2006 RV Southern Surveyor program

MARINE NATIONAL FACILITY

voyageplan

SS01/2006

Characterising the monsoonal atmosphere and ocean near Darwin – a contribution to the Tropical Warm Pool International Cloud Experiment (TWP-ICE).

Itinerary

Scientists arrive Monday 16 January 2006 to begin mobilisation.
Any work on vessel before this date by prior arrangement.

Depart Darwin 1000hrs, Friday 20 January 2006.
Arrive Darwin 0800hrs, Tuesday 14 February 2006 and demobilise.

CSIRO

Principal Investigators

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Peter Minnett (PI M-AERI): University of Miami, Rosenstiel School of Marine and Atmospheric Science, Miami, FL USA **Phone:** +1 305 3614104 **Email:** pminnett@rsmas.miami.edu

Scientific Objectives

In this voyage the RV Southern Surveyor will be deployed as part of a large experimental campaign carried out in the Darwin are – the Tropical Warm Pool International Cloud Experiment (TWP-ICE, see www.bom.gov.au/bmrc/wefor/research/twpice.htm). In the context of this experiment the ship will fulfil four major roles, which are linked to the overall experiment objectives of TWP-ICE. Dr Christian Jakob will be the coordinating Chief PI of the deployment, while Dr Matthias Tomczak will be the Chief Scientist aboard the vessel. The other PI's are directly linked to the tasks below.

1) To serve as a base for a second cloud and radiation observatory similar to the land-based ARCS site through the deployment of the Pacific Northwest National Laboratory (PNNL) Atmospheric Remote Sensing Laboratory (PARSL) and the Marine Atmospheric Emitted Radiation Interferometer (M-AERI) on the vessel away from direct land boundary effects (PI: Mather, Minnett)

2) To extend the radiosonde observation network over the open ocean and thereby provide a critical link in closing the network around Darwin (PI: Bradley, Reynolds)

3) To provide observations of surface meteorology, air-sea fluxes and precipitation (PI: Bradley, Reynolds)

4) To provide measurements of the ocean state to support both ocean and coupled modelling (PI: Tomczak)

Voyage Objectives

The following is a notional voyage plan to achieve all the above objectives. As is often the case, it may need to be modified to suit the conditions we encounter on the day. For example, we are operating in a region and at a time when the dynamics of both ocean and atmosphere are expected to be quite complicated. The most severe problem from the flux measurement point of view would be lack of steady wind direction due to storm activity. So the plan should be understood as an indication of observational principles.

The ship will be deployed for 24 days at a location about 100 km west of Darwin (12º17'S, 129º53'E). This location will form the centre of the operations area and the central Flinders mooring will be deployed here. The ship will operate within a square box of side about 25km around the central mooring, always beneath cover of the Darwin weather radar. There will be a short instrument and SeaSoar trial period within the box, during which two other moorings will be deployed at its perimeter at 12º20'S, 129º58'E and 12º14'S, 129º48'E (see attached map). All these moorings are in shallow water, so deploying and retrieving them will take very little time.

