

Developing a plan for Australian participation in CINDY-2011

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Australian Government
Bureau of Meteorology



Plans for an Australian ship to participate in CINDY are still being developed. A formal proposal has not yet been submitted, but will be required by ~ late 2009.

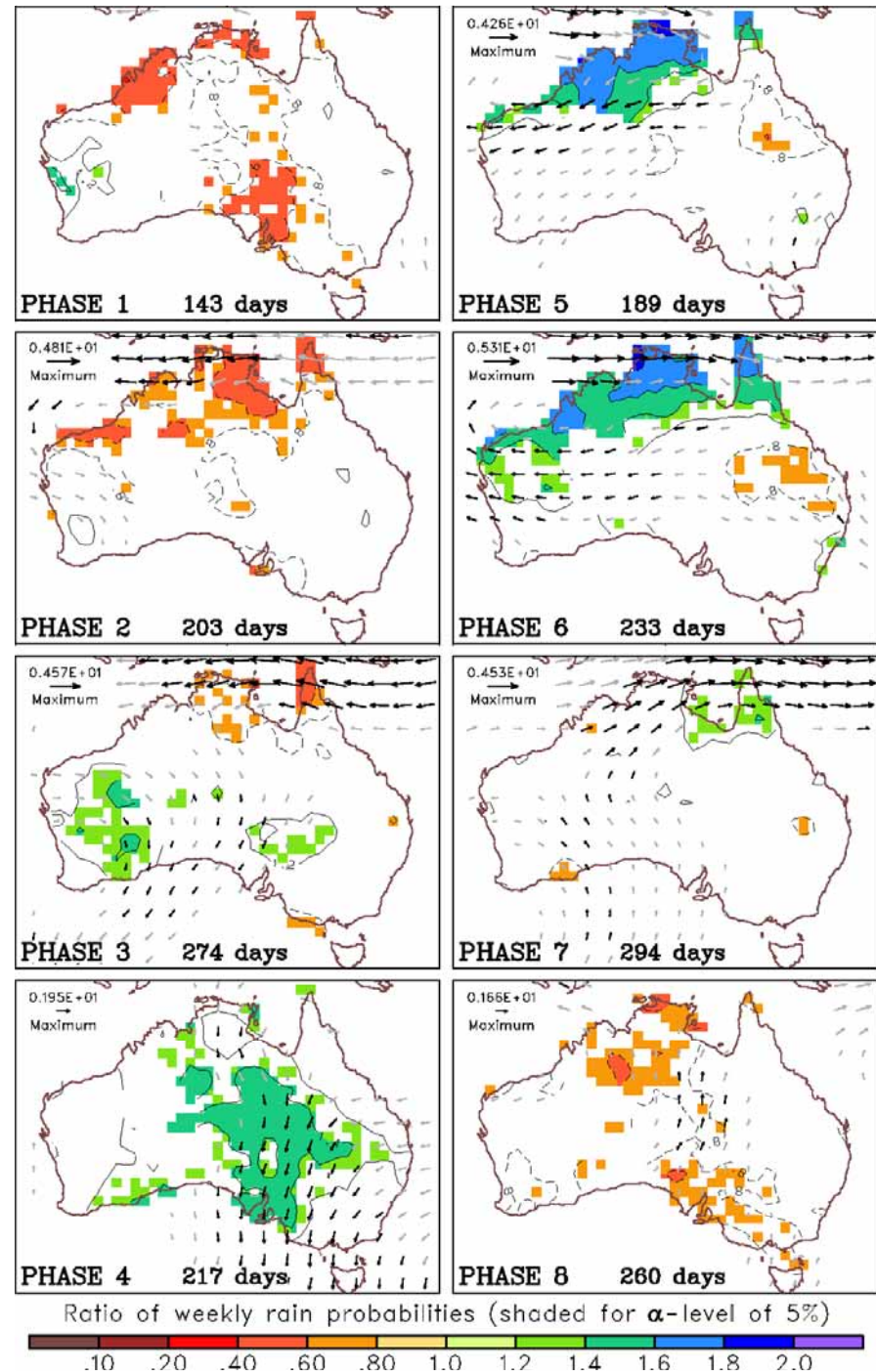
Thus, to help promote our ideas, I shall discuss:

- Some Australian-specific motivation
- Capability and past cruises of Australia's *Marine National Facility*
- Technical and practical considerations for participation of an Australian ship in CINDY
- Scientific considerations
- Coordination and other possible contributions

Our Motivation

- MJO has large direct impact on the Australian monsoon.
- But indirect effects extend far into southern Australia as well.
- Yet the MJO remains a challenge for our understanding and models.

MJO rainfall impact in Australia during DJF according to the phase of the MJO as defined by the Wheeler-Hendon index. Shown is the ratio of the probability of weekly rainfall exceeding the upper tercile relative to the climatological probability (contours and shading). Vectors are the 850 hPa wind anomalies. Adapted from Wheeler et al. (*J. Climate*; in press).





MARINE
NATIONAL FACILITY

Marine National Facility

Ship owned by Australian federal government and operated by CSIRO.

