RV *Investigator* Voyage Summary

Voyage #:	**IN2017_V01**		
Voyage title:	Interactions of the Totten Glacier with the Southern Ocean through multiple glacial cycles		
Mobilisation:	Hobart, Friday, 13 January 2017		
Depart:	Hobart, 1800 Saturday, 14 January 2017		
Return:	Hobart, 0900 Sunday, 5 March 2017		
Demobilisation:	Hobart, Monday, 6 March 2017		
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Project name:	Interactions of the Totten Glacier with the Southern Ocean through multiple glacial cycles.		
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VOYAGE SUMMARY

Objectives and brief narrative of voyage

Scientific objectives

The physical interaction between the Totten Glacier and the Southern Ocean during periods of warming and ice sheet retreat is poorly understood. Recent observations suggest that the Totten Glacier is rapidly thinning in a manner similar to the Pine Island Glacier in West Antarctica. A rapid retreat of the Totten Glacier into the large Aurora Basin, from which it drains, could cause an accelerated draw down of the East Antarctic Ice Sheet and matching acceleration in sea level rise. The Aurora Basin contains the thickest ice in Antarctica.

The increased loss of ice from Antarctica is mostly due to the rapid thinning and retreat of glaciers, driven by the enhanced melting of ice shelves that fringe the continent. It has been proposed that the Totten Glacier is melting because of intrusion of warm Circumpolar Deep Water onto the continental shelf, as is happening in Pine Island Bay in West Antarctica.

This study has gathered data to examine the physical interaction between the Totten Glacier and Southern Ocean through multiple glacial cycles by:

1. Mapping sediment deposited on the continental shelf and slope by the Totten Glacier and using this to understand sediment deposition processes

2. Sampling long sediment cores from the continental shelf and slope, and using the deposition model to interpret their formation processes.

3. Directly measuring a suite of ocean water and surface sediment properties, including microorganisms, trace elements and isotopes, to allow for accurate interpretation of sediments.

4. Mapping benthic habitats in the area, including studies of seafloor biota and geomorphological characteristics, using underwater video and still imagery.

PCAN Objectives.

Atmospheric aerosol populations in the Antarctic and Southern Ocean regions are key components of the global radiative balance and represent one of the few places on earth relatively untouched by anthropogenic influence. Recent investigations have shown that the region of the Polar Cell just north of the Antarctic continent is atmospherically distinct from those either north in the Southern Ocean, or on the continent itself. This region has only been measured a handful of times previously, and remains largely uncharacterised, yet the small number of observations showed unexpected properties uncharacteristic of the region. The objectives of this study are therefore to:

1. Increase the number and quality of atmospheric observations in a region that remains largely uncharacterised.
2. Characterise the chemical and physical properties of atmospheric aerosol populations in the northern region of the Antarctic Atmospheric Polar Cell

3. Understand the seasonal changes of the Polar Cell aerosol populations by comparing to springtime measurements at the same location taken in 2012 (AAD project 4032)
4. Observe the aerosol formation processes in the pristine atmosphere of the Antarctic polar cell.
5. Better understand the aerosol cloud interactions in the southern part of the Southern Ocean which exhibits the largest biases in radiation.
6. Coordinate with measurements made as part of the Swiss funded Antarctic Circumpolar Expedition (ACE) and NASA's ATom mission to better understand the aerosol properties of the Southern Ocean in its entirety.

Voyage objectives

Our voyage objectives were to map and then core in regions identified by Regions A-C (Figure 1). Regions A and C represented regions of the slope where records of deposition from the Totten Glacier were expected. Region A was our priority region of exploration whilst Area C was considered a back-up if we could not access Areas A or B due to poor weather. Area B represented the region directly in front of the Totten Glacier, which had there been a clear sea-ice free route for the RV *Investigator* to pass, our voyage objective would have been to sample in a planned trajectory in support of mapping, collaborative geophysical and oceanographic research priorities in a presently unknown region normally covered by sea-ice. Our voyage objectives also included the aim of supporting as much additional science as feasible whilst undertaking regional mapping particularly from the in-take water line. Finally, the collaborative training and cross-cultural exchange of students on this voyage was an important voyage objective.

PCAN: See scientific objectives.

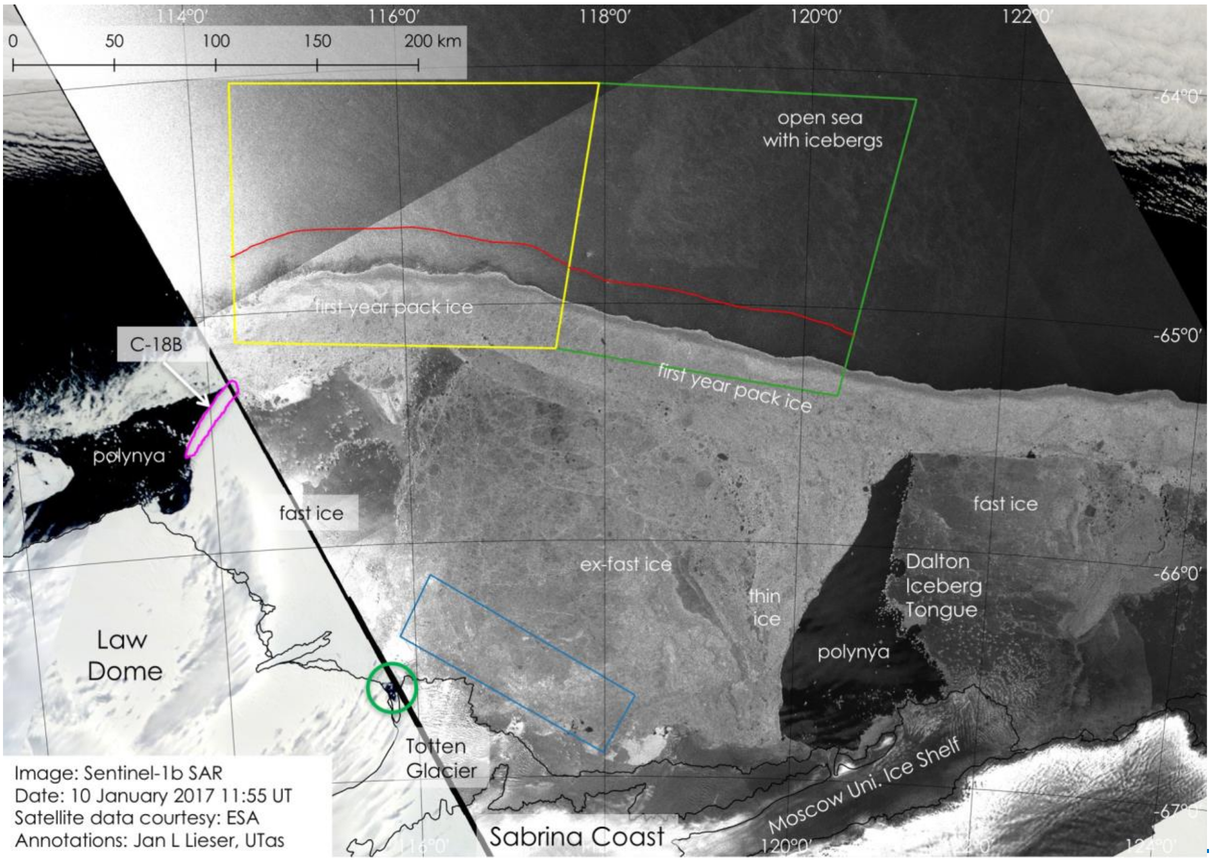


Figure 1. *Satellite image of the region a week prior to arrival, identifying Area A (yellow box) Area B (blue box) and Area C (green box). Red line delineates northern sea ice free region from south. Satellite image is sourced from Sentinel-1b SAR Scene, acquired on the 1/1/2017 and provided by PolarView; complemented by AQUA MODIS VIS scene, acquired on 10/01/2017 and provided by NASA. Image annotations and supply by Dr Jan Lieser, Antarctic Gateway Partnership Sea ice Service.*

Results

The survey was very successful in gathering data to examine the physical interaction between the Totten Glacier and Southern Ocean through multiple glacial cycles by:

1. Mapping sediment deposited on the continental shelf and slope by the Totten Glacier – The survey collected 48,000 km^2 multibeam bathymetry which was collected in relatively straight lines with overlapping swaths in order to provide good coverage and high quality backscatter data. These lines also collected about 4000 km of sub-bottom profiler data. Seismic reflection lines were collected totalling 322 km in length that complement existing data and provide higher resolution information (Figure 2).
2. Six long sediment cores were collected from the continental slope and subjected to preliminary physical properties analysis and biostratigraphy. These were complemented by 11 shorter kasten cores, which were logged and sampled on the vessel (Figure 2).
3. Directly measuring a suite of ocean water and surface sediment properties, including microorganisms, trace elements and isotopes, to allow for accurate interpretation of sediments.

4. Six camera tows were completed for the mapping of benthic habitats in the area (Figure 2).

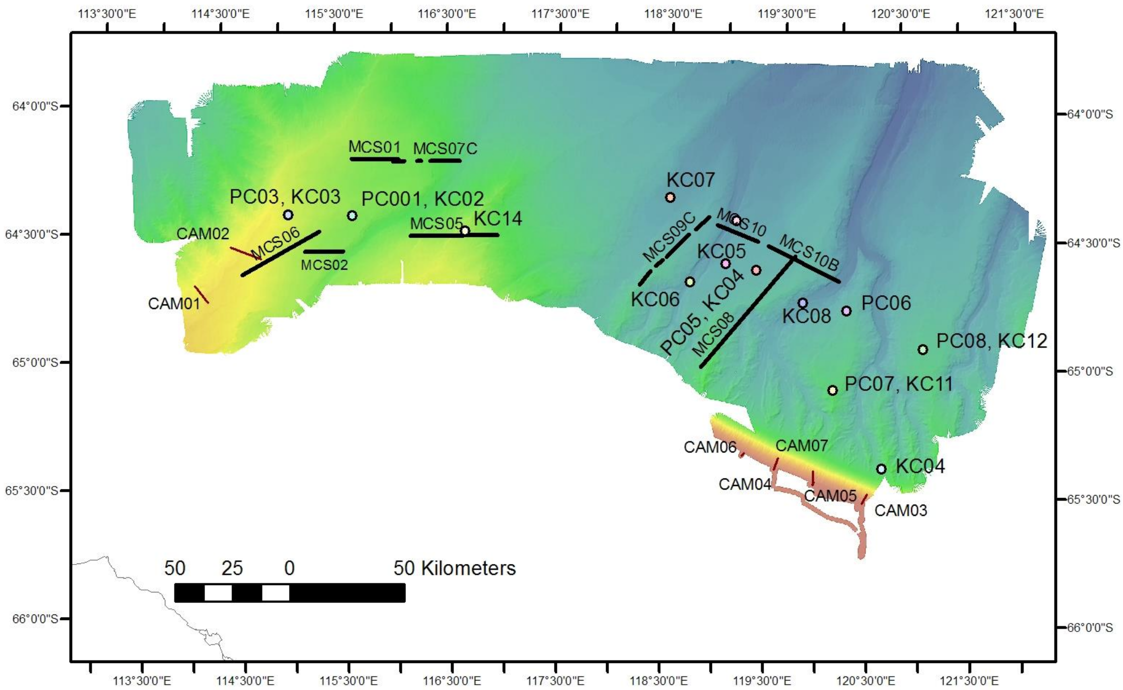


***Figure 2**. New multibeam bathymetry of the survey area as a shaded, colour fill grid with core sites, camera tows and new seismic lines overlain.*

Weather disruptions were minor, in so much that where rough weather was encountered, we could continue seafloor mapping of both Area A and C. In total, one scientific day was lost to bad weather. Sea-ice conditions, particularly those experienced after the 12-13th February (Refer to Appendix D1 for summary sea ice report), were not anticipated for the region based on previous annual sea-ice melt back events. Unfortunately, the voyage IN2017-V01 occurred in a region of East Antarctica where minimum sea ice conditions did not occur in 2017 (Refer to Appendix D2 for summary sea ice report). As the sea-ice extent was further north and impinged on our southern-most area boundaries, we were consistently blocked from reaching the shelf until the very final week of scientific time when we could finally reach the shelf and undertake mapping, camera tows and CTD sampling for oceanographic properties (Figure 3).

