Ocean acidification: The effect on trace metal speciation evaluated with WHAM/Model VII

A. STOCKDALE[1]*, E. TIPPING[2], S. LOFTS[2] AND R. J. G. MORTIMER[3]

[1]School of Earth and Environment, University of Leeds, Leeds, UK

[2]Centre for Ecology and Hydrology, Lancaster Environment Centre, Lancaster, UK

[3]School of Animal, Rural and Environmental Sciences, Nottingham Trent University, Nottingham, UK

*Correspondence: tony@biogeochemistry.org.uk

It has been recognised that continuing carbon emissions and the resulting changes to carbonate chemistry and acidification of the oceans will affect the chemical speciation of trace metals, many of which are essential nutrients for marine biota. This study quantitatively assesses the resulting changes in chemical speciation of both organically complexed (dissolved organic matter, DOM) and inorganic species. We used a model widely applied for assessing trace metal speciation in freshwater environments, WHAM/Model VII, under the assumption that DOM binding properties in marine waters are analogous to those in terrestrial environments.

Using fixed values for average metal (Fe, Al, Co, Ni, Cu, Zn, Cd and Pb) and DOM concentrations for the Atlantic Ocean and IPCC projections of ocean pH and pCO_2 under 4 Representative Concentration Pathways (RCPs) scenarios we calculated how speciation may evolve over time. Figure 1 shows the evolution of the iron free ion concentration up to the year 2100, showing that higher CO_2 emissions and thus decreasing pH will increase free Fe(III) activities.

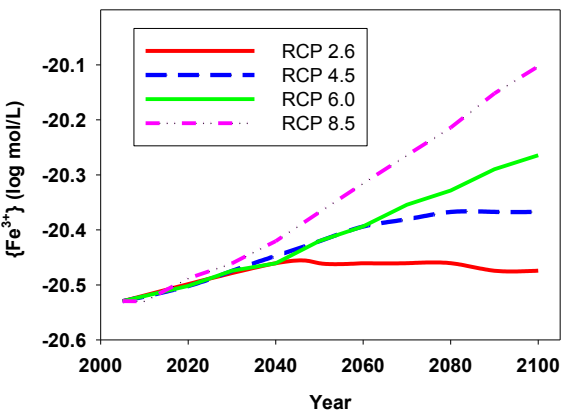

Figure 1. Calculated Fe(III) free ion concentrations under the evolving pH and pCO_2 conditions predicted by the IPCC under four different emissions scenarios.