

Report for the year 2016 and future activities

SOLAS *Australia*

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This report has two parts:

- **Part 1:** reporting of activities in the period of January 2016 – Jan-Feb 2017
- **Part 2:** reporting on planned activities for 2017/2018 and 2019.

The information provided will be used for reporting, fundraising, networking, strategic development and updating of the live web-based implementation plan.

IMPORTANT: May we remind you that this report should reflect the efforts of the SOLAS community in the entire country you are representing (all universities, institutes, lab, units, groups, cities)!

PART 1 - Activities from January 2016 to Jan/Feb 2017

1. Scientific highlight

The SOLAS-endorsed Reef to Rainforest campaign: The Great Barrier Reef as a significant source of climatically relevant aerosol particles



Reef To Rainforest

In September – October 2016 an international campaign was undertaken on board the RV Investigator to investigate the impact of the Great Barrier Reef as a source of climatically active particles. The campaign included scientists from 7 Australian institutions (QUT, CSIRO, BoM, University of Melbourne, Southern Cross University, University of Technology Sydney, University of Tasmania) 7 international institutions (Uni of Tsukuba, Japan; NIES, Japan; NIWA, New Zealand; Auckland University of Technology, New Zealand; Fudan University, China; NOAA; University of California, USA).

The main objective of the voyage was to acquire observations to address four key science questions:

1. Do marine aerosols along the north Queensland coast have a significant signature that is coral-derived?
2. How does this aerosol change its physicochemical properties, especially its capacity to act as CCN, as winds carry it from the reefs to the north Queensland rainforests?

3. What is the significance of this ecosystem as a source of aerosol particles and will potential degradation of the reef cause significant variations in particle number being generated over the reef?
4. Should changes in this aerosol, associated with reef degradation, be taken into account when modelling the radiative climate and rainfall?

Aerosol and atmospheric composition data was collected on board the RV Investigator at three dedicated atmospheric measurement stations, and during transient parts of the voyage. Special interest was paid to the transects through the reef that were repeated several times (see Figure 1 below and also available online at http://www.cmar.csiro.au/data/underway/?survey=in2016_v05). Detailed water composition data was also acquired including the DMSP lyase assay (DLA) to assess the relative contribution of phytoplankton and bacteria to DMS production, and DNA/RNA extractions and bacterial community analyses.

An opportunistic voyage objective was to testing UAVs to measure the emissions from the ship diesel engines and study their dispersion in the marine atmosphere.

In addition to the measurements on board the RV Investigator a measurement station (AIRBOX mobile air chemistry laboratory) was setup on the shore 20m from the waterline at Mission Beach.

The voyage attracted significant media attention with an Australian Broadcasting Corporation (ABC) crew filming on board for one week. This resulted in a number of live coverages from the RV Investigator as well as a number of articles both online and on ABC TV (see Section 4 below)

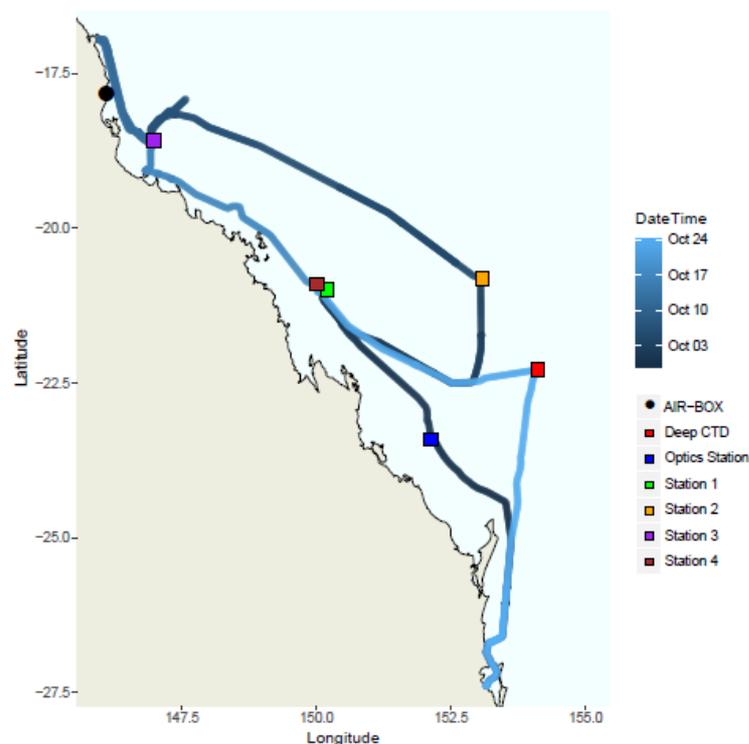


Figure 1 – voyage path from the Rainforest to Reef campaign

data intercomparisons, capacity building, international collaborations, contributions to int. assessments such as IPCC, interactions with policy makers or socio-economics circles, etc.)

Four major atmospheric measurement campaigns were undertaken on the RV Investigator during this period including

1. IN2016_V02 - CAPRICORN (Cloud aerosol precipitation, radiation and atmospheric composition over the southern ocean). Southern Ocean location.
2. IN2016_V03 - aerosol, cloud and atmospheric composition measurements on transect between ice edge to equator
3. IN2016_V05 - Great Barrier Reef study of aerosols and precursors (see science feature above)
4. IN2017_V01 - PCAN (Polar Cell Aerosol Nucleation) - study of aerosols and clouds off the East Antarctic coastline.