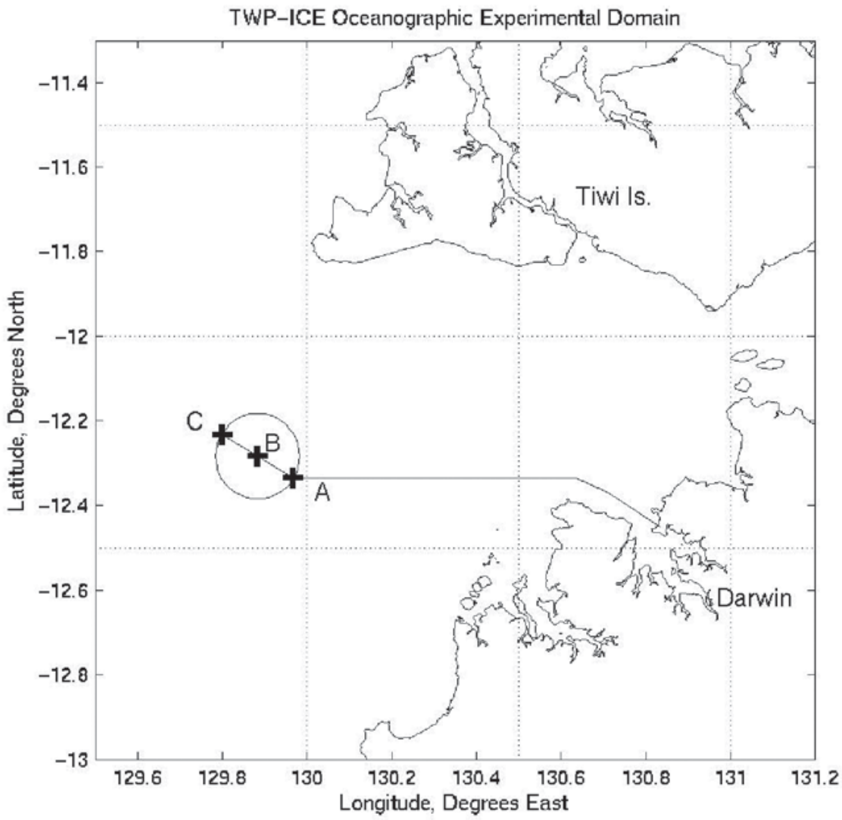
There will then begin a voyage routine, which will continue throughout the IOP. To minimize the effects of flow distortion and ship motion on the wind measurements, the best strategy to obtain continuous time series of air-sea fluxes is to steam slowly upwind without ship maneuvers for as long as possible. At 2 kts the ship will travel from the central mooring to the edge of the box in 3 hours on its "flux leg". It will then deploy the SeaSoar in tow-yo mode and return to the mooring at 8kts on an "ocean structure leg" taking from 45min to 1hour. The ship will then turn and proceed again upwind which may, of course, have shifted direction. Note that in light winds flux measurements would be valid on the return leg – data would only be lost while the ship was turning. In a shifting wind situation, the flux leg may need higher speed to keep the relative wind within a reasonable sector over the bow, and the ship would cross the entire box in both directions. The actual routine and timing will need to be determined after some experience, particularly of the SeaSoar handling.

Throughout the voyage continuous measurements will be taken with the PARSL observatory, and radiosondes will be launched at three-hourly intervals. These will be closely scheduled, and it would be impractical, and unnecessary to try and synchronize the ship leg routines with launches. If a balloon is likely to coincide with either end of a leg, the turn will be delayed until the launch is completed. There will inevitably be other contingencies, which affect the voyage timing, such as occasional CTD casts for comparison with the SeaSoar and ship's thermo-salinograph.

Of the aircraft flying during TWP-ICE, some will be measuring the state variables in the boundary layer, and surface fluxes. By observing spatial variability along the flight path, these complement the ship measurements and place them in the context of the whole experimental area. Experience with TOGA-COARE tells us that confidence in the datasets is greatly enhanced by providing for careful intercomparisons between the measurements of ships and aircraft (flying as close as practical to the surface). Such comparison flights are scheduled in the experiment plan. Detailed flight plans for these comparison flights are currently being developed and will be made available as soon as planning for them has been completed.

Voyage Track

The voyage track will be as outlined in the voyage objectives.



Time Estimates

The proposed operating area is within a circle of radius 6nm, centred on 12°17'S, 129°53'E. Water depth averages 24 fathoms (44m). Three moorings will be deployed – a central mooring and two minor moorings at the periphery of the circle on a line though the central mooring roughly perpendicular to the coastline. Allowing one hour to deploy each mooring and one hour to cross the circle, this operation should be completed by 1900hrs during daylight. At a time yet to be determined, during the 5 hour transit TWP-ICE will conduct a coordinated test balloon launch simultaneously from all 7 balloon sites, including the ship. This will require the ship to slow to 6kts, without changing course, for about 10 minutes. Proposed schedule:

1000 Friday 20 Jan 2005 throw lines
1500 12°20'S, 129°58'E dist approx. 53nm deploy mooring A
1630 12°17'S, 129°53'E dist 6nm deploy mooring B
1800 12°14'S, 129°48'E dist 6nm deploy mooring C

1900 Return to central mooring B and commence regular survey schedule for duration of the experiment. The ship will turn upwind and steam at 2kts for 3hrs (i.e. to the edge of the circle) making meteorological measurements. Then return to B at 6-8kts with the SeaSoar deployed making ocean measurements. The upwind direction will be assessed by one of the PIs before the beginning of each leg. This pattern will be flexible to accommodate the timing of balloon launches, CTDs at the central mooring, and weather patterns.

