**Revised paper point-by-point track of changes**

Dear editor, thank you for the opportunity to revise our manuscript. The suggestions made by the reviewers have helped improve the manuscript and we have included nearly all of them. The changes in the revised manuscript itself are highlighted in yellow and below we give a point-by-point review of the changes made. The page and line number are indicated for the revised document. The page and line number in between brackets are the ones from the original pdf manuscript.

Anonymous #1

*P2/L24 (P7847, L16): Please clarify what 2 % refers to.*

We have clarified this in the revised paper by adding "(cover < 2% of ocean surface)".

*P5/L5 (P7850, L10): Delete dash (-):*

The dash has been deleted in the revised paper.

*P6/L26 (P7852, L15): Change "smaller" for "shallower":*

"Smaller" has been changed to "shallower" in the revised paper.

*P6/L27 (P7852, L16): insert (,) after coastal zone:*

The comma has been inserted as suggested.

*P6/L27 (P7852, L16): delete "of":*

"Of" has been deleted in the revised paper.

*P8/L11 (P7854, L10): Delete dash (-):*

Dash (in L11) has been deleted in the revised paper.

*P10/L2-3 (P7856, L7): change "world's ocean" to "the world's oceans":*

The wording has been changed to "the world's oceans" in the revised paper.

Comments from J.-P. Gattuso

*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 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 have clarified this by rewording some sections. The rewording usually involves the addition of the word "total" where we are referring to both the organic and the inorganic components.

P1/L2 (P7845/L2): We added "total" to the title making it "...total carbon burial".

P3/L19 (P7848/L14): We added "total" to the sentence making it "… in long-term total carbon burial".

P6/L18 (P7852/L5): We added "total" to the title of section 4 making it "..to total carbon burial".

P9/L1 (P7855/L7): We added "total" to the sentence making it "… the potential total carbon burial is…".

P9L2-4 (P7855/L9): We added "total" twice to the sentence making it "The estimated potential total burial for the….. giving a potential total carbon burial of…".

*"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 have clarified this by adding a detailed description of our calculations being net primary production as all production rates discussed are net primary production rates.

P1/L21 (P7846/L13): We have added "net" to the revised paper making it "Net organic and inorganic production.."

P7/L10 (P7853/L4): We have added "net" to the revised paper making it "Net primary production.."

P8/L14 (P7854/L16): We have added "net" to the revised paper making it ".. and net organic production of.."

P10/L4 (P7856/L9): We have added "net" to the revised paper making it ".. to have a global average net primary production of.."

P28/L1 (P7870/L1): table 1 caption; We have added "net" to the revised paper in the caption making it "Table 1. Net primary production.."

*"Calcification": it is also not mentioned whether net of gross calcification is reported. I suspect that Table 4 mixes both.*

We have clarified this by adding a detailed description of 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 are based on net carbonate production rates (except for Hart and Kench, 2006 which we have removed; see below).

P7/L30 (P7853/L26): We have added "net" to the revised paper making it "The global net calcium carbonation production.."

P8/L11 (P7854/L13): We have changed "an" to "a net" to the revised paper making it "..CCA a net inorganic production was..."

P8/L12 (P7854/L14): We have added "net" to the revised paper making it "The net inorganic production for ..."

P8/L13 (P7854/L15): We have added "net" to the revised paper making it "Thus net inorganic production ..."

P10/L8 (P7856/L10): We have added "net" to the revised paper making it ".. which corresponds to a net inorganic production of..."

P34/L1 (P7873/L1): table 4 caption; We have added "net" to the revised paper in the caption making it "Table 4. Median net calcium carbonate production by.."

For consistency we have removed Hart and Kench (2006) from the table and the reference list to keep all the information net. Therefore some quantification has changed by a very small amount as well in the MS. This does not affect any of the discussion or paper outcomes.

P1/L22 (P7846/L14): "880 g CaCO" becomes "900 g CaCO".

P7/L29 (P7853/L25): "880 g CaCO" becomes "900 g CaCO".

P7/L31 (P7854/L2): "880 g CaCO" becomes "900 g CaCO".

