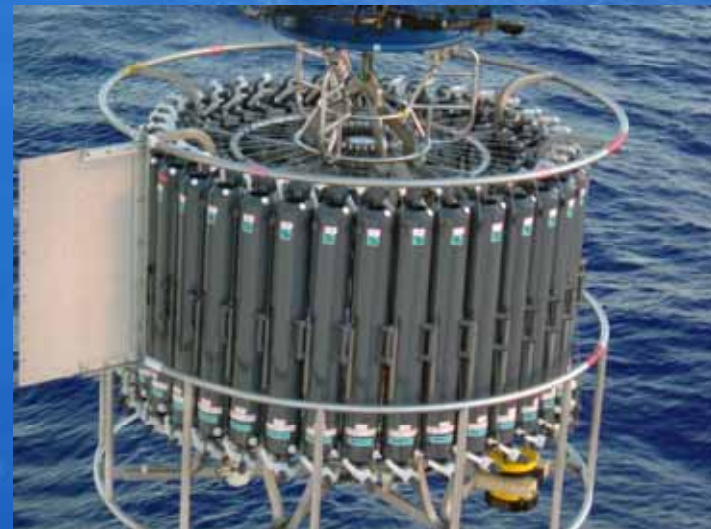
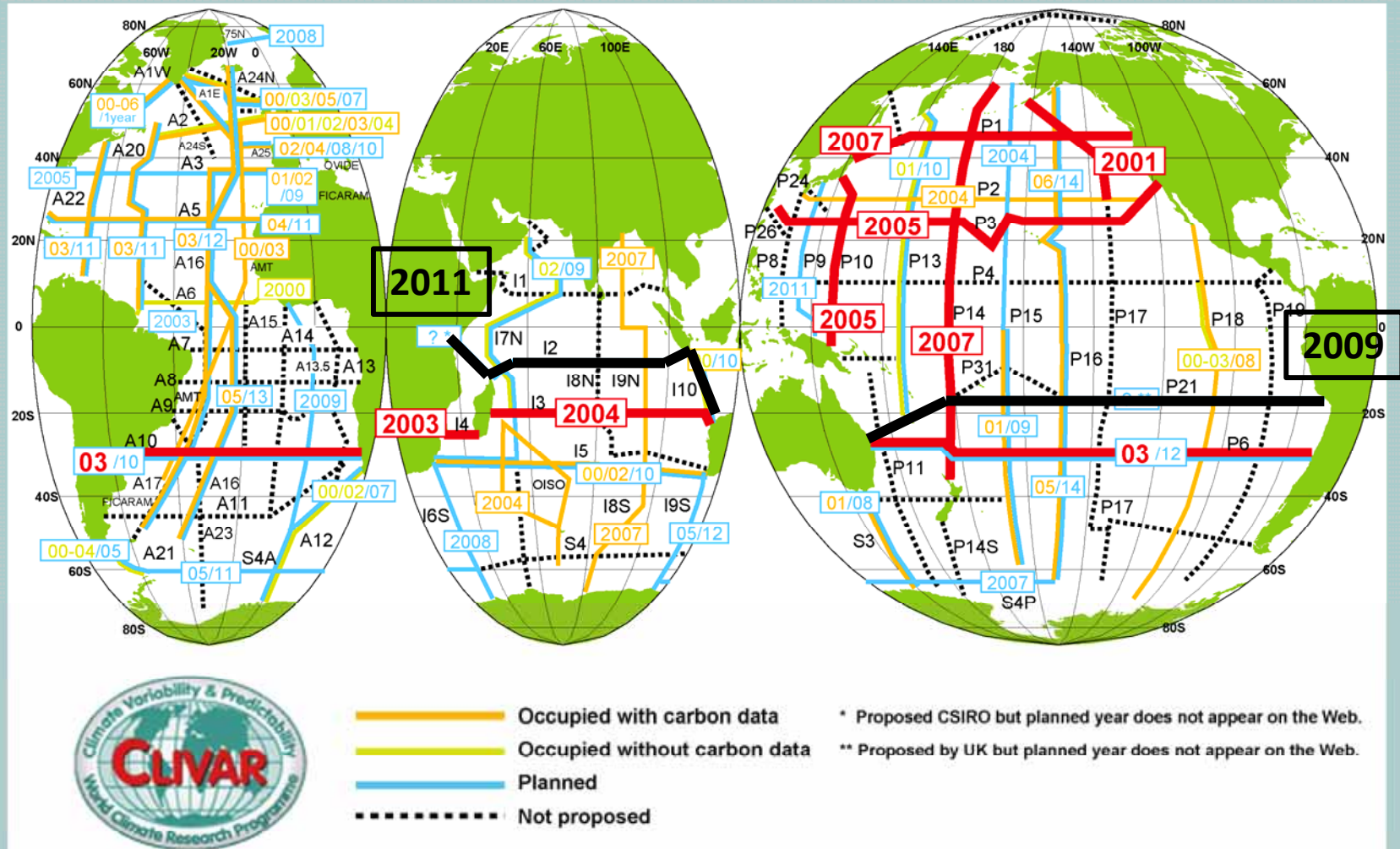


