

EGU21-12801, updated on 16 Jun 2021  
<https://doi.org/10.5194/egusphere-egu21-12801>  
EGU General Assembly 2021  
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## Using the depth of the centre of gravity as an indicator on the state of the general ocean circulation

**Benjamin Schmiedel** and Fabien Roquet

University of Gothenburg, Marine Science, Gothenburg, Sweden

An approach is here investigated that uses the depth of the centre of gravity as a central ocean property, thought to give a clear and practical indicator on the state of the general ocean circulation. The depth of the gravity centre can be directly linked to the volume-integral of potential energy, or of dynamic enthalpy when making the Boussinesq approximation, and therefore to the strength of the global mean stratification. Because the stratification is directly linked to the global overturning circulation, it is hypothesized that the depth of the centre of gravity can be used to assess the state of global circulation. In order to test this hypothesis, the depth of the centre of gravity is diagnosed in an ocean model simulation for an idealized square basin configuration with the NEMO model. The centre of gravity is compared to the value it would have if the ocean was perfectly well mixed, giving a state of maximum potential energy. We find in our idealized simulation that the centre of gravity is lowered by only 22 cm compared to the reference well-mixed state, reflecting the potential energy that would be required to destroy the ocean stratification. The smallness of that number highlights the inefficiency of the ocean engine. Furthermore, the dynamic balance setting the depth of the gravity centre is investigated, diagnosing separately the tendency terms on the equation of conservation of potential energy. A positive change (sinking) of the centre of gravity indicates an input of high density water into lower levels or low density water in upper levels, essentially enhancing the global mean stratification, while for a negative change (lifting) it is reversed. The goal is to compare the relative role of the wind stress, surface buoyancy forcing and internal mixing in setting the general circulation.