

***Interactive comment on* “Dissolution of calcium carbonate: observations and model results in the North Atlantic” by K. Friis et al.**

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Review of “Dissolution of calcium carbonate: observations and model results in the North Atlantic” by Friis, et al.

This paper address a relevant scientific question within the scope of Biogeosciences Discussions and presents a novel concept of presenting a large data set from the Northern Atlantic within the topic of dissolution of calcium carbonate in the water column. The authors makes a strong case from the measured data that limited water column dissolution of calcium carbonate occurs above the saturation horizons in this oceanic region. However when it comes to how much “proof” the model adds to the conclusions based on the measured data I am more sceptic. More on that below. I largely agree with the comments by Are Olsen and will not repeat his comments, but

focus on additional issues. Page 1717, line 10. What does “ \bar{E} to be a measure of the potential carbonate of lime \bar{E} ” mean? Page 1720, line 6. The alkalinity concentration at $S=0$ is given with one decimal. For the region investigated I am sure that alkalinity concentration of runoff and sea ice melt varies between close to zero and up to over 1000 $\mu\text{mol/kg}$. This variability could impact some of the interpretation of the data, mainly by increasing the scatter in for instance fig 3b. Anyway the used concentration should not be given with so many significant digits. Page 1721, line 14. The model balance the buried carbonate particles by a source of alkalinity in the surface water. How does this impact the model dissolution state of the water column? Page 1725, line 26. That the model excess alkalinity is much greater than the observations is explained by that the deep water ventilation is too low. This must be a critical factor in the computation of the SDCCD. It is stated on line 5 of the following page that the transport of TA^* from below is not important. How is this affected by changes in the ventilation rate? A further aspect that is not discussed in this paper is the possible contribution of sediment - water interaction on alkalinity. Even if the measured data are in the water column there could be contribution from the sediment through isopycnal mixing. In a large basin like the North Atlantic this is likely not a major issue, but in my mind it should be mentioned.

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