



Indian Ocean Implementation: agenda

- 1- Indian Ocean features and targets
- 2- Review completed cruises (map, sections and process studies)
 - *Australian Process study*
 - *French process study*
 - *Indian sections and process studies*
 - *Japanese section*
- 3- Planned sections (in the pipe: G, Fr, Au, In? Others?)
- 4- Missing and wishes

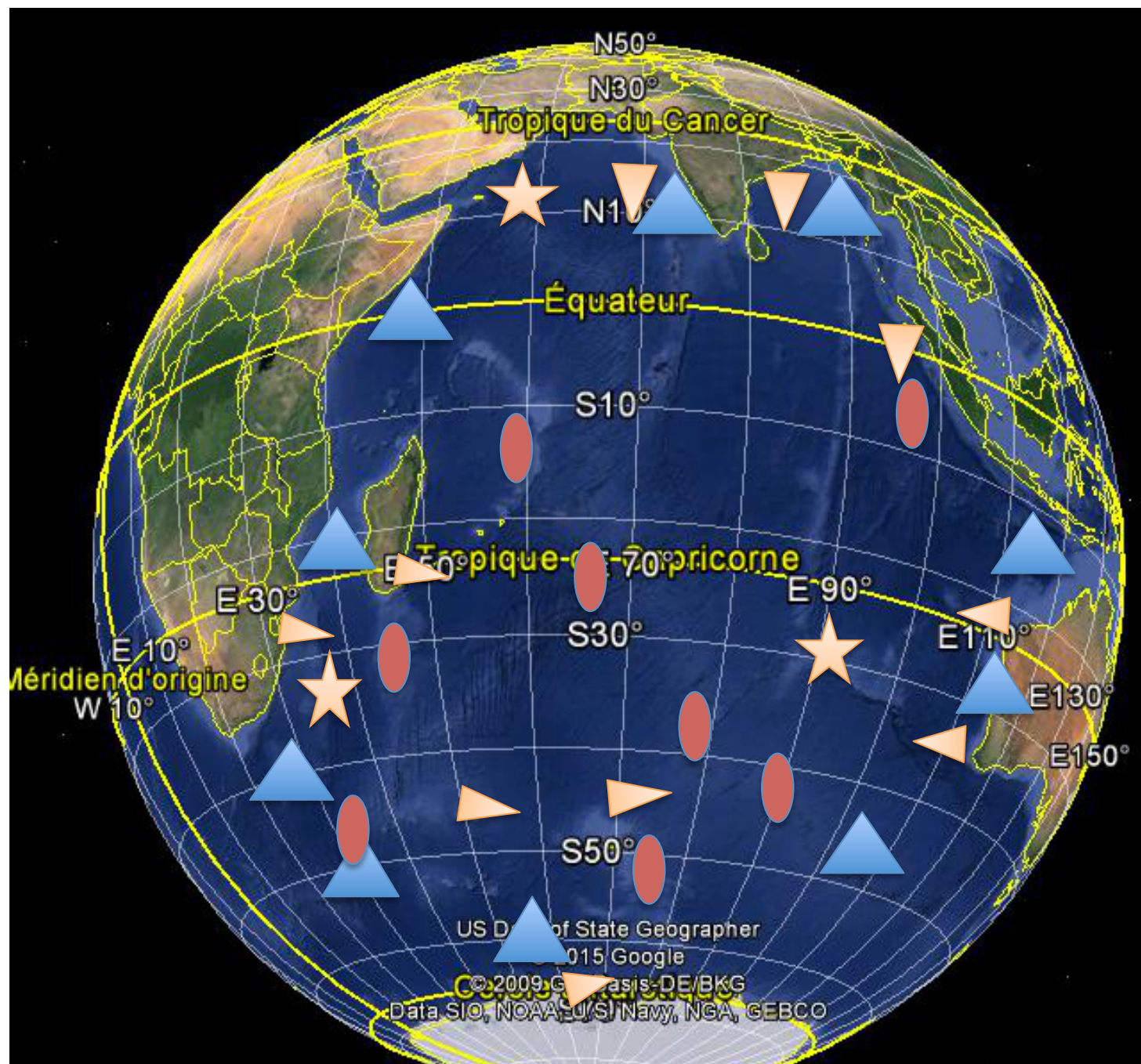


Indian Ocean: main targeted structures

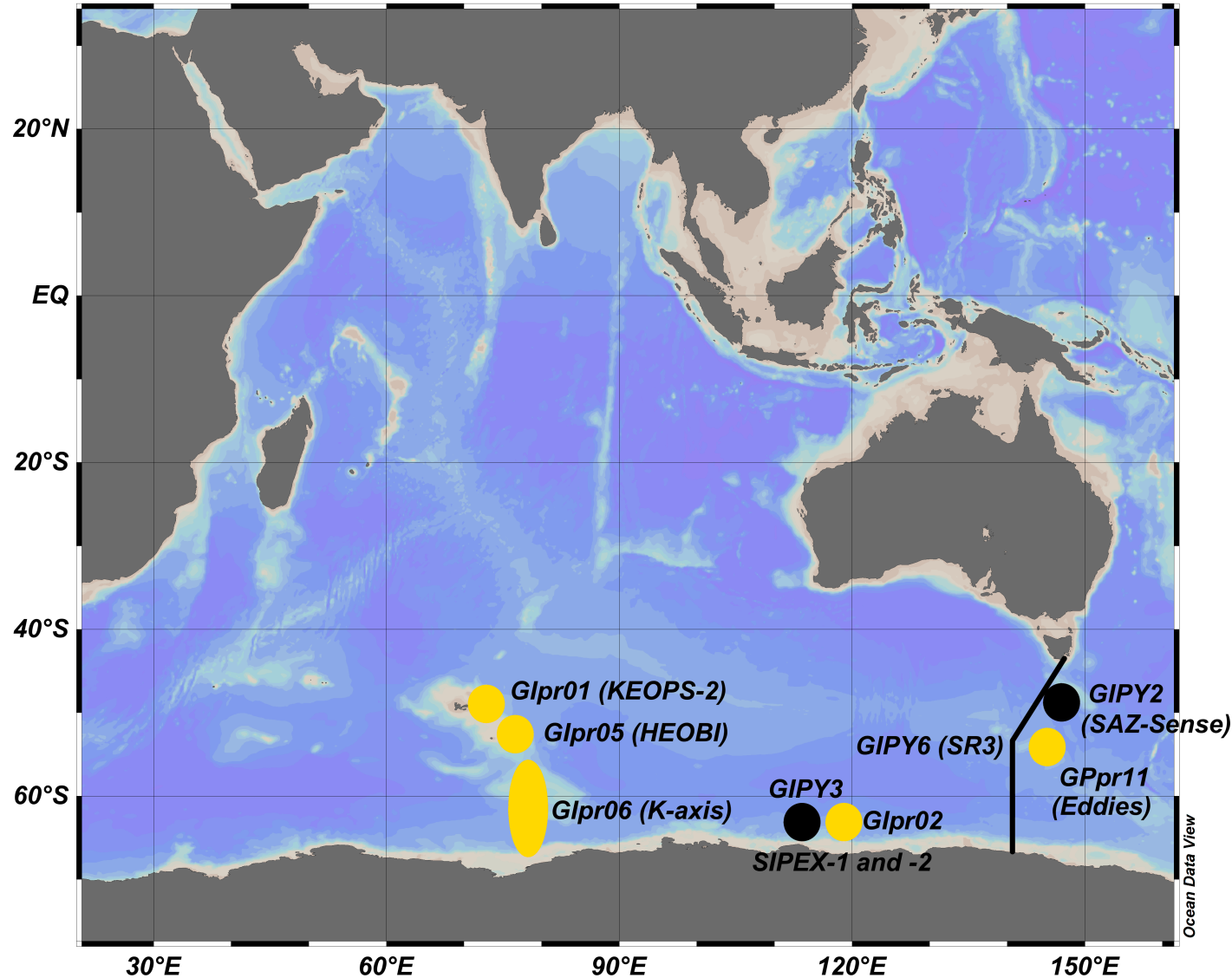
- Circulation (Fronts, Throughflow, Aghulas...) and water masses (ex: Red Sea, Atlantic and Pacific Influences)
- Biological hot spots (fronts, upwellings...)
- Internal processes (particle/dissolved exchange)
- Hydrothermal activity
- River and margin inputs
- Atmospheric dust