Repeat Hydrography/Carbon observations in the Indian Ocean by JAMSTEC

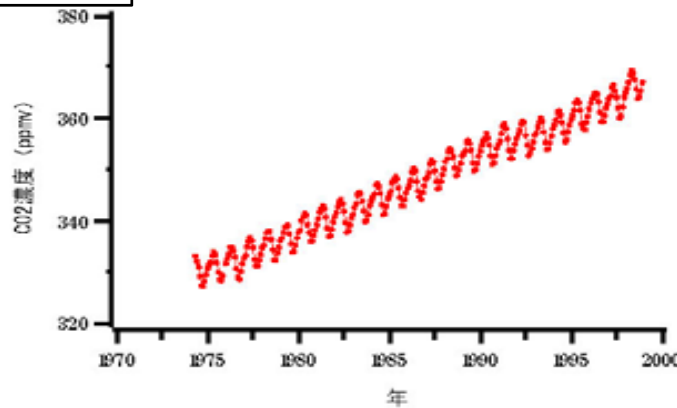
*Akihiko Murata and others
(IORGC/JAMSTEC)*



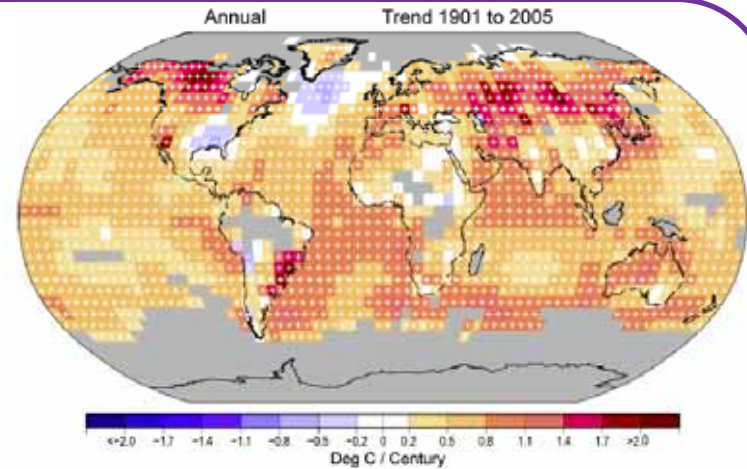
Repeat hydrography under CLIVAR/CO₂



Background

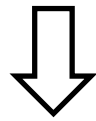


Elevated CO₂

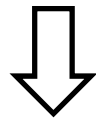


Global warming

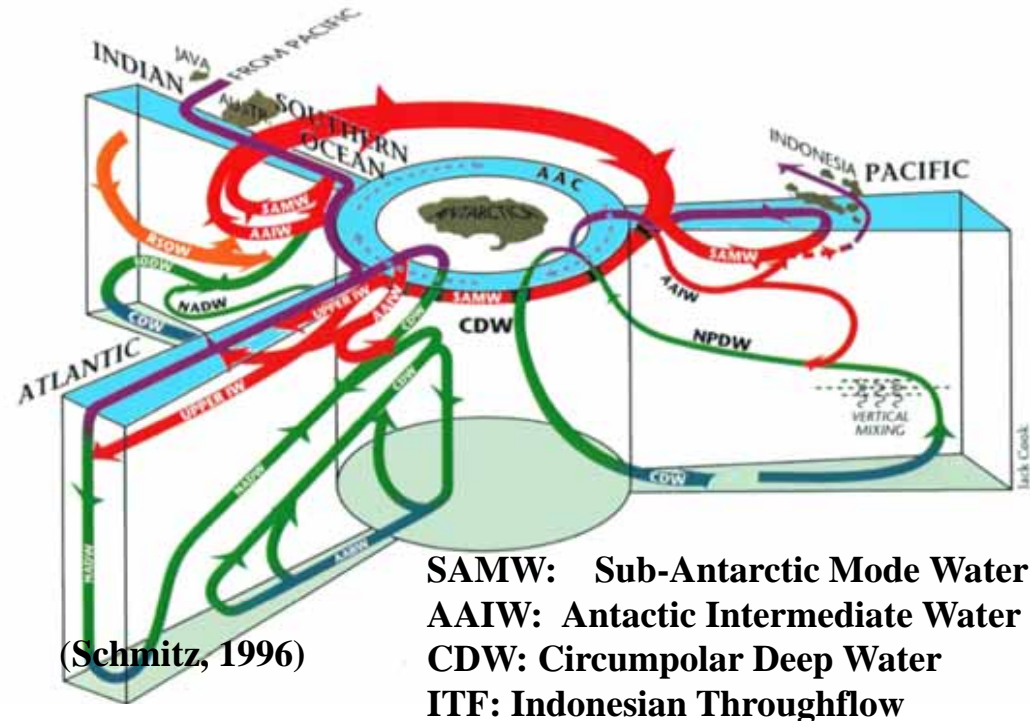
The ocean uptakes heat and anthropogenic CO₂