However, any group of Australian scientists may apply for ship time, including international collaborators.

During 1985-2002 the ship was the RV *Franklin*

Since 2002 it is the **RV *Southern Surveyor***

length: 66 m

(1/2 the length of the RV *Mirai*)

gross tonnage: 1600 t

(1/5 of the mass of the RV *Mirai*)



Past Cruises (with atmospheric and air-sea measurement components):

2 x **TOGA-COARE** cruises (1992-1993) western Pacific

2 x **Indian Ocean** cruises (1994 and 1996) around 2.5°S 92.5°E, departing from Colombo, finishing at Christmas Island.

MCTEX (1995) near Darwin

JASMINE III (1999) eastern Indian Ocean

TWP-ICE (2006) near Darwin

Example operations during TWP-ICE

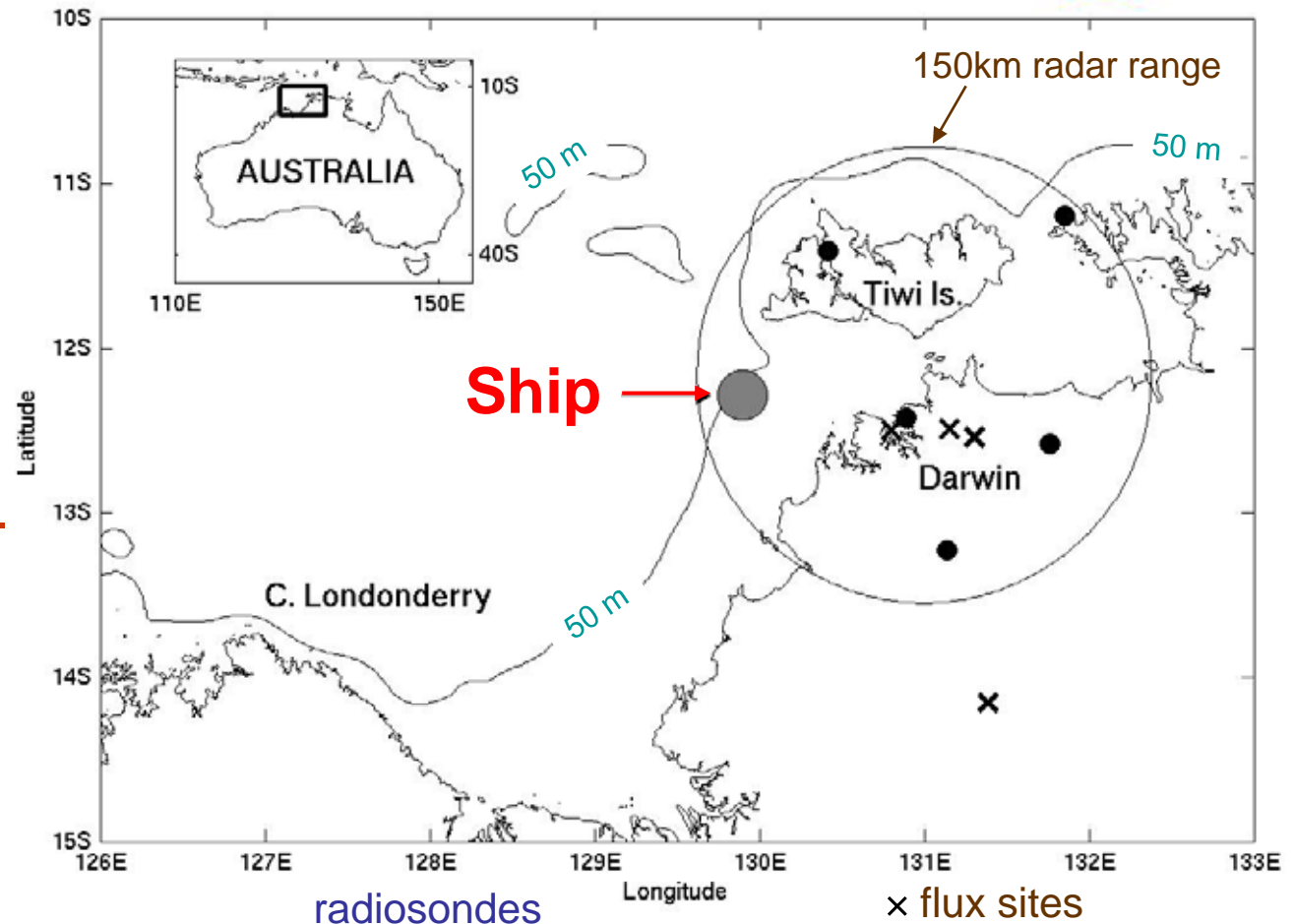


Principal Investigators: M. Tomczak, C. Jakob, **E. Schulz**,
F. Bradley, M. Reynolds, J. Mather, P. Minnett

Cruise dates:
20 Jan – 14 Feb 2006

Objectives:

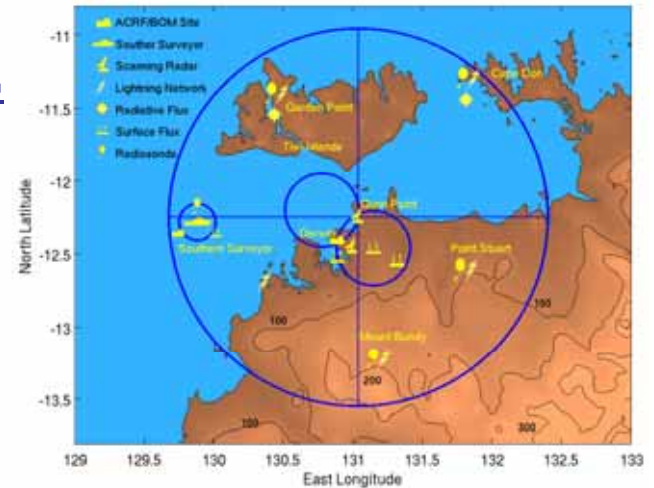
1. Extend radiosonde observation network
2. Fluxes + surface met.
3. Ocean state obs.
4. Provide additional cloud and radiation observatory



Instruments deployed for TWP-ICE

- CTD/SeaSoar oceanographic observations
- Thermosalinograph
- Radiometric SST
- Siphon rain gauge
- Bulk flux & surface met – **Bradley** (CSIRO), **Schulz** (BoM)
- Radiosondes (8 x daily) – **Jakob** (BoM)
- Radiative fluxes – **Reynolds** (Brookhaven)
- PNNL Atmospheric Remote Sensing Laboratory (PARSL)
ceilometer, microwave radiometer, temperature,
humidity, and optical rain gauge – **Mather** (PNNL)
- Marine Atmospheric Emitted Radiance Interferometer (M-AERI)
Minnett (Univ. Miami)

Come as standard with ship



A basic ship instrument package for CINDY

- CTD/SeaSoar oceanographic observations
- Thermosalinograph
- Radiometric SST
- Siphon and optical rain-gauges
- Radiometers
- Surface meteorology (for bulk fluxes)
- Radiosondes – *funded by CAWCR/Bureau of Meteorology*

Additional instrument packages would require external collaboration (e.g. covariance fluxes, CO₂, cloud observatory, etc.).

We are also seeking interest from CSIRO oceanographers.

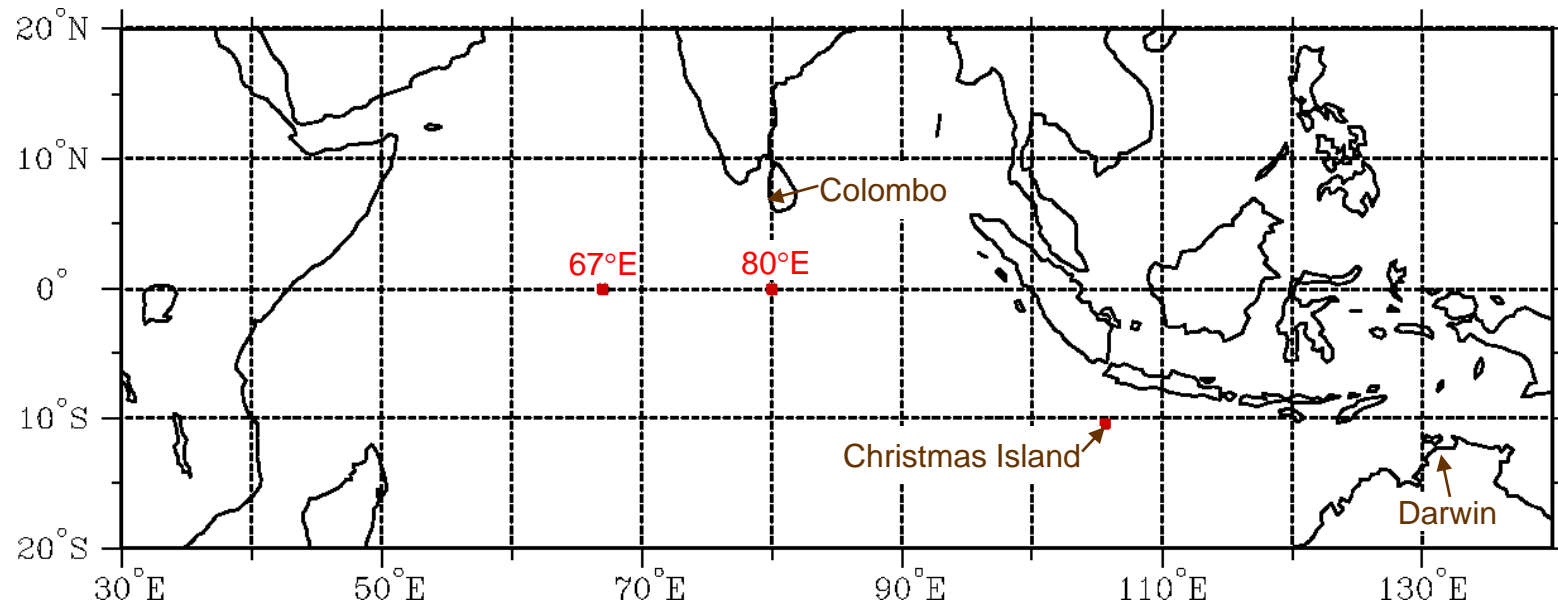
Mooring deployments and maintenance (e.g. for RAMA or DART) are also possible.