Yves Plancherel Scientific interests

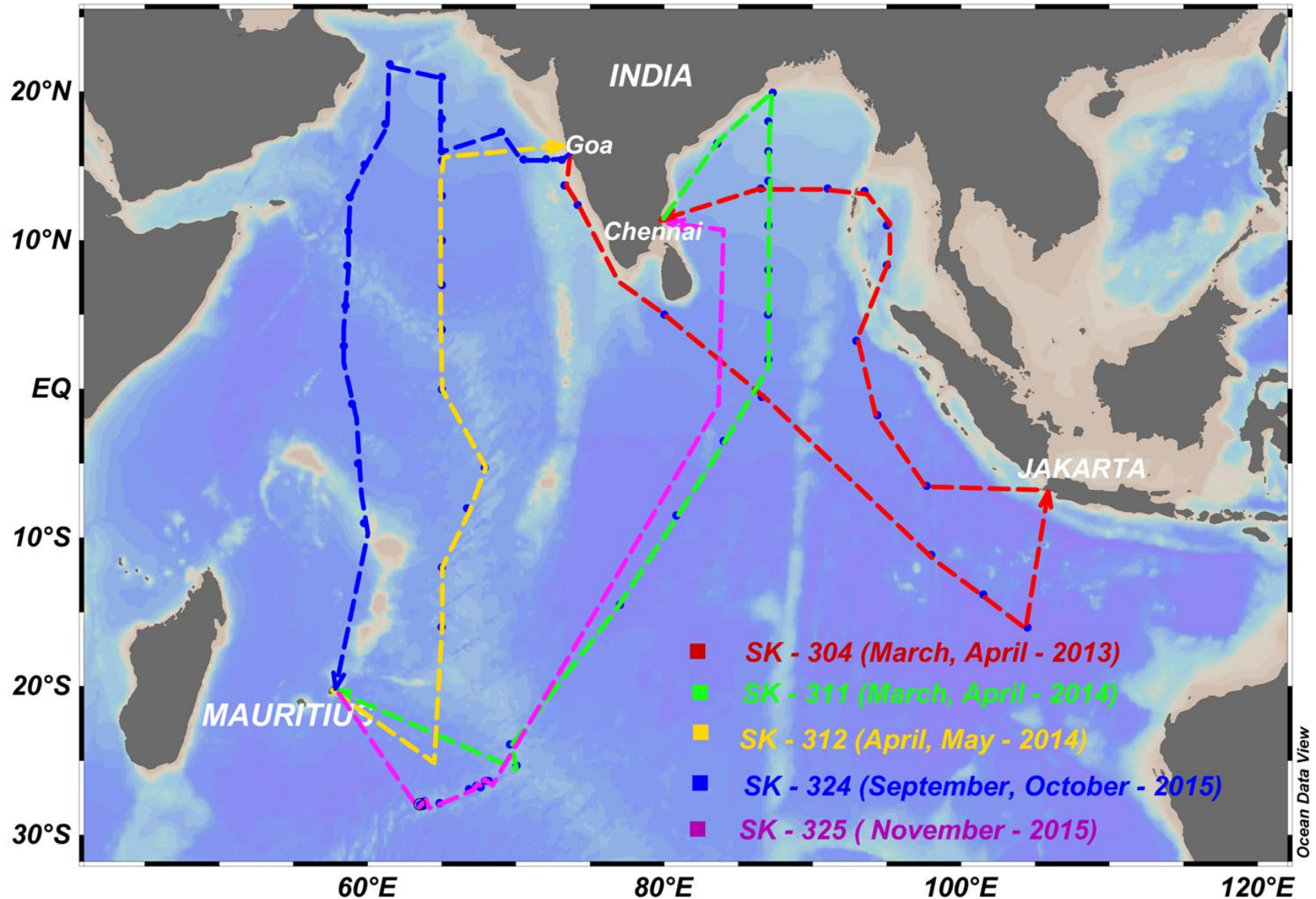
- Constraining the I. Throughflow origin and pathway with the TEIs?
- Salinity and redox gradients: ideal for multi-proxy analysis of processes, inter-element comparison, TEI cycling vs. major nutrient cycling (Red Sea, BofB, OMZ Arabian Sea, shelves).
- Evolution and fate of anthropogenic Pb (and other pollutant TEI) from Asia?
- What is the fate of Indian Deep Waters? How do IDW form, what are they? Do they upwell in the Southern Ocean? Role/fate of bottom waters formed along the Indian sector of Antarctica? New insights from TEIs?
- Can TEI help constrain the varieties of AAIW along the Southern Ocean? Can TEI help inform AAIW formation mechanisms generally?
- Temporal variability: Moonsons
- Comparative analysis of the worlds “main estuaries”: Bay of Bengal vs Amazon vs Nile vs. Congo vs Arctic rivers vs Mississippi, etc



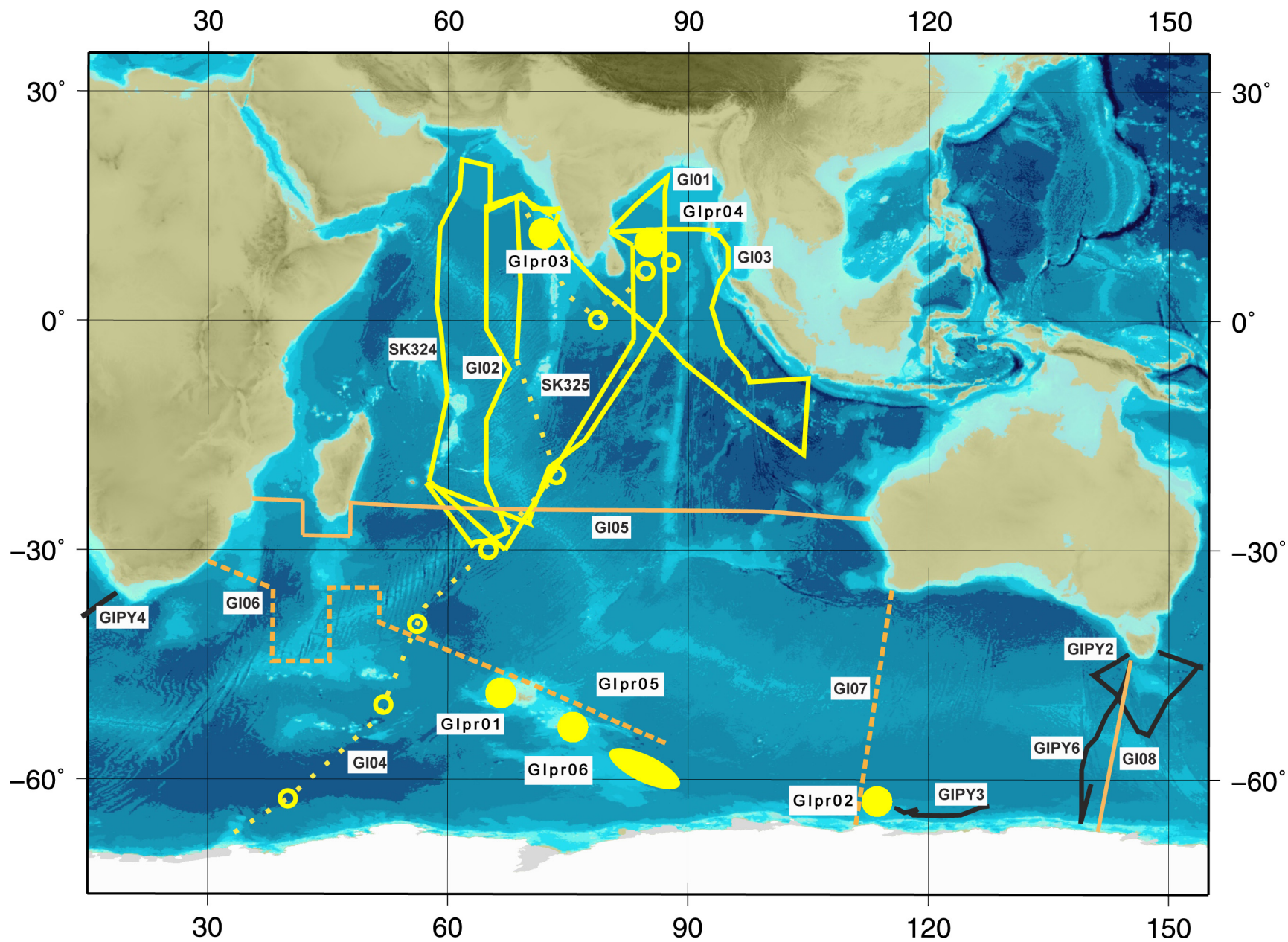
Australian and French GEOTRACES Indian Ocean completed cruises



