RV *Investigator* Scientific Highlight

Voyage #:	**IN2016_V03**		
Voyage title:	Monitoring Ocean Change and Variability along 170°W from the ice edge to the equator		
Mobilisation:	Hobart, Tuesday 26 April, 2016		
Depart Leg 1:	Hobart, 2000 Tuesday 26 April, 2016		
Arrive Leg 1:	Wellington (NZ): 1100 Thursday 26 May		
Depart Leg 2:	Wellington (NZ): 1230, Friday 27 May, 2016		
Arrive Leg 2:	Lautoka (Fiji), 0800 Wednesday, 30 June, 2016		
Demobilisation:	Hobart, Thursday July 14th, Friday July 15th & Monday July 18th, 2016		
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Supplementary Project			
Principal Investigator:	Alex Forrest, University of Tasmania		
Project name:	Working from the other side: facing the challenges of under-ice for autonomous navigation in Antarctica		
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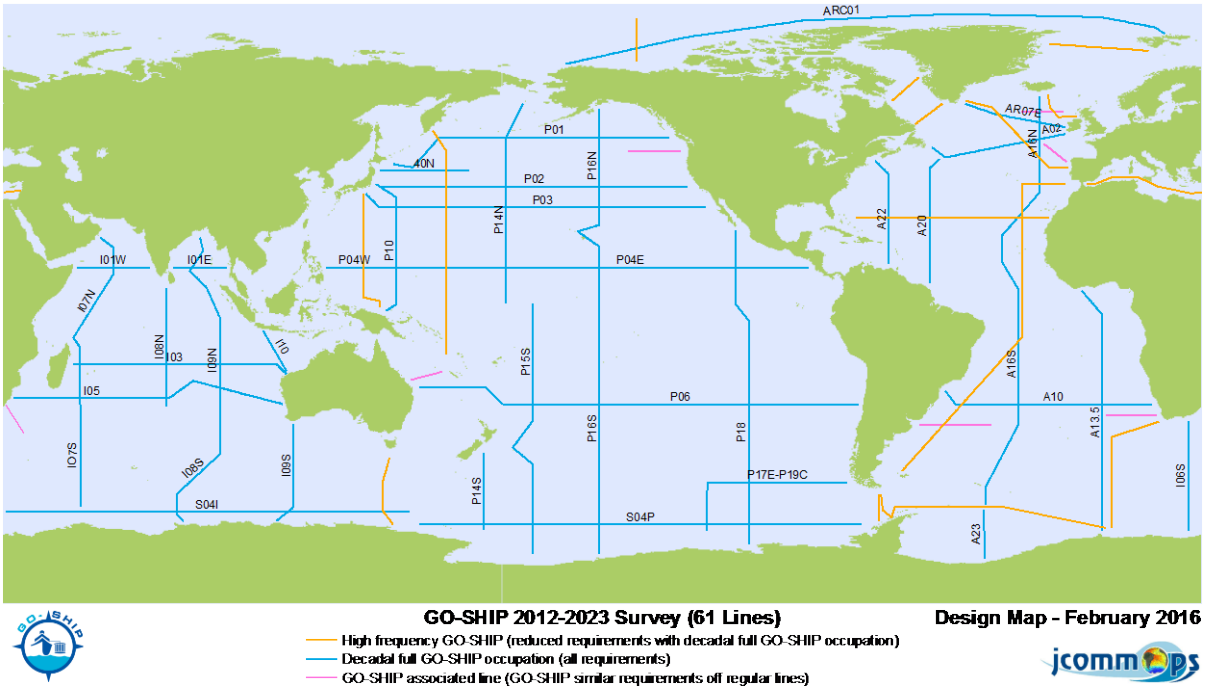
Introduction

Ocean warming accounts for around 90% of the excess energy trapped in the Earth system through anthropogenic changes to atmospheric composition. The oceans also sequester around 25% of anthropogenic emissions of carbon dioxide, and thus are a major player in regulating atmospheric CO_2 concentrations. The ability of the ocean to continue to ameliorate anthropogenic forcing remains uncertain, as ocean reservoirs will saturate in heat and the efficiency of carbon sinks may decline.