Technical/Practical Considerations

The length of each cruise is limited to about 25-30 days.

Hence, we must either try to minimize the steaming time from Australia, and/or use port facilities elsewhere (e.g. Colombo or Christmas Island).

80°E is more feasible than 67°E.

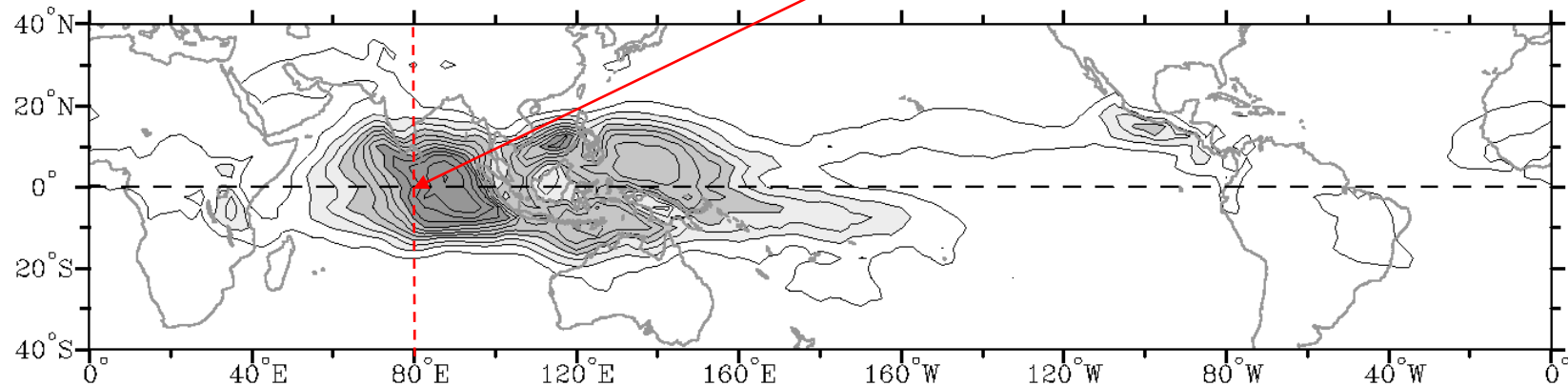


Note: Ship steaming speed is 12 knots (about 5° per day at equator).

Scientific Considerations

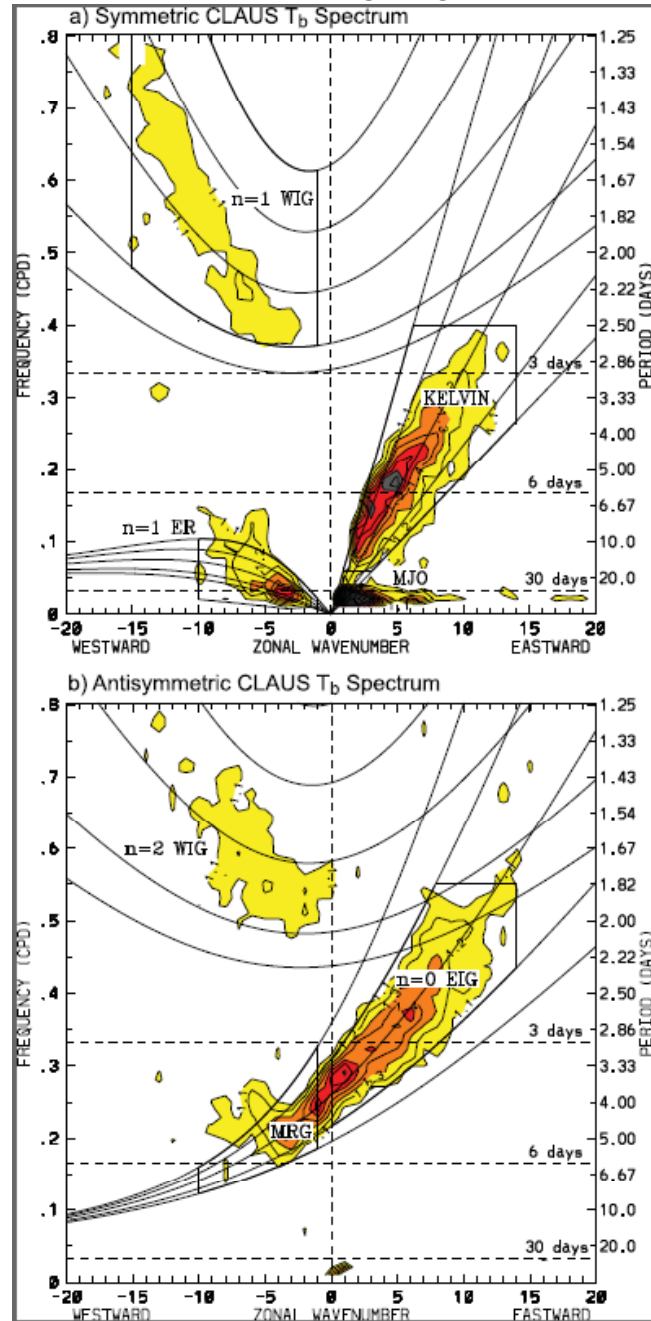
One of the main scientific aims is to observe the initiation process of MJO convection, and its relationship to equatorial waves.