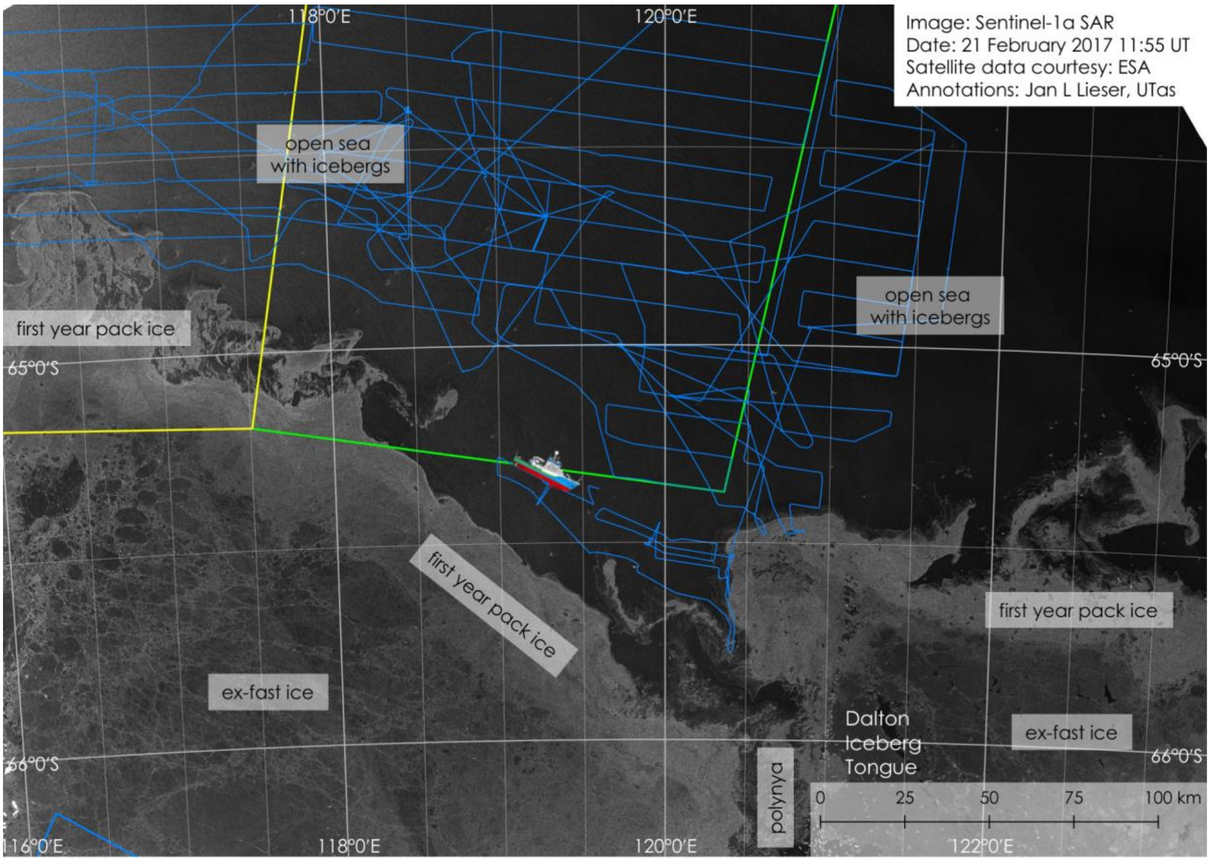


Figure 3. *Satellite image showing the RV Investigator's ship track on to the shelf break when sea-ice conditions eased towards the end of the voyage. Satellite image is a Sentinel-1a SAR scene, acquired 21/2/2017 and provided by PolarView. Annotations by Dr Jan Lieser, Antarctic Gateway Partnership Sea Ice Service see ice report #09.5/2017 (fig 1).*

PCAN:

The voyage has generally been successful in achieving all its objectives. PCAN instrumentation runs continuously from port to port. Most instruments have been working well throughout the voyage, and although data still requires significant processing and filtering of ship exhaust, initial data inspection suggests excellent data quality. Further data processing has been hindered by Principle Investigators being located ashore and FTP communications not functioning. In Figure 4, data from the Cloud Condensation Nuclei counter shows the instrument working well and extremely low concentrations being measured. Figure 5 shows a sample of data from the Aerosol Chemical Speciation Monitor showing a dominance of sulfate aerosol and large spikes in mass concentration when the exhaust gets sampled.

The only major problem we have had is that some pressure issues within the main sampling inlet which have affected pressure sensitive instrumentation. The cause of this at present is unknown, and at the time of writing, this is under investigation.

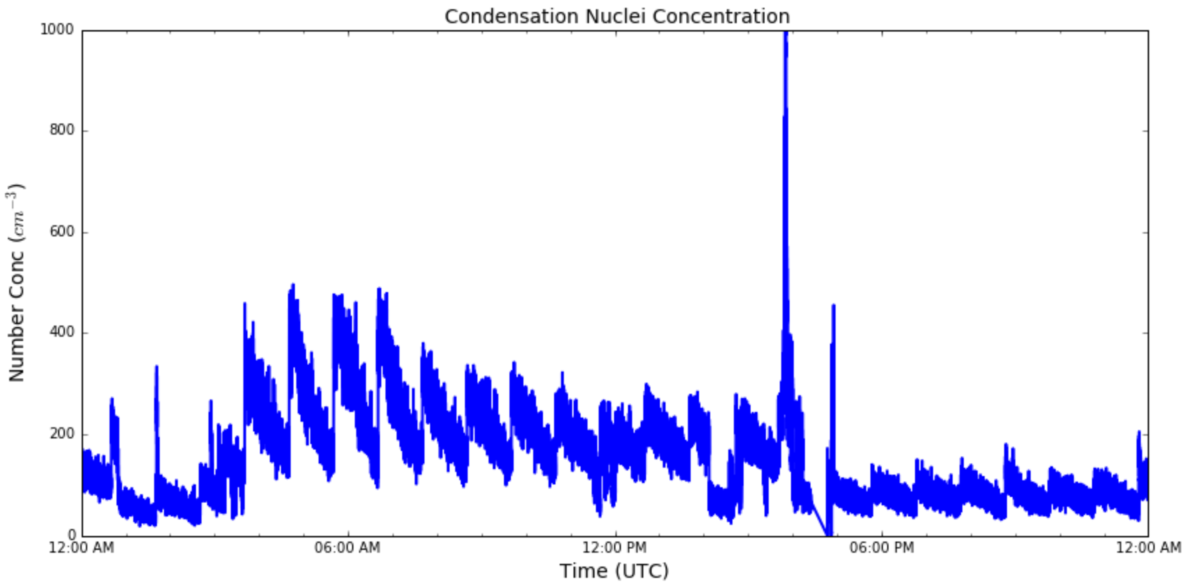


Figure 4*: Raw data showing cloud condensation nuclei (CCN) counts (number of CCN per mL). Each hour the instrument goes through a cycle of supersaturations, starting at 1% and decreasing to just 0.3% (i.e. 101% and 100.03% relative humidity). The higher supersaturations result in more of the aerosol population being able to grow to detectable sizes. The large spike just before 4pm UTC is when I was doing my daily checks and the instrument was measuring lab air for a short period. Just after these checks, we experienced a big snowstorm which scavenged lots of the particles, resulting in very low concentrations compared to earlier in the day.*

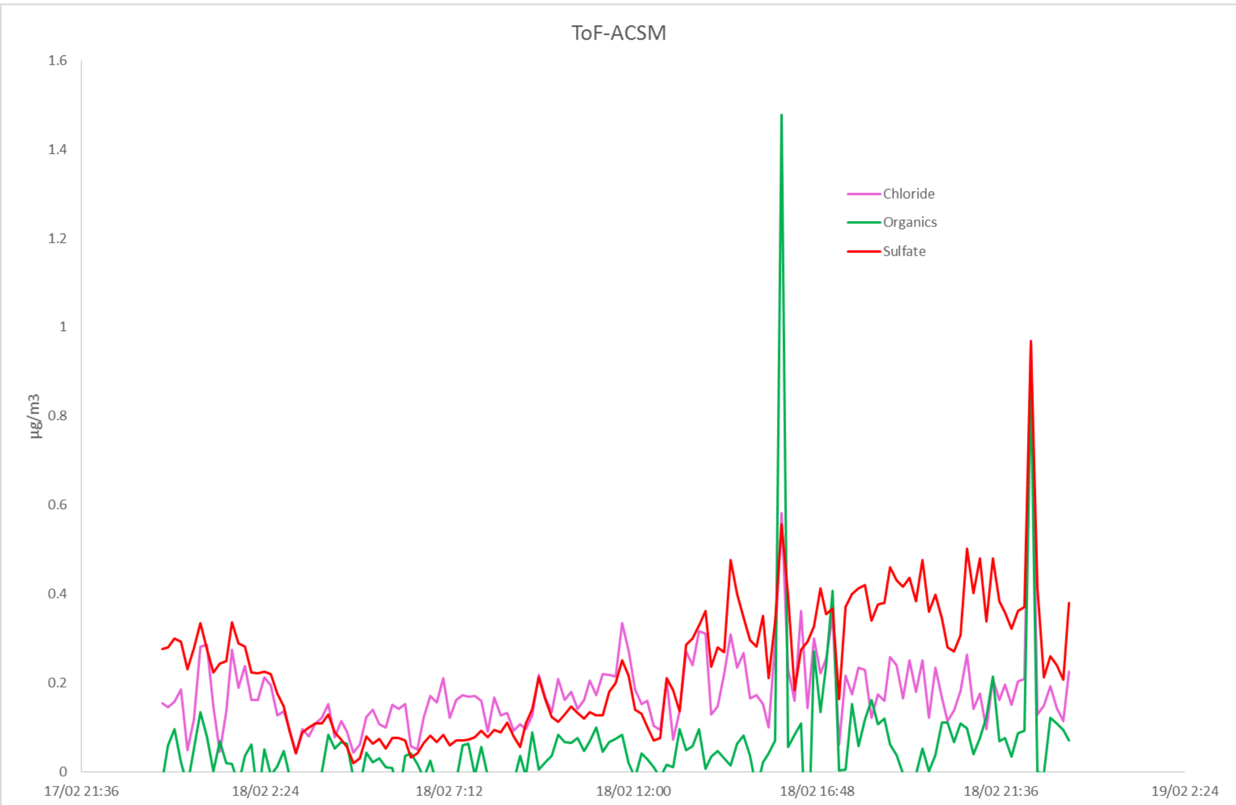


Figure 5*: Real-time aerosol chemical composition as measured by the aerosol chemical speciation monitor. Large spikes within the data represent periods of measuring ship exhaust.*

Voyage Narrative

The survey departed Hobart on 14 January and arrived at the NE corner of the survey area on 20 January. Systematic E-W multibeam and sub-bottom profiler lines were collected in Area A in order to obtain good quality multibeam backscatter data and readily interpretable sub-bottom profiler lines. About 2000 km of straight lines were collected across the area. Seismic reflection lines were also shot W-E shot on 22 January and 24 January. Seismic was interrupted by whale approaches on several occasions. CTDs were deployed at coring sites and to sample a fresh water plume from a large iceberg. Two camera tows were conducted in the SW corner of Area A in waters less than 2000 m deep. The kasten, piston and multicores were successfully collected at 2 sites though deployment of the piston corer for the second time resulted in damage to the trigger mechanism requiring repair and modification. From 25 January onwards, SE to S winds pushed pack ice into the central part of Area A, preventing further southerly extension of the survey and overlapping with planned sample sites. After coring, on 31 January, operations moved east to Area C.

The vessel collected multibeam and sub-bottom profiler data along the northern edge of the survey area then headed south along the eastern edge of Area C to attempt to reach the shelf edge. The SE corner of the area was reached on 2 February but sea ice prevented access to the upper slope and shelf edge. Further multibeam and sub-bottom surveying continued in Area C with seismic shot on 4 February. Another piston core deployment resulted in damage to the system on 5 February so further surveying, CTDs and plankton net deployments took place while the piston corer was repaired. The piston corer was successfully deployed on 6 February and seismic line 9 shot. Kasten and multicores were collected on 7 February before the vessel headed south to again test the edge of the sea ice for access to the shelf. February 8 and 9 were the first days where bad weather strongly curtailed the program, but we were still able to finish off mapping of Area C. Multiple kasten cores were attempted in the floor of submarine canyons. Two recovered successions featuring diatomaceous sediments while two others returned empty. Abrasion of the core barrel suggested sand in these locations.