Moderation of global warming



Evaluation of storages of heat and anthropogenic CO₂ in the ocean interior



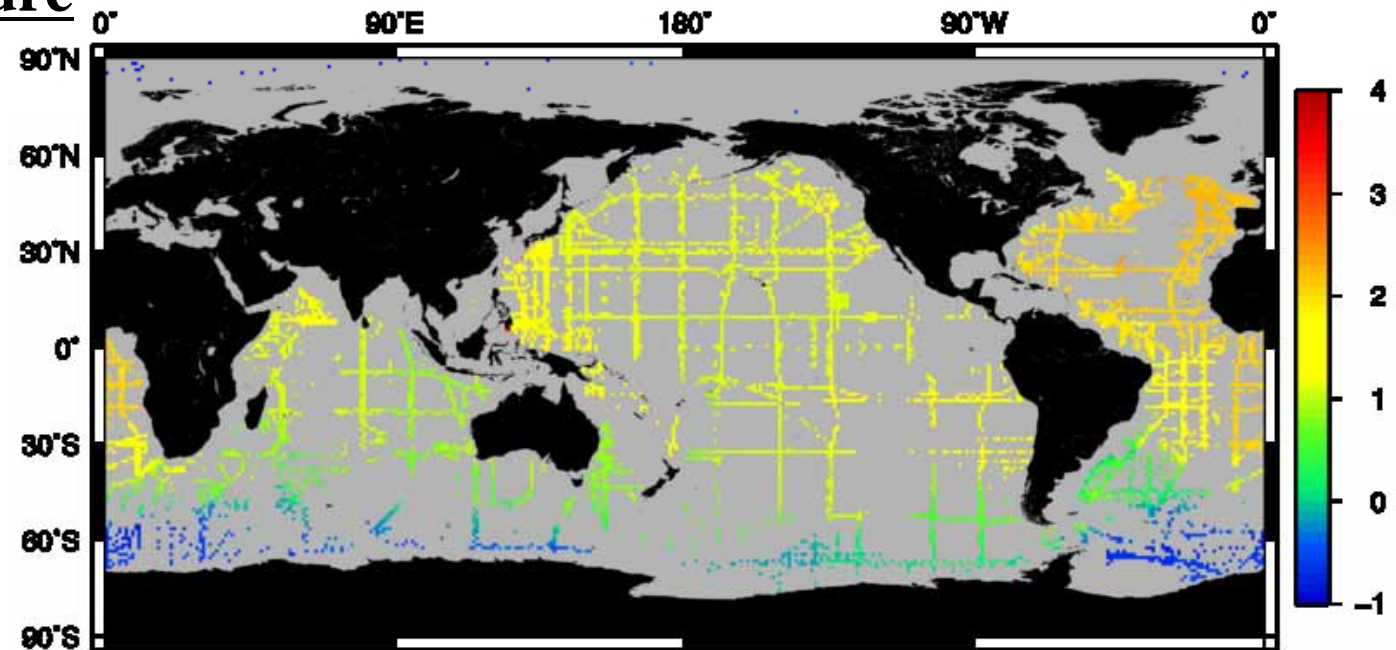
Why P21 and I2/I10 lines?