While upper ocean (above 2000 m) salinity and temperature is monitored by the Argo array, the full suite of ocean observations including deep ocean heat and carbon reservoirs remain poorly measured. This voyage completed 140 full-depth hydrographic stations along 170°W from the sea-ice edge to the equator to monitor and detect ocean variability and change including changes in the carbonate chemistry associated with acidification. The measurements taken include high-precision temperature, salinity, oxygen, carbon, and tracer measurements. These data, together with other GO-SHIP section data and numerical models, will allow for the detection and attribution of ocean change and variability and to assess the impact of the ocean on climate variability.



Contribution to the nation

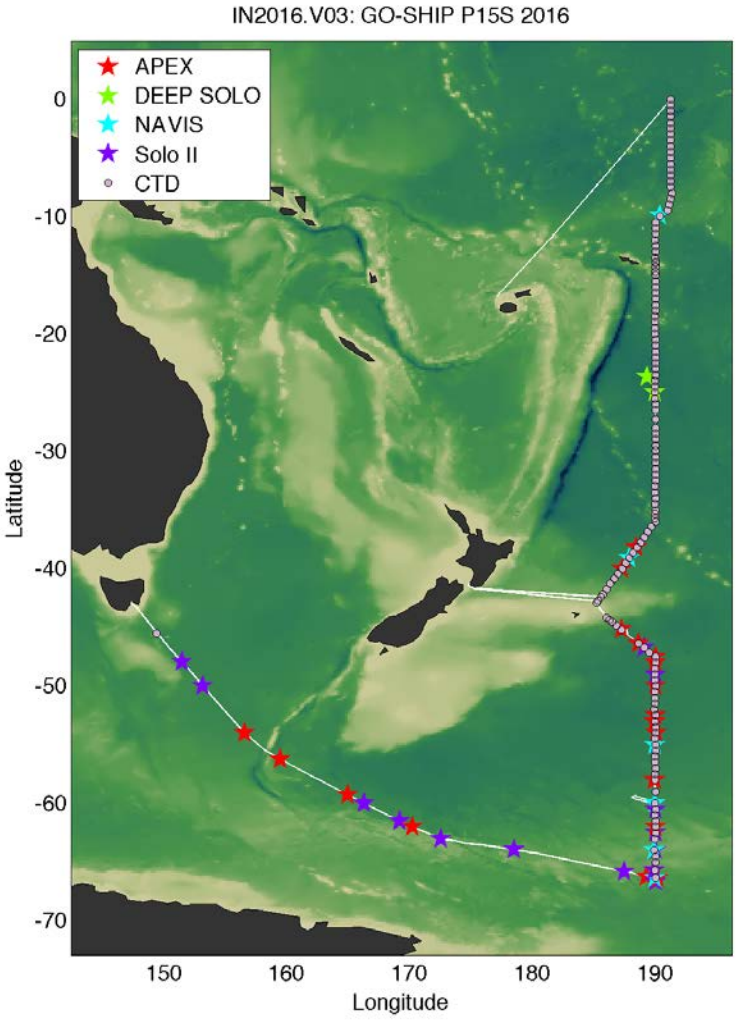
The ocean plays a crucial role in setting the rate and nature of climate variability and change, through its moderation of the planetary heat and carbon budgets. Significant changes in the ocean heat, freshwater and carbon content have been detected using ocean observations. The continued commitment to ocean observation will enable us to detect interannual to decadal climate variability that will aid understanding of the role of the ocean in moderating climate change and variability, including sea level rise and ocean acidification.

This voyage is an Australian contribution to Global Ocean Ship-based Hydrographic Investigations Program (GO-SHIP). GO-SHIP is part of the Global Climate Observing System/ Global Ocean Observing System GCOS/ GOOS. This section (P15S) is the only section in GO-SHIP that monitors the deep western boundary current of the South Pacific Ocean which provides a direct circulation route of Antarctic Bottom Water and Lower Circumpolar Deep Water to the deep basins of the Pacific Ocean where significant ocean property changes are observed.

As a result of this voyage

We have collected high-quality, full-depth ocean observations of temperature, salinity, pressure, oxygen, fluorometry, shear and micro-scale temperature major nutrients, oxygen, salinity, CFC helium and carbon components. We have supported the deployment of Argo floats in the Southern and South Pacific Oceans, XBT deployments, and the bio-geochemical float deployments as part of the Southern Ocean Carbon and Climate Observations and Modeling (SOCCOM) experiment. The voyage also undertook novel N-cycle experiments and genomic sampling over diverse oceanographic conditions.

