AMT Annual Report 2020

The Atlantic Meridional Transect (AMT)

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Selected highlights

1. Selected scientific highlights since last report

Last report was submitted to Brest SSC meeting, June 2019. Each highlight needs to be VERY short, bullet points, with a link to publication if applicable.

AMT is now in its 25th year of research activities in the Atlantic Ocean. Last year saw the publication of 15 papers, total list of >350 can be found at https://www.amt-uk.org/Publications . AMT provides exceptional opportunities to UK and international partners to access the remote regions of the Atlantic Ocean including the rarely visited South Atlantic Gyre. To date 289 individuals from 77 institutes in 29countries have taken part in AMT cruises and according to BODC records there have been 124000 downloads of AMT data since 2011 by the international community. AMT also contributes to capacity building in the developing nations through support from POGO (Partnership for Observation of the Global Ocean) and to date has supported training to 12 individuals, this years fellows came India and Venezuela.

The AMT29 research cruise (DY110) set sail from Southampton on October 13th, 2019 aboard the Royal Research Ship Discovery and arrived in Punta Arenas, Chile, on November 25th, 2019. Participation of 20 research scientists from 10 institutes and of 12 different nationalities (Austria, China, France, Germany, India, Italy, Portugal, Russia, Spain, Sweden, UK, Venezuela).

The highlights of AMT29 were as follows:

- 55 CTD profiles measuring key physical and biogeochemical parameters including: temperature, salinity, chlorophyll, oxygen, nutrients, pH, alkalinity, plankton abundance, respiration, genetics and microbial dynamics.

- Daily sampling down to 2000 m in an attempt to resolve the Antarctic Intermediate Waters (AAIW). AAIW is an important water mass is thought to sustain primary production in a large fraction of the ocean. Sampling included measurements of oxygen, nutrients, pH, DIC/TA, REEs, PFAAs, Cr isotopes, flow cytometry and tintinnids.

- Continuous underway temperature, bio-optical and biogeochemical measurements covering an almost 100° range in latitude and vastly contrasting ocean biomes.
- Vertical net hauls to determine the abundance of different species of zooplankton and larger phytoplankton.
- Optics rig deployments to measure optical properties of the upper 500 m of the water column.
- Weather balloon launches.
- Test of two new instruments (new FFRF and new chlorophyll-a meter). AMT as an ideal platform to test instrumentation over a wide range of environments.
- First measurements of depth profiles and sea-spray aerosol enrichment of perfluoroalkyl acids (important to predict environmental transport of contaminants and to understanding the chemical composition of sea-spray aerosol)
- Continuous underway measurements of optical properties, sea-surface temperature, radar backscatter and gas fluxes to validate products from satellite sensors (ESA, JAXA and NASA).
- Collected samples for single-cell phytoplankton stoichiometry at the Atlantic basin scale.
- Incubator experiments to better understand the interactive effect of temperature and nutrients availability in different phytoplankton and bacteria communities along the transect.
- Wide suite of complementary measurements to determine the carbon fluxes (net and gross primary production, net community production, size-fractionated photosynthesis irradiance curves, pigments, etc.) due to phytoplankton and bacteria in the surface sunlit layer.
- New high-resolution meridional cross section of Rare Earth Elements (REE) specifically targeting the water masses of the upper water column to investigate the role of biological features and processes, if any, on the REE distribution. This is important because RREs can be used to investigate processes such as particle scavenging, dust dissolution, river input, pore-water diffusion, etc.
- Flow-cytometry and Coulter-counter measurements as well and sample collection to characterize the distribution and abundance of Archea, bacteria, pico- and nano-eukaryotic phytoplankton, and to investigate the contribution of phytoplankton to the particle size distribution.
- Deployment of six NOAA-PMEL Deep-Argo floats contributing to the regional pilot array in the Brazilian Basin and several additional core Argo floats for the UKMO.
- Recovery of a deep (5000 m) sediment trap mooring in the South Atlantic oligotrophic gyre for the National Oceanography Centre, UK, which had previously been deployed in October 2018, and the construction and deployment of a new sediment trap mooring at the same location.