Several attempts to reach the shelf and upper slope failed because of persistent pack ice cover, but on 20 February, sea ice cleared sufficiently from the area around 120^{o}E for the vessel to proceed on to the shelf. Here we collected several CTD casts and deployed the sea floor camera four times on the upper slope. Further CTDs, seismic lines, kasten cores and piston cores were collected in Area C before one last incursion into Area A was attempted. For Area C, 1821 km of straight multibeam and sub-bottom profiler lines were surveyed. A single kasten core was collected in Area A on 24 February before the vessel proceeded East where a CTD cast was completed to repeat a station at 122^{o} 53'E, 65^{o} 23'S visited by a US survey. The RV *Investigator* then headed for Hobart, arriving on 5 March.

In total, 6 piston cores, 11 kasten cores, 4 multicores, 7 plankton net tows, 6 camera tows and 31 CTDs were completed. Seismic lines totalled 322 km and 48,000 km^2 of sea floor was surveyed by multibeam echo sounder in the survey area.

A table detailing mission's major sampling events is presented in Appendix C. As the scientific plan was flexible dependent on weather, sea-ice, mapping and sampling events no one scientific activity was over or underspent on time. Figure 6 reveals the percentage of ship time budget used with respect to the activities listed in Appendix C across the complete voyage. Expectedly, transiting time was the largest proportion of time taken during the voyage, with much of the transiting time within the survey area representing time spent mapping the seafloor (57%). Seismic activities (6%), CTDs (4%) and then the various coring deployments (totalling 5%) took up the remainder of time. Camera Tows and plankton nets took up less than 2% of the total scientific time.

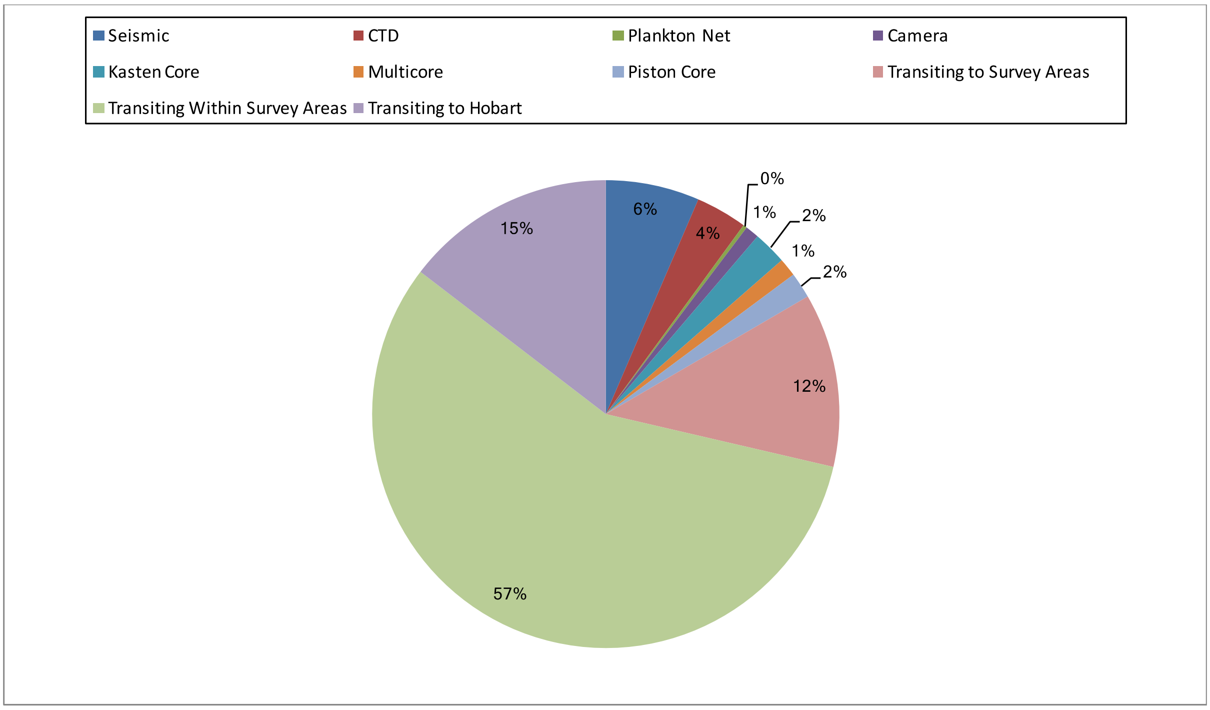


Figure 6. Time allocation (by percentage) allocated to ship-time activities undertaken on IN2017-V01.

PCAN:

The PCAN instrument suite (detailed in Summary of Measurements) was running as expected on departure from Hobart. Software on the Grimm SMPS was not running for the 14th and 15th of January, meaning SMPS data was not logged during this time. Measurements continued as expected until the 20th of January, where the Tekran Ambient Mercury Vapor Analyzer began displaying null output. The instrument was running as expected by the 26th of January. Reactive mercury filters were changed on the 27th of January. Water in the cartridges due to the harsh outside environment may effect results. On the 6th of February, PM1 filters were connected to the pump switch, ensuring they would not be contaminated by ship exhaust from this date forward. On the 12th of February an effect of opening the lab door on particle counting measurements was noticed. It is believed this issue is caused by a lack of manifold pressure in conjunction with relatively low atmospheric pressure causing backflow through the sample line. Throughout the voyage, lower than expected flow was observed in the TSI SMPS. This may be related to the low inlet pressure issue described above. Despite these challenges, for most of the voyage, comprehensive data describing aerosol populations was continuously collected. Eight sets of 5-10 MicroTops sun photometry measurements were completed throughout the voyage, for use in the Marine Aerosol Network component of NASA's global AERONET program. A greater number of measurements were unable to be completed due to the persistent presence of cloud throughout the cruise.

Summary

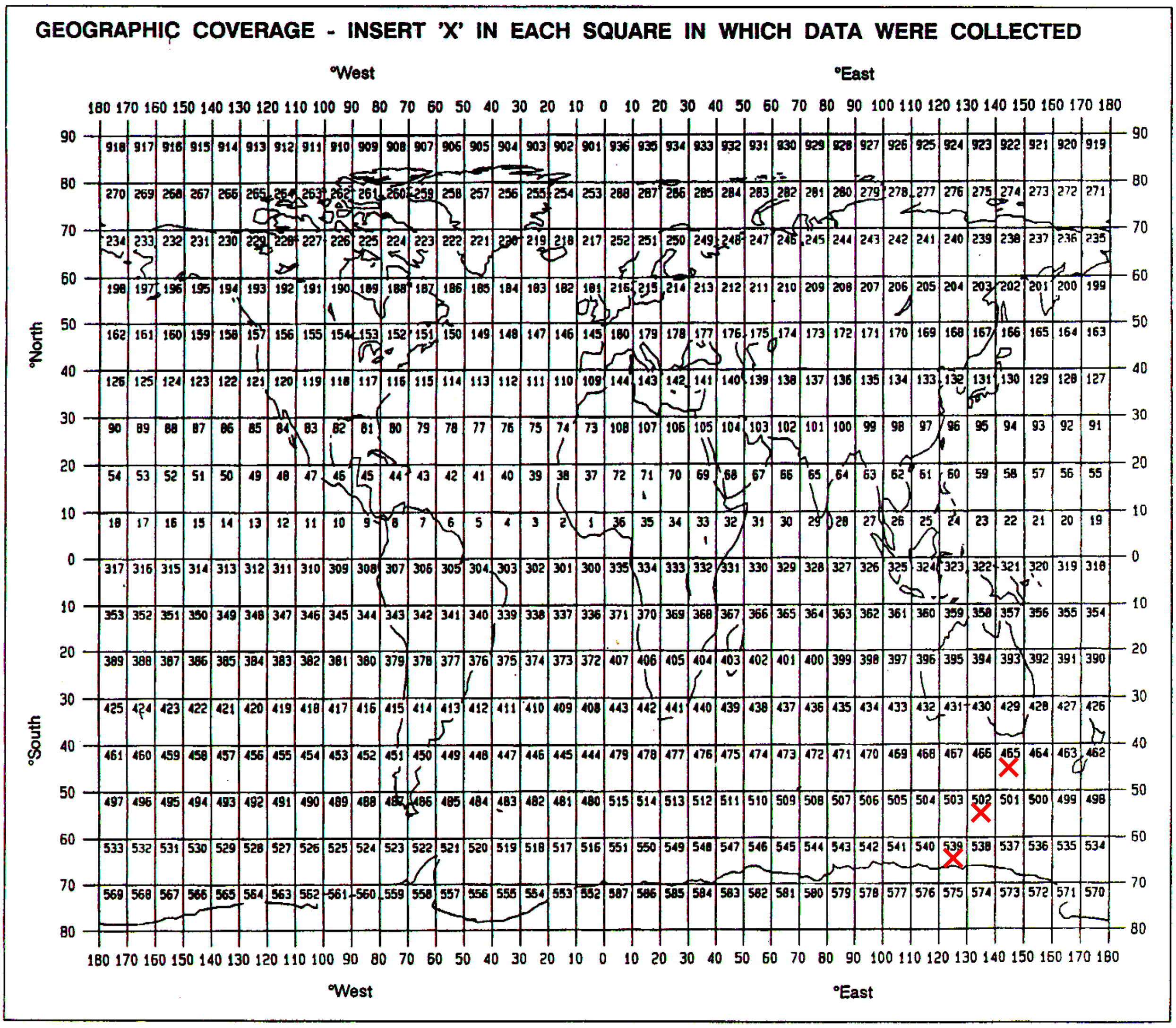
The primary scientific aims of the survey were fulfilled. The calm weather conditions allowed for a larger area to be surveyed than originally expected. However, these same conditions resulted in the spread of sea ice beyond the median ice edge position in Area A during the entire survey so that less of that area was covered than hoped. The geophysical data obtained will give excellent insight into the nature of the sediments sampled. The kasten corer was particularly effective in obtaining sediment records representative of the different depositional environments across the area. The four piston cores collected likely contain good paleoclimate records covering 2-3 glacial cycles whereas two cores possibly contain sediments dating back to the Pliocene.

PCAN:

PCAN scientific objectives have overwhelmingly been achieved, despite limitations imposed by instrument malfunctions prior to the voyage, which prevents their inclusion on board. Data quality is high and instruments have been running almost continuously, providing a complete record for later analysis. We are yet to determine the impact of ship exhaust on the measurements, which will have to be removed from the dataset.

Marsden Squares

Move a **red "x"** into squares in which data was collected



Summary of measurements and samples taken.

Item No.	PI see page above	NO see above	UNITS see above	DATA TYPE Enter code(s) from list at Appendix A	DESCRIPTION Identify, as appropriate, the nature of the data and of the instrumentation/sampling gear and list the parameters measured. Include any supplementary information that may be appropriate, e. g. vertical or horizontal profiles, depth horizons, continuous recording or discrete samples, etc. For samples taken for later analysis on shore, an indication should be given of the type of analysis planned, i.e. the purpose for which the samples were taken.
1.	MNF	51	Days	M06, M71	Cloud Condensation Nuclei Counter (CCNC): CCN number concentrations. Continuous recording, data QA/QC required.
2.	MNF	51	Days	M06, M71	Scanning Mobility Particle Sizer (GRIMM SMPS): aerosol size distribution. Continuous recording, data QA/QC required.
3.	MNF	51	Days	M06, M71	Nephelometer: aerosol optical properties – scattering. Continuous recording, data QA/QC required.
4.	MNF	51	Days	M06, M71	MAAP: aerosol optical properties – absorption. Continuous recording, data QA/QC required.
5.	MNF	51	Days	M06, M71	Ozone monitor: ozone mixing ratios. Continuous recording, data QA/QC required.
6.	MNF	51	Days	M06, M71	Radon monitor: radon concentrations. Continuous recording, data QA/QC required.
7.	MNF	51	Days	M06, M71	Aerodyne and picarro: greenhouse gas mixing ratios. Continuous recording, data QA/QC required.
8.	Paul Selleck	51	Days	M71	Aerosol chemical speciation monitor (ACSM): realtime aerosol chemical composition. Continuous recording, data QA/QC required.
9.	Ruhi Humphries	51	Days	M71	Condensation particle counter: aerosol number concentrations. Continuous recording, data QA/QC required.
10.	Ruhi Humphries	51	Days	M71	SMPS (TSI) – aerosol size distribution. Continuous recording, data QA/QC required.
11.	Paul Selleck	56	Filters	M71	Aerosol filters: detailed chemical composition of integrated sample. Discrete integrated samples are analysed using chromatographic techniques for detailed chemical composition of aerosol samples.