In addition, aerosol and precipitation sampling for trace metals and major ions was conducted on voyages IN2016_T02, IN2016_V04 and IN2016_V05, in waters off the eastern coasts of Australia from Hobart to the Great Barrier Reef.

Long term aerosol-cloud measurements are being made at Macquarie Island for two years – one year of data has been collected to date.

An on-going aerosol trace metal and major ion sampling program at land-based locations around Australia has been extended to new stations on Lord Howe Island and at Mt Wellington (southern Tasmania), and a short campaign was conducted at Mission Beach (Queensland) to coincide with ship-based observations in voyage IN2016_V05.

3. Top 5 publications in 2016 (only PUBLISHED articles) and if any, weblinks to models, datasets, products, etc.

Gras, J.L. and Keywood, M (2016): Cloud condensation Nuclei over the Southern Ocean: wind dependence and seasonal cycles, *Atmos. Chem. Phys. Discuss.*, doi:10.5194/acp-2016-998, accepted for publication.

Swan, H.B., Crough, R.W., Vaattovaara, P. et al. *J Atmos Chem* (2016) 73: 303. doi:10.1007/s10874-016-9327-7

Swan, H. B., Jones, G. B., Deschaseaux, E. S. M., and Eyre, B. D (2017): Coral reef origins of atmospheric dimethylsulfide at Heron Island, southern Great Barrier Reef, Australia, *Biogeosciences*, 14, 229-239, doi:10.5194/bg-14-229-2017.

Winton, V., Dunbar, G., Atkins, C., Bertler, N., Delmonte, B., Andersson, P., Bowie A.R., Edwards, R. (2016). The origin of lithogenic sediment in the south-western Ross Sea and implications for iron fertilization. *Antarctic Science*, 28(4), 250-260. doi:10.1017/S095410201600002X

Winton, V. H. L., Edwards, R., Bowie, A. R., Keywood, M., Williams, A. G., Chambers, S. D., Selleck, P. W., Desservettaz, M., Mallet, M. D., and Paton-Walsh, C.: Dry season aerosol iron solubility in tropical northern Australia, *Atmos. Chem. Phys.*, 16, 12829-12848, doi:10.5194/acp-16-12829-2016, 2016.

4. Did you engage any stakeholders/societal partners/external research users in order to co-produce knowledge in 2016? If yes, who? How did you engage?

Media coverage of Great Barrier Reef voyage:

How the corals of the Great Barrier Reef affect Queensland's climate, The Science Show
<http://www.abc.net.au/radionational/programs/scienceshow/how-the-corals-of-the-great-barrier-reef-affect-queensland%E2%80%99s-cl/8086844>

Qld research raises fears a dying reef could impact weather patterns (PM Radio)
<http://www.abc.net.au/pm/content/2016/s4555969.htm>

Does coral create rain? ABC News
<http://www.abc.net.au/news/2016-10-14/how-the-great-barrier-reef-coral-impacts-rainfall/7928714>

Australia's Young Climate Scientists. ABC News
<http://www.abc.net.au/news/2016-11-07/the-young-climate-scientists-aboard-the-rv-investigator/7997864>

Media coverage of PCAN voyage:

<https://www.theguardian.com/world/2017/feb/22/antarctic-study-examines-impact-of-aerosols-on-climate-change>

<https://sites.google.com/site/sabrinaseafloorsurvey/school-pages/atmospheric-aerosols>

<http://www.uowblogs.com/2017antarcticatmosphere/>

PART 2 - Planned activities from 2017/2018 and 2019

1. Planned major field studies and collaborative laboratory and modelling studies, national and international (incl. all information possible, dates, locations, teams, work, etc.)

RV Investigator Voyages IN2017_T01 and IN2017_V05 September – November 2017. Natural iron fertilisation of oceans around Australia: linking terrestrial dust and bushfires to marine biogeochemistry. Two voyages around the north and west coasts of Australia from Sydney to Broome and Broome to Fremantle.

RV Investigator voyage IN2018_V01 January – February 2018. Two combined projects: (i) Detecting Southern Ocean change from repeat hydrography, deep Argo and trace element biogeochemistry, and (ii) CAPRICORN-II: Clouds, Aerosols, Precipitation, Radiation, and atmospheric Composition Over the southern ocean

2. Events like conferences, workshops, meetings, schools, capacity building etc. (incl. all information possible)

Atmospheric Composition Observations and Modelling Conference & Cape Grim Annual Science Meeting and 8th Australia and New Zealand Aerosol Workshop, Murramarang Beachfront Nature Reserve, Australia, 28 - 30 November 2017

3. Funded national and international projects / activities underway (if possible please list in order of importance and indicate to which part(s) of the SOLAS 2015-2025 Science Plan and Organisation (downloadable from the SOLAS website) the activity topics relate – including the core themes and the cross cutting ones)

Data workshops are planned for 2017 on Heron Island to examine data from the Great Barrier Reef as a Source of Climatically Active particles campaign (science feature).

4. Plans / ideas for future projects, programmes, proposals national or international etc. (please precise to which funding agencies and a timing for submission is any)

Proposal for the Australian Antarctic Science Program (AASP) called “CAMMPCAN – Chemical and Mesoscale Mechanisms of Polar Cell Aerosol Nucleation” is currently being considered for a grant and logistical support for the 2016/17 round. If successful campaign will be undertaken in Southern Ocean.

5. Engagements with other international projects, organisations, programmes etc.

The IGAC Scientific Steering Committee will be held in Murramarang Australia in 2017 in conjunction with the Atmospheric Composition Observations and Modelling Conference & Cape Grim Annual Science Meeting

Comments