- **Sparse high-accurate data, especially in the Southern Hemisphere.**

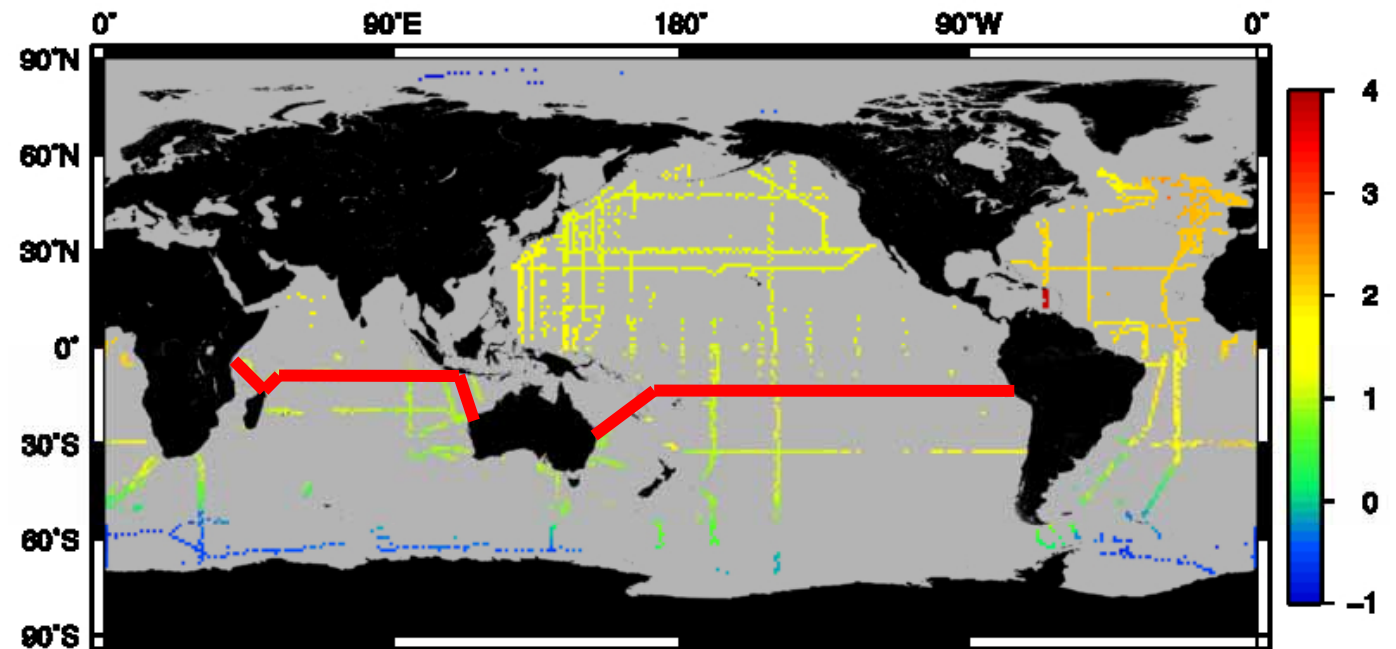
Water temperature

1985-1995

WOCE period



1996-2006



Why P21 and I2/I10 lines?

