SOUTHERN OCEAN OBSERVING SYSTEM

Report Series

The Weddell Sea and Dronning Maud Land (WSDML) Regional Working Group Virtual Science Workshop, 20-23 October 2020

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The Weddell Sea and Dronning Maud Land (WSDML) Regional Working Group Virtual Science Workshop

20-23 October 2020

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1) Introduction:

The WSDML RWG science workshop was originally planned to take place in April 2020 in the Hanse Wissenschaftskolleg in Delmenhorst, Germany and was Covid-related re-scheduled for October 2020 as a virtual workshop based at AWI. The workshop took place during four three-hour long afternoon (CET) sessions. The workshop's agenda was built around coherent disciplinary sessions with focus on biology, biogeochemistry, and physics in the WSDML region. The sessions were composed of presentations as signed up for the original workshop as well as additional presentation allowed by the easier terms of the virtual attendance. Participants had the opportunity to present preliminary results or short pieces of information in a virtual poster session, which consisted of a round of quick (~3-minutes) flash talks. In addition to scientific exchange among the participants, the agenda also allowed for SOOS- and RWG-related discussions, such as on SOOS data management, different national and international field campaigns in the coming years to the focus region, as well as steps toward a special publication volume on papers focusing on the WSDML. Nearly all members of the WSDML RWG leadership team were actively involved in either the planning committee or as discussion leaders in scientific or organizational sessions.

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1) Scientific Sessions

a. 20 Oct 2020: BIO-sessions (60-70 participants)

Chaired by Sebastien Moreau and Julian Gutt

The session included 8 talks on biology in the Weddell Sea, both from the sea ice and upper water column, as well as the benthos. Ilka Peeken (AWI) presented her latest results about sea-ice productivity and pigments composition form the western Weddell Sea. Her results suggested that the internal layers of sea ice may not be as productive as previously assumed. Hanna Kauko (NPI) presented her latest results from both the Norwegian 2019 cruise to the Kong Haakon VII Sea and a phenology analysis from satellite derived-ocean colour. Her results suggested a weak influence of sea ice on phytoplankton phenology in the area. Thomas Ryan-Keogh (CSIR) presented results of the phytophysiology of Southern Ocean phytoplankton from 4 cruises that happened through all 4 seasons (Winter, Spring, Summer and Fall) in the eastern part of the Weddell Gyre, south of South Africa. His results suggested a strong change in photophysiology between early and late spring in the open waters of the ACC. Astrid Cornils (AWI) presented the spatial and temporal patterns of copepods diversity in the Weddell Sea over the last two decades. Asmita Singh (CSIR) presented the results of the iron-addition experiments she carried out during the Norwegian 2019 cruise to the Kong Haakon VII Sea. Her results suggested that iron was not limiting primary production in the open waters of the Kong Haakon VII Sea during fall. Santiago Pineda-Metz et al. (AWI) showed changes over a 26-year period in benthic composition going along with an increase of sea-ice cover and iceberg abundance. Heike Link (Rostock University) analysed benthic boundary fluxes (oxygen, silicic acid, nitrate, phosphate, and ammonium). Spatial variability was

high in the Weddell Sea compared to adjacent study areas, at the Peninsula.

The discussion showed that it might be justified to design future surveys, which reveal results allowing conclusions for larger areas and being representative for larger components of the ecosystem and not only refer to the local scale. Also challenging is a question-driven linking of biological processes in the euphotic zone and the benthos.

b. 21 Oct 2020: PO-session (60-70 participants)

Chaired by Laura de Steur and Markus Janout

The session included a series of 10 physics-focused presentations, ranging from larger scale heat budget of the Weddell Gyre (Krissy Reeve) to marginal ice zone processes based on models (Marcello Vichi) and observations using gliders and other autonomous devices (Sebastiaan Swart, Marcel Du Plessis). Upper ocean conditions preconditioning the occurrence of the Maud Rise Polynya were discussed by John Mojica. Two presentations focused on observations and preliminary model results from the north-western Weddell Sea near the Larsen C ice shelf, presenting hydrographic (Katherine Hutchinson) and oxygen isotopes (Joshua Mirkin) data from a recent 2019 Weddell Sea expedition. A general Weddell Sea ice update (Christian Haas presented by Stefanie Arndt) and specific sea ice and platelet ice in Atka Bay (Stefanie Arndt) both indicated unchanged ice conditions in the WSDML sector since the 1980s. The connectivity of WSDML was discussed by Tore Hattermann, who showed that an upstream freshening of the DML region may lead to changes in the Antarctic slope front to allow for an enhanced inflow of warmer water to the Filchner Ronne ice shelves.

The following plenary discussion focused on observing techniques involving gliders under sea ice and ice shelves, and different observational campaigns and gaps.

c. 22 Oct 2020: remaining PO and BGC sessions

Chaired by Mario Hoppema and Sarah Fawcett

The third day started with two more talks on physical issues. Olaf Eisen presented a paper with many co-authors about field observations from several projects as boundary conditions for ice sheet –ocean interactions. The bathymetry of ice cavities in the Filchner trough was improved which also improved the knowledge of the water circulation. The physical characteristics of sea ice, its thickness, drift, decay and the heat fluxes, was presented by Louise Biddle. The differences between winter and spring were discussed for the eastern Weddell Sea.

