Interactive comment on “An upgraded carbon-based method to estimate the anthropogenic fraction of dissolved CO₂ in the Atlantic Ocean” by M. Vázquez-Rodríguez et al.

Anonymous Referee #1

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Since I have not done the actual computations of anthropogenic CO₂ inventory in the water column using the “back-calculation” techniques, I found this to be a real interesting article with good review of what have been done in the past and what are the problems that cause the uncertainties in the estimates of anthropogenic CO₂ content. I think it is a good idea to get better estimates of preformed properties from data obtained below the surface mixed layer for the improvement of anthropogenic CO₂ estimates. The choice of the subsurface depth should vary as a function of ocean basins and latitudinal zones because of various mixed layer depth and the mechanism of deep water mass formation. Is 100-200m depth used in this article for the whole east basin of Atlantic? There are a lot of detailed efforts in dealing with problematic Cdis term in
the “back-calculation” method (more appropriate reviewers should be people who have
done the actual calculations, such as Sabine, Gruber, Lee and Matsumoto etc.) I was
expecting that the uncertainty would be cut way down after this new method is applied.
However, I got the impression that the Cant uncertainty using this improved method is
near 5 umol/kg on average, which is also the general uncertainty from previous com-
puting methods. For example, Lee et al. (2003) had 6 umol/kg, which is almost the
same. In the end, the comparison of results from this improved method with those
from previous computations, as shown in Fig. 6, indicates that they are all very similar
except in the Nordic Seas and the Southern Ocean. In the northern hemisphere, the
Cant inventory began to drop off north about 50N. All three estimates have a similar
trend, except this method maintains high value further north. In the Southern Ocean,
it really makes a big difference south of about 50S. This feature is a direct result from
the new treatment of Cdis in this study. I am not sure if previous C* results were de-
ferred from l06 cruise data which are used for this study. Does the availability of new
data have anything to do with the difference shown in Fig. 6. If not, this improved C*
method could provide fresh information for other sections of Southern Ocean regarding
its capacity to store more anthropogenic CO2. I also noticed that the discussion of this
article is only limited to Eastern Basin of the Atlantic Ocean. Since the ocean dynamics
in Western Basin is very different from the Eastern Basin, it would be very interesting
for these authors to make the same calculations in the Western Basin for comparison
with the previous results. Although the ratio of Cant inventory between east and west
is used to estimate the Atlantic total inventory, it would be much more convincing if the
actual calculated results from the western basin are used. The other question is about
the applicability of this improved method beyond Atlantic Ocean. Can it be used for the
Pacific and Indian oceans? The future further improvements as listed in the conclusion
are great, but it would be more desirable to test the current method outside of Atlantic
Ocean.

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