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Comment

Interactive comment on “Comparing solubility algorithms of greenhouse gases in Earth-System modelling” by V. M. N. C. S. Vieira et al.

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As this work demonstrated, accurate solubility estimates are fundamental for accurate Earth-System modelling of greenhouse gas in the oceans, its exchange with the atmosphere and thus its impact in climate change. Consequently, they are also fundamental for the specialized scientific community to produced information useful to society. There are not any previous works addressing these issues and there impacts in Earth-System Modelling.

This article stands on its own and can well be published even in the absence of its companion. This article also has an introduction, methods and results. Therefore, merging both would result in a gigantic article deterring potential readers.

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Considering each pixel in Figures 1-3 corresponds to roughly 121Km² and that there are 41776 pixels, the modelled area is roughly 5054896 Km². This value was inserted in the text. It took us great effort to arrive at the mass balance estimates. These cannot be roughly approximated in the absence of all required information and thus we provided all information to substantiate how we did it. The algorithms were applied exactly as in their references, making use of the Henry's law coefficient in its several forms as their authors determined i.e, in mol/l/atm, in atm*l/mol and in its scalar form. (see Sander 1999, Johnson 2010, Weiss 1974, Weis and Price 1980, Sarmiento and Gruber 2013). The terminology was applied as presented in these references as well as in the tens of literature on the subject. The scalar Henry's law coefficient was already presented in Sander 1999, Johnson 2010 and Vieira et al 2013, among other published works, all subject to rigorous reviews. It is not equal to the Ostwald coefficient but its inverse.

The basic gas exchange formula was applied in two alternative, yet equivalent, formulations depending on the units the gas concentrations were provided (see the first paragraph of the introduction). The first was implemented as in Liss and Slater (1974) and Johnson (2010). The second was implemented as in previous works by researchers as the own reviewer Dr Wanninkhof or Drs Fairall, Frankignoulle, Grachev, Goddard, Jähne, McGillis, Smedman, Wolf, Zappa, Zhang, Zhao, to name a few. Preliminary tests demonstrated both formulations always matched. Since our data provided concentrations in partial pressure, we used the second formulation for the calculus.

We never say solubility affects the gas transfer velocity. But it does affect its estimates from field measurements using eddy-covariance methods. This is one of the topics addressed and we made it clear. A mistake meanwhile rectified in Figure 4 caption does not make the article confusing.

We are revising grammar and syntax, include an explanation to k₆₀₀ and change Figure 4 caption as the reviewer suggested.

BGD

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