For the initiation of MJO convection 80°E seems ideal.

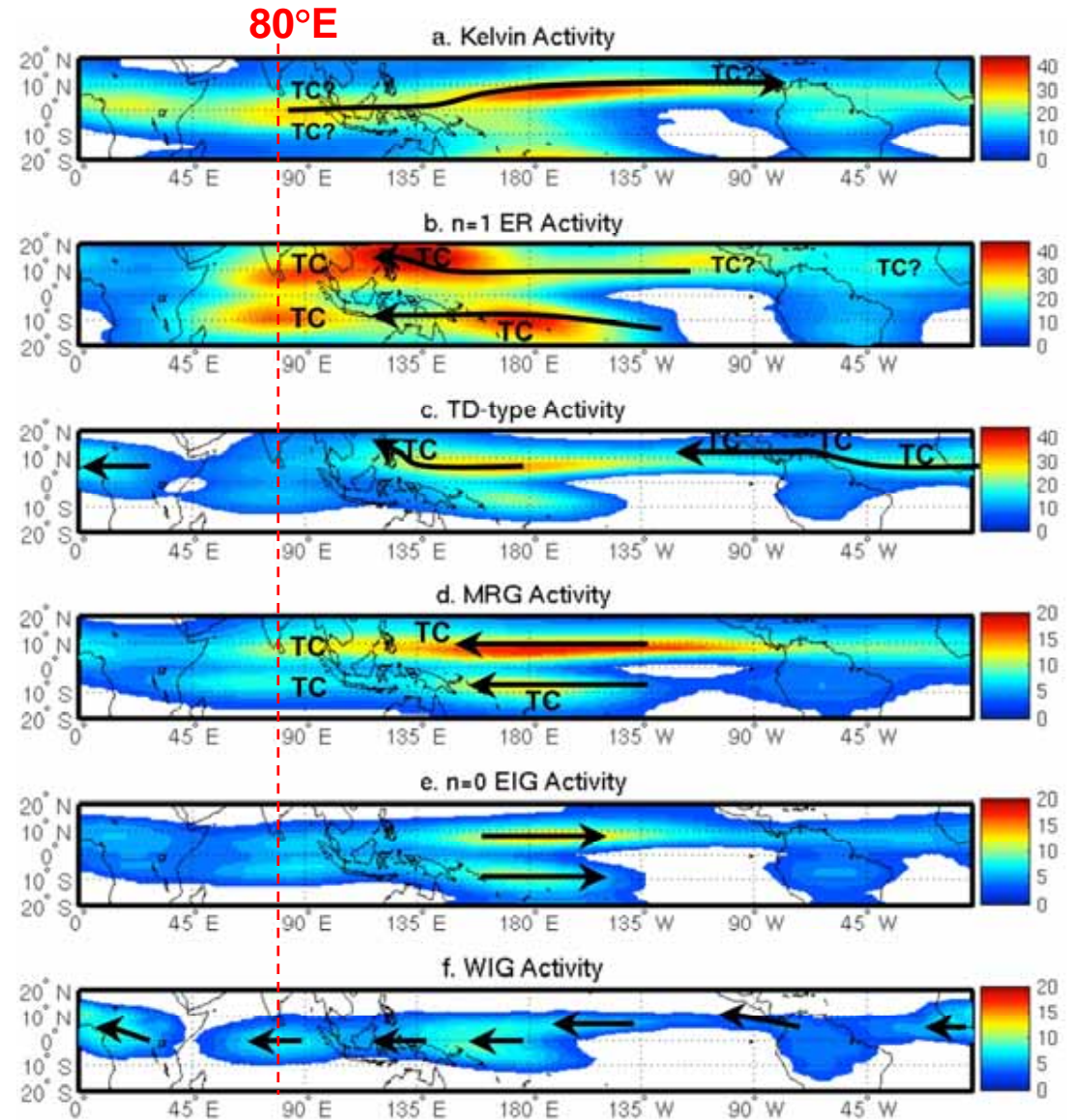


MJO-associated OLR variance (in W^2m^{-4}) during the OND season for 1974-2006, computed using multiple linear regression of daily OLR data with the two-component (RMM1,RMM2) Wheeler-Hendon MJO index.