P8/L13 (P7854/L15): "147 g C-inorganic" becomes "150 g C-inorganic".

P8/L14 (P7854/L16): "105 g C-inorganic" becomes "108 g C-inorganic".

P8/L15 (P7854/L17): "of 0.32 (PIC.." becomes "of 0.33 (PIC .."

P34/table 4 (P7873/table 4): Hart and Kench and the whole line is removed from table 4.
P17/L21-22 (P7862/L21): Hart and Kench, 2006 is removed from the reference list.

*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 have updated this section and added some more recently published articles that reflect the current knowledge.
P9/L6 – P9/L32: This section now reads:
*" Increasing atmospheric $pCO_2$ will increase DIC and shift the equilibrium of the carbonate system to higher $CO_2$ and bicarbonate ion-levels, lower carbonate ion concentration and lower pH (Feely et al., 2009). Coralline algae may be vulnerable to the warming and lowering sea water pH of sea water, caused by recent increases in anthropogenic $CO_2$ (Kleypas et al., 2006); the sensitivity of algae is of widespread importance and it has generated several recent reviews which find coralline algae may show mixed response to global change. For example, high $pCO_2$ conditions negatively affect community growth (Jokiel et al., 2008; Hofmann et al., 2012; Ragazzola et al., 2012), recruitment (Kuffner et al., 2008), calcification (Anthony et al., 2008; Gao and Zheng, 2010) size and abundance (Kuffner et al., 2008; Hall-Spencer et al., 2008; Porzio et al., 2011; Kroeker et al., 2013; McCoy and Ragazzola, 2014; Donnarumma et al., 2014) as well as epithelial integrity (Burdett et al., 2012). Conversely, increased atmospheric $pCO_2$ is expected to have a positive impact on the organic production and growth of algae due to increased $pCO_2$ availability (Hendriks et al., 2010). For example, Semesi et al. (2009) observed an increase in photosynthetic rates of coralline algae with a rising $pCO_2$ of seawater, however, whether this also translates to their accretion at longer time scales is still not clear.*

*The high-Mg calcite (HMC) cell-walls of coralline algae, containing 7.7-28.8 % $MgCO_3$, play a crucial role in their response to the risen temperature and acidification of seawater (Basso, 2012; Kamenos et al., 2013). Biogenic HMC cell-walls, containing > 8 – 12 % $MgCO_3$, have a high solubility and sensitive response to ocean acidification (Andersson et al., 2008). Despite this, there is evidence that they can continue to calcify in elevated $pCO_2$ (Kamenos et al., 2013; Martin et al., 2013b; Diaz-Pulido, 2014) but with altered skeletal integrity (Ragazzola et al., 2012; Kamenos et al., 2013; McCoy and Ragazzola, 2014). Overall it is expected that any decreasing abundance and growth of coralline algae may have knock-on consequences for worldwide coastal ecosystems (Johansen, 1981; Martin and Gattuso, 2009; Basso, 2012). "*

We have added the following references to the reference list:
P12/L23: Brodie, J., Williamson, C. J., Smale, D. A., Kamenos, N. A., Mieszkowska, N., Santos, R., Cunliffe, M., Steinke, M., Yesson, C., Anderson, K. M., Asnaghi, V., Brownlee, C., Burdett, H. L., Burrows, M. T., Collins, S., Donohue, P. J. C., Harvey, B., Foggo, A., Noisette, F., Nunes, J., Ragazzola, F., Raven, J. A., Schmidt, D. N., Suggett, D., Teichberg, M., and Hall-Spencer, J. M.: The future of the northeast Atlantic benthic flora in a high CO2 world, Ecology and Evolution, 4, 2787–2798, 2014.

P13/L1: Burdett, H. L., Aloisio, E., Calosi, P., Findlay, H. S., Widdicombe, S., Hatton, A., and Kamenos, N. A.: The effect of chronic and acute low pH on the intracellular DMSP production and epithelial cell morphology of red coralline algae, Marine Biology Research, 8, 756–763, 2012.

