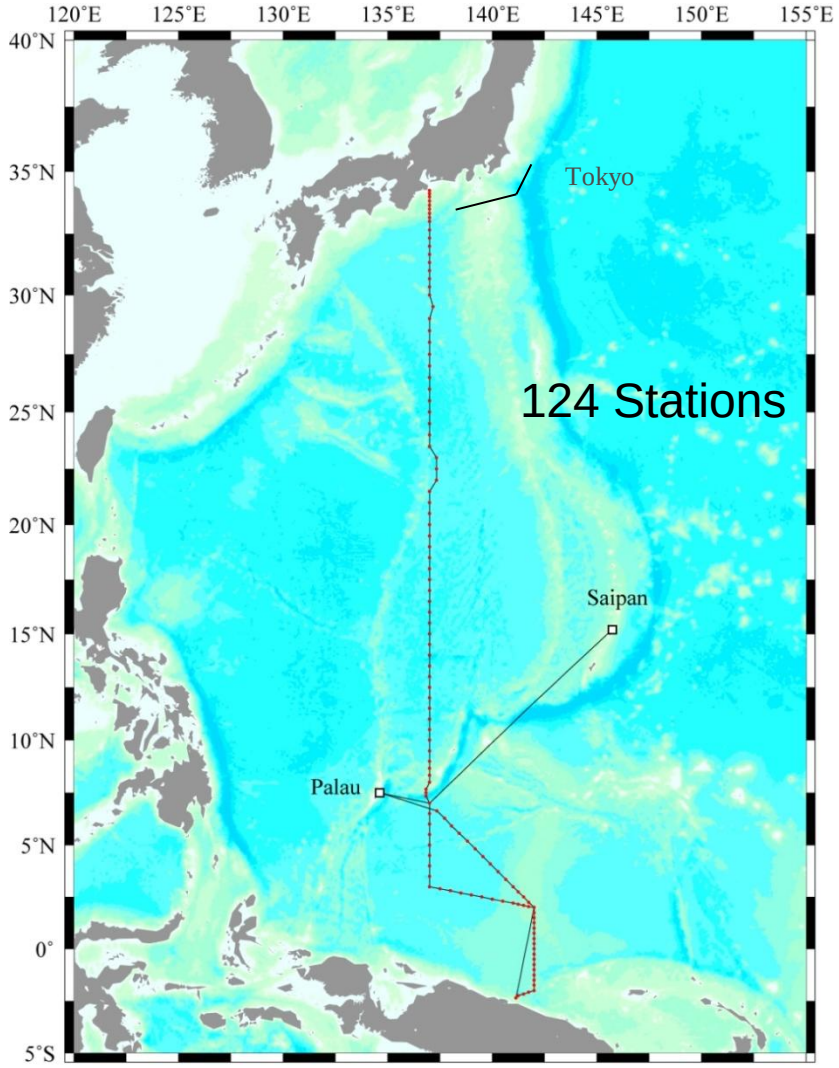
Cost can be traced back to Antarctica within 35 years including wave dynamics Supporting the result of Suginohara and Fukasawa(1992) that a pressure disturbance around the Antarctica can cross the Equator with local wave dynamics much faster than water advection .

Thank you !





Σε ευχαριστώ !