Wave filtering regions



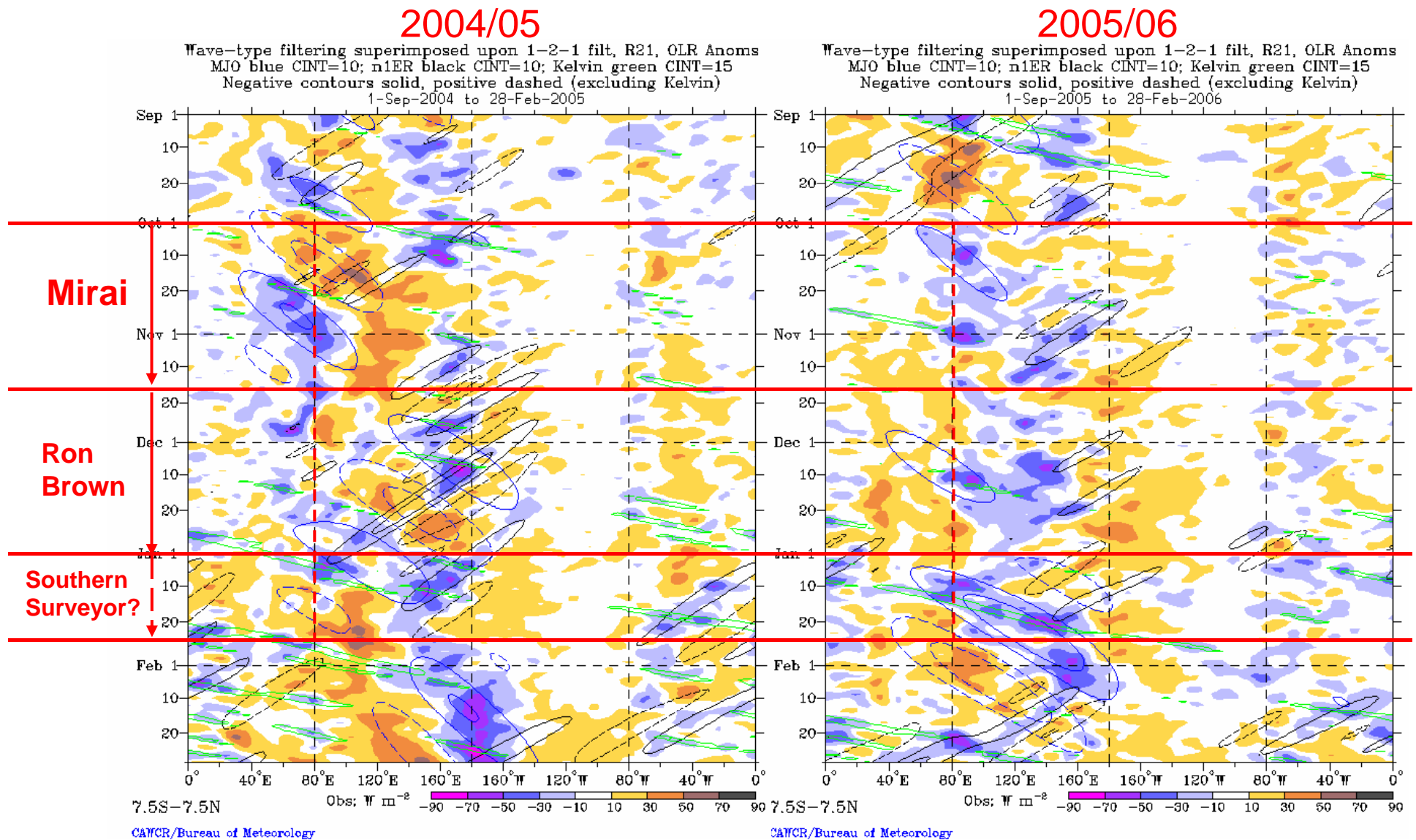
The variance of the convectively-coupled equatorial waves, and their association with TCs is also well represented at 80°E.



