DENSE WATER FORMATION

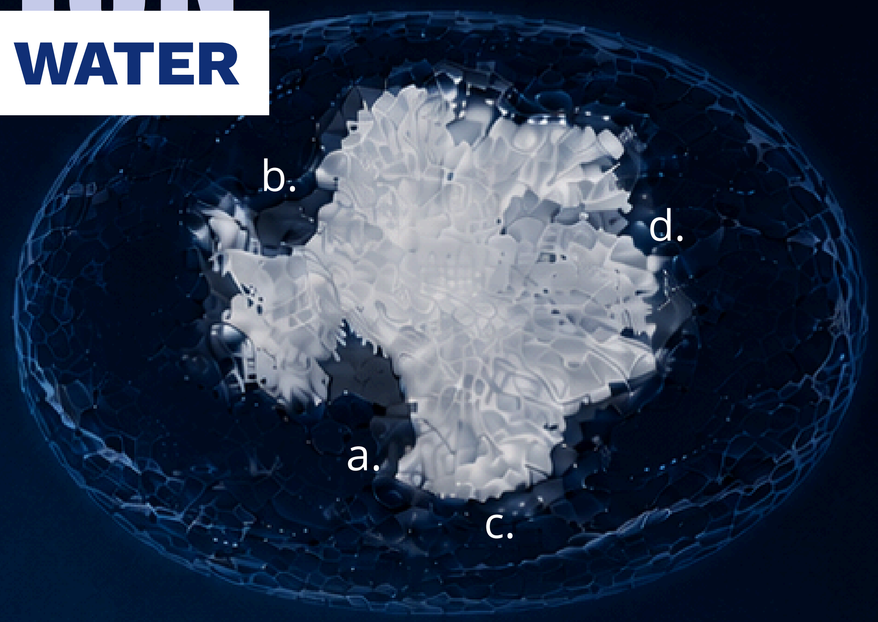
ANTARCTIC BOTTOM WATER

1. Introduction

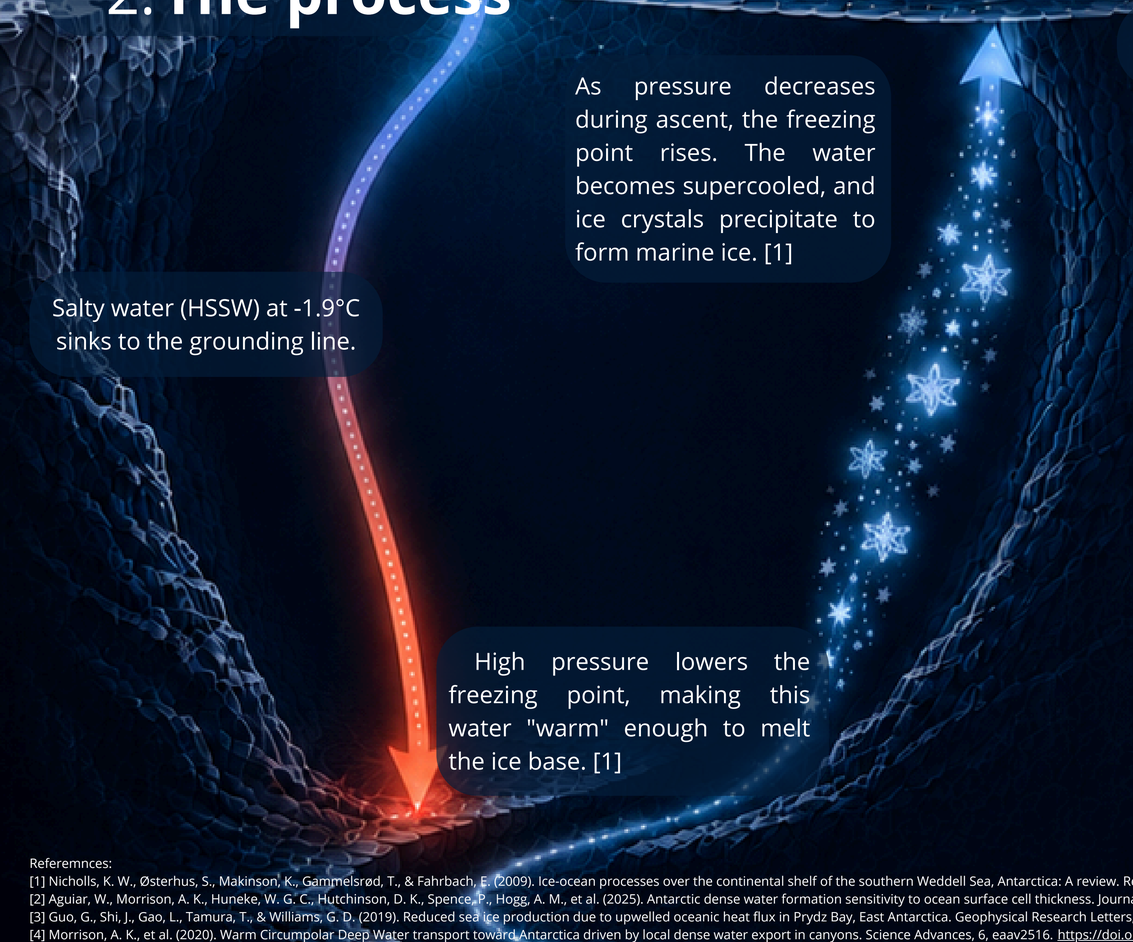
The Weddell Sea is key for global thermohaline circulation, being the place with the largest share of Antarctic Bottom Water (AABW) production. This poster explores the process and different mechanisms, where it happens, its importance and threat in the future and today.

3. Origins

a. Ross Sea
b. Weddell Sea
c. Adelie Coast
d. Prydz Bay
[2]



2. The process



4. Global relevance

Thermohaline circulation [4]

- Drives global overturning circulation
- Connects polar and tropical oceans
- Influences climate patterns

Oxygen Transportation

- Ventilates deep ocean basins
- Sustains abyssal ecosystems
- Enables deep-sea respiration

Long term carbon sequestration

- Stores dissolved CO_2 in deep waters
- Carbon retained for centuries
- Helps regulate atmospheric CO_2

Heat distribution and climate system regulation [4]

- Redistributes ocean heat globally
- Buffers regional climate extremes
- Influences sea ice formation

5. Threats

Surface freshening [3]

- Increased glacial meltwater input
- Lowers surface salinity
- Reduces water density

Reduced dense water formation [3]

- Weakens bottom water production
- Slows abyssal circulation
- Limits deep ocean ventilation

Referemnces:
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[2] Aguiar, W., Morrison, A. K., Huneke, W. G. C., Hutchinson, D. K., Spence, P., Hogg, A. M., et al. (2025). Antarctic dense water formation sensitivity to ocean surface cell thickness. Journal of Advances in Modeling Earth Systems, 17, e2024MS004913. https://doi.org/10.1029/2024MS004913
[3] Guo, G., Shi, J., Gao, L., Tamura, T., & Williams, G. D. (2019). Reduced sea ice production due to upwelled oceanic heat flux in Prydz Bay, East Antarctica. Geophysical Research Letters, 46, 4782–4789. https://doi.org/10.1029/2018GL081463
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[5] Shadwick, E. H., B.Tilbrook, and G. D.Williams (2014), Carbonate chemistry in the Mertz Polynya (East Antarctica): Biological and physical modification of dense water outflows and the export of anthropogenic CO2, J. Geophys. Res. Oceans, 119, 1–14, https://doi:10.1002/2013JC009286.

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