Indian Sections

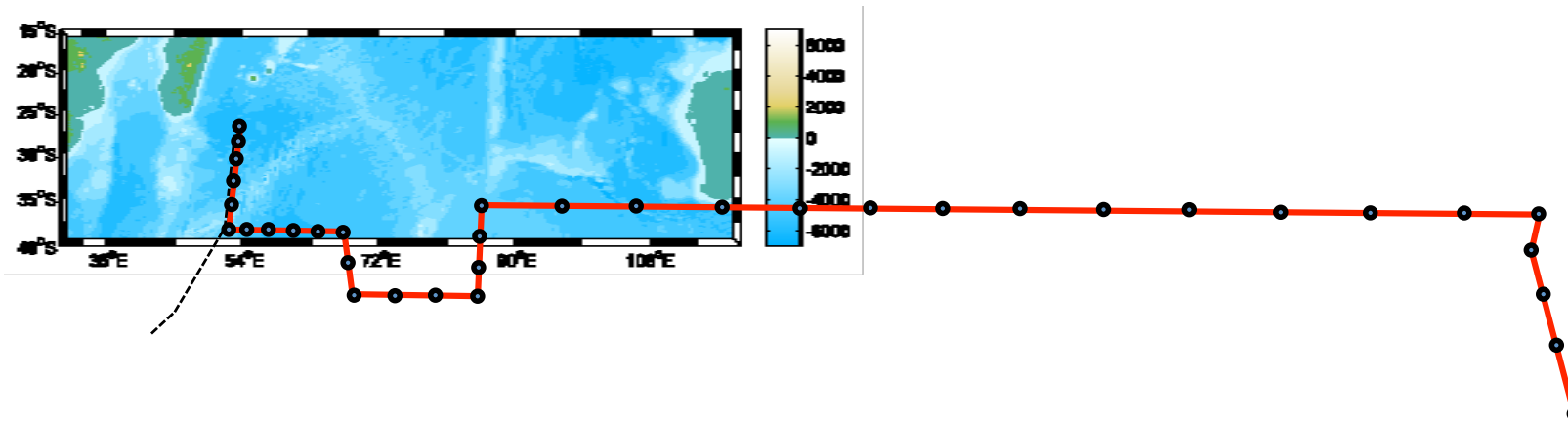


Japanese Section



Planned sections (in the pipe)

The « German » cruise (PI Achterberg)



DURBAN-PERTH

2018?

From M. Frank's mail (based on the German South East Atlantic section)

All core parameter metals - Eric Achterberg

d15Nitrate - GEOMAR in collaboration with MPI Bremen

d13C - samples will be taken, currently working on who will measure it.

$^{231}\text{Pa}/^{230}\text{Th}/^{232}\text{Th}$ - Gideon Henderson, Fefei Deng, Oxford

Pb isotopes - Steve Galer, MPI Mainz

Nd isotopes and REEs - Martin Frank, GEOMAR

Particles and aerosols - Eric Achterbeg, GEOMAR

In addition:

transition metals and metal speciation - A. Koschinsky, Jacobs University Bremen

radium isotopes - Jan Scholten, University of Kiel

cadmium isotopes - Abouchami, MPI Mainz

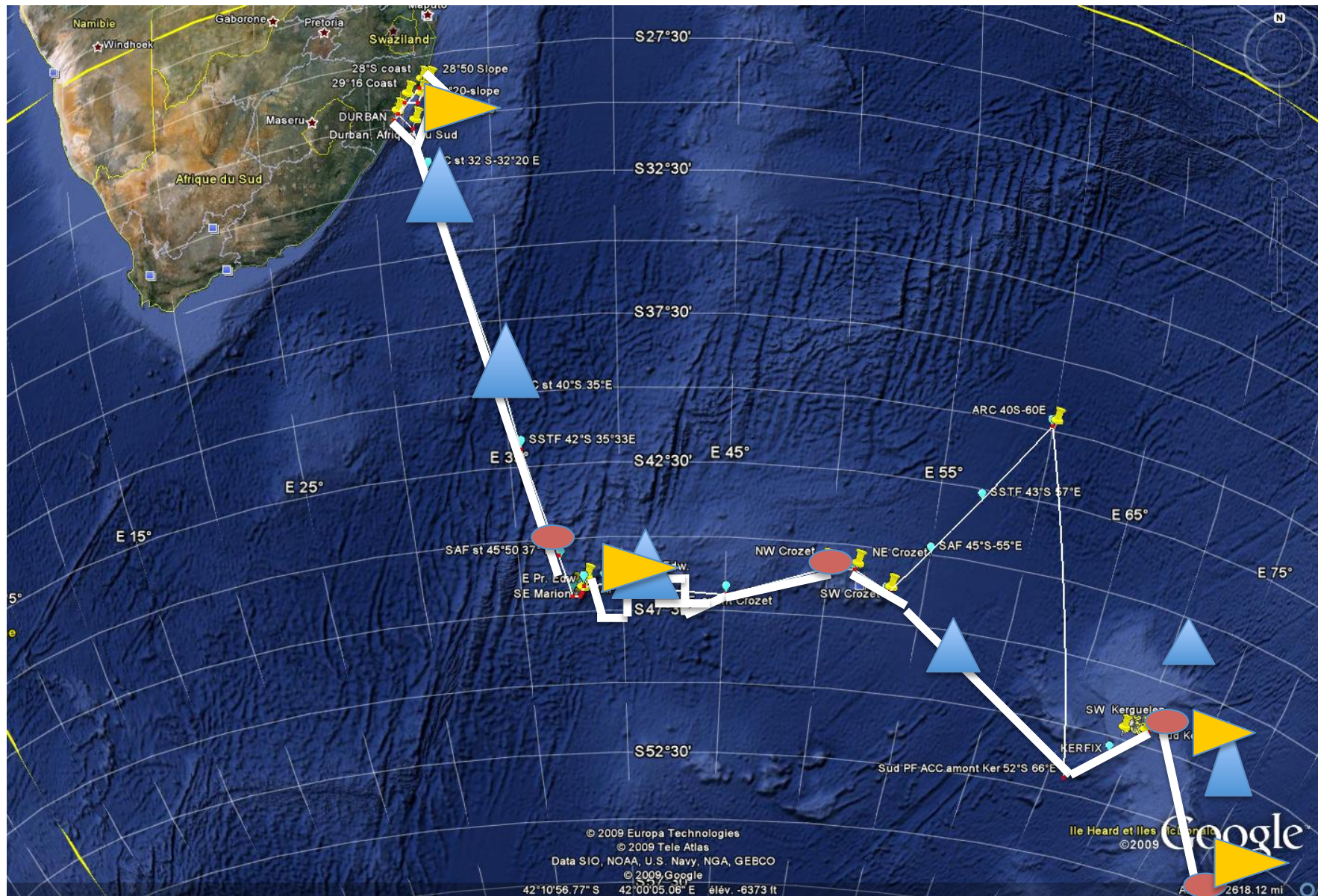
N fixation and N loss - Lavik et al., MPI Bremen

