Waves and surface current observations during the Antarctic Circumnavigation Expedition

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Southern Ocean:

- Regulates momentum, heat and gas exchanges between the atmosphere and ocean.
- Modulats the expansion of Antarctic sea ice in the winter and its retreat in summer and hence affecting the global albedo.

Mean spatial bias in wave height for the 2006 global hindcast (Zieger et al., 2015):





Locations of the NDBC Buoys



Locations of the in situ buoy sites in the Southern Ocean (Young et al., 2020):



Antarctic Circumnavigation Expedition (ACE) sailed Southern Ocean to acquire wave data



Antarctic Circumnavigation Expedition (ACE) Dec. 2016 – Mar. 2017





Wave, wind and surface current are measured using a \checkmark radar-based wave and surface current monitoring system (WaMoS-II) built on board of the research icebreaker Akademik Tryoshnikov both in the open ocean and Antarctic marginal ice zone.









 ✓ Preliminary data from
WaMoS showed ~60% offset from CAWCR hindcast!





 \checkmark Wave spectrum is estimated assuming ship as a big buoy.



✓ NEMOH, developed at Ecole Centrale de Nantes, is an open source boundary element method solver, used to model the RAO.





- ✓ The reconstructed sea state is validated against satellite data-sets from SAR and Altimeter.
- ✓ WaMoS-II observations are calibrated based on the reconstructed sea state.



Image from: Ribel & Young (2019)

Altimeter data from satellites:

- SENTINEL-3A,
- JASON-3,
- SARAL,
- HY-2,
- CRYOSAT, and
- JASON-2

SAR data from satellites:

- Sentinel-1A, and
- Sentinel-1B





 \checkmark WaMoS-II observations are calibrated based on the reconstructed sea state.





✓ Calibrated WaMoS-II observations are calibrated against satellite data-sets from Altimeter and SAR.





✓ WaMoS-II observations include:

□ Wave data:

- Hs
- Tp
- Tm
- Full directional spectrum, etc.



The data used in this study is published in the Australian Antarctic Data Centre and can be accessed via the link below. <u>https://data.aad.gov.au/metadata/records/AAS_4434_ACE_WAMOS</u>



The calibrated WaMoS-II observations validated against satellite data-sets



✓ WaMoS-II surface current observations are compared with Copernicus Globe Current data-set from altimetric geostrophic current and modelled







- \checkmark The interaction of waves with aerosol is under study in this region.
- ✓ The presented data-set underpin the set up, calibration and validation of a WaveWatch III wave model over a domain covering the Southern Hemisphere.

 ✓ Australian Antarctic Data Centre: https://data.aad.gov.au/metadata/records/AAS_4434_ACE_WAMOS



Image from: National Snow and Ice Data Centre



