



Sensitivity of pelagic CaCO_3 dissolution to ocean acidification in an ocean biogeochemical model

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In ocean biogeochemical models pelagic CaCO_3 dissolution is usually calculated as $R=k \cdot S^n$, where k is the dissolution rate constant transforming S , the degree of (under-) saturation of seawater with respect to CaCO_3 , into a time dependent rate R , and n is the reaction rate order. Generally, there are two ways to define the saturation state of seawater with respect to CaCO_3 : (1) ΔCO_3^{2-} , which reflects the difference between the in-situ carbonate ion concentration and the saturation concentration, and (2) Ω , which is approximated by the ratio of in-situ carbonate ion concentration over the saturation concentration. Although describing the same phenomenon, the deviation from equilibrium, both expressions are not equally applicable for the calculation of CaCO_3 dissolution in the ocean across pressure gradients, as they differ in their sensitivity to ocean acidification (change of CO_3^{2-}) over depth. In the present study we use a marine biogeochemical model to test the sensitivity of pelagic CaCO_3 dissolution to ocean acidification (1-4x CO_2 + stabilization), exploring the possible parameter space for CaCO_3 dissolution kinetics as given in the literature. We find that at the millennial time scale the resulting reduction in CaCO_3 export ranges from two to more than ten percent, which means that there are significant differences in the impact on particle ballasting, depending on the kinetic expression applied.