Si isotopes - Martin Frank, GEOMAR

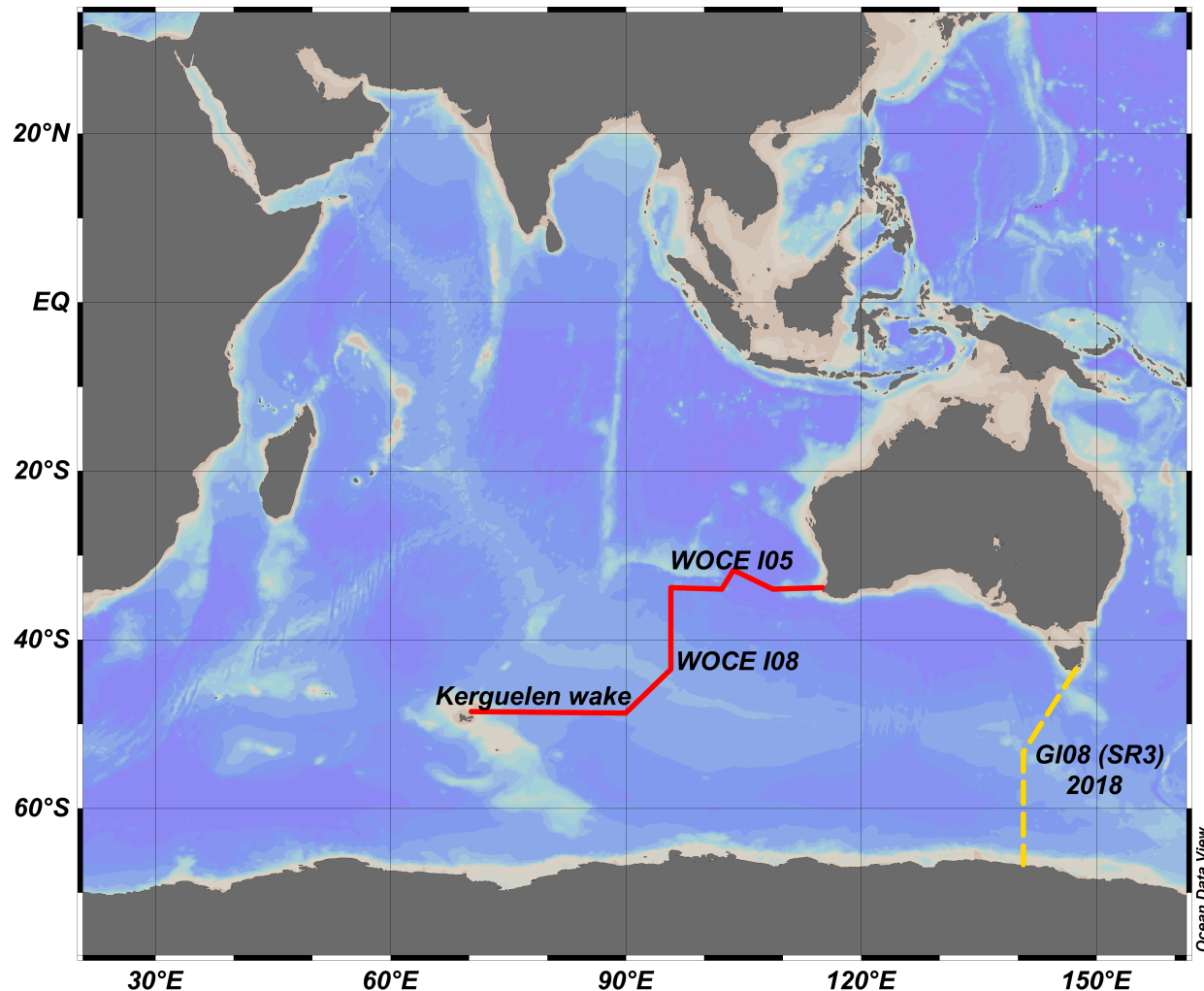
French's objectives

- Contribute to close the SW Indian ocean (A/I exchange)
- Follow the fronts activities (dynamic and biology) and TEI transports (water masses, currents)
- TEI source from South Africa (margin study)
- Hydrothermal hotspots
- North-south contrasts
- East Kerguelen to ...Australian cruises

SWInGS map



Australian GEOTRACES Indian Ocean section plans



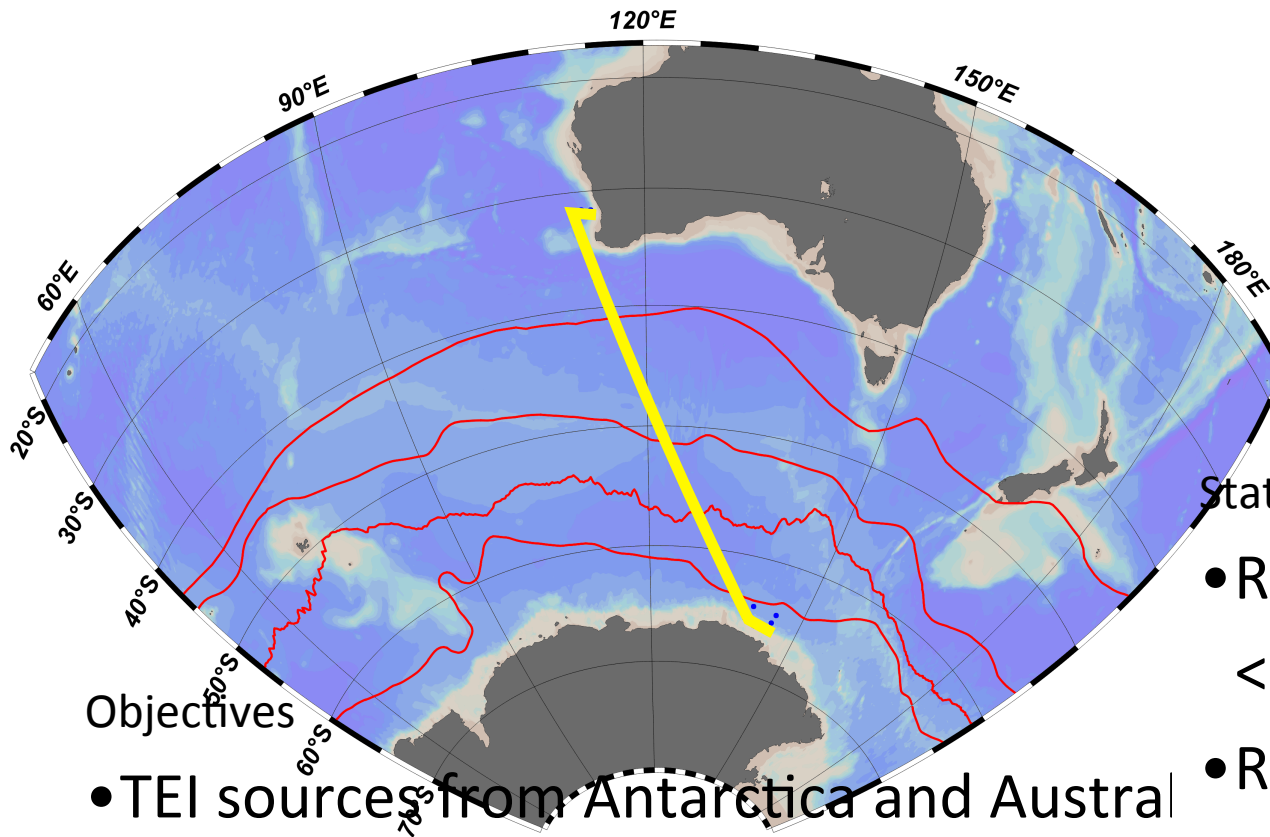
SR3 features

- Funded for summer 2018
- Builds repeat of previous occupations
- Spring 2001, autumn 2008
- Seasonal and decadal changes
- Addition of more TEIs, particles, aerosols
- Full water column coverage