12.	Grant Edwards	51	Days	M71	Mercury monitor (Tekran): total gaseous mercury concentrations. Continuous recording, data QA/QC required.
13.	Grant Edwards	56	Filters	M71	Mercury filters: mercury speciation. Discrete integrated samples are analysed for detailed mercury speciation.
14.	Alain Protat	51	Days	M90	Cloud LIDAR: aerosol and cloud occurrence and vertical profiles. Continuous recording, data QA/QC required. Cloud distribution and aerosol and cloud droplet number concentration able to be extracted from data.
15.	Alexander Smirnov	8	Measurement sets (5-10 scans)	M90	Microtops photometer: aerosol optical depth. Discrete samples when solar disc is visible. Absorption measurements are used to calculate aerosol optical depth.
16.	MNF	28	Deployments	H13	eXpendable BathThermograph (XBT) deployments.
17.	MNF	51	Days	D71	Acoustic Doppler Current Profiler (ADCP) data. Continuous recording, data QA/QC required.
18.	MNF	51	Days	B28	Fisheries echosounder data (EK60, ME70). Continuous recording, data QA/QC required.
19.	MNF	51	Days	G74	Multibeam echosounder (EM122, EM710). Continuous recording.
20.	MNF	51	Days	G73	Sub-bottom profiler (SBP120). Continuous recording, QA/QC required.
21.	MNF	51	Days	G27	Gravity measurements. Continuous recording, data QA/QC required.
22.	MNF	51	Days	H71	Thermosalinograph, surface measurements underway. Continuous recording.
23.	Alix Post	6	Tows	G08	Seafloor camera transects were acquired using the MNF's Deep Tow Camera system. Downward facing still images and high definition video were collected, with standard definition video from a forward-facing video. Still images were collected every 5 seconds once on the seafloor, with a height of <3m above the seafloor maintained. A USBL beacon was used for navigation.
24.	Alix Post	6	Towed CTD data	D90	CTD data was collected during each camera transect using a SBE 37. This instrument recorded pressure, temperature, conductivity, dissolved oxygen and salinity.
25.	Leventer	50	filters	B08	Seawater filtered onto 0.45 micron HAWG filters for phytoplankton assemblage analysis, seawater from uncontaminated seawater line.
26.	Leventer	91	filters	B08	Seawater filtered onto 0.45 micron HAWG filters for phytoplankton assemblage analysis, seawater from 25 CTD casts.

27.	Leventer	25	filters	B08	Seawater filtered onto 0.45 micron HAWG filters for phytoplankton assemblage analysis, seawater from 8 plankton tows.
28.	Leventer	566	Sediment samples	G04	Sediment samples for diatom assemblage analysis from 11 kasten cores.
29.	Leventer	120	Sediment samples	G04	Sediment samples for diatom assemblage analysis from 5 multi cores.
30.	Leventer	39	Sediment samples	G04	Sediment samples for diatom assemblage and biostratigraphic analysis from 4 piston cores.
31.	Armand/ O'Brien	23	cores	G04	6 piston cores, 11 kasten cores, 4 multicores.
32.	Carbulotto	322	km	G76	96 channel seismic reflection data.
33.	Amaranta Focardi / Linda Armbrecht	52	Filters	B02	Chlorophyll concentration: water samples collected from underway seawater system on a GFF filter. Chlorophyll will be extracted and analysed with a spectrophometer.
34.	Amaranta Focardi/ Linda Armbrecht	83	Filters	B02	Chlorophyll concentration: water samples collected from CTD at different depths on a GFF filter. Chlorophyll will be extracted and analysed with a spectrophometer.
35.	Amaranta Focardi	34	Filters	B07, B08	Seawater samples collected from the underway seawater system on a sterivex filter to study the microbial community composition.
36.	Amaranta Focardi	98	Filters	B07, B08	Seawater samples collected from different depths with the CTD on a sterivex filter to study the vertical composition of the microbial community.
37.	Amaranta Focardi	53	Filters	B07	Seawater samples collected both from underway and CTD to study the Viriome.
38.	Amaranta Focardi	114	Seawater samples	B07, B08	Seawater samples collected to study the abundance of different picoplankton and bacteria with flow cytometry.
39.	Amaranta Focardi	160	Seawater samples	B07, B08	Seawater samples collected to study the abundance of different picoplankton and bacteria with flow cytometry and calculate the rates of viral lysis and grazing over picoplankton.
40.	Christian Rinke (Amaranta Focardi)	32	Sediment samples	B90	Single cell analysis of Archea in sediments.
41.	Linda Armbrecht	528 (264x 2)	Sediment samples	B90, G04	Sediments in sterile 15 mL centrifugation tubes, from Kasten Core, duplicates from each depth (total NO given), frozen at -80°C, ancient DNA analysis anticipated.
42.	Linda Armbrecht	52	Sediment samples	B90, G04	Sediments in sterile plastic bags, from Multicore, frozen at -80°C, ancient DNA analysis anticipated.

43.	Linda Armbrecht	316	Sediment samples	G04	Sediment samples (~10cc) wrapped in aluminium foil then in plastic bag, from Kasten and Multicore, frozen at -20°C, GDGT analysis anticipated.
44.	Linda Armbrecht	43	Filters	B08, B09	Filtered seawater from underway intake on Millipore SSWP filter paper preserved in 4% Lugol's solution, phytoplankton abundance and composition analysis anticipated.
45.	Linda Armbrecht	51	Filters	B08, B09	Filtered seawater from CTD Niskin water on Millipore SSWP filter paper preserved in 4% Lugol's solution, phytoplankton abundance and composition analysis anticipated.
46.	Linda Armbrecht	9	Water samples	B08, B09	Water samples from underway intake in 4% Lugol's solution, phytoplankton abundance and composition analysis anticipated.
47.	Linda Armbrecht	24	Water samples	B08, B09	Water samples from CTD Niskin water in 4% Lugol's solution, phytoplankton abundance and composition analysis anticipated.
48.	Linda Armbrecht	14	Water samples	B07, B08, B09	Water samples from Multicore Niskin and bottom water in 4% Lugol's solution, phytoplankton abundance and composition analysis anticipated.
49.	Linda Armbrecht	13	Water samples	B08, B09	Water samples from Plankton Net in 4% Lugol's solution, phytoplankton abundance and composition analysis anticipated.
50.	Linda Armbrecht	132	Single cells	B08, B09	Single cells isolated from seawater, frozen at -80°C, single cell genomics and whole genome sequencing anticipated.
51.	April Abbott (Linda Armbrecht)	49	Sediment samples	G04	Sediment samples from multicore, frozen at -20°C, Rare Earth Element (esp. Neodymium) analysis anticipated.
52.	Linda Armbrecht/ Amaranta Focardi	12	Filters	B07, B08, B09	Multicore Niskin and Bottom water Sterivex filter, frozen at -80°C, DNA analysis.
53.	Simon Belt (Linda Armbrecht)	316	Sediment samples	G04	Sediment samples from Kasten and Multicore, frozen at -80°C, highly-branched-isoprenoid (HBI) analysis anticipated.
54.	Simon Belt (Linda Armbrecht)	44	Water samples	H90	Water samples from underway intake and plankton net, frozen at -80°C, highly-branched-isoprenoid (HBI) analysis anticipated.
55.	Simon Belt (Linda Armbrecht)	75	Filters	H90	Water samples filtered on Whatman GF/F filter papers frozen at -80°C, highly-branched-isoprenoid (HBI) analysis anticipated.
56.	Simon Belt (Linda Armbrecht)	13	Water samples	H90	Backup water samples from plankton net, frozen at -80°C, highly-branched-isoprenoid (HBI) analysis anticipated.

57.	Simon Belt (Linda Armbrecht)	20	Filters	H90	Backup water samples filtered on Whatman GF/F filter papers, frozen at -80°C, highly-branched-isoprenoid (HBI) analysis anticipated.
58.	Wojtek Majewski (Linda Armbrecht)	10	Sediment samples	G04	Sediment samples from Multicore, 45 mL tubes, duplicates (total NO given), frozen at -80°C, microscopy/genomic analysis anticipated.
59.	Phil Heraud (Linda Armbrecht)	632	Sediment samples	G04	Sediment samples from Kasten and Multi Core, duplicates (total NO given), frozen at -80°C, spectroscopy analysis anticipated.
60.	Phil Heraud (Linda Armbrecht)	51	Water samples	H90	Water samples, concentrated, from underway intake, triplicates (total NO given), fixed in 4% formaldehyde 4°C, spectroscopy analysis anticipated.
61.	Chris Bowler (Linda Armbrecht)	17	Filters	B90	Water samples from underway intake filtered on polycarbonate filter, frozen at -80°C, HBI/genomic analysis anticipated.
62.	Chris Bowler (Linda Armbrecht)	20	Filters	B90	Backup water samples from underway intake filtered on polycarbonate filter, frozen at -80°C, HBI/genomic analysis anticipated.
63.	John Beardall (Linda Armbrecht)	56	Water samples	B08, B90	Thirty-nine (10 L each) discrete seawater samples from the CTD for Neodymuim isotope and rare earth element measurements. Five (~4-8 L each) seawater samples were collected by combining water from the multicorer, Niskin bottle and bottom water from the multicore sediment tubes.
64.	Taryn Noble	43	Water samples	H32 and H90	Geochemical measurements (Neodymium isotopes, rare earth elements, opal concentrations, trace and redox sensitive metals) and physical measurements of grain size. Multicore were sampled at 1cm intervals.
65.	Taryn Noble	5	Multi-cores	H30, H32 and H90	Sections of Kasten cores were sampled using a U-channel for continuous measurement (every 2 mm) of elements, magnetic susceptibility and x-ray analyses by Itrax core scanner
66.	Taryn Noble	11	U-channel sediment cores	H30, H90	Discrete samples from 11 Kasten cores taken at 2 or 5 cm intervals for heavy mineral dating and geochemical analyses
67.	Taryn Noble	11	Cores	H30, H32 and H90	Discrete samples from 11 Kasten cores taken at 2 or 5 cm intervals for mineralogical and geochemical analyses.
68.	Carlota Escutia Dotti	6	Piston Cores	G90	GEOTEK Multi-Sensor Core Logger. Physical properties (Magnetic susceptibility, Natural Gamma, P-wave velocity and Electrical resistivity). Continuous measurements (every 5cm).

69.	Carlota Escutia Dotti	7	Trigger Cores	G90	GEOTEK Multi-Core Logger. Physical properties (Magnetic susceptibility and Natural Gamma). Continuous measurements (every 1cm)
70.	Carlota Escutia Dotti	5	Archive Multi-Cores	G90	GEOTEK Multi-Core Logger. Physical properties (Magnetic susceptibility). Continuous measurements (every 1cm)
71.	Carlota Escutia Dotti	11	Kasten Cores	G90	Magnetic Susceptibility Meter (Surface scanning pointer). Continuous measurements (every 2cm) for both big and small u-channels
72.	Carlota Escutia Dotti	11	Kasten Cores	G04	Discrete sediment samples (20cc) from Kasten Cores. Sampling interval every 20cm. X-ray diffraction (XRD) mineralogical analysis.
73.	Carlota Escutia Dotti	11	Kasten Cores	G04	Discrete sediment samples (20cc) from Kasten Core. Sampling interval every 20cm. X-ray fluorescence(XRF) analysis. Major and trace elements determination.
74.	Leanne Armand (Kelly-Anne Lawler)	427	Sediment Samples	B09	Sediment samples from Kasten and Multicores, stored at 4°C to be used for radiolarian assemblage analysis ashore. Some samples sieved onboard and permanent slides made for radiolarian identification.
75.	Leanne Armand (Kelly-Anne Lawler)	3	Water Samples	B09	Plankton net samples, all sieved onboard to make permanent slides for radiolarian identification.
76.	Brad Opdyke	11	cores	G04	Kasten core sediment samples (total of 468 sub-samples :207 wet, 261 sieved and dried) preserved for future microscopy and chemical (stable isotope, trace element and carbon dating) analysis on microfossils.
77.	Brad Opdyke	4	cores	G04	Multi-core sediment samples (total of 108 wet sub-samples) preserved for future microscopy and chemical (stable isotope, trace element, carbon dating) analysis on microfossils.
78.	Brad Opdyke	1	cores	G04	Piston core sediment samples (total of 2 sieved sub-samples) preserved for future microscopy and chemical (stable isotope and trace element) analysis on microfossils.
79.	Brad Opdyke	6	cores	G04	Piston core sediment sections (total of 87 sections) for future microscopy and chemical (stable isotope, trace element and carbon dating) analysis on microfossils.