P15/L9: Diaz-Pulido, G., Nash, M. C., Anthony, K. R. N., Bender, D., Opdyke, B. N., Reyes-Nivia, C., and Troitzsch, U.: Greenhouse conditions induce mineralogical changes and dolomite accumulation in coralline algae on tropical reefs, Nat Commun, 5, 2014.

P15/L14: Donnarumma, L., Lombardi, C., Cocito, S., and Gambi, M. C.: Settlement pattern of Posidonia oceanica epibionts along a gradient of ocean acidification: an approach with mimics, Mediterranean Marine Science, 15, 498–509, doi:10.12681/mms.12677, 2014.

P16/L23: Gao, K. S., and Zheng, Y. Q.: Combined effects of ocean acidification and solar UV radiation on photosynthesis, growth, pigmentation and calcification of the coralline alga Corallina sessilis (Rhodophyta), Global Change Biology, 16, 2388–2398, 2010.

P17/L23: Hofmann, L. C., Yildiz, G., Hanelt, D., and Bischof, K.: Physiological responses of the calcifying rhodophyte, Corallina officinalis (L.), to future $CO_2$ levels, Marine Biology, 159, 783–792, 2012.

P19/L8: Koch, M., Bowes, G., Ross, C., and Zhang, X.-H.: Climate change and ocean acidification effects on seagrasses and marine macroalgae, Global Change Biology, 19, 103–132, 2012.

P19/L10: Kroeker, K. J., Kordas, R. L., Crim, R., Hendriks, I. E., Ramajo, L., Singh, G. S., Duarte, C. M., and Gattuso, J.-P.: Impacts of ocean acidification on marine organisms: quantifying sensitivities and interaction with warming, Global Change Biology, 19, 1884–1896, 2013.

P20/L24: Martin, S., Cohu, S., Vignot, C., Zimmerman, G., and Gattuso, J. P.: One-year experiment on the physiological response of the Mediterranean crustose coralline alga, Lithophyllum cabiochae, to elevated pCO2 and temperature, Ecology and Evolution, 3, 676–693, 2013b.

P22/L12: Porzio, L., Buia, M. C. and Hall-Spencer, J. M.: Effects of ocean acidification on macroalgal communities, J. Exp. Mar. Bio. Ecol., 400, 278–287, doi:10.1016/j.jembe.2011.02.011, 2011.

P22/L24: Ragazzola, F., Foster, L. C., Form, A., Anderson, P. S. L., Hansteen, T. H., and Fietzke, J.: Ocean acidification weakens the structural integrity of coralline algae, Global Change Biology, 18, 2804–2812, 2012.

*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.*
P10/L3-4 (P7856/L7): We have changed 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 have clarified the definition by the adding of some words and explanation as previously described. This has slightly adjusted some of the calculations but does not impact the conclusions of the study.

*P7852/L9: "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.*
P6/L30 – P6/L31 (P7852/L20): We have clarified this further in our wording by changing the sentence in:

"However, as there are substrates (e.g. sandy substrata or other soft-bottom substrates) that are an unsuitable habitat for coralline algae, to be conservative, we have assumed only half of the estimated surface coverage percentages estimated above contain coralline algae (CCA = 26.25 %, rhodoliths = 22.5 %, coralline algae = 22.5 %)."

*P7852/L10: are 6 citations really useful here?*
P6/L22 (P7852/L10): We have reduced the citations to the most pertinent, those of Charpy-Robaud and Sournia, 1990. We have therefore deleted the following references from the reference list: Ryther, 1969; Koblentz-Mischke et al, 1970; Bunt, 1975; Platt and Subba Rao, 1975. The reference for (Whittaker and Likens, 1973) and (Smith, 1981) are cited elsewhere in the manuscript and therefore remain in the reference list.

*P7856/L9: word missing:*
P10/L4 (P7856/L9): We have included "production" between "primary" and "of" in the revised paper.

*If the paper is accepted, I recommend that the supplementary tables are provided in a numeric format.*
We have ensured that the citing papers are in the table and the locations of coralline algae are mentioned within those papers. Inclusion of a table here would generate a table several hundred pages long due to the large number of locations.

