

EGU22-9990

<https://doi.org/10.5194/egusphere-egu22-9990>

EGU General Assembly 2022

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How does the Weddell Gyre circulation influence long-term trends in nutrient concentrations?

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The large-scale mean horizontal circulation of the Weddell Gyre was determined solely from Argo floats drifting throughout the gyre since 2002. The circulation describes an elongated, double-celled gyre, where the eastern sub-gyre is stronger and subject to mesoscale variability in comparison to the considerably weaker western sub-gyre. Since positive long-term nutrient trends across the western sub-gyre have been associated with an increase in upwelling, this study aims to compare long-term nutrient trends in the western sub-gyre, from Kapp Norvegia to Joineville Island, to those along the Prime Meridian section, spanning the eastern sub-gyre. We find the strongest trends in surface Silicate in the central part of the western sub-gyre, where the horizontal circulation is weakest. Across the eastern sub-gyre, along the Prime Meridian, the strongest Silicate trends occur in the westward flowing southern limb, south of Maud Rise. This suggests that there are different dynamical causes of the nutrient trends in the east versus the west, since the strongest upwelling at the Prime Meridian occurs north of Maud Rise, where some of the lowest long term trends in nutrients were observed. We hypothesise that while increased upwelling may be the cause of positive long-term nutrient trends in the western Weddell Gyre, mesoscale variability and convection associated with Maud Rise in the eastern Weddell Gyre have a larger impact on nutrient concentrations, making long-term trends more challenging to extract.