P09 (2010) / JMA

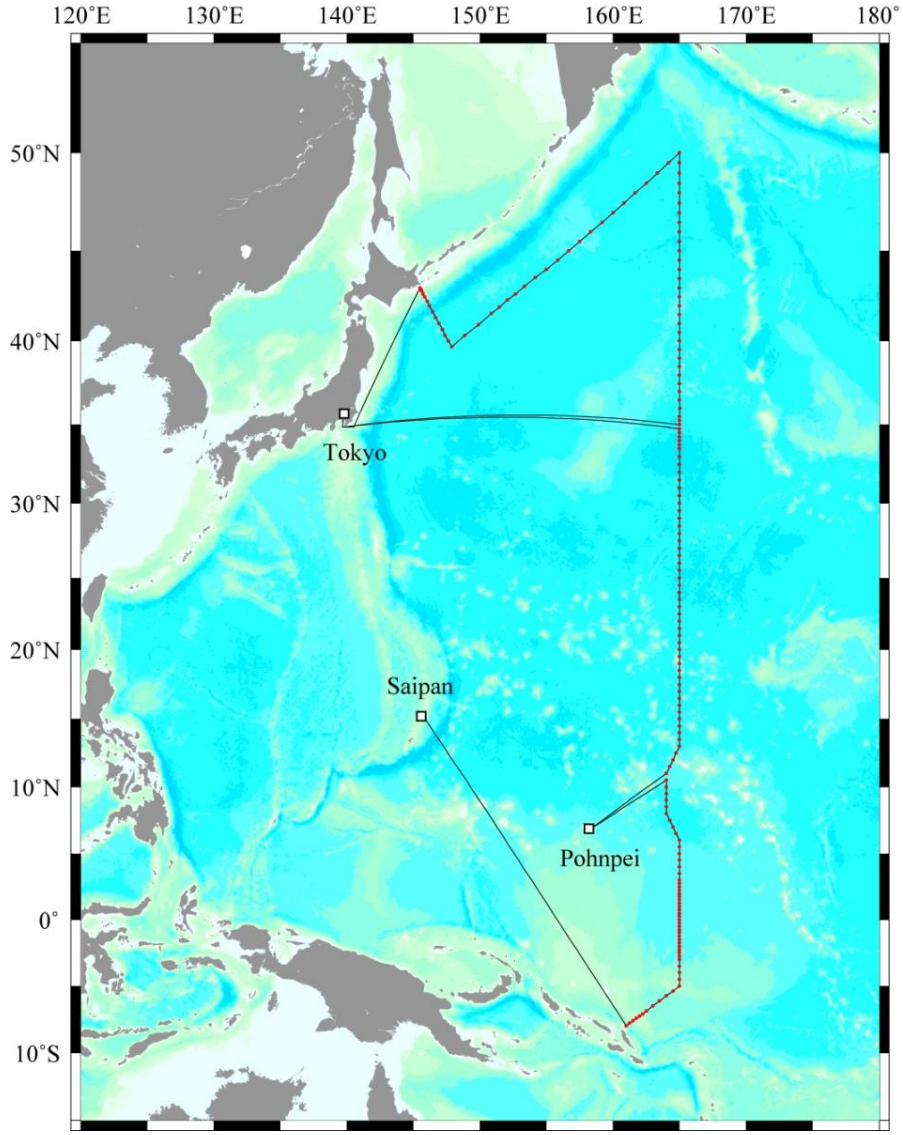
2010/07/06 Dept. Tokyo
2010/07/28 Arr. Palau
2010/08/01 Dept. Palau
2010/08/22 Arr. Saipan
2010/08/26 Dept. Saipan for Tokyo

Chief Scientist:
Dr. Toshiya Nakano

Research Vessel : Ryofu-maru

Approx. 20 participants

Every Station (30nm) : CTDO, Nutrients
Every other station (60nm) : DIC/TA, pH, Dissolved Oxygen, Salinity
CFC-11,-12 (<2,500m+3 layer), Chlorophyll-a (<200m)



