EGU22-10528
https://doi.org/10.5194/egusphere-egu22-10528
EGU General Assembly 2022

Unsupervised classification identifies coherent thermohaline structures in the Weddell Gyre

Dan(i) Jones[1], Maike Sonnewald[2,3,4], Isabella Rosso[5,6], Shenjie Zhou[1], and Lars Boehme[7]
[1]British Antarctic Survey, NERC, UKRI, Cambridge, UK (dannes@bas.ac.uk)
[2]Atmospheric and Oceanic Sciences, Princeton University, Princeton, NJ, USA
[3]Oceans and Cryosphere Division, Geophysical Fluid Dynamics Laboratory, Princeton, NJ, USA
[4]School of Oceanography, University of Washington, Seattle, WA, USA
[5]Scripps Institution of Oceanography, UCSD, San Diego, CA, USA
[6]GeoOptics Switzerland SA, Lausanne, Switzerland
[7]SMRU, University of St Andrews, UK

The Weddell Gyre is a dominant feature of the Southern Ocean and an important component of the climate system; it regulates air-sea exchanges, controls the formation of deep and bottom water, and hosts upwelling of relatively warm subsurface waters. It is characterized by extremely low sea surface temperatures, active sea ice formation, and widespread salt stratification that stabilizes the water column. Studying the Weddell Gyre is difficult, as it is extremely remote and largely covered with sea ice; at present, it is one of the most poorly-sampled regions of the global ocean, highlighting the need to extract as much value as possible from existing observations. Thanks to recent efforts of the EU SO-CHIC project, much of the existing Weddell Gyre data, including ship-based CTD, seal tag, and Argo float profiles, has been assembled into a coherent framework, enabling new comprehensive studies. Here, we apply unsupervised classification techniques (e.g. Gaussian Mixture Modeling) to the new comprehensive Weddell Gyre dataset to look for coherent regimes in temperature and salinity. We find that, despite not being given any latitude or longitude information, unsupervised classification algorithms identify spatially coherent thermohaline domains. The highlighted features include the Antarctic Circumpolar Current, the central Weddell Gyre, and the Weddell-Scotia confluence waters; we also find potential signatures of the inflow of Weddell Deep Water, the intrusion of Circumpolar Deep Water into the gyre, and export pathways of Antarctic Bottom Water. We show how varying the statistical, machine learning derived representations of the data can reveal different physical structures and circulation pathways that are relevant to the delivery of relatively warm waters to the higher-latitude seas and their associated ice shelves.