Influence of seasonal variability on Zn cycling in OGCMs with different spatial resolutions

C.EISENRING[1*], G.F. DE SOUZA[1], S. KHATIWALA[2], D.VANCE[1]

[1] Institute of Geochemistry and Petrology, Departement of Earth Sciences, ETH Zurich, Switzerland (*correspondence: claudia.eisenring@erdw.ethz.ch)

[2] Departement of Earth Sciences, University of Oxford, UK

With the GEOTRACES-driven increase in data availability, the marine Zn cycle has received more attention in the last few years. While several modelling studies have been performed to gain a deeper understanding of the global oceanic Zn distribution, to date the potential influence of seasonal variability in ocean circulation and Zn uptake by phytoplankton has been neglected [1-4]. Here, we present the results of a detailed comparison of four modelling approaches in which the influence of these two modes of seasonal variability on Zn cycling are considered both separately and in combination. We also examine the influence of the spatial resolution of the underlying ocean general circulation model (OGCM). Our goal is to assess some basic assumptions commonly made in models of marine Zn cycling.

Simulations are carried out using the transport matrix method [5]. Transport matrices (TMs) derived from the ocean state estimate ECCO (1° x 1° lateral resolution; 23 vertical levels), are either annually or monthly averaged. In the biogeochemical model, the biological uptake of Zn in the surface ocean is directly related to that of PO_4 [3]. The uptake of PO_4 in the surface ocean is driven by restoring concentrations towards (either monthly- or annually-averaged) observations from World Ocean Atlas 2013 [6]. For the assessment of the effect on the global oceanic Zn distribution resulting from changes in spatial resolution of the underlying OGCMs, we compare the results to those obtained by de Souza et al. [3], who used TMs from the coarser-resolution MITgcm2p8 (2.8° x 2.8° lateral resolution; 15 vertical levels). To further assess the dependence of our results on physical circulation models, we will extend our analysis by including simulations using TMs derived from the UVic Earth System Climate Model [7].

[1] Roshan *et al.* (2018) *Global Biogeochemical Cycles*, **32**, 1833–1849. [2] Weber *et al.* (2018) *Science*, **361**, 72–76. [3] de Souza *et al.* (2018) *EPSL,* **9**, 51-69. [4] Vance *et al.* (2017) *Nature Geosci.*, **10**, 202–206. [5] Khatiwala *et al.* (2005) *Ocean Model.* **9**, 51-69. [6] Garcia *et al.* (2013) *NOAA Atlas NESDIS* **76**. [7] Kvale *et al.* (2017), *Geosci. Model Dev.*, **10**, 2425-2445.