Biogeosciences Discuss., 12, C5553–C5556, 2015
www.biogeosciences-discuss.net/12/C5553/2015/

Biogeosciences Discussions
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Interactive comment on "Calculating the global contribution of coralline algae to carbon burial" *by* L. H. van der Heijden and N. A. Kamenos

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Received and published: 21 September 2015

We would like to thank Prof. Gattuso for his constructive, in depth, comments. They will significantly improve our manuscript and we will include them in the edited version.

van der Heijden and Kamenos have done an impressive compilation of data from the literature and report on the distribution, surface area covered, primary production and calcification of coralline algae. This is not a formal review, I would just like to highlight a few issues and provide suggestions that the authors might find useful.

1. A major problem is the considerable uncertainty regarding the definition of key parameters. - "Carbon burial" is not defined, and I think misused. It is the amount of organic carbon that is exported to the bottom and escapes remineralization in the

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water column and sediment. It is therefore the amount of carbon preserved in the sediment. This process is not really looked into in the manuscript. Five rates of CaCO3 accumulation are given in Table 5 but the amount of organic carbon buried is not reported. We will add a clear definition of carbon burial in the revised paper. In this case, we shall clarify that we are discussing carbon accumulation. We will also reword and expand the section which discusses that little available organic carbon data h available for coralline algal deposits.

- "Primary production": is also not defined and the term used loosely. It is absolutely critical to mention whether rates of gross or net primary production are discussed. This issue may explain the quite surprising conclusion that "Coralline algae therefore have production rates similar to mangroves, saltmarshes and seagrasses". We will add a clear definition of primary production in the revised paper. In addition, we will add detailed discussion on our calculations being net primary production as nearly all of the available source data are only endpoint production rather than compartmentalized gross production.

- "Calcification": it is also not mentioned whether net of gross calcification is reported. I suspect that Table 4 mixes both. We will add a clear definition of calcification in the revised paper. In addition, we will add detailed discussion on our calculations being net calcification as most of the available source data are only endpoint carbonate production rather than compartmentalized gross calcite production. All carbonate production rates discussed, with the exception of the data from Hart and Kench, 2006, are based on net carbonate production rates.

- "Carbon storage": even though it is acknowledged that calcification is a source of CO2, statements such as "coralline algae have a significant capacity to store carbon" or "Using this potential carbon storage by coralline algae, the global production of free-living algae/CCA was ... suggesting a total potential carbon sink of ..." are misleading. I would suggest that a proper CO2 balance is made, taking into consideration all processes involved (gross primary production, respiration, gross calcification, dissolution)

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is order to defined the sink/source behavior in terms of C and CO2. The approach of Gattuso et al. (1995) might be useful. This is an excellent suggestion and is something we wished to do. However, at a global scale there is a paucity of the gross data preventing us from doing this. This is certainly the next step that is needed to quantify the C sink/storage of coralline algae.

2. Section 5 “Future prospects: ocean acidification and rising temperature” is very succinct and does not assess the most recent papers. It could better reflect the current knowledge. We will update this section and add more recently published articles that reflect the current knowledge. These will include specific papers cited in the recent review on the impact of global change on coralline algae by McCoy and Kamenos 2015 in J Phycol as well as Diaz-Pulido et al. 2014, Nat Com & Short et al. Est. Coast Shelf Sea Sci 2015.

3. Section 6 “Conclusions” - “Reduction of CO2 to a sustainable level is required to avoid further environmental damage and various solutions have already been proposed.” Is vague and it is not clear which solutions are being referred to. We will change this sentence to: “Reduction of CO2 to a sustainable level is required to avoid further environmental damage” in the revised version.

- Calculations should be refined as part of this paper by qualifying the terms used and ascertaining that the aggregated numbers are correct. We will add clear definitions of the terms used in the revised version.

4. Other comments - 7852/9: “The total surface area of the coastal zone, thus the potential habitat for benthic coralline algae, is estimated between...”. That is incorrect because it includes a lot of soft-bottoms, very little of which is a proper habitat for coralline algae. Prof. Gattuso is correct, not all substrata are suitable for coralline algal growth. We will clarify this further in our wording to specify that our estimates are based on the currently known distribution of coralline algae which tend not to grow on soft substrata. That estimate already includes an adjustment (both depth (33% of coastal

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zone) and space (50% of the 33%) restriction) allowing for the limited distribution of corallines. In some cases distributions approach 100% of space as on the east coast of Brazil from 2°N to 25°S, however, in many cases distribution reports are vague in the literature and will often be less than 100%. Given the available data at present, we feel our approach is a reasonable estimation of their distribution to allow the first global estimates of carbon storage.

- 7852/10: are 6 citations really useful here? We will reduce the citations to the most pertinent, those of Charpy-Robaud and Sournia, 1990.

- 7856/9: word missing: We will include “production” between “primary” and “of” in the revised paper.

- 7856/11: space missing: We will edit as suggested.

- If the paper is accepted, I recommend that the supplementary tables are provided in a numeric format. We will present the supplementary table 2 in a numeric format to aid the reader.

Interactive comment on Biogeosciences Discuss., 12, 7845, 2015.