Curation Report

Data curation is subject to several Australian government, university and international institutional agreements, some related explicitly to research funding supporting this project or from students undertaking research as part of their degrees from the following agencies: the Marine National Facility, the Australian Antarctic Division, the Australian Research Council, Geoscience Australia, Macquarie University, The Australian National University, the University of Tasmania, Italian Antarctic program support PNRA, Spanish Ministry of Economy and Competitivity (MINECO), United States National Science Foundation's Polar Program -Antarctic Integrated System Science, Australian and New Zealand IODP Committee (ANZIC).

The data management plans submitted to both the MNF (IN2017-V01) and the Australian Antarctic Division (#4333) covers all metadata record placement through their respective database portals with acknowledged curation of some data sets being covered by national or international arrangements for data submission to following:

1. For Camera tow video and images: the Australian Marine Video and Imagery Collection http://geonetwork.nci.org.au/geonetwork/srv/eng/catalog.search#/metadata/f9737_6449_6141_8160
2. Core and seafloor physical archives and subsamples Geoscience Australia MARS data base (http://dbforms.ga.gov.au/pls/www/npm.mars.search
3. For Seismic Data National Offshore Petroleum Information Management System (NOPIMS, www.ga.gov.au/nopims). The data will also be housed at Istituto Nazionale di Oceanografia e di Geofisica Sperimentale (OGS) in Italy, where it will be processed. Processed sections and navigation will be lodged with the SCAR Antarctic Seismic Data Library System (SDLS), at OGS, and made available on the SDLS web page and the SDLS branch libraries under the SCAR SDLS data distribution policies (http://sdls.ogs.trieste.it/). Geoscience Australia houses the Australian branch library. SDLS rules allow for a two year moratorium on seismic data.
4. All genomic data will be submitted to GenBank (https://www.ncbi.nlm.nih.gov/genbank/ NIH genetic sequence database, an annotated collection of all publicly available DNA sequences), SILVA (https://www.arb-silva.de/ for the submission of rna data) and Bioplatforms Australia (agilbert@bioplatforms.com).

Item	DESCRIPTION
1.	Cloud Condensation Nuclei Counter (CCNC): CCN number concentrations. MNF owned instrument. Data available after QA/QC.
2.	Scanning Mobility Particle Sizer (GRIMM SMPS): aerosol size distribution. MNF owned instrument. Data available after QA/QC.
3.	Nephelometer: aerosol optical properties – scattering. MNF owned instrument. Data available after QA/QC.
4.	MAAP: aerosol optical properties – absorption. MNF owned instrument. Data available after QA/QC.
5.	Ozone monitor: ozone mixing ratios. MNF owned instrument. Data available after QA/QC.
6.	Radon monitor: radon concentrations. MNF owned instrument. Data available after QA/QC.
7.	Aerodyne and picarro: greenhouse gas mixing ratios. MNF owned instrument. Data available after QA/QC.
8.	Aerosol chemical speciation monitor (ACSM): realtime aerosol chemical composition. Externally owned. Data made publically available after 18 months.
9.	Condensation particle counter: aerosol number concentrations. Externally owned. Data made publically available after 18 months.
10.	SMPS (TSI) – aerosol size distribution. Externally owned. Data made publically available after 18 months.
11.	Aerosol filters: detailed chemical composition of integrated sample. Externally owned. Data made publically available after 18 months.
12.	Mercury monitor (Tekran): total gaseous mercury concentrations. Externally owned. Data made publically available after 18 months.
13.	Mercury filters: mercury speciation. Externally owned. Data made publically available after 18 months.
14.	Cloud LIDAR: aerosol and cloud occurrence and vertical profiles. Externally owned. Data made publically available after 18 months.
15.	Microtops photometer: aerosol optical depth. Externally owned. Data made publically available as part of the NASA's AERONET program.
16.	XBT data: MNF owned instrument. Data available.
17.	ADCP data: MNF owned instrument. Data available after QA/QC.
18.	Fisheries echosounder data: MNF owned instrument. Data available.

19.	Multibeam echosounder data: MNF owned instrument. Data available after QA/QC.
20.	Sub-bottom profiler data: MNF owned instrument. Data available after QA/QC.
21.	Gravity data: MNF owned instrument. Data available.
22.	Thermosalinograph data: MNF owned instrument. Data available.
23.	Deep tow camera system. MNF owned instrument. Archived with MNF, GA, NCI.
24.	CTD data associated with deep tow camera system. MNF owned instrument. Archived with MNF, GA.
25.	Filtered seawater uncontaminated seawater line: Diatom assemblage data made publically available after 18 months; samples stored at Colgate University, NY, USA.
26.	Filtered seawater CTD samples: Diatom assemblage data made publically available after 18 months; samples stored at Colgate University, NY, USA.
27.	Filtered seawater plankton tows: Diatom assemblage data made publically available after 18 months; samples stored at Colgate University, NY, USA.
28.	Sediment samples kasten cores: Diatom assemblage data made publically available after 18 months; samples stored at Colgate University, NY, USA.
29.	Sediment samples multi cores: Diatom assemblage data made publically available after 18 months; samples stored at Colgate University, NY, USA.
30.	Sediment samples piston cores: Diatom assemblage and biostratigraphic data made publically available after 18 months; samples stored at Colgate University, NY, USA.
31.	Core samples stored at Geoscience Australia core repository.
32.	Seismic data stored and processed at OGS, Trieste, Italy. Processed data will be made available via the SCAR Seismic Data Library System as per Antarctic Treaty agreement. It will be available for cooperative research after 2 years and publicly available after 4 years. Field data to be stored at Geoscience Australia.
33.	Chlorophyll concentration underway samples: data made available after publication; samples stored at Macquarie University, Sydney , Australia.
34.	Chlorophyll concentration CTD samples: data made available after publication; samples stored at Macquarie University, Sydney, Australia.
35.	Microbial community composition: data made available after publication; samples stored at Macquarie University, Sydney, Australia.
36.	Microbial community composition: data made available after publication; samples stored at Macquarie University, Sydney, Australia.

37.	Viriome composition; data made available after publication; samples stored at Macquarie University, Sydney, Australia.
38.	Flow cytometry analysis of picoplankton, bacterial and viral population: data made available after publication. Samples stored at Macquarie University, Sydney, Australia.
39.	Grazing and viral infection rates upon picoplankton population: data made available after publication. Samples stored at Macquarie University, Sydney, Australia.
40.	Sediment samples for single cell genomics: data made available after publication. Samples stored at Macquarie University, Sydney, Australia.
41.	aDNA Kasten Core: Data made publically available after publication; samples stored at Macquarie University, Sydney, Australia.
42.	aDNA Multi Core: Data made publically available after publication; samples stored at Macquarie University, Sydney, Australia.
43.	GDGT Kasten and Multi Core: Data made publically available after publication; samples stored at Macquarie University, Sydney, Australia.
44.	Phytoplankton abundance and composition (SSWP filter; underway intake): Data made publically available after publication; samples stored at Macquarie University, Sydney, Australia.
45.	Phytoplankton abundance and composition (SSWP filter; CTD): Data made publically available after publication; samples stored at Macquarie University, Sydney, Australia.
46.	Phytoplankton abundance and composition (bottle; underway intake): Data made publically available after publication; samples stored at Macquarie University, Sydney, Australia.
47.	Phytoplankton abundance and composition (bottle; CTD): Data made publically available after publication; samples stored at Macquarie University, Sydney, Australia.
48.	Phytoplankton abundance and composition (bottle; Multicore and bottom water): Data made publically available after publication; samples stored at Macquarie University, Sydney, Australia.
49.	Phytoplankton abundance and composition (bottle; plankton net): Data made publically available after publication; samples stored at Macquarie University, Sydney, Australia.
50.	Single cells (genomics): Data made publically available after publication; samples stored at Macquarie University, Sydney, Australia.
51.	Sediment samples Multicore (REE): Data made publically available after publication; samples stored at Macquarie University, Sydney, Australia

52.	DNA Multicore Niskin and Bottom water): Data made publically available after publication; samples stored at Macquarie University, Sydney, Australia.
53.	HBI Sediment: Data made publically available after publication; samples stored at Plymouth University, U.K.
54.	HBI Water: Data made publically available after publication; samples stored at Plymouth University, U.K.
55.	HBI Filters: Data made publically available after publication; samples stored at Plymouth University, U.K.
56.	HBI Water (backup water Plankton Net): Data made publically available after publication; samples stored at Macquarie University, Australia.
57.	HBI Water (backup filters): Data made publically available after publication; samples stored at Macquarie University, Australia.
58.	Multicore surface sediment microscopy/genomics: Data made publically available after publication; samples stored at Macquarie University, Australia.
59.	HBI Spectroscopy sediments: Data made publically available after publication; samples currently stored at Macquarie University, Australia, to be transferred to Monash University, Melbourne, Australia.
60.	HBI Spectroscopy concentrated water samples: Data made publically available after publication; samples currently stored at Macquarie University, Australia, to be transferred to Monash University, Melbourne, Australia.
61.	HBI Genomics (filters): Data made publically available after publication; samples stored at IBENS, Paris, France.
62.	HBI Water (backup filters): Data made publically available after publication; samples currently stored at Macquarie University, Australia, to be transferred to IBENS, Paris, France.
63.	Water samples: Data made publically available after publication; samples stored at Monash University, Melbourne, Australia.
64.	Data on seawater Nd isotopes and rare earth elements (REE) concentrations will be made publically available after publication (e.g. PANGAEA® Data Publisher); samples destroyed during analyses.
65.	Multicore core isotope and geochemical datasets will be made publically available after publication (e.g. PANGAEA® Data Publisher); some samples destroyed during analyses, others will be stored at the University of Tasmania.
66.	U-channel data sets will be will be made publically available after publication (e.g. PANGAEA® Data Publisher); all 25 mm u-channels and three 100 mm uchannels (A005-KC02, C025-KC12, C042-KC14) stored at the University of Tasmania and the remaining 100 mm u-channels at Geoscience Australia.

67.	Kasten core isotope and geochemical data sets will be made publically available after publication (e.g. PANGAEA® Data Publisher); some samples destroyed during analyses, remainder will be stored at the University of Tasmania and or Geoscience Australia.
68.	GEOTEK Multi- Sensor Core Logger: Physical properties measurements (Magnetic susceptibility, Natural Gamma, P-wave velocity and Electrical resistivity). Sydney Institute of Marine Science owned instrument on loan to Macquarie University.
69.	GEOTEK Multi-Sensor Core Logger: Physical properties measurements (Magnetic susceptibility and Natural Gamma). Sydney Institute of Marine Science owned instrument on loan to Macquarie University.
70.	GEOTEK Multi-Sensor Core Logger: Physical properties measurements (Magnetic susceptibility). Sydney Institute of Marine Science owned instrument on loan to Macquarie University.
71.	Magnetic Susceptibility Meter MS3. Externally owned (Colgate University).
72.	X-ray diffraction (XRD)- XRD-mineralogy of discrete sediment samples from Kasten Cores. Externally owned (IACT-CSIC-UGR).
73.	X-ray fluorescence (XRF)- XRF analysis of major and trace elements on discrete sediment samples from Kasten Cores. Externally owned (IACT-CSIC-UGR).
74.	Permanent slides to be stored at Macquarie University. Data and relevant microscopic images to AADC.
75.	Permanent slides to be stored at Macquarie University. Data and relevant microscopic images to AADC.
76.	Kasten core sediment samples. Stored at the Australian National University.
77.	Multi-core sediment samples. Stored at the Australian National University.
78.	Piston core sediment samples (sieved and dried). Stored at the Australian National University.
79.	Piston core sediment samples (sieved and dried) and used in destructive analyses. Stored until analysis at the Australian National University.

PCAN:

Much of the PCAN dataset includes permanent instrumentation already covered by MNF data policy and will be made available as soon as the usual processing is performed. Campaign based instrumentation will be made available after 18 months has elapsed to enable PI's to utilise the collected data first.