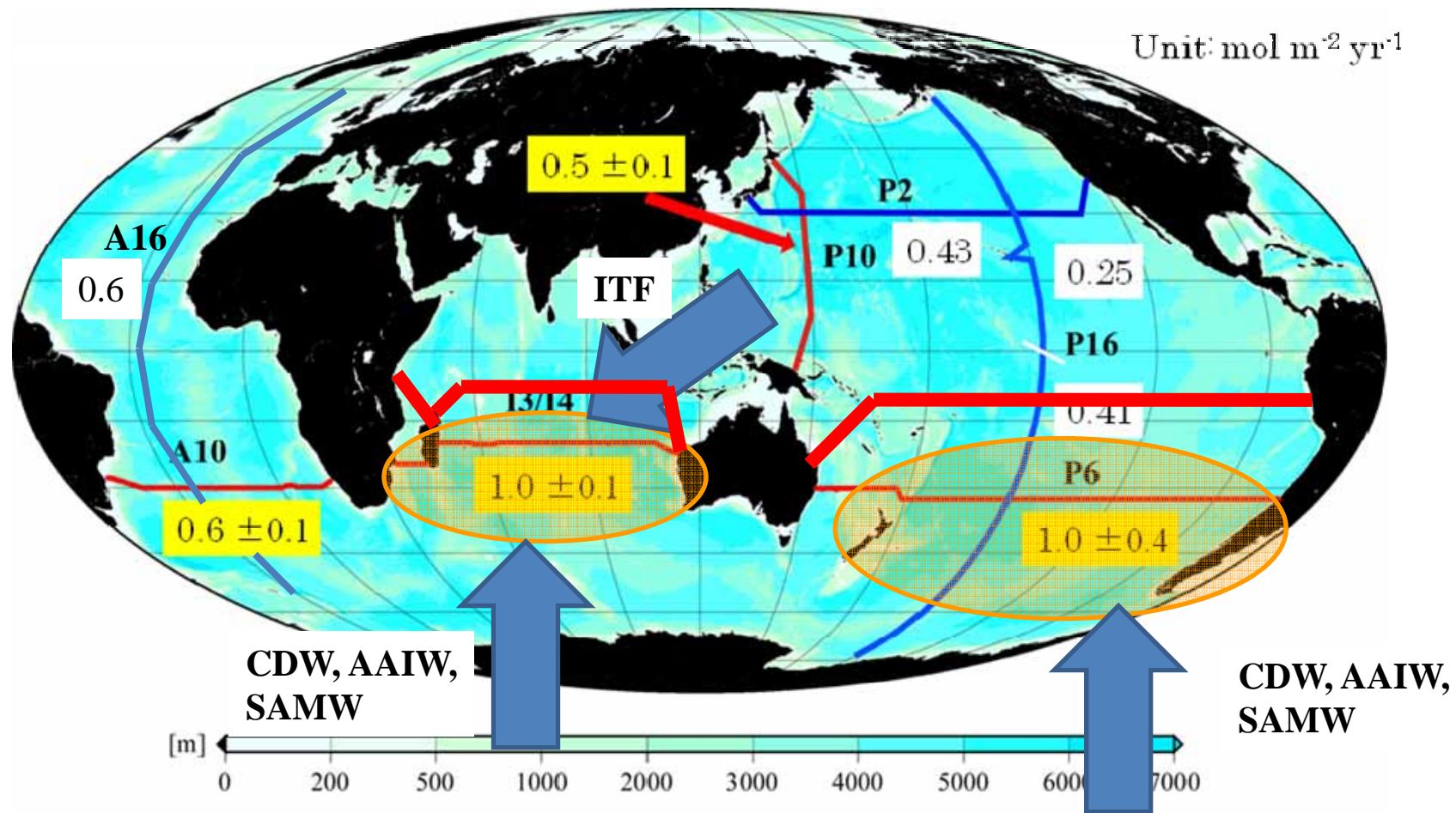
- Data shortage of high-accurate data, especially in the Southern Hemisphere.
- High rate of accumulation of anthropogenic CO₂ in the South Pacific and South India.

