

Interactive comment on “Distributions of the carbonate system properties, anthropogenic CO₂, and acidification during the 2008 BOUM cruise (Mediterranean Sea)” by F. Touratier et al.

Anonymous Referee #2

Received and published: 22 June 2012

GENERAL COMMENTS

I found discussion (P 2728 to 2733) a bit personal and a bit aggressive with terms like ‘inappropriately applied’ (P 2728) ‘not scientifically correct’ (P 2730) ‘do not provide any scientific argument’ (P 2729). In fact the discussion (pros and cons of each CATN method) does not reflect at all the results section that deal with comparison between the 2001-2008 cruises (which does correspond to the title of the paper).

I know it is not nice when papers show your method differs from others, and question your method and ideas, data. Yet, everyone knows the essence of science is that methods, results, etc. . . must be questioned. In high quality journals, I believe that

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tone should always remain polite and objective.

This paper could/should have been :

- (1) a description of the BOUM data
- (2) a comparison of the BOUM data with the Meteor data (2001)
- (3) a in depth discussion of the different methods based on the comparison of CANT computed from these different methods using both BOUM and Meteor data.

As it stands the paper is stuck somewhere in between (2) and (3).

The paper does not achieve (3) since it just throws some arguments at each method/paper.

The authors should decide if they want to go all the way to (3) or go back to (2). Personally, I would be in favor that the authors go back to (2) removing all of the discussion that could be published as a parallel short communication.

Anyway, I really would like to see some discussion on why CANT is changing so fast in 7 years in the Mediterranean (maybe some elements are given in intro but the reader has to make the link). This a very intriguing and interesting result and I would like to learn what could be the possible mechanisms behind it.

MAJOR COMMENTS

L 2729 L 9 : Authors state that Troca cannot be used with classical Redfield ratios and that it is required to develop local/regional Redfield ratios. And this can explain the discrepancies between methods. So what ? Why not test this with the present data sets ? Replace RON, ROP, RCO values with classical Redfield ratios and show the difference.

L 2730 L 4-6 : If delta_C_* and Troca do not fit in the Atlantic can we really extrapolate this conclusion to the Mediterranean ? Why not check ? Please compute CANT with

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both standard Troca and ΔC methods and show the difference.

I would like to see discussed how the decadal changes described by the same authors in the northwestern Mediterranean (Touratier & Goyet 2009) fit with the present results/interpretation.

MODERATE COMMENTS

P 2715 L 5 : rather than referring to the figure of a paper why not simply a figure of theta versus S from both cruises ? Same applies later for AT. Why not plot AT versus S from both cruises ?

P 2717-2718 : The authors only indicate in the introduction the papers where Troca provides consistent results with other methods. They should at least mention the papers that give CANT values from Troca that are clearly divergent (Huertas et al. 2009; Yool et al. 2010). An introduction should give the overall picture.

In P 2719 L 22 : The authors state that classical Redfield ratios RON and ROP cannot be applied in the Mediterranean, but in P 2723 L7 the authors state that the RCO is the classical Redfield ratio. Please clarify as this cannot work both ways.

P 2726 L 2 : I'm surprised that throughout text authors provide values of CANT at 0.1 $\mu\text{mol/kg}$ level, when the actual measurement error of DIC is close to 1 $\mu\text{mol/kg}$ (on the good days). I suggest to round all values to unit, in agreement with the stated accuracy of CANT (6 $\mu\text{mol/kg}$, P 2728).

P 2726 L 17 : the y-intercept of the regression is at 0.01 $\mu\text{mol/kg}$ level which is even more surprising. Round value to unit.

P 2727 L 16 : please quantify 'accurately' by computing the error on calculated pH by propagation errors on DIC and AT (include this at end of material and methods).

P 2727 L 24 : regarding term 'acidified'. I'm not sure that this term is adequate. pH might have dropped faster than elsewhere but in surface waters pH remains within

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acceptable levels (pH > 8.05, Fig. 12).

P 2728 L 7-9 : Here the authors compute the pH change from changes in CANT from 2001-2008 cruises. I would like to see a comparison with the pH change computed from difference of the 2001-2008 but from pH computed directly from AT and DIC field data (without the troca and mix modeling).

P 2730 L 20-25 : I find this comment a bit unfair. Validation of a 3-D OGCM with sparse DIC and AT cruise data is a very tricky business. But anyway, a model will always be an unperfected tool that allows to check a working hypothesis by a series of tests. This is what Yool et al. (2010) did, although I understand that the authors dislike their conclusion.

MINOR COMMENTS

P 2712 L 20 : might want to refer a general introductory paper of the BOUM experiment if it exists ?

P 2712 L 22 : spell out INSU/CNRS

P 2713 L 9 : spell out CTD

P 2716 L 9 : why an approximation of 100 km on distance from Marseille ? Why not exact distance ?

P 2716 L 16, L22 : use AT abbreviation

P 2718 L 17 : I not sure 'persuasive' is the adequate term here.

P 2724 : include here (Material and methods) the estimated errors on CANT values from Troca and MIX. This only appears much later in the text (start of discussion, P 2728), so that reader only 'discovers' error estimates after reading all of the results.

P 2727 L 24-25 : provide the time frame for these pH decreases (100 yrs ? 50 yrs ?)

P 2728 L 9-10 : please add 'if we assume a linear trend'.

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P 2729 L 13 : who => why

P 2729 L 23 : Learn => Compute

REFERENCES

Huertas et al. Anthropogenic and natural CO₂ exchange through the Strait of Gibraltar, *Biogeosciences*, 6, 647-662, 2009

Touratier F & C Goyet, Decadal evolution of anthropogenic CO₂ in the northwestern Mediterranean Sea from the mid-1990s to the mid-2000s, *Deep-Sea Research I* 56 (2009) 1708–1716

Yool et al. , A model-based assessment of the TrOCA approach for estimating anthropogenic carbon in the ocean, *Biogeosciences*, 7, 723-751, 2010

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