Track Chart

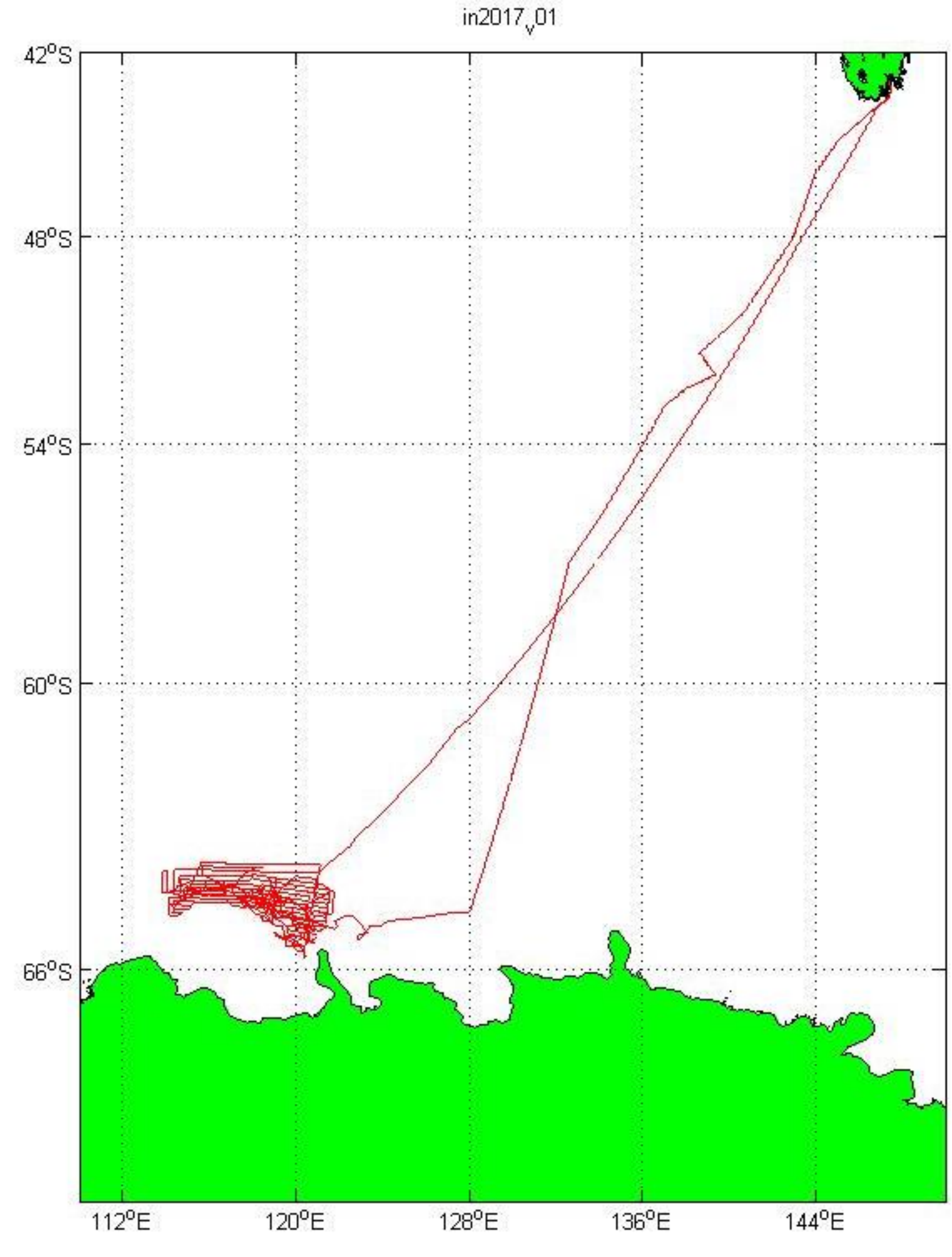


Figure 7. Voyage Track IN2017-V01. Source MNF K. Malakoff.

Personnel List

1.	Doug Thost	Voyage Manager	CSIRO MNF
2.	Nicole Morgan	SIT Support	CSIRO MNF
3.	Rod Palmer	SIT Support	CSIRO MNF
4.	Mark Lewis	SIT Support - Deck Mechanic	CSIRO MNF
5.	Jason Fazey	SIT Support - Deck Mechanic	CSIRO MNF
6.	Tara Martin	GSM Support	CSIRO MNF
7.	Stuart Edwards	GSM Support	CSIRO MNF
8.	Hugh Barker	DAP Support	CSIRO MNF
9.	Karl Malakoff	DAP Support	CSIRO MNF
10.	Peter Hughes	Hydrochemistry Support	CSIRO MNF
11.	Dr Sheri Newman	Doctor	Aspen Medical
12.	Asaesja Young	Comms / Photographer	CSIRO MNF
13.	Leanne Armand	Chief Scientist	Macquarie University
14.	Phil O'Brien	Co-chief Scientist	Macquarie University
15.	Alix Post	Benthic habitat mapping	Geoscience Australia
16.	Bradley Opdyke	Sedimentologist	Australian National University
17.	Taryn Noble	Geologist	University of Tasmania
18.	Linda Armbrecht	Diatomist-Ancient DNA	Macquarie University
19.	Amaranta Focardi	Microbiologist	Macquarie University
20.	Vanessa Pirotta	Marine Mammal Observer	Macquarie University
21.	Kelly-Anne Lawler	Student - Master	Macquarie University
22.	Amy Leventer	Diatomist	Colgate University
23.	Andrea Caburlotto	Seismic	National Institute of Oceanography and Experimental Geophysics
24.	Diego Cotterle	Seismic	National Institute of Oceanography and Experimental Geophysics
25.	Roberto Romeo	Seismic	National Institute of Oceanography and Experimental Geophysics
26.	Thomas Connell	Master Student – Seismics	Macquarie University
27.	Aaron Flint	Master Student - Seismics	Macquarie University
28.	Sarah Tynan	Student - PhD	Australian National University
29.	Liam Holder	Student - Honours	Australian National University
30.	Rushi Perera	Student - Honours	Australian National University
31.	Meghan Duffy	Student - Undergraduate	Colgate University

32.	Dimitrios Evangelinos	Student – PhD Geologist	Instituto Andaluz de Ciencias de la Tierra, Uni of Granda, Spain
33.	Adrian López Quirós	Student – PhD Geologist	Instituto Andaluz de Ciencias de la Tierra, Uni of Granda, Spain
34.	Jack Simmons	Atmospheric student	University Wollongong
35.	Stuart Gifford	CSIRO Educator aboard	Taroona High School, Hobart

Marine Crew

Name	**Role**
Michael Watson	Master
Roderick Quinn	Chief Mate
Adrian Koolhof	Second Mate
Andrew Roebuck	Third Mate
Gennadiy Gervasiev	Chief Engineer
Sam Benson	First Engineer
Ian McDonald	Second Engineer
Damian Wright	Third Engineer
Shane Kromcamp	Electrical Engineer
Alan Martin	Chief Steward
Emma Lade	Steward
Matt Gardiner	Chief Cook
Rebecca Lee	Cook
Jonathan Lumb	Chief Integrated Rating
Dean Hingston	Integrated Rating
Christopher Dorling	Integrated Rating
Murray Lord	Integrated Rating
Mathew McNeill	Integrated Rating
Kel Lewis	Integrated Rating
Darren Capon	Integrated Rating

Acknowledgements

We thank the Marine National Facility, the IN2017-V01 scientific party-led by the Chief Scientists L.K. Armand and P. O'Brien, MNF support staff and ASP crew members led by Captain M. Watson for their help and support on board the RV *Investigator.* Ship time was funded by the Marine National Facility (IN1207-V01), scientific funding in support of the voyage and the post-cruise analyses have been provided through numerous national and international agencies specifically: the Australian Antarctic Division (AAS grants #4333, #4320); the Italian Antarctic program support PNRA TYTAN Project (PdR 14_00119); the Spanish Ministry of Economy and Competitiveness (MINECO; CTM2015-60451-C2-1-P & CTM2015-60451-C2-2-P); the United States National Science Foundation's Polar Program - Antarctic Integrated System Science (#1143834, 1143836, 1143837, 1143843, 1313826); the Australian and New Zealand IODP Committee (ANZIC-SASG #2016); and through the Australian Research Council Discovery Project (#170100557). Institutional support has been generously provided by Macquarie University, Geoscience Australia, The Australian National University, University of Tasmania/IMAS/Antarctic Gateway Partnership, Instituto Andaluz de Ciencias de la Tierra, University of Granada (Spain) and Colgate University (U.S.A.).

PCAN:
The PCAN team would like to thank the MNF SITS team for their continued and dedicated work in getting instrumentation setup and working through the issues we've encountered on the voyage. The IT crew has also been very accommodating with getting the instruments setup on the network with effective data management. We would also like to thank the Chief Scientist Leanne Armand and the rest of the scientific crew for having the project on board.

Signature

Your name	Leanne Armand
Title	Chief Scientist, Associate Professor
Signature	
Date:	**4th May 2017**

List of additional figures and documents

Appendix A - 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

	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

D06	Neutrally buoyant floats
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

B28	Acoustic reflection on marine organisms
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

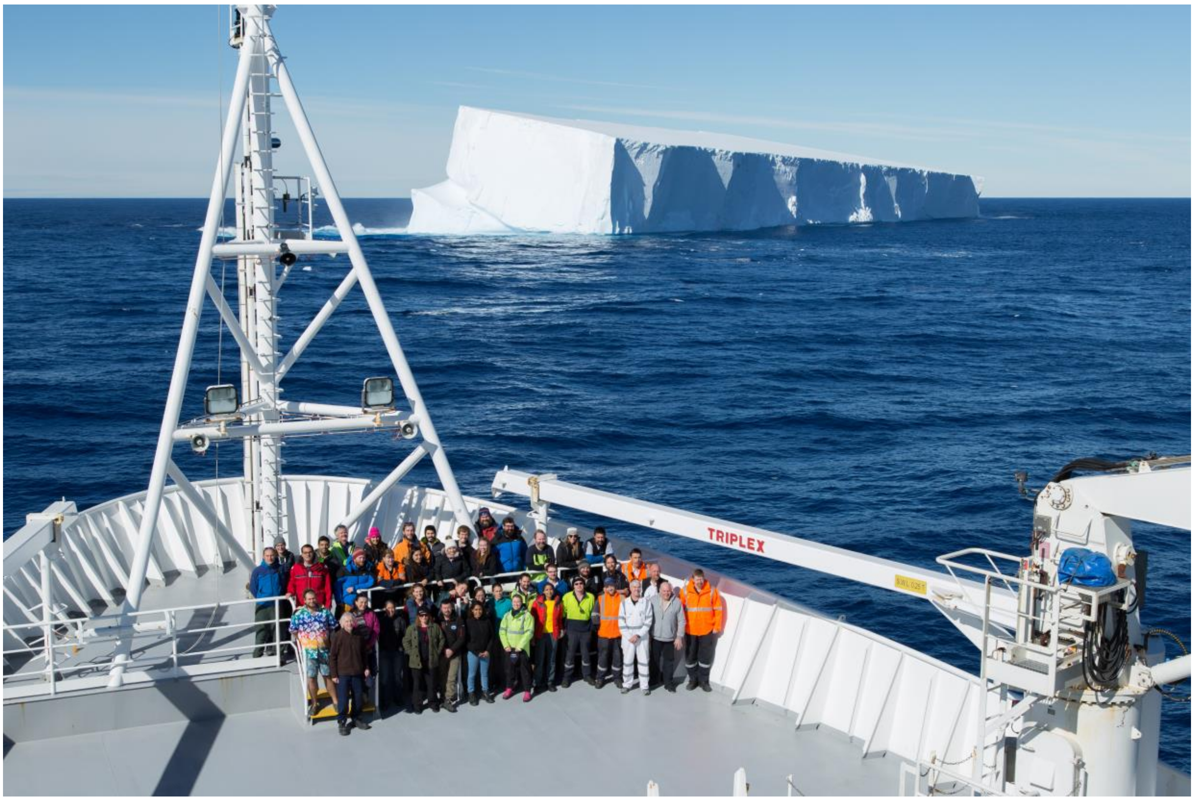
Appendix B – Communications and Photographs.

A CSIRO communications advisor (Ms Asaesja Young) was placed on board the ship to help promote the voyage and the underway science. Interviews conducted with the principal investigators on board helped identify suitable stories for media. Utilising photographs and video footage, story ideas were pitched to journalists in Australia, resulting in more than twenty interviews and strong media coverage. Social media was also utilised to share facts about the voyage and announce milestones, as well as to promote the 11 students on board.

Photography equipment used by the MNF included a Cannon DSLR 6D camera and video camera. Photographs taken for the MNF by the Voyage Manager, Doug Thost, were taken using a Canon 5D mark III.

Communication channels used were mainstream media, ECOS, CSIRO blog, Sabrina Seafloor blog, Twitter, Facebook and Instagram. A dedicated website (https://sites.google.com/site/sabrinaseafloorsurvey/) was hosted independently by the Chief Scientist and a ground support team. This site had over 21,000 hits during the seven week duration of the voyage.

As the number of images procured was enormous it is impossible for them all to be included here and all enquiries for photographs should be directed to the MNF Communications Advisor, Mr Matt Marrison (Matt.Marrison@csiro.au).