Proposed new line features

- Dust inputs near Australia
- Hydrothermal SE Indian Ocean ridge
- Island wake bloom
- Flows from IO to SO
- Crosses SO fronts
- Follows WOCE I05 line west of Aus, then I08 line south, then west to meet SWiNGS section
- Proposed for 2020 or after

K. Pahnke

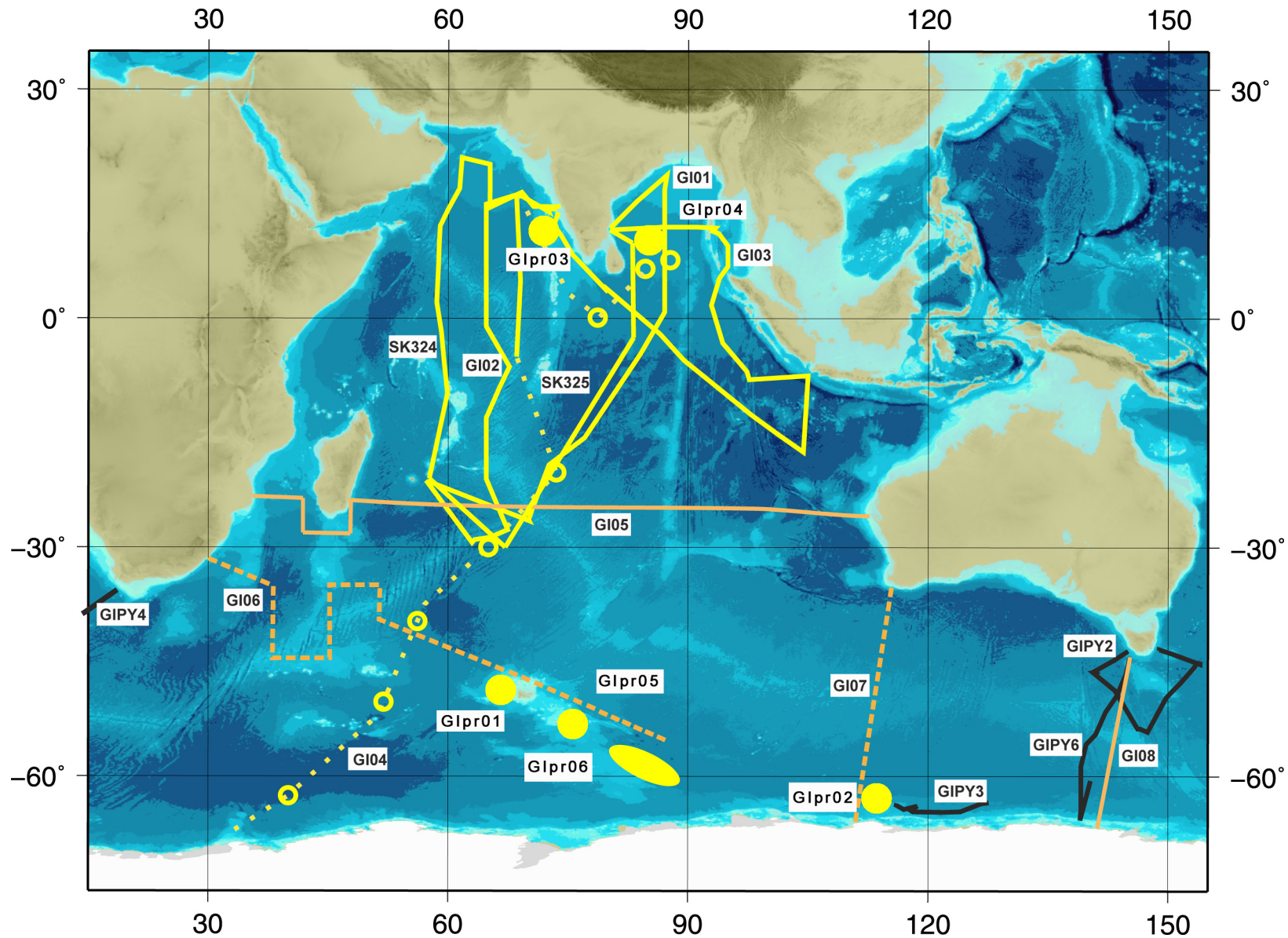


- Objectives
- TEI sources from Antarctica and Australia
 - TEI transport in the ACC
 - TEI signatures of major water masses
 - TEI distributions across the circum-Antarctic frontal system
 - particulate TEI supply from icebergs/dirty ice
 - AABW formation region