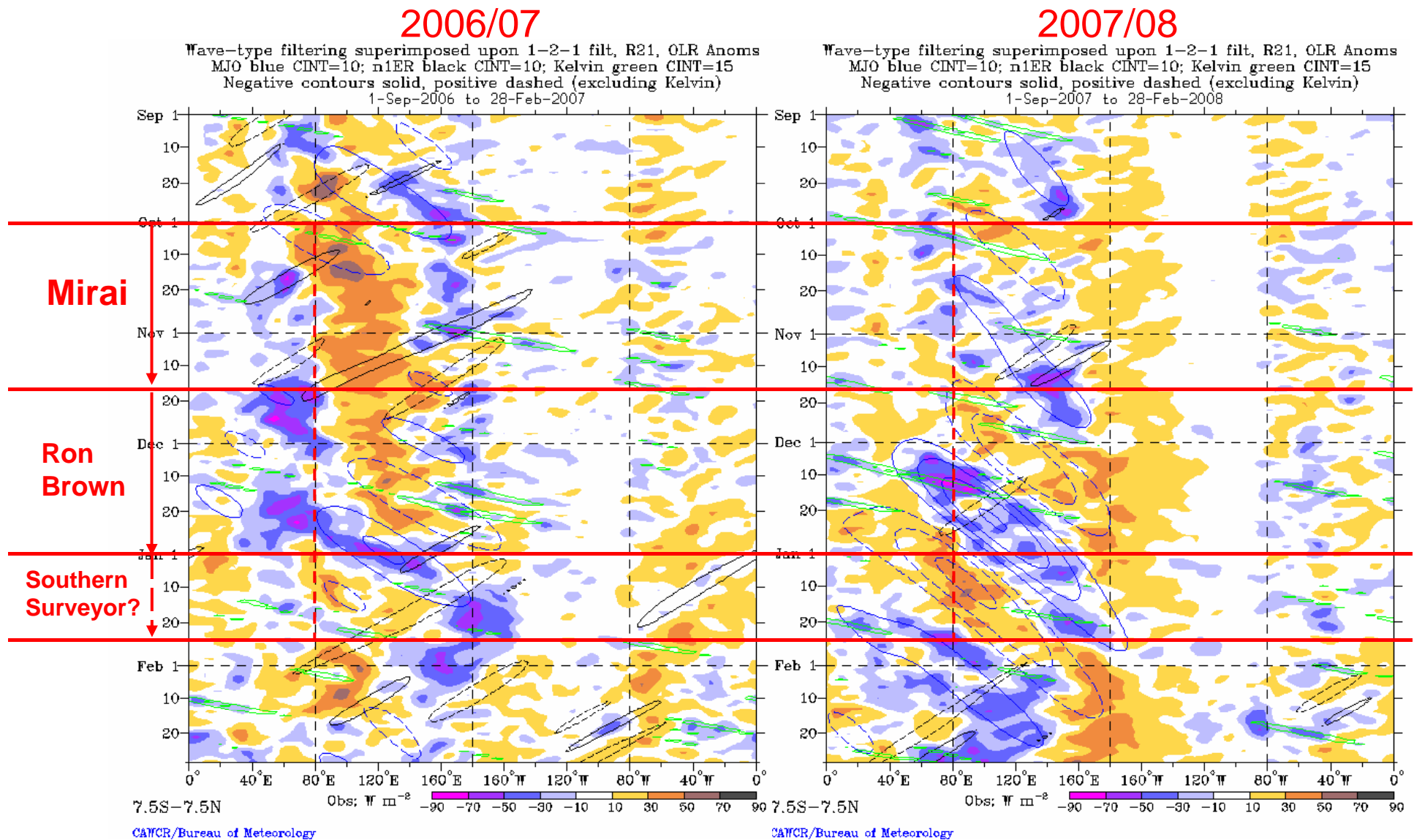
Variance maps from Kiladis et al. (*Rev. Geophys.*; in press)

For Australian ship participation, we have the choice:

1. Provide additional observations (e.g. at 95°E or to form 4th point in an array) during the IOP.
2. Extend the IOP into January by being stationed at 80°E after the *Mirai* and *Ron Brown* leave.



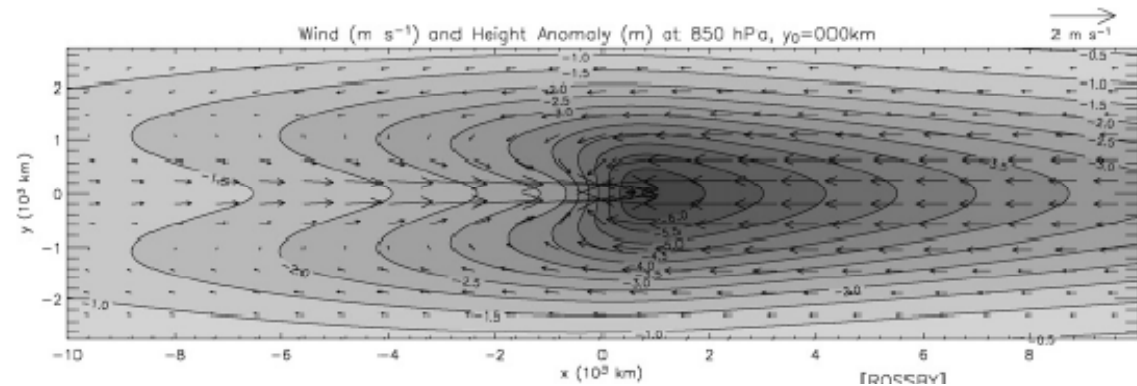
Option #2 would significantly increase the chance of observing the full cycle of a strong MJO event.



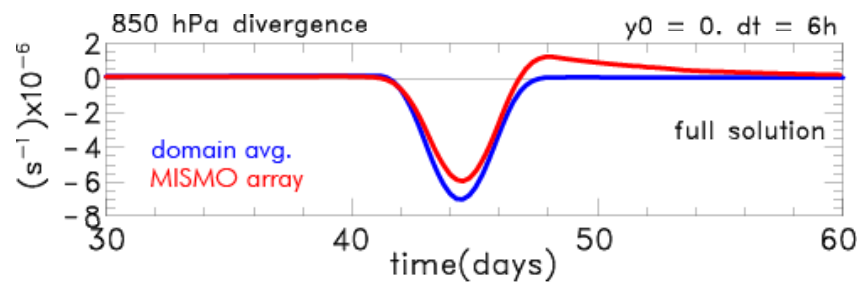
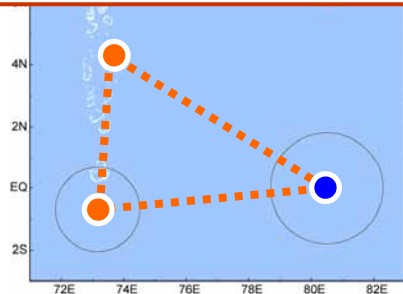
Option #1 may reduce errors in the computation of atmospheric budgets from the surrounding array.