2. Publications since last report

Please add all publications since last report to the table below (see notes for details on "Class" and "Activity" fields).

Publication *with DOI*	***Class 1, 2, 3***	***Activity****
2020 *Dutkiewicz, S., P. Cermeno, O. Jahn, M.J. Follows, A.E. Hickman, D.A.A. Taniguchi and B.A. Ward. 2020. Dimensions of marine phytoplankton diversity. Biogeosciences 17, 609-634. doi:10.5194/bg-17-609-2020* *Humpreys, M.P., Y. Artioli, D.C.E. Bakker, S.E. Hartmann, P. León, S. Wakelin, P. Walsham and P. Williamson. 2020. Air-sea CO_2 exchange and ocean acidifcation in UK seas and adjacent waters. MCCIP Science Review 2020, 54-75. doi:10.14465/2020.arc03.oac* *Kulk, G., T. Platt, J. Dingle, T. Jackson, B.F. Jönsson, H.A. Bouman, M. Babin, R.J.W. Brewin, M. Doblin, M. Estrada, F.G. Figueiras, K. Furuya, N. González-Benítez, H.G. Gudfinnsson, K. Gudmundsson, B. Huang, T. Isada, Ž. Kovač, V.A. Lutz, E. Marañón, M. Raman, K. Richardson, P.D. Rozema, W.H. van de Poll, V. Segura, G.H. Tilstone, J. Uitz, V. van Dongen-Vogels, T. Yoshikawa and S. Sathyendranath. 2020. Primary production, an index of climate change in the ocean: satellite-based estimates over two decades. Remote Sensing 12(5), art: 826. doi:10.3390/rs12050826* ***2019*** *Balch, W.M., B.C. Bowler, D.T. Drapeau, L.C. Lubelczyk, E. Lyczkowski, C. Mitchell and A. Wyeth. 2019. Coccolithophore distributions in the North and South Atlantic Ocean. Deep-Sea Research I 151, art: 103066. doi:10.1016/j.dsr.2019.06.012* *Brewin, R.J.W., T.G. Brewin, J. Phillips, S. Rose, A. Abdulaziz, W. Wimmer, S. Sathyendranath and T. Platt. 2019. A printable device for measuring clarity and colour in lake and nearshore waters. Sensors 19(4), art: 936. doi:10.3390/s19040936* *Burridge, A.K., R. van der Hulst, E. Goetze and K.T.C.A. Peijnenburg. 2019. Assessing species boundaries in the open sea: Applying an integrative taxonomic approach to the pteropod genus Diacavolinia. Zoological Journal of the Linnean Society, zlz049. doi:10.1093/zoolinnean/zlz049* *Garcia-Martin, E.E., M. Aranguren-Gassis, D.M. Karl, S. Martínez-García, C. Robinson, P. Serret and E. Teira. 2019. Validation of the in vivo iodo-nitro-tetrazolium (INT) salt reduction method as a proxy for plankton respiration.*	*All Class 3*	

Frontiers 6, art: 220. doi:10.3389/fmars.2019.00220

Gregg, W.W. and C.S. Rousseaux. 2019. Global ocean primary production trends in the modern ocean color satellite record (1998–2015). Environmental Research Letters 14, art: 124011. doi:10.1088/1748-9326/ab4667

Holding, T., I.G. Ashton, J.D. Shutler, P.E. Land, P.D. Nightingale, A.P. Rees, I. Brown, J.-F. Piolle, A. Kock, H.W. Bange, D.K. Woolf, L. Goddijn-Murphy, R. Pereira, F. Paul, F. Girard-Arduin, B. Chapron, G. Rehder, F. Arduin and C.J. Donlon. 2019. The FluxEngine air-sea gas flux toolbox: simplified interface and extensions for in situ analyses and multiple sparingly soluble gases. Ocean Science Discussions 15(6), 1707-2019. doi:10.5194/os-2019-45