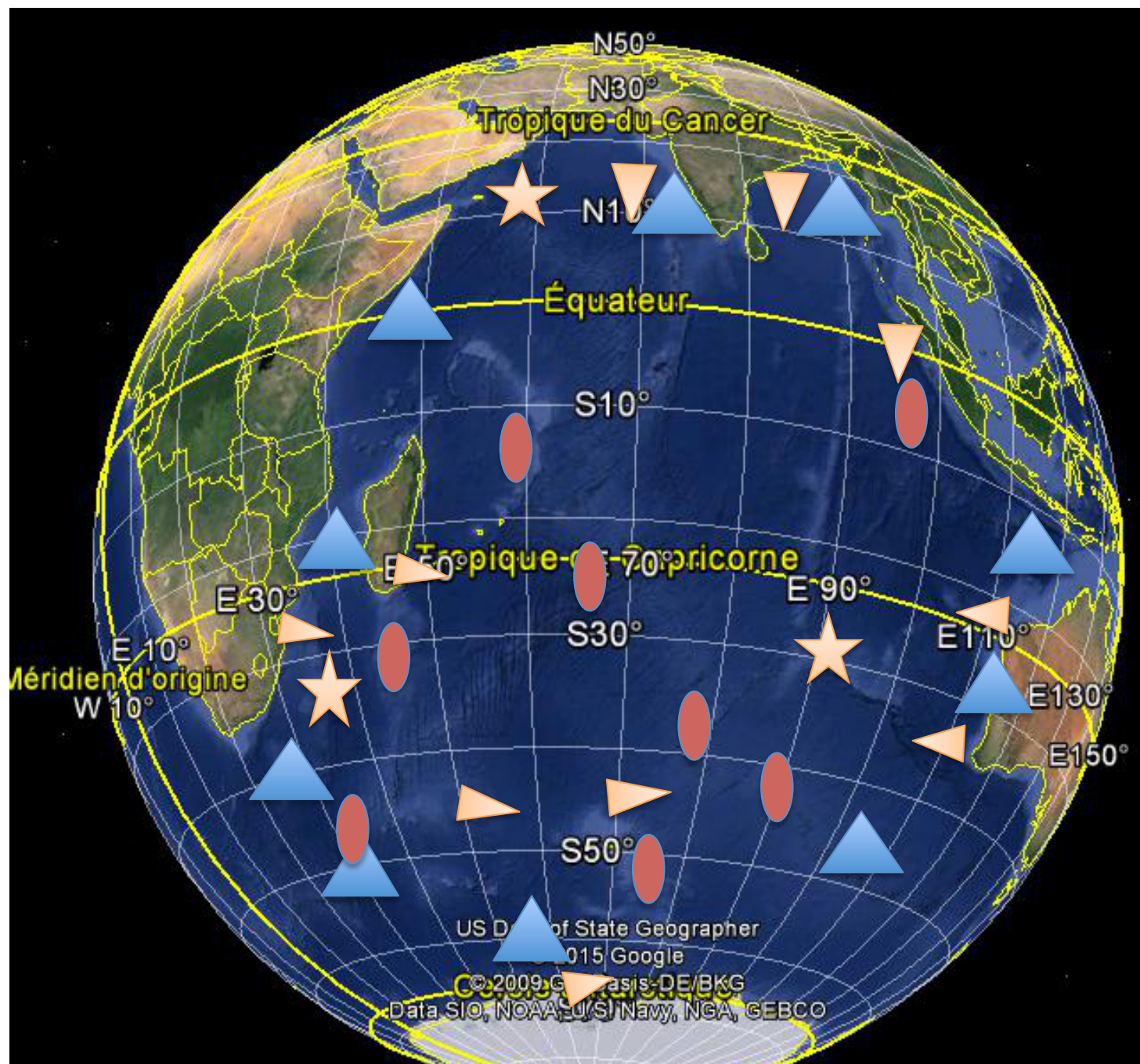
Status

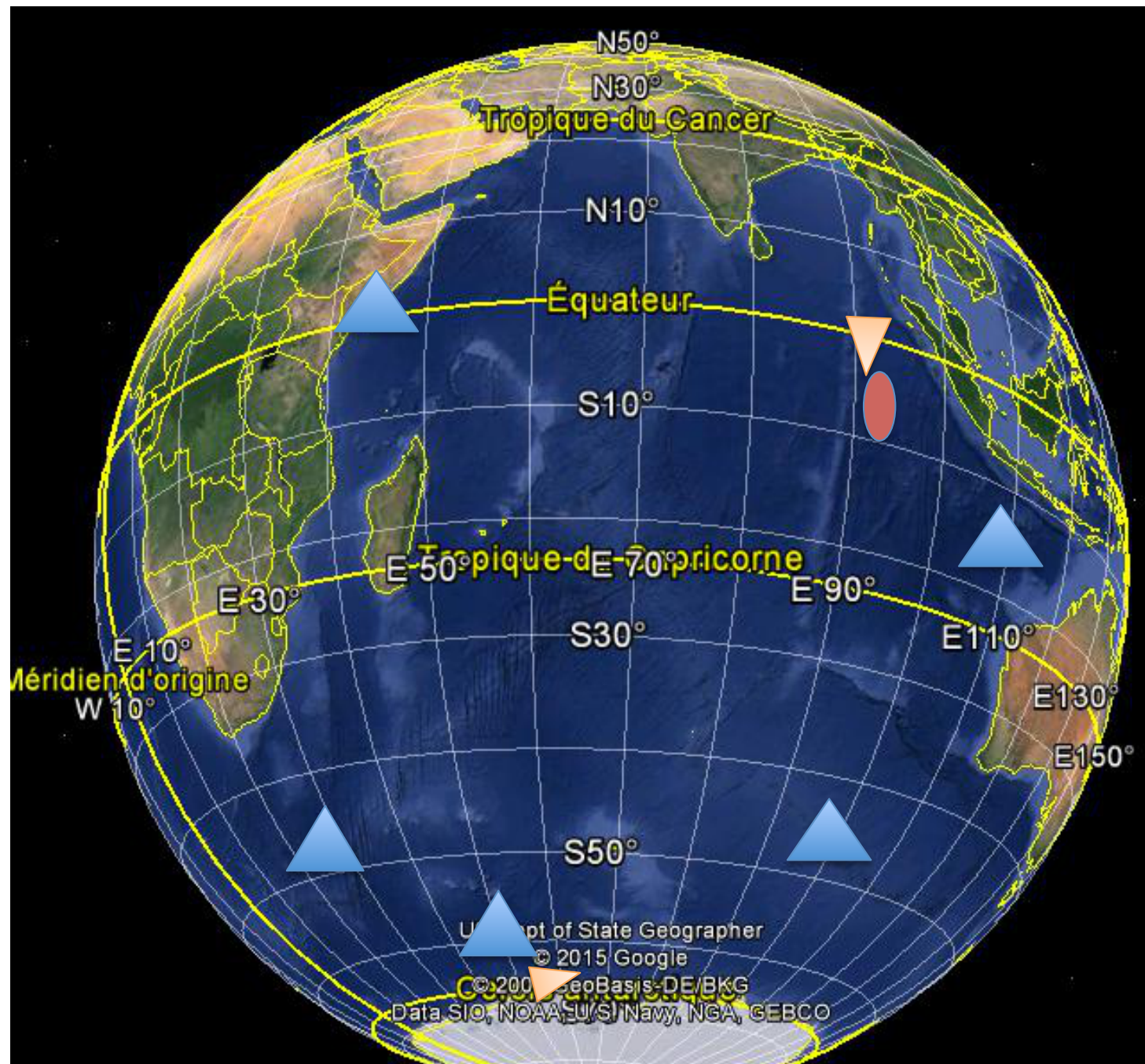
- R/V Sonne only operates <60°S
- R/V Polarstern requires strong AWI involvement / coverage of AWI interests (Geochemists & Geologists)
 - ➔ longer-term planning
- meeting in Fall at AWI