Rates of accumulation of anthropogenic CO₂

Uptake of 2.2GtC yr⁻¹ by the ocean

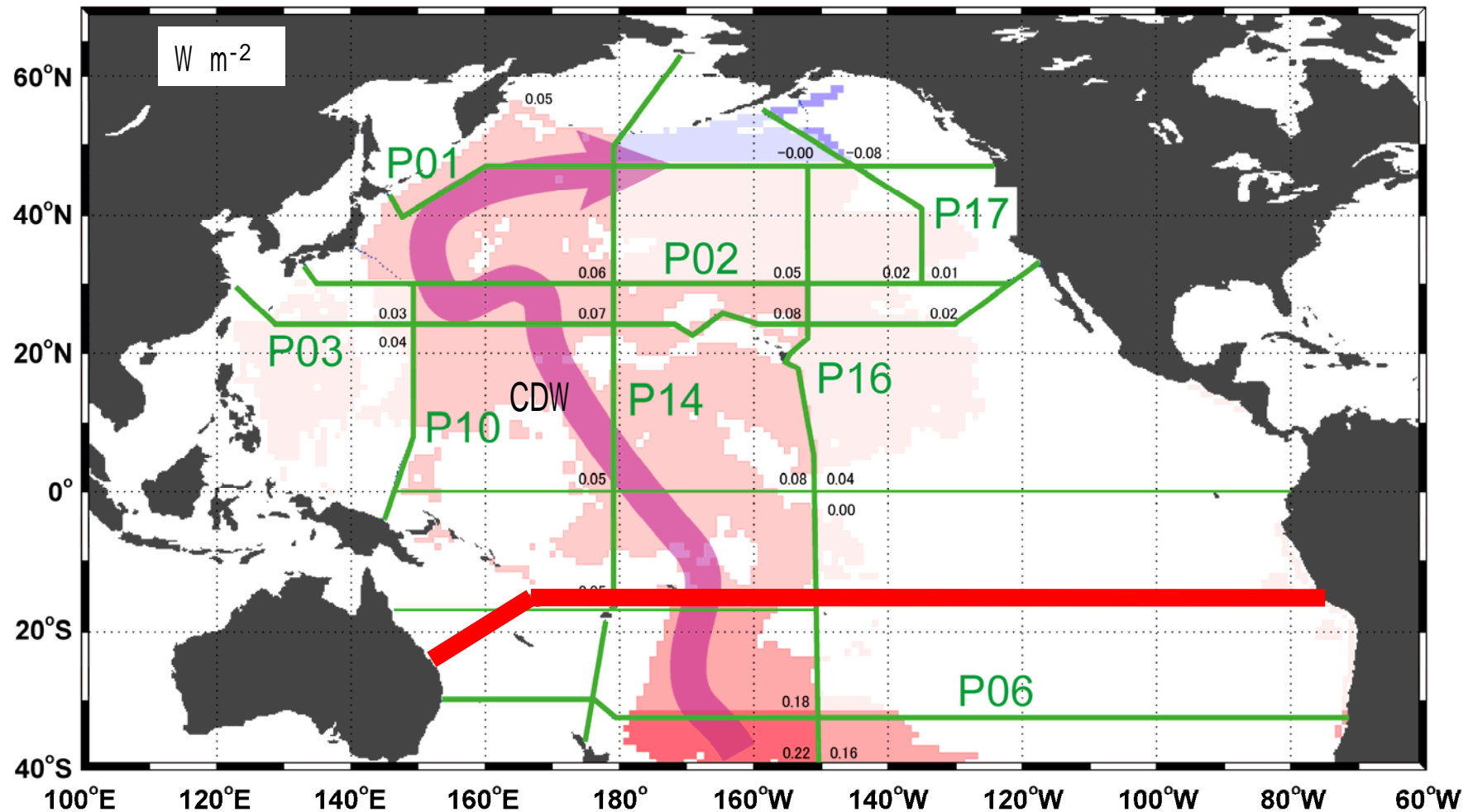


Divided by the global ocean surface, 0.55 mol m⁻² yr⁻¹

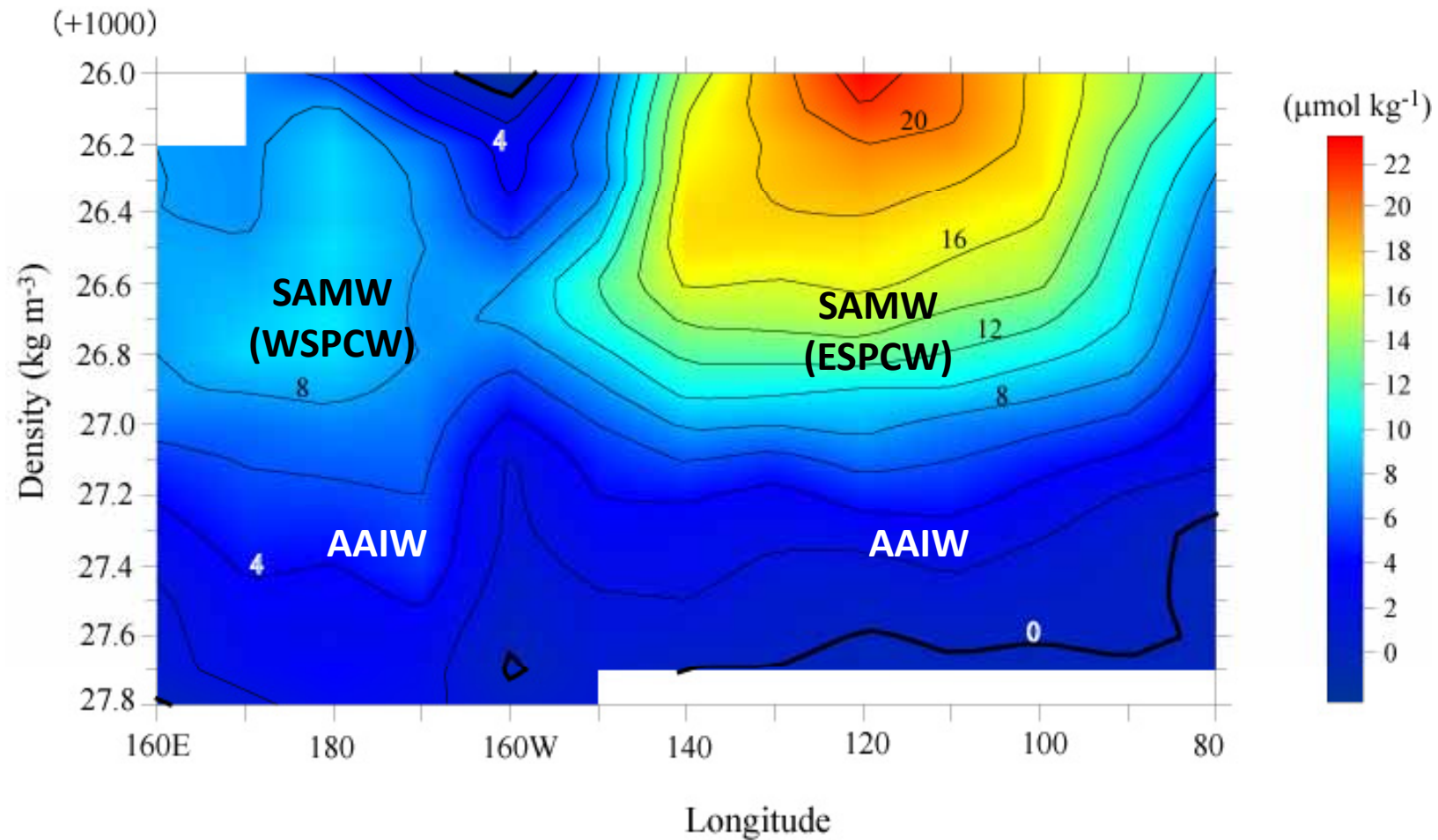


Bottom-layer warming

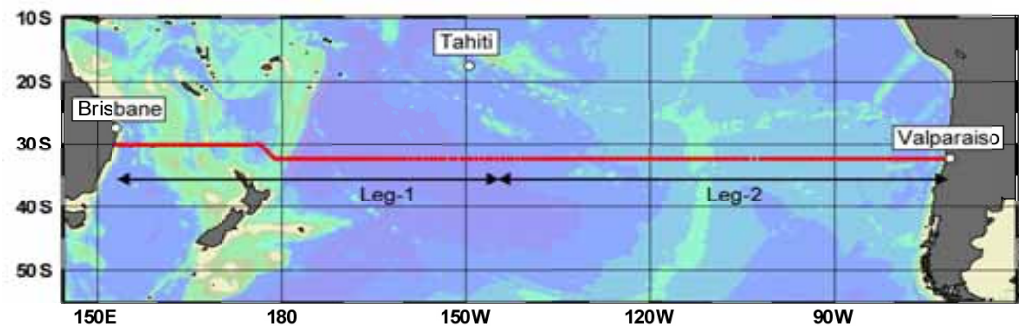
High heat storage along Circumpolar Deep Water (CDW)



Increases of anthropogenic CO₂ along the P6 section between 2003 and 1992



SAMW: Sub-antarctic mode water
AAIW: Antarctic intermediate water
WSPCW: Western South Pacific Central Water
ESPCW: Eastern South Pacific Central Water