Martiny, A.C., M.W. Lomas, W. Fu, P.W. Boyd, Y.L. Chen, G.A. Cutter, M.J. Ellwood, K. Furuya, F. Hashihama, J. Kanda, D.M. Karl, T. Kodama, Q.P. Li, J. Ma, T. Moutin, E.M.S. Woodward and J.K. Moore. 2019. Biogeochemical controls of surface ocean phosphate. Science Advances 5(8), art:eaax0341. doi:10.1126/sciadv.aax0341

Perkins, D.M., A. Perna, R. Adrian, P. Cermeño, U. Gaedke, M. Huete-Ortega, D.A. White and G. Yvon-Durocher. 2019. Energetic equivalence underpins the size structure of tree and phytoplankton communities. Nature Communications 10, art:255. doi:10.1038/s41467-018-08039-3

Rasse, R. and G. Dall'Olmo. 2019. Do oceanic hypoxic regions act as barriers for sinking particles? A case study in the eastern tropical North Atlantic. Global Biogeochemical Cycles 33(12), 1611-1630. doi:10.1029/2019GB006305

Reintjes, G., C. Arnosti, B. Fuchs and R. Amann. 2019. Selfish, sharing and scavenging bacteria in the Atlantic Ocean: a biogeographical study of bacterial substrate utilisation. Proceedings of the National Academy of Sciences 13, 1119-1132. doi:10.1038/s41396-018-0326-3

Smyth, T., G. Tarran and S. Sathyendranath. 2019. Marine picoplankton size distribution and optical property contrasts throughout the Atlantic Ocean revealed using flow cytometry. Applied Optics 58, 8802-8815. doi:10.1364/AO.58.008802

Wall-Palmer, D., M. Hegmann, E. Goetze and K.T.C.A. Peijnenburg. 2019. Resolving species boundaries of the Atlanta brunnea group (Gastropoda, Pterotracheoidea) from a global dataset. ZooKeys 899, 59-84. doi:10.3897/zookeys.899.38892

**If appropriate, please list the IMBeR activity through / by / from / during which the publication arose*

*******Notes on publications*******

Publications are logged in the IMBeR Zotero library which is publicly accessible online - https://www.zotero.org/groups/2448334/imber_library_2/library

[Due to space limitations, publications from 1999-2017 are in a separate Zotero library - https://www.zotero.org/groups/38770/imber_library_1/library]

Publications are categorised by "Class" and linked to "Activities":

Class 1 publications are specifically generated through/by/from/during ***IMBeR activities*** - for example, arising from IMBIZOs and IMBeR conferences such as the IMBeR open science meeting and the IMBeR CJK symposia and from the activities of the working groups, regional programmes and the SPIS scoping teams.

Class 2 publications are on topics relevant to the IMBeR Science Plan that benefitted from some interaction with IMBeR or ***IMBeR activities***, for example by IMBeR symposium attendees, past and present SSC members, working group, regional programme and endorsed project members, or national contacts.

Class 3 publications are on topics relevant to the IMBeR Science Plan but for which there is no direct link to or benefit from an IMBeR activity. These might include publications by SSC members, working group, regional programme or endorsed project members or members of the IMBeR international community that were written as part of the normal scientific activity of the authors and would have occurred irrespective of IMBeR's existence. You can report Class 3 publications, but they will no longer be logged in the IMBeR database.

[See https://drive.google.com/open?id=1OQWn41KJvQ-LyWJlkiYnc5qZ2IuNQOrg or https://pan.ecnu.edu.cn/p/DTrpUb4QiFAYoQ4 for further information on "What is an IMBeR publication?".]

Why list 'Class' and 'Activity'? This helps us to declare authentically which publications IMBeR has helped to generate, and it makes it easier for us to demonstrate the value of the Regional Programmes, the Working Groups, the Endorsed Projects, and IMBeR in general, and it helps us to justify support for IMBeR activities when we can list tangible outputs.