all what has been done + pipe

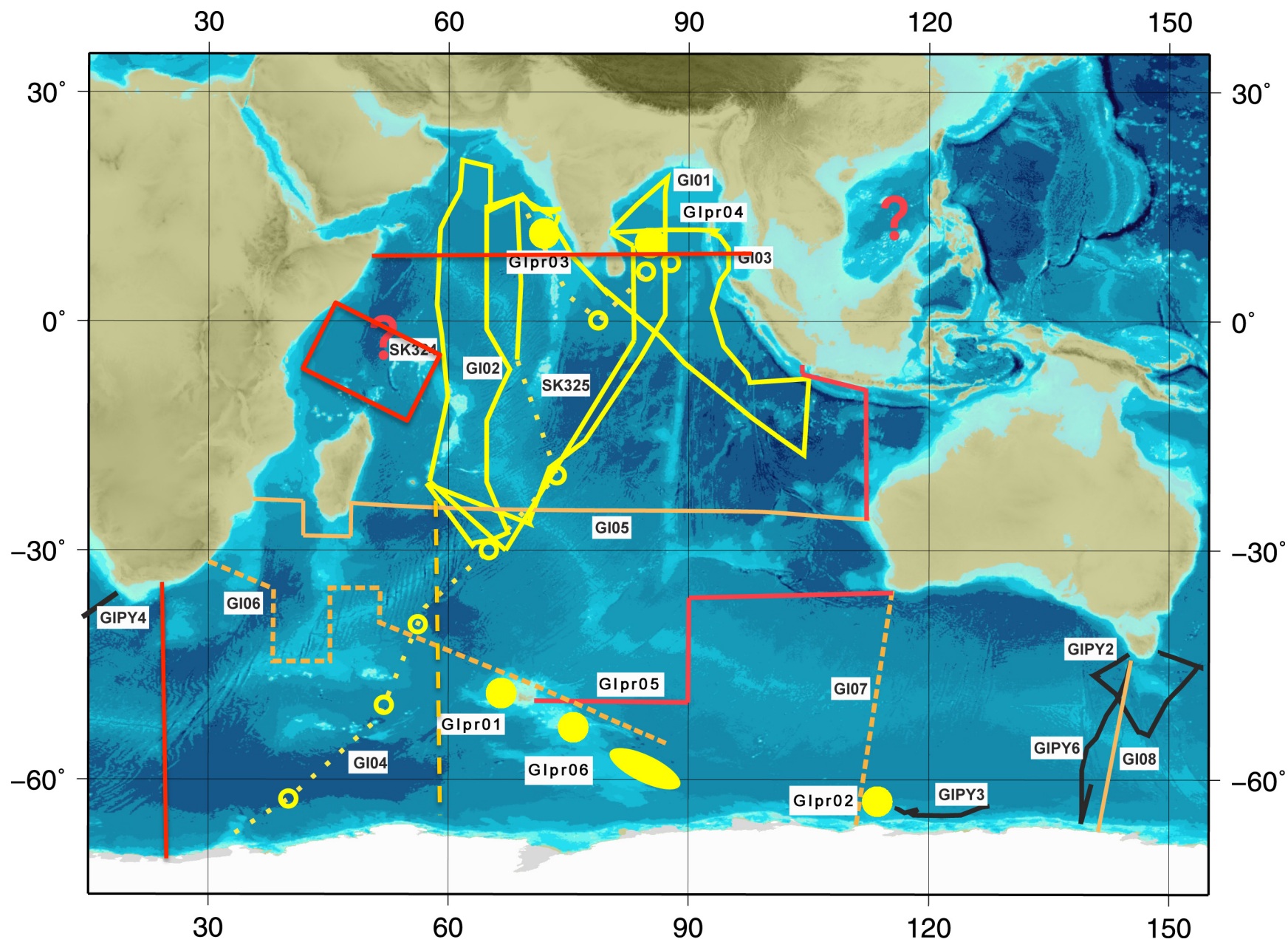


Missing and wishes



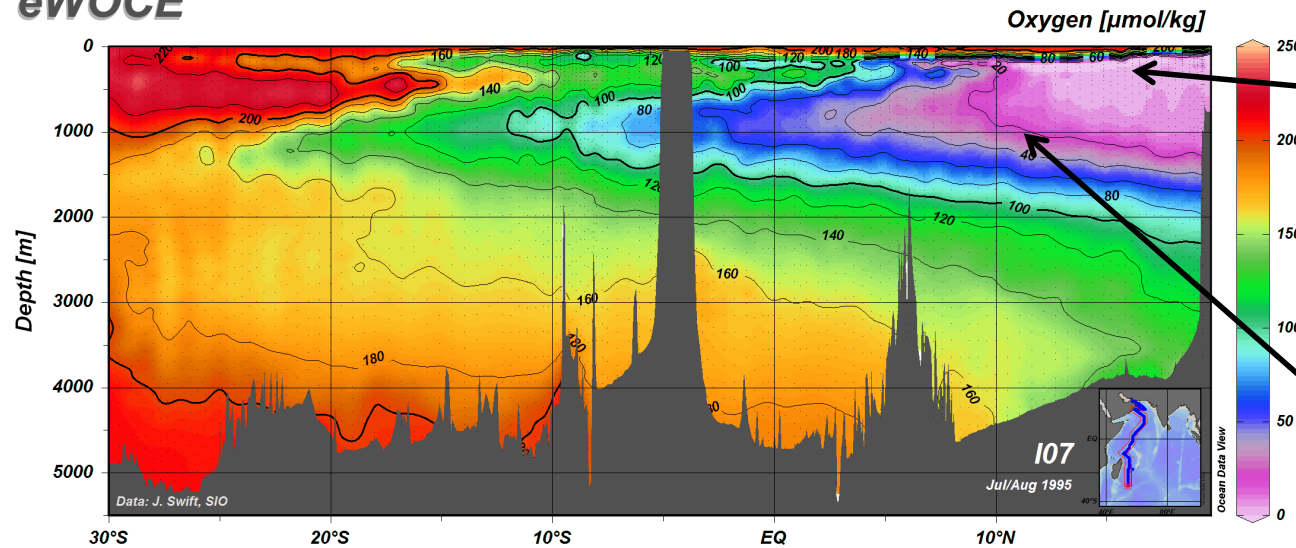


Suggested map



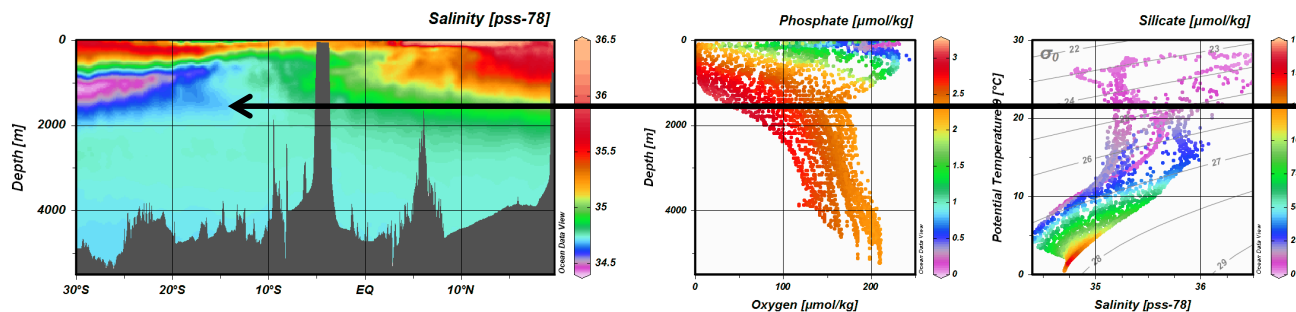
Trace metal stable isotopes ($\delta^{114}\text{Cd}$, $\delta^{56}\text{Fe}$, Cu, Ag?)

eWOCE



1. High-res sampling for dissolved and particulate Cd/P and $\delta^{114}\text{Cd}$ across rapid shallow transition into OMZ (and other metals)

2. Influence of the OMZ and other deep sources on dFe and $\delta^{56}\text{Fe}$ cycling and signatures



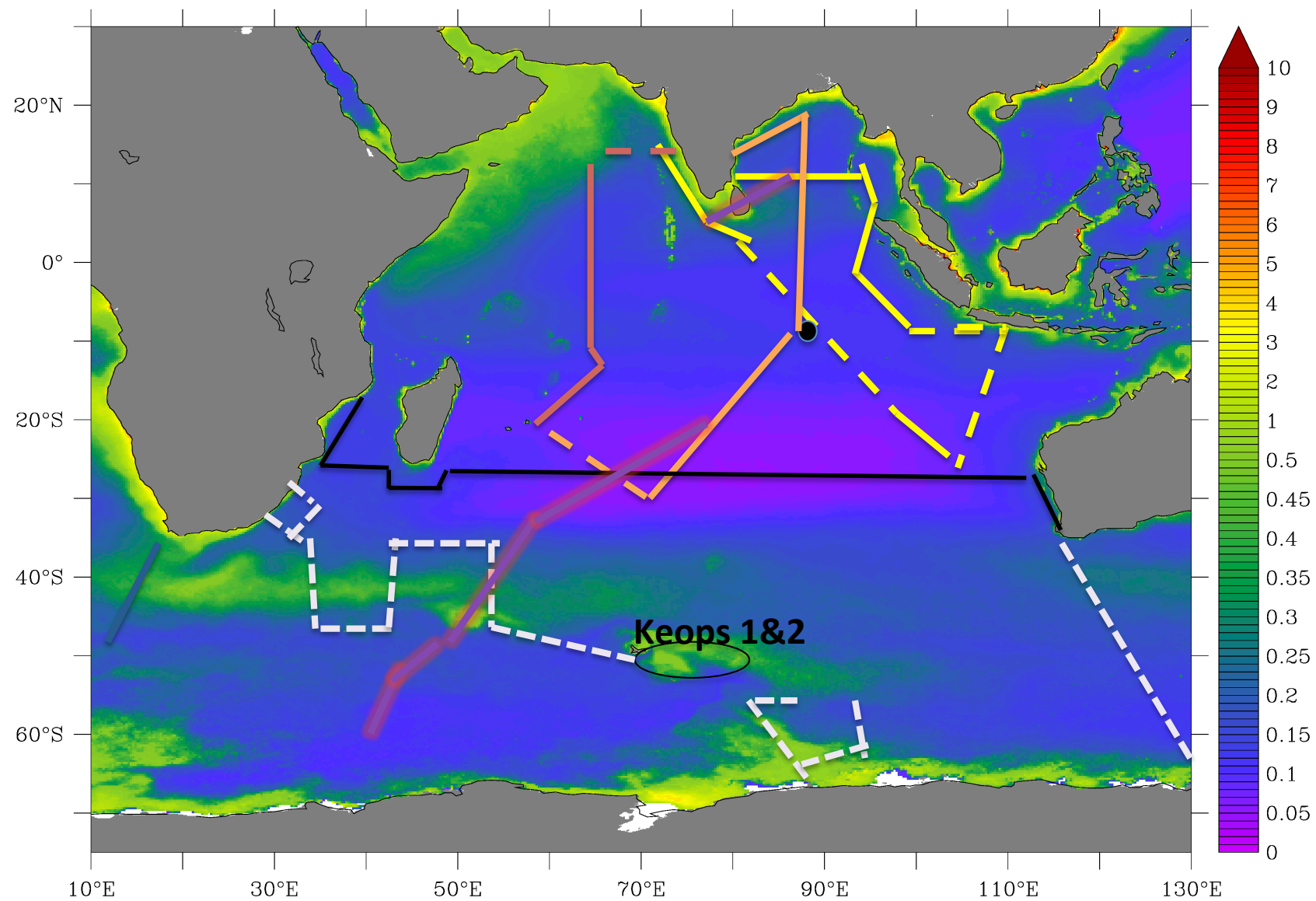
3. Large-scale $\delta^{114}\text{Cd}$ cycling with water mass movement and S. Ocean influences