Anonymous #2
*It remained unclear to me whether and if so, to which extent deep water corals do play a role here. I did not find (or overlooked) an explicit statement on those, although potential regions are depicted on the map? Please expand on this matter.*
In this paper we are not discussing cold water corals but coralline algae. Cold water corals are thus not relevant to our calculations and therefore we have not mentioned them in our manuscript.

*P7847/L1: please update this reference, atmospheric pCO2 has crossed the 400ppm mark.*
We have updated this as suggested using (http://www.esrl.noaa.gov/gmd/ccgg/trends/).
P2/L8 (P7847/L1): changed the sentence to "..280 ppm in 1750 (Denman and Brasseur, 2007) to nearly 400 ppm in 2014 (Diugokencky and Tans, 2015) at a rate unprecedented in geological history (Denman and Brasseur, 2007).
In the reference list, we added the following reference:
P15/L12: "Diugokencky, E., and Tans, P., NOAA/ESRL:, http://www.esrl.noaa.gov/gmd/ccgg/trends/, last access: 14 October 2015."

*P7850/L18: why "approximately" 1 mole? Why not 1 mole?*
P5/L13 (P7850/L18): The word "approximately" has been deleted.

*P7851/L11: please be clarify: Precipitation of 1 mole (!) CaCO3 ....*
P5/L29-30 (P7851/L11-12): The reviewer is correct, we have changed the sentence in line 11-12 to: "Precipitation of 1 mole $CaCO_3$ decreases DIC by 1 mole and total alkalinity by two mole:"

*P7851/L12: the unit for alkalinity is mole, "equivalents" have been decommissioned decades ago!*
P5/L29-30 (P7851/L11-12): The reviewer is correct, as above, we have changed the sentence in line 11-

12 to: “Precipitation of 1 mole $CaCO_3$ decreases DIC by 1 mole and total alkalinity by two mole:”

*P7851/L20-21: this statement is unclear to me? What the relation between export, preservation and the given figures?*
P6/L7 (P7851/L20-21): The statement is a little confusing and detracts from the point being made. We have deleted the statement in the revised version of the manuscript.

*P7852/L1-2: What has temperature limitation to do with supersaturation? The surface oceans are everywhere supersaturated, except for in region where salinity is lower (brackish, or polar environments). Please delete or rephrase this statement.*
P6/L14-15 (P7852/L1-2): We have changed the statement in the revised version of the paper into: “Coralline algal alcification is indirectly affected by temperature, often over a season cycle, as well as light limitation (Martin et al., 2006).”

*P7855: it is not so much a question of pCO2 (or pH), it is the carbonate ion concentration with primarily matters here. Please reword accordingly.*
P9/L6 (P7855/L15): We have clarified the wording here by adding the following sentence to the revised version of the paper in section 5: “Increasing atmospheric $pCO_2$ will increase DIC and shift the equilibrium of the carbonate system to higher $CO_2$ and bicarbonate ion-levels, lower carbonate ion concentration and lower pH (Feely et al., 2009).”
P16/L4: We have also added the reference of (Feely et al., 2009) to the reference list: “Feely, R. A., Doney, S. C., and Cooley, S. R.: Ocean acidification: present conditions and future changes in a high-$CO_2$ world, Oceanography, 22, 36–47, doi:10.5670/oceanog.2009.95, 2009.”

Some additional changes we have made:
P3/L18: “(Martin et al., 2013)” becomes “(Martin et al., 2013a)”
P3/L28: “is for” becomes “occurs when” and “crusts to replace” becomes “crusts replace”
P3/L32: “McCoy and Ragazolla” becomes “McCoy and Ragazzola”
P4/L11: we removed “resulting in a wide distribution” from the MS.
P4/L23: we changed to “with coverage varying due to differences in the abundance of turf algae and herbivory pressure.”
P4/L25: we added a comma to line so it becomes “reefs, CCA”
P5/L5: “(Martin et al., 2013)” becomes “(Martin et al., 2013a)”
P8/L23 : we added “systems” to the end of the sentence.
P20/L19: we added an “a” so it becomes “2013a.”
P21/L13: “McCoy, S. J. and Ragazolla” becomes “McCoy, S. J. and Ragazzola”