R/V MIRAI



Length: 129 m
Breadth: 19 m
Gross tonnage: 8,687t

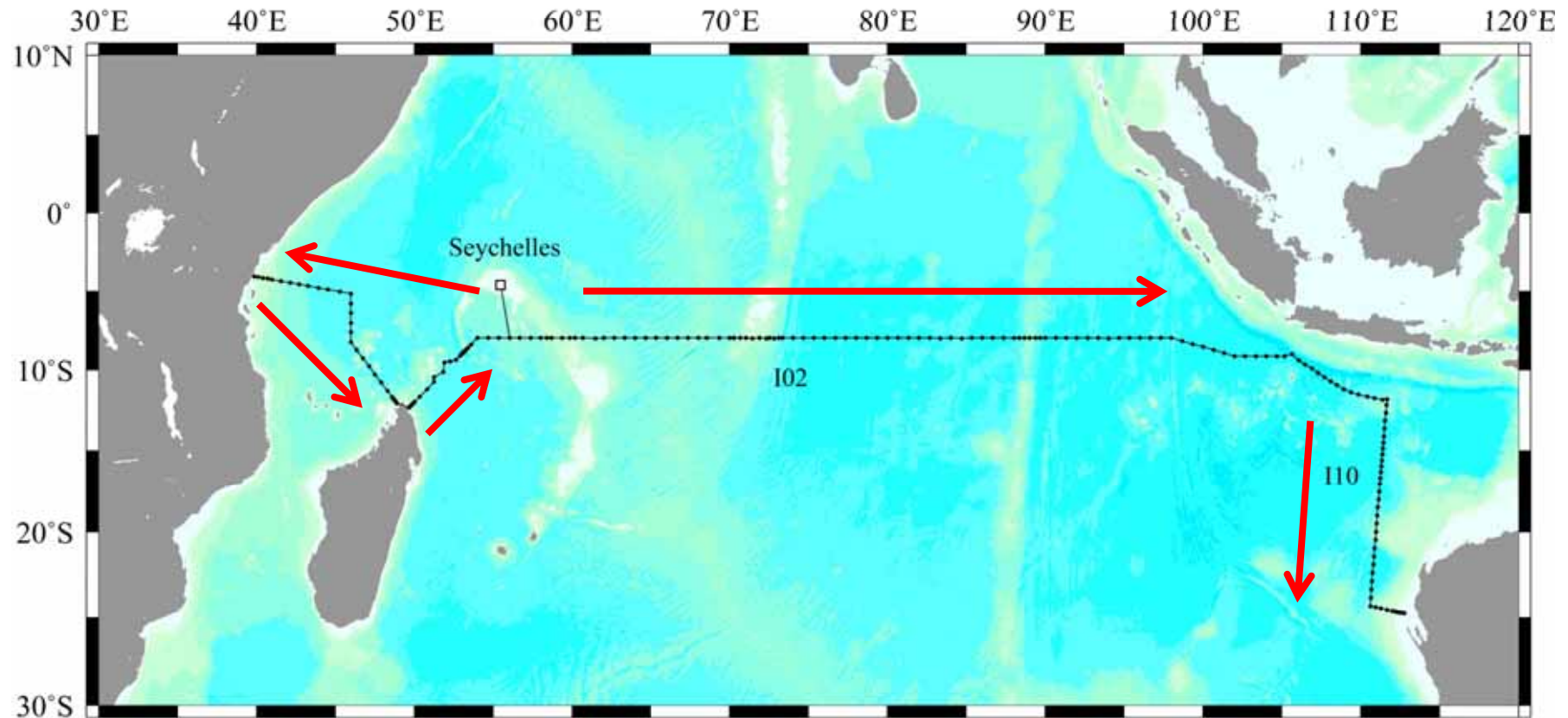
Scientists: 46
Crews: 34

Revisit cruise for WHP I02 and I10 lines:

Period: from late 2011 to early 2012

Ship time: 55 days

Onboard scientists: 34 (max. 46)



Measured properties

Underway: SST, SSS, ADCP, atmospheric and surface water pCO_2 , etc.

Sensors: CTD, LADCP, oxygen, fluorescence, turbidity

Water samples for: salinity, dissolved oxygen, nutrients, dissolved inorganic carbons, total alkalinity, pH, and chlorofluorocarbons, ^{14}C , ^{13}C , etc.

at hydrocast stations

102 Revisit, GMT+ (0), [2008/04/11 04:30 UTC]



6	01/6	102
		12
		102



		TIME																										
Date		0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24		
1	01	102W 1244			102W 1243			102W 1242				102W 1241				102W 1240				102W 1239					102W 1238			
2	01/2				102W 1237							102W 1236							102W 1235						102W 1234			
3	01/3					102W 1233							102W 1232							102W 1231						102W 1230		
4	01/4	102W 1230					102W 1229						102W 1228							102W 1227						102W 1226		
5	01/5	102W 1226						102W 1225						102W 1224							102W 1223						102W 1222	
6	01/6	102W 1221							102W 1221					102W 1220						102W 1219					102W 1218		102W 1217	
7	01/7	102W 1216								102W 1215					102W 1214						102W 1213					102W 1212		102W 1211
8	01/8		102W 1210								102W 1209						102W 1208							102W 1207			102W 1206	
9	01/9		102W 1206									102W 1205								102W 1204					102W 1203		102W 1202	
10	01/10					102W 1201								102W 1200							102W 1199					102W 1198	102W 1197	
11	01/11	102W 1197					102W 1196								102W 1195							102W 1194					102W 1193	
12	01/12			102W 1192									102W 1191	1d0h0m														
13	01/13	1d0h0m																										
14	01/14	Seychelles UTC-4																										
15	01/15	Seychelles UTC-4																										
16	01/16	Seychelles UTC-4																		102W 1191				102W 1190				
17	01/17					102W 1189								102W 1188						102W 1187					102W 1186		102W 1185	
18	01/18			102W 1184										102W 1183							102W 1182					102W 1181		102W 1180
19	01/19					102W 1179									102W 1178										102W 1177		102W 1176	
20	01/20						102W 1175									102W 1174										102W 1173		102W 1172
21	01/21					102W 1171										102W 1170										102W 1169		102W 1168
22	01/22			102W 1167											102E 1166											102E 1165		102E 1164
23	01/23			102E 1161												102E 1160											102E 1159	
24	01/24						102E 1156									102E 1155											102E 1154	

Our cruise (MR11-??)



Cast at 272 stations



CTD measurements

Preparation for water sampling



Water sampling



Chemical analysis

Data obtained

Data obtained in MR11-?? (CLIVAR/CO₂) cruise in the Indian Ocean are open to public within a few years through the Data Management Office in JAMSTEC, and also submitted to international data centers.

Related poster presentations:

K. Katsumata (IORGC): Water property changes observed along WHP lines I03 and I04 between 1995 and 2003.

S. Kouketsu (IORGC): Changes at intermediate depths in the Indian Ocean using repeat hydrography and Argo data.

Y. Kumamoto (IORGC): Chemical tracers in the Indian Ocean.