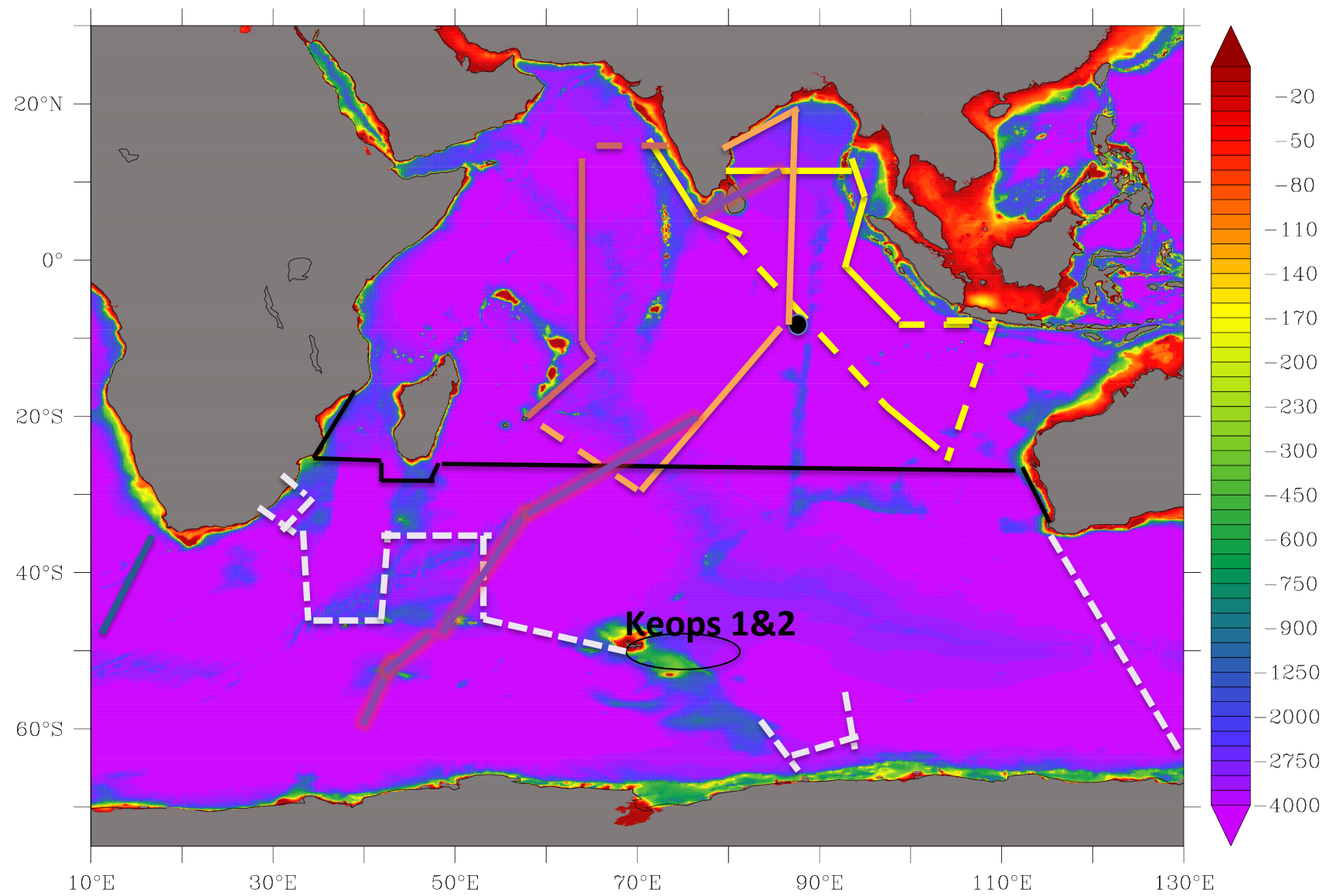
Tim Conway, University of South Florida, USA
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Péré Masque Interests

- C export and remineralisation using $^{234}\text{Th}/^{238}\text{U}$, $^{210}\text{Po}/^{210}\text{Pb}$ and ^7Be
- Atmospheric inputs of TEIs using ^7Be as a proxy
- SGD and nutrients and TEIs inputs to the ocean using the radium quartet
- Artificial radionuclides (^{137}Cs , ^{90}Sr , Pu isotopes, ^{237}Np , ^{129}I and ^{236}U): sources, water mass tracers, scavenging

Indian Ocean average Chla 1998-2010

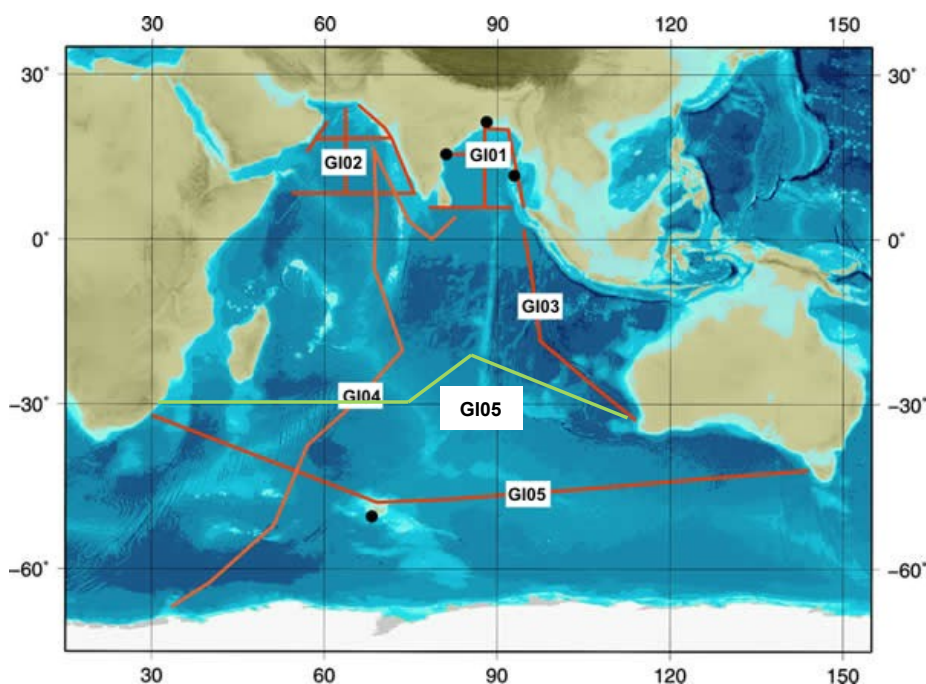




GEOTRACES GI05 section



- Aus/France/others(?) GEOTRACES GI05 section for 2016-17?
- ~34 berths, ~40 days shiptime
- Choice of cruise track:
 - (1) southerly zonal GI05 section from Hobart/Fremantle to Kerguelen (on GDAC)
 - (2) northerly zonal section in the Southern Indian Ocean (tracks WOCE I5 line)



- (1) - the southernmost line is subjected to ACC jets and transports of tracers, and dispersion of Kerguelen plume (difficult to interpret?)
 - the 30°S section is crossing gyres, which aren't highly dynamic places
 - Southern route captures AABW
- (2) - lack of GEOTRACES Indian Ocean coverage
 - the northerly line is likely to be more impacted by dust
 - Northern route captures inflow to Indian Ocean

- Possible compromise - run the section east from Kerguelen to study the plume and then to Fremantle or Hobart to get dust