1200 Monday 13 Feb 2005 begin retrieving moorings as convenient. Continue to collect meteorological data and launch balloons on schedule.

2330 local time (1500/13GMT) final balloon launch
0200 Tuesday Feb 14 depart area for port Darwin
0800 berth at Darwin

Southern Surveyor Equipment

SeaSoar
Crane (to load/unload container)
Winch for mooring deployment
Real-time navigational, meteorological and ship data via network
Ship data display monitor in fish lab
Thermosalinograph
CTD
Siphon raingauge
Chemistry lab
Fish lab

User Equipment

20’ container with cloud radar and lidar equipment (PARSL) – on fo’csl deck
M-AERI (U. of Miami) – forward port side of wheelhouse roof
3 shallow water moorings with ADCP, Seacats, etc. (Flinders U.)
2 PRP radiation packages (BNL) top level of foremast
2 bulk flux measurement packages (BNL) – on crossarms attached to foremast
1 flux measurement package (CSIRO) – ditto
3 optical raingauges (CSIRO) – foredeck and wheelhouse roof
ISAR IR instrument for SST (BNL) – wheelhouse roof
Total Sky Imager (TSI) - wheelhouse roof
Sea snake, towed SST sensor, deployed from port bow area
Digicora atmospheric sounding system (BoM) – fish lab. Whip antenna on winch-house rail
Balloon launching equipment, helium gas etc. (BoM) – forward port side after deck
Frame and canvas shelter for balloon filling (BoM) – ditto
Recording equipment for some foremast instruments – bench in wheelhouse
M-AERI electronics in rack (U. Miami) – chemistry lab
Recording equipment for most foremast instruments – ditto

Note – The perspex hatch between the wet lab and the chemistry lab will be replaced *pro tem* with a similar one with a large hole to accommodate M-AERI and other cables

Because instruments are distributed widely over the ship, installation of mounting hardware, running of cables and checking out all systems will absorb a considerable amount of scientists’ time. We therefore propose to carry out this work, which will not require assistance from ship personnel, steadily during the week beginning January 9. As expressed above we expect the full mobilization, including personnel from CMAR, to begin on Monday, 16 January. It is vital to the success of the deployment that we can

lift the PARSL container into place on that day, so that its equipment can be unpacked, deployed and tested well before sailing time.

Personnel List

Matt Tomczak	Flinders University	Chief Scientist
Simon Borlace	Flinders University	Oceanographer
Eric Schulz	Bureau of meteorology	Meteorologist
Mike Reynolds	Brookhaven National Lab.	Meteorologist
Jeremiah Reynolds	BNL	Flux support
Connor Flynn	Pacific Northwest Lab.	PARSL cloud radars
Chuck Pavlovski	DoE	PARSL and soundings
Peter Minnett	University of Miami	M-AERI
Alex Williams	BoM	Senior sonde operator
Wing Ng	University of NSW	Student sonde operator
Melissa Coman	ANU	Student sonde operator
*Ron Plaschke	CSIRO National Facility	Voyage Manager, operational support
*Mark Underwood	CSIRO National Facility	Electronics
Lindsay Pender	CSIRO National Facility	Computing, Seasoar

* System Support Technician to comply with AMSA requirements for additional berths on vessel.

This voyage plan is in accordance with the directions of the National Facility Steering Committee for the Research Vessel Southern Surveyor.

Christian Jakob
Coordinating PI

Matthias Tomczak
Chief Scientist

Appendix A – Details of the PARSL equipment

94 GHz radar (1.5 m diameter antenna will be mounted on the roof of the container)
Average power: 2.2 W
Beam width: 0.25 degrees
Orientation: Fixed, zenith

Dual wavelength lidar, 532 nm and 355 nm
Both channels are eye-safe at zero distance from the instrument
Orientation: Fixed, zenith (emitted through window in roof of the container)

Vaisala CT25K Ceilometer
Eye-safe lidar operating at 905 nm
Orientation: Fixed, zenith
Mounted adjacent to PARSL container (footprint ~0.5m x 0.5m)

Radiometrics Two-channel microwave radiometer (passive)
Detects atmospheric emission at 23.8 and 31.4 GHz
Mounted on roof of PARSL container

Heitronics KT19.85 radiometer
Passive, detects atmospheric emission in 9.6-11.5 micron band
Mounted on roof of PARSL container

Planning to also include compact Temperature, humidity, and rainfall sensors on, or adjacent to, the PARSL container.