There were five talks in the biogeochemistry session. Mario Hoppema started with relationships between nutrients, CO2 and trace metals, i.e., Mn and Fe. The latter behave like nutrients, but in particular regions they do not appear to be limiting productivity, as generally assumed. Enrique Isla and Walter Geibert spoke about particle fluxes in the Weddell Gyre – of particular interest is the fact that despite the high productivity of the region, the organic matter flux to the seabed is one of the lowest (the lowest?) on Earth and we still don't know why. Agneta Fransson presented CO2 data collected during the summer 2019 Norwegian cruise (DML-Ecosystem) to the Kong Haakon VII Sea. Finally, Raquel Flynn presented productivity data from the 2019 Weddell Sea Expedition (Jan/Feb) to the Larsen C Ice Shelf – there appears to be a high degree of nutrient draw-down at stations closest to the ice, although there is considerable variability.

d. Poster (flash talks) session (60-70

participants)

Chaired by Louise Biddle

At the end of the day, we had a "poster" session with 10 posters contributed that represented all of the fields covered at the workshop. We had an overview of the Argo array (Klein/Donnelly) and a presentation of an observational strategy in the Weddell Sea (Gutt), discussions of sea ice and icebergs (Mata, Morioka and Aaboe), ice shelf processes (Sun and Lauber), biogeochemistry focuses on trace metals and the carbon sink (van Manen and Droste) and a report on the presence of ice-fishes in the Weddell Sea (Papetti) – a true broad sweep of the varied inputs we have in the working group. Discussions were short but good within the poster session, and there was some take up of the available Google Doc to interact with the poster presenters during the session and in the day(s) afterwards. The set-up of 3 minute flash talks and available "chat space" worked well to build interactions.

e. Friday 23 Oct 2020: BIO-sessions (~45 participants)

Chaired by Mia Wege and Julian Gutt

There were five talks in this biology session. Daniel Zitterbart spoke about using remote sensing to determine the health and foraging success of an Emperor Penguin colony, to potentially use it as an indicator of ecosystem health. Mia Wege showed how satellite images were used to model crabeater seal breeding habitat in the Weddell Sea, the first and largest of its kind. Both Zitterbart and Wege's talks shows that remote sensing has great promise to study remote, hard to access areas in the Southern Ocean, but it still needs a lot of ground-truthing and validation. Celine Le Bohec gave an overview of the MARE programme, whereby Emperor penguins are used as a sentinel species to monitor the health of Antarctic marine ecosystems. This places emphasis on the need of long-term studies in the Antarctic and Southern Ocean. Theoni Photopoulou represented diving data of Weddell Seals collected from CTD tags. She showed how Hidden Markov Models could be used to identify different behaviours between male and female Weddell seals. Both males and females make benthic and surface dives, but only female Weddell seals moved off the continental shelf and dived pelagically. Lastly, Tomas Marina presented a network approach to understand the connectivity and sensitivities in the Weddell Sea food web.

f. SOOS Data session

Pip Bricher, the SOOS data officer, led a discussion on SOOS data and information tools, most importantly SOOS-Map and DueSouth. SOOS Map provides curated Southern Ocean observations across many disciplines, and serves as a major data portal in support of scientific studies. Due South is an information portal designed to share national and international field efforts and projects within the Southern Ocean community.

g. Planned field experiments and updates

Chaired by Andrew Meijers

Short updates were provided from participants informing about their national field plans, and about Covid-related adjustments. Contributions included updates from the UK, South Africa, France, Sweden, USA, Norway and Germany. Ongoing and upcoming shipboard expeditions will be carried out to DML onboard the Malik Arktika organised by the Norwegian Polar Institute in December 2020-January 2021, and an international southern Weddell Sea expedition organised by the Alfred Wegener Institute onboard the RV Polarstern in February-March 2021.

Overall, the organisers were very satisfied with the level of interaction, participation, and scientific presentations and discussions throughout the workshop. Based on the feedback provided, the workshop was also well-received among the participants. The number of 50-70 participants during each day allowed for good discussions while maintaining a more familiar atmosphere. The workshop was hosted as a Webex-meeting, and provided a suitable framework without any major network or technical issues. The benefits of an in–person workshop were of course missing. Important interactions usually take place during coffee breaks and evening meals and drinks, which is often how collaborations and partnerships are fostered and strengthened. In post-pandemic times it will be desirable to host personal meetings again. However, on a positive note, online meetings save travel costs and resources, and allow for easier participation, and therefore contributed to the broad international participation with scientists from nearly all continents. It was agreed that a RWG-organised workshop such as this one is valuable to foster exchange within the community, and could therefore be held every ~1.5-2 years, perhaps in a flexible format that combines personal participation with remote attendance options.

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