

How Argo is transforming our understanding of the Southern Ocean in the global climate

Keep an eye out for: AWI-led 2025 Weddell Sea voyage, OCEAN:ICE

Key Topics:

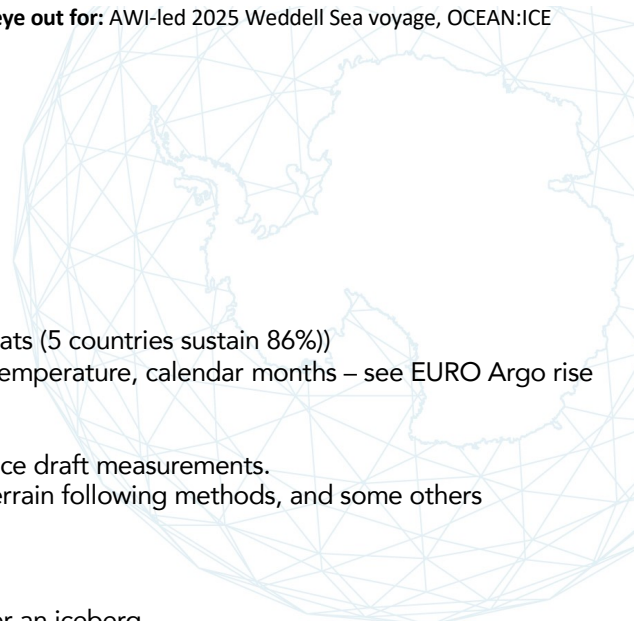
- Polar Argo: current state, highlights, advances and challenges & Deep Argo
- Uses of Argo Intentionally-grounded float (a.k.a 'muddy' floats)
- Sea ice formation and melt rates estimate from under ice Argo
- Drivers of Winter Water
- Poleward Shift of Circumpolar Deep Water
- An updates Gravest Empirical Model climatology – for the Southern Ocean
- Insights into Southern Ocean eddies from historical observations

Main Developments:

- Polar Argo: is really Core Argo that now extends into the Poles (252 active, target is 378; 12 countries deploy floats (5 countries sustain 86%))
 - AWI came up with an algorithm that helps Argo avoid ice, allows them to go under ice now (uses critical temperature, calendar months – see EURO Argo rise report). Also ice guards such as the egg-beater attached to top of Argo float.
 - Most floats last about 4 years, but there is one that has reaches 11 years.
 - Under-ice Argo data is an up and coming data set – can let you know what is going on in the wintertime, ice draft measurements.
 - To locate them under-ice you can use a nearby moored array of acoustic receivers, or geolocation using terrain following methods, and some others
 - More Polar Argo activities ASFAR mooring Frame, ARcticGO, REFINE/TAKUVIK projects.
- Intentionally-grounded float (a.k.a 'muddy' floats)
 - For these floats, the parking depth is set to a fixed level (e.g. 2000 -> 800 m).
 - Discoveries: Dense water observed on the west of the Ronne-Filchner and super-cooled water found under an iceberg.
- Deep Argo:
 - Year-round full-depth (0-6000 m) profiles of temperature and salinity. They are ice capable as well.
 - Most of these floats are currently focused in basin-scale pilot arrays.
 - Seasonality of AABW: basin wide very small signals (10^{-3} psu and 0.01 deg. C), if you only look close to the continental shelf the seasonal change is bigger; two pulse signal seen in deep Argo matches that seen in moorings upstream
- Using floats the calculate the salinity budget suggests average annual net sea ice productions is about 1 m near the coast and -1 m at 59S.
- Snow that falls on sea ice can settle or cause snow loss overall, a bit counter-intuitive but due to high winds.
- Antarctic Winter Water has largescale spatial and temporal variability, it is largely governed by geostrophy, implication is to move away from considering it in a zonal sense.
- Satellite GEM: the surface ocean is very well observed, and you can map patterns of T and S, with their SSH signature, then make a climatology of those data.

Open Questions/Future Directions:

- SOCCOM and Argo-BGC are coming up for renewal – critical that these programs get renewed.
- Continuing work in ice-guards and a need to share information about failures as well as successes.
- Getting mixing rates from Deep-Argo.
- Constrain magnitude of loss processes for snow on ice.
- Continued monitoring of offshore changes, to see how that impact the East Antarctica ice shelf (potential to shift toward West Antarctic situation).
- Use updated GEM to extend to BGC data, look at time trends



Day 3: Morning