Voyage Group Photo. D. Thost/CSIRO

Appendix C IN2017-V01 Major sampling events

Key:

SL - Seismic line; CTD - CTD cast; PN - Plankton Net; CAM – Camera Tow; KC – Kasten core; MC – Multicore; PC – Piston Core;

Event	Date	Station Number	Julian Day	Activity	Latitude (S)	Longitude (E)	Start Time (UTC 24 Hour)	Stop Time (UTC 24 Hour)
	14/01/2017 20/01/2017	T1	14-20	Transiting	64 06.49	120 55.92	07:00:00	09:45:01
	20/01/2017 26/02/2017	T2	20-57	Transiting	64 06.49 64 53.73	120 55.92 128 02.07	09:45:01	18:00:00
	26/02/2017 05/03/2017	T3	57-	Transiting	64 53.73	128 02.07	18:00:00	22:10:00
1	21/01/2017 22/01/2017	A-SL01	21-22	SL01 Start SL01 Stop	64 15.01 64 15.39	115 37.56 116 02.91	00:24:00	03:19:00
2	23/01/2017 24/01/2017	A-SL05	23-24	SL02 Start SL02 Stop	64 33.31 64 33.31	116 08.83 116 37.62	22:21:00	01:55:00
3	24/01/2017 24/01/2017	A-SL05B	24	SL03 Start SL03 Stop	64 33.22 64 33.32	116 36.77 116 56.62	03:12:00	05:41:00
4	24/01/2017 25/01/2017	A-SL02	24-25	SL04 Start SL04 Stop	64 36.67 64 36.62	115 11.11 115 32.26	22:03:00	00:38:00
5	25/01/2017 25/01/2017	A-001	25	CTD01 Start CTD01 Stop	64 37.56 64 37.35	115 38.83 115 38.54	02:47:38	03:15:33
6	26/01/2017 26/01/2017	A-002	26	PN01 Start PN01 Stop	64 40.98 64 40.97	115 17.02 115 16.92	07:34:22	07:48:48
7	26/01/2017 26/01/2017	A-003	26	CTD02 Start CTD02 Stop	64 57.07 64 57.05	114 06.64 114 06.79	16:25:29	16:58:18

8	26/01/2017 27/01/2017	A-004	26-27	CAM01 Start CAM01 Stop	64 47.67 64 43.75	114 16.74 114 10.05	23:29:33	01:47:35
9	27/01/2017 27/01/2017	A-SL06	27	SL05 Start SL05 Stop	64 41.65 64 31.99	114 36.25 115 19.12	04:12:00	10:10:00
10	27/01/2017 27/01/2017	A-005	27	CTD03 Start CTD03 Stop	64 28.26 64 28.42	115 37.39 115 37.55	11:51:19	13:27:56
11	27/01/2017 27/01/2017	A-006	27	CTD04 Start CTD04 Stop	64 27.77 64 27.84	115 02.56 115 02.40	16:05:37	17:33:12
12	27/01/2017 27/01/2017	A-005	27	KC01 Start KC01 Stop	64 28.26 64 28.26	115 37.37 115 37.38	21:09:41	22:36:39
13	27/01/2017 28/01/2017	A-005	27-28	KC02 Start KC02 Stop	64 28.26 64 28.26	115 37.37 115 37.38	22:42:26	00:04:37
14	28/01/2017 28/01/2017	A-005	28	MC01 Start MC01 Stop	64 28.26 64 28.26	115 37.37 115 37.38	02:18:05	03:47:01
15	28/01/2017 28/01/2017	A-005	28	PN02 Start PN02 Stop	64 28.23 64 28.08	115 37.39 115 37.84	04:15:47	05:12:23
16	28/01/2017 29/01/2017	A-005	28-29	PC01 Start PC01 Stop	64 28.27 64 28.27	115 37.31 115 37.31	21:55:33	00:04:36
17	29/01/2017 29/01/2017	A-SL07	29	SL06 Start SL06 Stop	64 15.80 64 15.79	115 59.93 116 06.23	04:11:00	04:57:00
18	29/01/2017 29/01/2017	A-SL07B	29	SL07B Start SL07B Stop	64 15.75 64 15.74	116 13.03 116 15.27	05:59:00	06:16:00
	29/01/2017 29/01/2017	A-SL07C	29	SL07C Start SL07C Stop	64 15.79 64 15.92	116 20.05 116 35.92	06:55:00	08:54:00
19	29/01/2017 29/01/2017	A-007	29	CTD05 Start CTD05 Stop	64 33.26 64 33.25	116 38.61 116 38.57	11:24:51	12:48:04
20	29/01/2017 29/01/2017	A-008	29	CAM02 Start CAM02 Stop	64 34.93 64 37.92	114 30.59 114 47.05	18:36:55	21:59:08

21	30/01/2017 30/01/2017	A-006	30	KC03 Start KC03 Stop	64 27.80 64 27.80	115 02.55 115 02.55	00:31:00	01:45:22
22	30/01/2017 30/01/2017	A-006	30	PC02 Start PC02 Stop	64 27.85 64 27.85	115 02.55 115 02.58	03:00:00	03:53:06
23	30/01/2017 30/01/2017	A-009	30	CTD06 Start CTD06 Stop	64 19.04 64 19.32	114 54.88 114.54.17	04:53:19	06:17:25
24	30/01/2017 30/01/2017	A-006	30	PC03 Start PC03 Stop	64 27.80 64 27.80	115 02.63 115 02.63	21:47:08	23:24:49
25	31/01/2017 31/01/2017	A-006	31	MC02 Start MC02 Stop	64 27.80 64 27.80	115 02.63 115 02.63	02:15:07	03:38:29
26	01/02/2017 01/02/2017	C-010	32	CTD07 Start CTD07 Stop	64 57.02 64 56.99	119 25.69 119 25.82	17:43:11	20:03:25
27	02/02/2017 02/02/2017	C-011	33	CTD08 Start CTD08 Stop	65 00.70 65 00.69	120 27.40 120 27.38	03:52:02	06:15:13
28	02/02/2017 02/02/2017	C-011	33	PN03 Start PN03 Stop	65 00.60 65 00.56	120 27.41 120 27.23	06:56:41	07:27:23
29	03/02/2017 03/02/2017	C-012	34	KC04 Start KC04 Stop	64 40.52 64 40.52	119 10.07 119 18.07	08:31:37	10:38:23
30	03/02/2017 03/02/2017	C-012	34	MC03 Start MC03 Stop	64 40.52 64 40.52	119 18.07 119 18.07	11:08:17	13:14:51
31	03/02/2017 04/02/2017	C-SL08	34-35	SL08 Start SL08 Stop	65 03.64 64 36.90	118 49.10 119 39.29	21:14:00	07:01:00
32	04/02/2017 04/02/2017	C-012	35	PN04 Start PN04 Stop	64 40.53 64 40.54	119.18.16 119 18.09	08:54:14	09:13:57
33	04/02/2017 04/02/2017	C-012	35	CTD09 Start CTD09 Stop	64 40.53 64 40.49	119 18.10 119 18.14	09:22:37	11:26:35
34	04/02/2017 04/02/2017	C-012	35	PC04 Start PC04 Stop	64 40.51 64 40.51	119 18.08 119 18.08	22:02:24	22:24:33

35	05/02/2017 05/02/2017	C-013	36	CTD010 Start CTD010 Stop	64 39.23 64 39.22	119 01.00 119 39.22	00:13:38	02:27:07
36	05/02/2017 06/02/2017	C-012	36-37	PC05 Start PC05 Stop	64 40.52 64 40.52	119 18.13 119 18.13	21:25:24	00:22:45
37	06/02/2017 06/02/2017	C-SL09A	37	SL09A Start SL09A Stop	64 44.69 64 41.36	118 14.51 118 20.17	04:02:00	05:19:00
38	06/02/2017 06/02/2017	C-SL09B	37	SL09B Start SL09B Stop	64 40.20 64 38.66	118 23.12 118 27.03	05:56:00	06:35:00
	06/02/2017 06/02/2017	C-SL09C		SL09C Start SL09C Stop	64 37.99 64 32.64	118 28.64 118 41.00	06:55:00	09:06:00
	06/02/2017 06/02/2017	C-SL09D		SL09D Start SL09D Stop	64 31.28 64 28.40	118 44.36 118 51.52	09:41:00	10:54:00
39	06/02/2017 07/02/2017	C-013	37-38	KC05 Start KC05 Stop	64 39.23 64 39.23	119 01.07 119 01.13	22:30:27	00:57:39
40	07/02/2017 07/02/2017	C-013	38	MC04 Start MC04 Stop	64 39.23 64 39.23	119 01.14 119 01.14	01:19:00	03:25:40
41	07/02/2017 07/02/2017	C-014	38	CTD011 Start CTD011 Stop	65 25.68 65 25.69	120 32.60 120 32.58	22:46:32	23:11:43
42	07/02/2017 08/02/2017	C-014	38-39	CTD012 Start CTD012 Stop	65 25.70 65 25.71	120 32.57 120 32.55	23:20:54	00:03:49
43	08/02/2017 08/02/2017	CTDTest 01	39	CTD013 Start CTD013 Stop	64 41.27 64 41.45	119 03.06 119 02.81	07:22:48	07:52:29
	08/02/2017 08/02/2017	CTD Test 02	39	CTD014 Start CTD014 Stop	64 34.30 64 34.30	118 56.52 118 56.53	09:28:27	09:37:26
	08/02/2017 08/02/2017	CTD Test 03	39	CTD015 Start CTD015 Stop	64 34.31 64 34.31	118 56.50 118 56.52	09:46:01	09:57:08
44	11/02/2017 11/02/2017	C-015	42	KC06 Start KC06 Stop	64 43.74 64 43.74	118 41.81 118 41.81	00:06:53	02:22:11

45	11/02/2017 11/02/2017	C-015	42	MC05 Start MC05 Stop	64 43.73 64 43.73	118 41.80 118 41.80	02:58:20	05:10:15
46	11/02/2017 11/02/2017	C-015	42	PN05 Start PN05 Stop	64 43.89 64 43.94	118 42.04 118 42.02	05:31:17	05:47:45
47	11/02/2017 11/02/2017	C-015	42	MC06 Start MC06 Stop	64 43.71 64 43.71	118 41.81 118 41.77	05:57:32	08:15:14
48	11/02/2017 11/02/2017	C-015	42	CTD016 Start CTD016 Stop	64 43.71 64 43.75	118 41.77 118 41.85	08:23:41	10:28:54
49	11/02/2017 11/02/2017	C-017	42	CTD017 Start CTD017 Stop	64 40.89 64 40.87	118 04.17 118 04.08	12:21:42	14:14:40
50	11/02/2017 11/02/2017	C-016	42	CTD018 Start CTD018 Stop	64 25.89 64 25.93	118 22.91 118 22.96	16:20:28	16:36:51
51	11/02/2017 11/02/2017	C-018	42	CTD019 Start CTD019 Stop	64 24.05 64 24.12	118 30.07 118 30.21	17:32:40	19:42:51
52	11/02/2017 11/02/2017	C-018	42-43	KC07 Start KC07 Stop	64 24.05 64 24.04	118 29.85 118 29.85	22:32:37	00:55:45
53	13/02/2017 14/02/2017	C-SL10	44-45	SL010 Start SL010 Stop	64 30.37 64 33.72	118 59.89 119 18.55	23:48:00	02:21:00
54	14/02/2017 14/02/2017	C-SL10B	45	SL010B Start SL010B Stop	64 34.14 64 42.34	119 20.67 120 03.39	02:39:00	08:26:00
55	14/02/2017 14/02/2017	C-019	45	PC06 Start PC06 Stop	64 49.13 64 49.14	120 08.60 120 08.60	21:43:10	00:58:41
56	15/02/2017 15/02/2017	C-020	46	KC08 Start KC08 Stop	64 47.63 64 47.63	119 44.31 119 44.31	04:26:09	06:49:21
57	16/02/2017 16/02/2017	C-021	47	KC09 Start KC09 Stop	64 44.40 64 44.40	120 22.97 120 22.97	03:24:11	05:42:52
58	16/02/2017 16/02/2017	C-021	47	KC010 Start KC010 Stop	64 44.40 64 44.40	120 22.97 120 22.96	05:50:24	08:16:47