P13 (2011) / JMA

June-September, 2011
90 days（12,500NM）

Leg 1：Tokyo - Tokyo（25days）

Leg 2：Tokyo - Pohnpei（25days）

Leg 3：Pohnpei - Saipan（23days）

Leg 4：Saipan - Tokyo（8days）

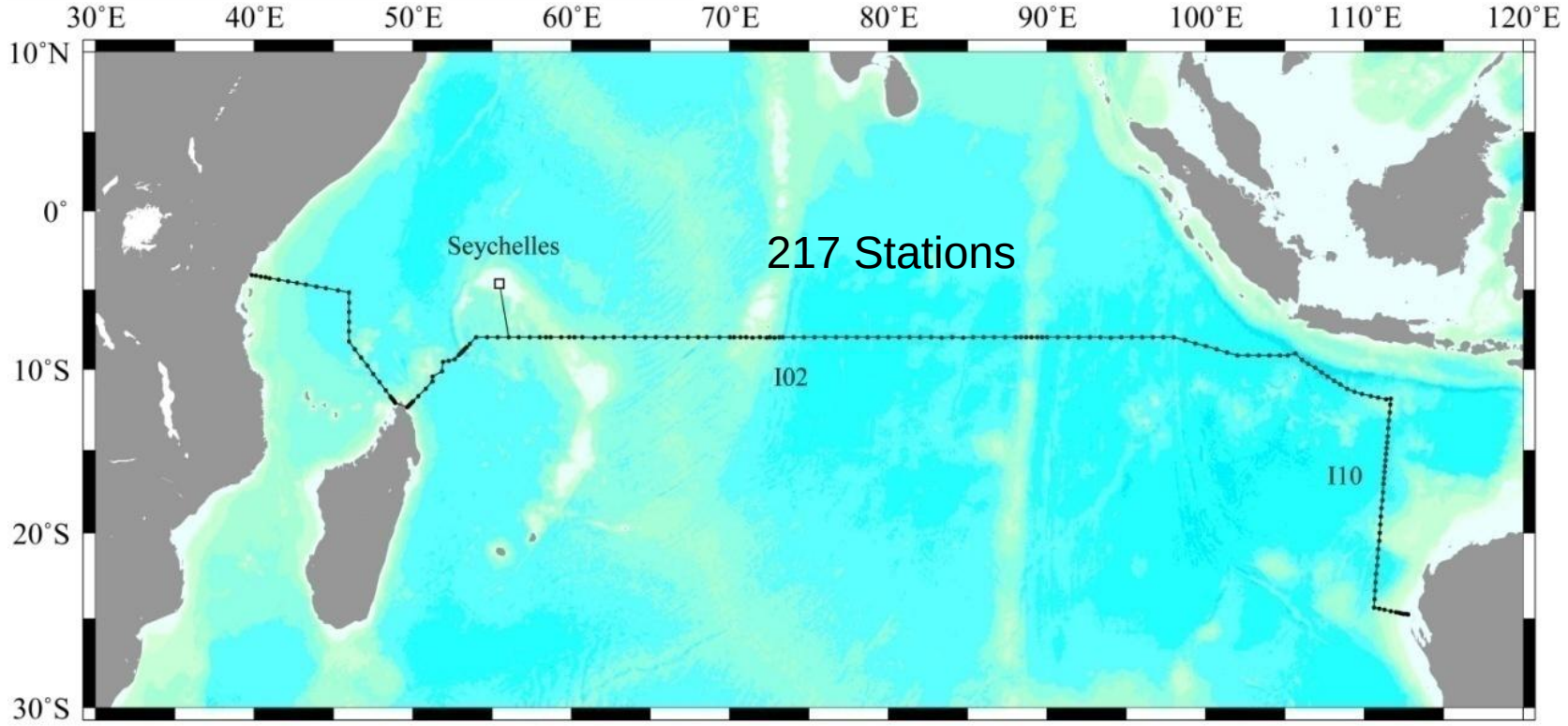
Chief Scientist : TBD

Research Vessel : Ryofu-maru

Approx. 20 participants

Every Station (30nm) : CTDO, Nutrients
Every other station (60nm) : DIC/TA, pH, Dissolved Oxygen, Salinity
CFC-11,-12 (<2,500m+3 layer), Chlorophyll-a (<200m)

