Dear Reviewer #2

Reply to your comments of June 9 (os-2020-19-RC2.pdf)

General comments: This clearly-written article is based on a sound analysis of GLODAPv2 and SOCAT data that reveals large discrepancies between the temperature and salinity dependence of published carbonic acid stoichiometric dissociation constants and relationships estimated from available data. These discrepancies are particularly extreme at cold temperatures and thus have enormous implications for understanding of carbon cycling and ocean acidification in high latitude ocean regions. This study further suggests that the uncertainty for carbonic acid dissociation constants at cold temperatures is more substantial than previous studies indicate and that the potential for bias in estimation of pCO2 from other carbonate system parameters is not well constrained. The factors that contribute to the inconsistencies between studies are beyond the scope of the study and highlight a need for future studies based on contemporaneous in situ measurements of all four carbonate system parameters as well as laboratory studies.

We thank you for your time and for this review, and we agree that our work indicates the need for further measurements to reduce the uncertainty in the carbonic acid stoichiometric dissociation constants. We would be glad to respond to any further questions and comments that you may have.

Sincerely,

Olivier Sulpis, Siv K. Lauvset and Mathilde Hagens

June 9, 2020