In combination with the global decadal survey, coordinated by GO-SHIP, this section will provide significant insights into the importance of the ocean in climate and climate variability. These data will be used to documented changes in the oceanic inorganic carbon content, driven by both the uptake of anthropogenic CO_2 and natural variability; monitor large-scale changes in oceanic oxygen concentrations; quantify the global-scale warming of abyssal waters of Antarctic origin, and freshening of these waters in deep basins adjacent to Antarctica; determine deep ocean stratification changes and estimate changes in the magnitude of the lower limb of the Meridional overturning circulation; and provide estimates of water mass formation rate.


IN2016.V03: GO-SHIP P15S 2016
APEX
DEEP SOLO
NAVIS
Solo II
CTD
0
-10
-20
-30
-40
-50
-60
-70
Latitude
150
160
170
180
190
Longitude

CSR/ROSCOP Parameter CodeS

	METEOROLOGY
M01	Upper air observations
M02	Incident radiation
M05	Occasional standard measurements
M06	Routine standard measurements
M71	Atmospheric chemistry
M90	Other meteorological measurements

	PHYSICAL OCEANOGRAPHY
H71	Surface measurements underway (T,S)
H13	Bathythermograph
H09	Water bottle stations
H10	CTD stations
H11	Subsurface measurements underway (T,S)
H72	Thermistor chain
H16	Transparency (eg transmissometer)
H17	Optics (eg underwater light levels)
H73	Geochemical tracers (eg freons)
D01	Current meters
D71	Current profiler (eg ADCP)
D03	Currents measured from ship drift
D04	GEK
D05	Surface drifters/drifting buoys
D06	Neutrally buoyant floats

	MARINE BIOLOGY/FISHERIES
B01	Primary productivity
B02	Phytoplankton pigments (eg chlorophyll, fluorescence)
B71	Particulate organic matter (inc POC, PON)
B06	Dissolved organic matter (inc DOC)
B72	Biochemical measurements (eg lipids, amino acids)
B73	Sediment traps
B08	Phytoplankton
B09	Zooplankton
B03	Seston
B10	Neuston
B11	Nekton
B13	Eggs & larvae
B07	Pelagic bacteria/micro-organisms
B16	Benthic bacteria/micro-organisms
B17	Phytobenthos
B18	Zoobenthos
B25	Birds
B26	Mammals & reptiles
B14	Pelagic fish
B19	Demersal fish
B20	Molluscs
B21	Crustaceans
B28	Acoustic reflection on marine organisms

D09	Sea level (incl. Bottom pressure & inverted echosounder)
D72	Instrumented wave measurements
D90	Other physical oceanographic measurements

	CHEMICAL OCEANOGRAPHY
H21	Oxygen
H74	Carbon dioxide
H33	Other dissolved gases
H22	Phosphate
H23	Total – P
H24	Nitrate
H25	Nitrite
H75	Total - N
H76	Ammonia
H26	Silicate
H27	Alkalinity
H28	PH
H30	Trace elements
H31	Radioactivity
H32	Isotopes
H90	Other chemical oceanographic measurements

B37	Taggings
B64	Gear research
B65	Exploratory fishing
B90	Other biological/fisheries measurements

	MARINE GEOLOGY/GEOPHYSICS
G01	Dredge
G02	Grab
G03	Core - rock
G04	Core - soft bottom
G08	Bottom photography
G71	In-situ seafloor measurement/sampling
G72	Geophysical measurements made at depth
G73	Single-beam echosounding
G74	Multi-beam echosounding
G24	Long/short range side scan sonar
G75	Single channel seismic reflection
G76	Multichannel seismic reflection
G26	Seismic refraction
G27	Gravity measurements
G28	Magnetic measurements
G90	Other geological/geophysical measurements

	MARINE CONTAMINANTS/POLLUTION
P01	Suspended matter
P02	Trace metals
P03	Petroleum residues
P04	Chlorinated hydrocarbons
P05	Other dissolved substances
P12	Bottom deposits
P13	Contaminants in organisms
P90	Other contaminant measurements