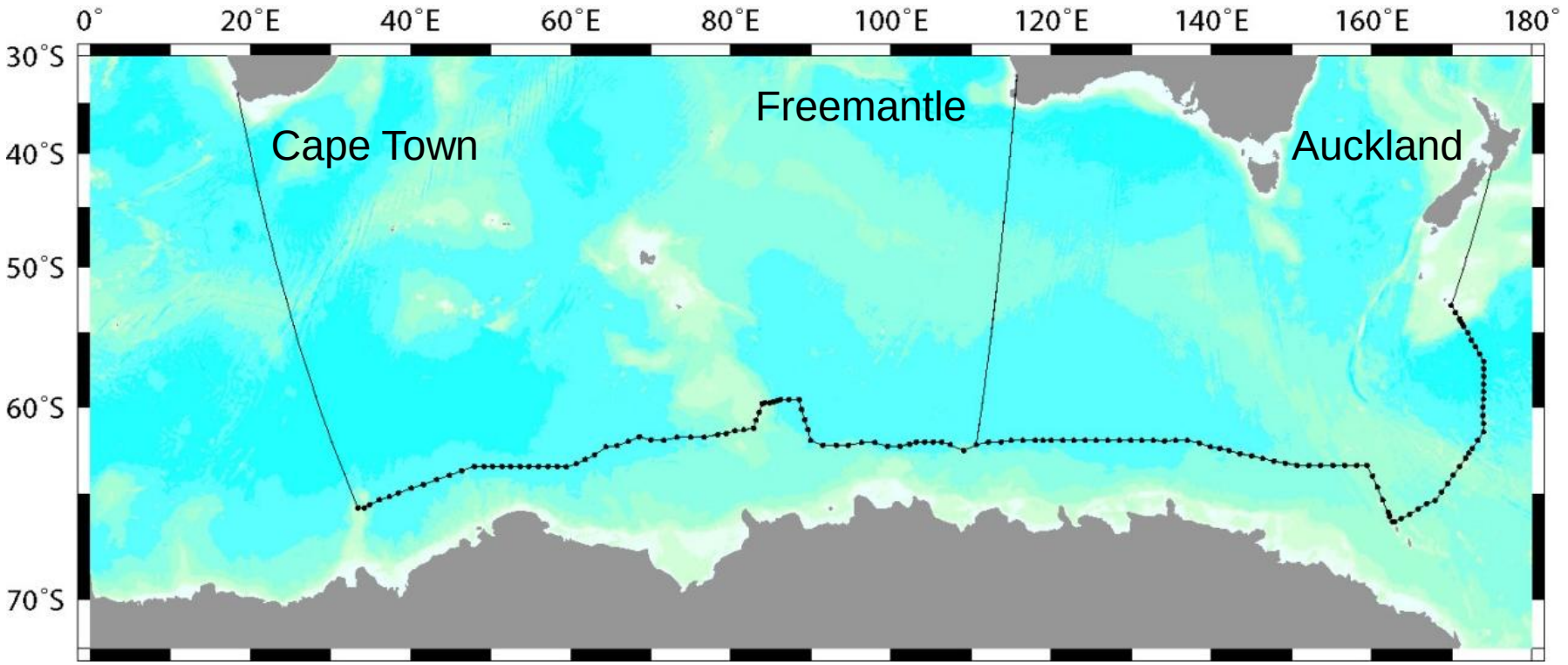
I02 + I10 (2012) / JAMSTEC



Seyschelles – Seychelles – Darwin (Tentative) 55 days
Observation line could be changed due to Vandalism off Somalia
Chief Scientist : Dr. Akihiko Murata Research Vessel : MIRAI

Every Station	: CTDO+LADCP, Dissolved Oxygen, Salinity, Nutrients, CFC-11,-12, -113, SF6 (Selected layers)
Every other station	: DIC/TA, pH
Selected stations	: C-13, C-14 (Selected layers), Chlorophyll-a (<200m)

S04P+S04I (2013) / JAMSTEC



Auckland – Freemantle – Cape Town (or opposite direction)
Ca. 65 days by R/V MIRAI

Every Station	: CTDO+LADCP, Dissolved Oxygen, Salinity, Nutrients, CFC-11,-12, -113, SF6 (Selected layers)
Every other station	: DIC/TA, pH
Selected stations	: C-13, C-14 (Selected layers), Chlorophyll-a (<200m)