59	16/02/2017 16/02/2017	C-022	47	PC07 Start PC07 Stop	65 07.88 65 07.88	120 02.95 120 02.95	21:13:57	 00:18:50
60	17/02/2017 17/02/2017	C-022	48	KC011 Start KC011 Stop	65 07.88 65 07.88	120 02.95 120 02.95	01:55:00	 03:49:19
61	17/02/2017 17/02/2017	C-023	48	CTD020 Start CTD020 Stop	65 28.11 65 27.98	120 47.52 120 47.14	09:52:15	 11:27:52
62	17/02/2017 17/02/2017	C-024	48	CTD021 Start CTD021 Stop	65 07.90 65 07.86	120 03.01 120 02.58	16:30:43	 18:32:09
63	17/02/2017 17/02/2017	C-SL11	48-49	SL011 Start SL011 Stop	64 58.72 64 59.91	119 25.87 119 44.55	21:37:00	 23:56:00
	18/02/2017 18/02/2017	C-SL11B		SL011B Start SL011B Stop	64 59.97 65 00.08	119 45.62 119 47.68	00:04:00	 00:19:00
	18/02/2017 18/02/2017	C-SL11C		SL011C Start SL011C Stop	65 00.35 65 01.00	119 52.05 120 02.19	00:51:00	 02:07:00
64	18/02/2017 19/02/2017	C-025	49-50	KC012 Start KC012 Stop	64 57.23 64 57.23	120 51.82 120 51.82	23:34:11	 01:30:02
65	19/02/2017 19/02/2017	C-025	50	MC07 Start MC07 Stop	64 57.23 64 57.23	120 51.79 120 51.80	02:51:58	 04:44:48
66	19/02/2017 19/02/2017	C-025	50	PN06 Start PN06 Stop	64 57.23 64 57.20	120 51.80 120 51.62	05:02:42	 05:19:47
67	19/02/2017 19/02/2017	C-025	50	CTD022 Start CTD022 Stop	64 57.19 64 57.05	120 51.57 120 51.52	05:28:43	 07:21:52
68	19/02/2017 19/02/2017	C-025	50	PC08 Start PC08 Stop	64 57.22 64 57.22	120 51.80 120 51.81	21:20:31	 23:58:46
69	20/02/2017 20/02/2017	C-025	51	MC08 Start MC08 Stop	64 57.22 64 57.22	120 51.81 120 51.81	01:20:21	 03:16:34
70	20/02/2017 20/02/2017	C-026	51	CAM03 Start CAM03 Stop	65 34.16 65 31.86	120 22.68 120 25.37	08:14:51	 09:37:00

71	20/02/2017 20/02/2017	C-027	51	CTD023 Start CTD023 Stop	65 32.27 65 32.27	120 24.38 120 24.38	10:38:38	11:30:14
72	20/02/2017 20/02/2017	C-028	51	CAM04 Start CAM04 Stop	65 30.32 65 29.55	119 54.29 119 55.03	19:18:22	19:34:34
73	20/02/2017 20/02/2017	C-028	51	CAM05 Start CAM05 Stop	65 30.27 65 27.04	119 54.39 119 57.87	20:27:31	22:07:37
74	21/02/2017 21/02/2017	C-029	52	CTD024 Start CTD024 Stop	65 35.28 65 35.27	120 22.99 120 22.97	01:02:42	01:15:38
75	21/02/2017 21/02/2017	C-030	52	CTD025 Start CTD025 Stop	65 41.07 65 41.07	120 22.32 120 22.29	04:10:56	04:39:05
76	21/02/2017 21/02/2017	C-031	52	CTD026 Start CTD026 Stop	65 31.59 65 31.59	119 32.40 119 32.20	08:49:17	09:18:07
77	21/02/2017 21/02/2017	C-032	52	CAM06 Start CAM06 Stop	65 24.04 65 24.04	119 13.69 119 13.69	16:04:48	17:27:52
78	21/02/2017 21/02/2017	C-033	52	CTD027 Start CTD027 Stop	65 24.24 65 24.06	119 33.81 119 33.78	19:15:10	20:17:14
79	22/02/2017 22/02/2017	C-034	53	CTD028 Start CTD028 Stop	65 23.45 65 23.31	120 21.62 120 21.77	00:31:06	02:20:01
80	22/02/2017 22/02/2017	C-035	53	CTD029 Start CTD029 Stop	65 18.31 65 18.29	119 35.07 119 35.11	04:41:00	06:27:30
81	22/02/2017 22/02/2017	C-036	53	CAM07 Start CAM07 Stop	65 27.13 65 24.23	119 32.11 119 34.10	07:52:15	09:09:09
82	22/02/2017 22/02/2017	C-015	53	PC09 Start PC09 Stop	64 43.78 64 43.78	118 41.91 118 41.91	21:22:23	21:30:23
83	22/02/2017 22/02/2017	C-037	53	PC010 Start PC010 Stop	64 43.01 64 43.01	118 42.38 118 42.38	23:26:32	23:26:32
84	23/02/2017 23/02/2017	C-038	54	KC013 Start KC013 Stop	64 28.97 64 28.97	119 06.21 119 06.21	02:17:02	04:44:11

85	23/02/2017 23/02/2017	C-038	54	PN07 Start PN07 Stop	64 28.97 64 28.94	119 06.21 119 06.42	04:56:37	05:15:59
86	23/02/2017 23/02/2017	C-039	54	CTD030 Start CTD030 Stop	64 28.78 64 29.00	119 03.29 119 04.17	05:46:13	08:01:30
87	23/02/2017 23/02/2017	C-040	54	CTD031 Start CTD031 Stop	65 05.19 65 05.21	118 56.16 118 56.20	12:40:11	14:31:53
88	23/02/2017 23/02/2017	C-041	54	CTD032 Start CTD032 Stop	64 58.96 64 59:00	118 31.39 118 31.36	17:07:27	19:11:47
89	23/02/2017 24/02/2017	C-015	54-55	PC011 Start PC011 Stop	64 43.85 64 43.85	118 41.54 118 41.54	21:38:02	01:02:52
90	24/02/2017 24/02/2017	C-SL12	55	SL012 Start SL012 Stop	64 44.46 64 44.37	118 59.10 118 58.53	04:30:30	04:35:12
	24/02/2017 24/02/2017	C-SL12B	55	SL012B Start SL012B Stop	64 43.30 64 41.66	118 51.72 118 39.46	05:51:19	07:32:11
	24/02/2017 24/02/2017	C-SL12C	55	SL012C Start SL012C Stop	64 39.98 64 39.88	118 30.25 118 29.62	09:16:35	09:22:10
91	24/02/2017 24/02/2017	A-042	55	KC014 Start KC014 Stop	64 32.32 64 32.32	116 38.43 116 38.42	22:02:10	23:39:11
92	25/02/2017 25/02/2017	A-042	56	PN08 Start PN08 Stop	64 32.32 64 32.32	116 38.42 116 38.42	00:10:28	00:29:59
93	25/02/2017 26/02/2017	C-043	56-57	CTD033 Start CTD033 Stop	65 22.77 65 23.11	122 53.04 122 52.26	22:26:42	00:08:58

End of Record.

Appendix D1. Sea Ice report 14th February 2017.

Sea ice report, revealing extraordinary northward sea-ice movements, which perturbed scientific operations after a storm on the 12th February 2017.

Sea Ice Report #08.2/2017

by the Antarctic Gateway Partnership Sea Ice Service*
Analyst: Jan L Lieser

14/02/2017

Sabrina Coast

As an update to Sea Ice Report #8.1/2017, Figure 1 shows a SAR scene on top of visible data, off Sabrina Coast, with coloured rectangles indicating areas of operational interest to a marine science voyage on-board RV *Investigator*. The blue line shows the cruise track of the vessel (up to 14/02/2017 00:00 UT).

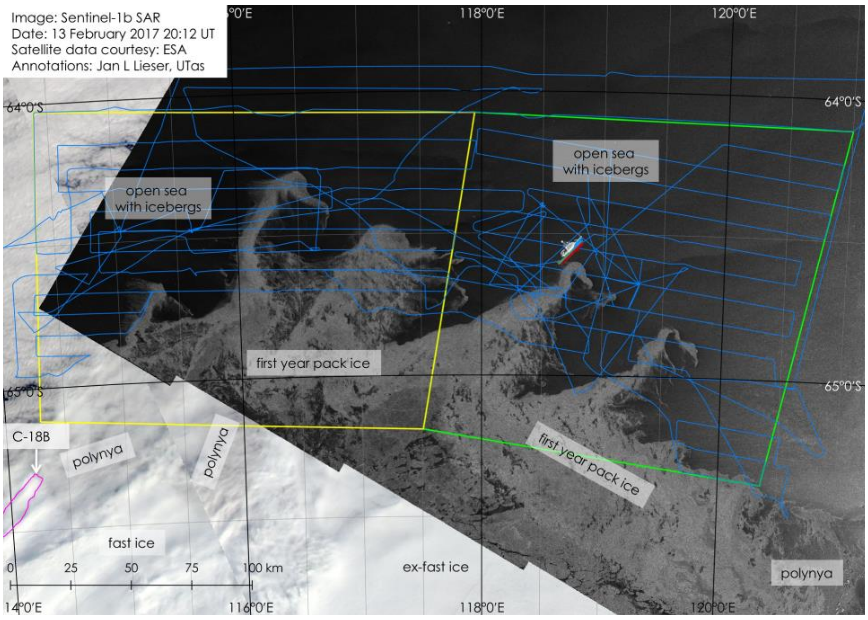


Figure 1: Sentinel-1b SAR scene, acquired 13/02/1016 and provided by PolarView; Background: TERRA MODIS VIS scene, acquired 13/02/1016 and provided by NASA.

The SAR scene provides a view through the clouds. Hook-like sea-ice features extending northward from the first-year pack ice are clearly identified. Open water patches are also visible, in the southern part of the SAR scene, showing some of the cracks and leads mentioned previously.

*Disclaimer: *Every effort is made to ensure the data provided in this report are accurate at the date of publication; however the report is provided without warranty of any kind. The figures and charts provided in this report are intended only as a guide to ice conditions and are not suitable for navigation.*

Appendix D2. Antarctic Sea Ice report 15th February 2017.

Sea Ice Report #08.4/2017

by the Antarctic Gateway Partnership Sea Ice Service*
Analyst: Jan L Lieser

15/02/2017

Antarctica

Figure 1 shows the sea-ice concentration anomaly for January 2017, which is the difference between the mean sea-ice concentration for January 2017 and the average January sea-ice concentration (reference period 1992-2016). The black line in the figure represents the average January sea-ice extent.

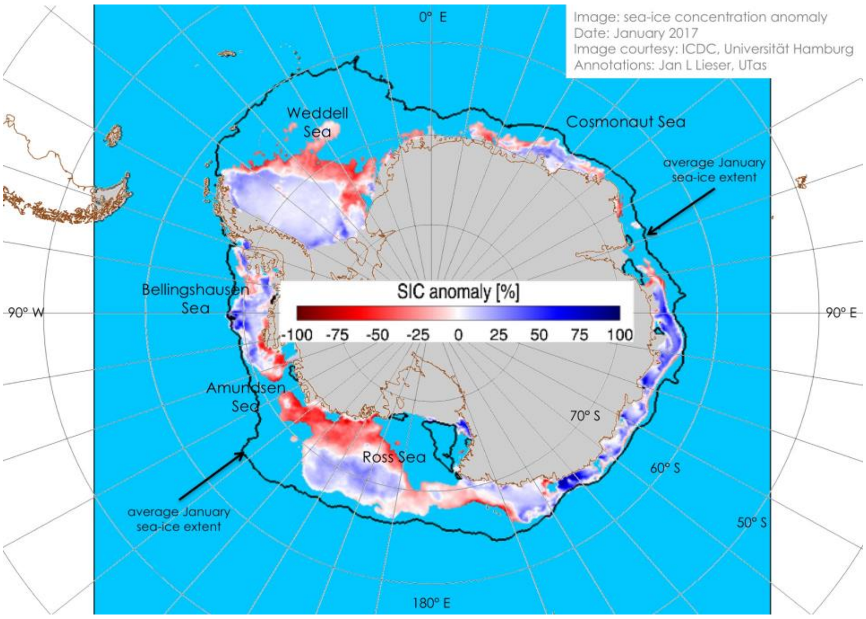


Figure 1: Sea-ice concentration anomaly for January 2017, provided by ICDC, Universität Hamburg.

The pan-Antarctic sea-ice extent is well below the range of ± 2 standard deviations of the mean and therefore anomalously low. The regional distribution of sea-ice concentration anomaly reveals how much below the average the sea-ice extent is, except for two regions — at around 90° W and in parts of East Antarctica. On 12/02/2017, a new lowest sea-ice extent minimum was recorded (2.246×10^6 km^2), but the end of the sea-ice season is still ahead and it is likely to go even lower.

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