Simulating atmospheric budgets with the theoretical MJO wind field of Schubert and Masarik (2006).

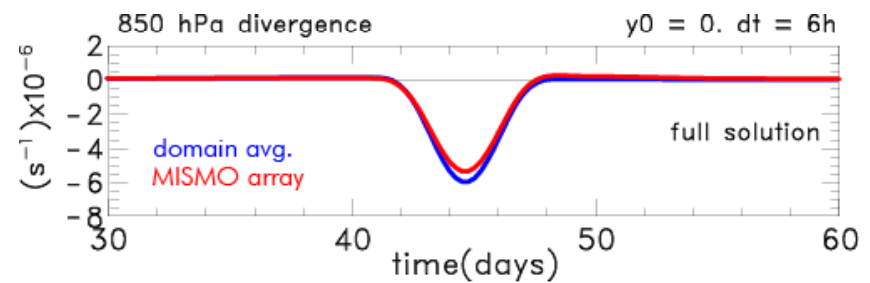
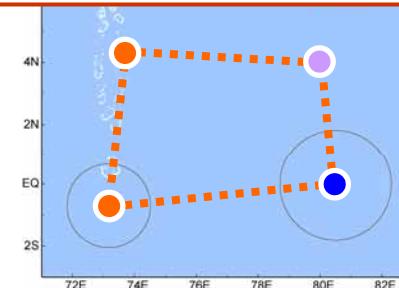
Courtesy of M. Katsumata (IORGC)



MISMO triangle array



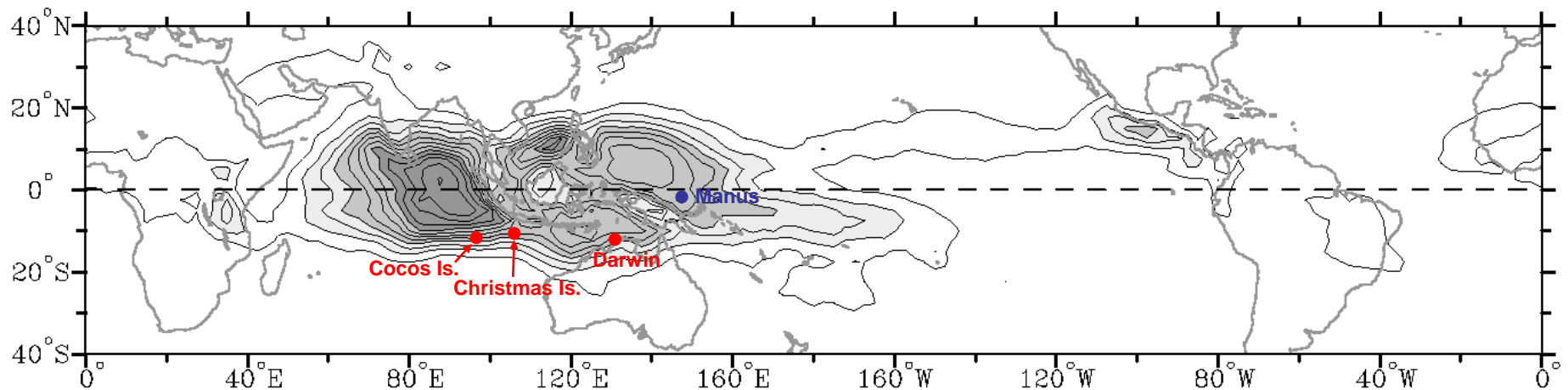
MISMO array + 1 (rectangular)



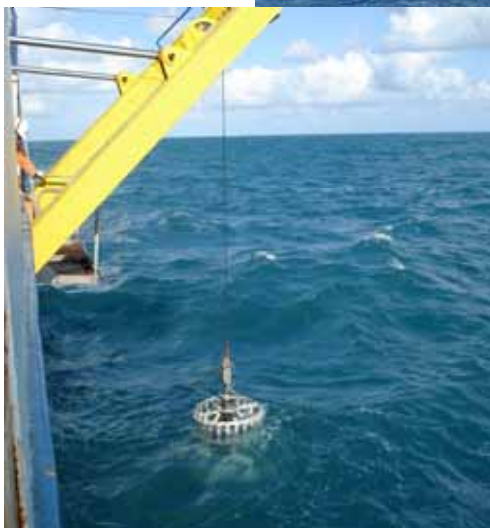
Coordination and other possible contributions

The Australian Bureau of Meteorology also conducts standard meteorological observations from **Cocos** and **Christmas** Islands, and we could propose to enhance the radiosonde frequency there if scientifically justified.

Darwin and **Manus** are designated ARM monitoring sites, from where MJO convection may be observed downstream.



Time for Discussion?



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