

Interactive comment on “Coastal hypoxia/anoxia as a source of CH₄ and N₂O” by S. W. A. Naqvi et al.

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This paper describes CH₄ and N₂O dynamics in marine hypoxic and anoxic areas. As a review, it contains almost all the information available in the literature on the subject and is thus very helpful. I have two major comments: first the authors use the term “coastal” in an inappropriate way in the title and throughout the paper; second, this is more a compilation than a review and some synthesis effort would greatly improve the impact of the paper.

The coastal zone is defined as the area extending from estuaries at the limit of the tidal influence to the continental shelf break (generally the 200m depth isobath). So the coastal zone includes littoral ecosystems like estuaries, lagoons and embayments, that very often experience hypoxia and anoxia, behave as hotspots of CH₄ and N₂O

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fluxes, but that are not treated in this review. A famous site is Cape Lookout Bight that emits huge amounts of CH₄ (see eg Martens C.S and Klump J.V. (1980) GCA). Also, the coastal zone excludes marine sites like the Black Sea or the Cariaco basin, which are treated here. I suggest the authors use the term “marine hypoxia” in their title and then use the term “continental shelf” when appropriate in the text. It must also be stated in the MS that this review does not include estuaries, fjords and lagoons.

Review or compilation? The MS is very long mainly because of the choice of a structure based on the geographic criteria. Less than 3 discussion pages are dedicated to synthesis and some kind of cross system comparison. Although such choice is understandable to some extent, it leads to many repetitions, when dealing with the processes that control N₂O and CH₄ within each geographic region. I would find interesting to put more synthesis effort by dealing together with systems that have similar patterns regarding hypoxia/anoxia and CH₄ / N₂O distribution. Figures 2 to 11 are also very repetitive, although they deal with different geographic regions, many of them tell the same story: figure 3,4,6,10,11 deal with spatial variations and figures 2,5,7,8,9 deal with temporal variations. Note that all these figures have been already published, so publishing all of them here again is not necessary. Instead it would be better for readers to get some kind of “general” spatial and temporal patterns in few figures as examples, eventually some exceptional patterns in other figures, and also more synthesize information for all systems in other figures and tables (to that respect Fig 1 is great). Maybe groups like “river influenced and shallow” / “mid shelf” / “upwelling influenced” and “deep with anoxic bottom water” would match. Some suggestion for more synthesis: First of all a table with all available data of CH₄ / N₂O concentrations by oceanic regions (range, average+/-SD). Classify sites and datasets according to oxic/hypoxic/suboxic/anoxic as defined in Table 1. Note that it would be interesting to compare also with the well oxygenated ocean, as a reference. Another interesting table would provide calculated atmospheric CH₄ and N₂O fluxes from each sub-system, with their respective surface areas. Try also to find some general trends between parameters (plot CH₄/NO₂ versus oxygen for instance, try correlations with water depths,

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water residence time. . .) indentifying the different oceanic regions with different symbols. Think also about some conceptual drawing starting from oxic to hypoxic, suboxic and anoxic.

Detailed comments: P9459L7 dealing with nitrification “the yield of N₂O relative to N₂” is “relative to NO₃-“ P9462L24 the final step . . . using CO₂” refer to acetate also P9465 top and elsewhere in the paper: any possibility of N₂O production also by dissimilatory nitrate reduction to ammonium? See eg Welsh et al. Marine Biology. 139: 1029-1036. L11 and P9466top definition of EBUE? P9467top what are the water depths of these sites? P6468L19-24 not understandable L26 explain and define more clearly “high coastline-to-ocean area ratio” P9471: geographical definitions not clear: inner shelf, mid- outer shelf L21-23 be more explicit P9472 and elsewhere in text: the potentially important processes of ebullition/bubble dissolution is ignored in this review: why? Read : McGinnis et al. (2006). Fate of rising methane bubbles in stratified waters: how much methane reaches the atmosphere? Journal of Geophysical Research 111. Computed fluxes appear here alone for the Arabian sea. It is important to compare with other sites. P9474 bottom : where can we see the record of 765nM in table or figure? P9475 top: in water incubation where not suboxic, what where they? P9475 again a calculated flux here that should be in a special section. P9491 Section 5 is entitled “methane and nitrous oxide in anoxic zones”. This title is too general. Estuarine circulation is something else that what is written on L4. Section 4.5 and section 5 both deal with the Baltic Sea P9493 interesting information is given concerning processes involved in N₂O cycling in the black sea, based on N and O stable isotopes. It would be interesting if this information could be compared with what is discussed other sections. P9496top explain “nitrifier denitrification”

Figures: F1: the numbers given here follow a different order from the one of the different section, which makes reading more difficult. F2 Msexcell default format F3&4 where is Goa? F6 Where is Mangalore. CH₄ at SK37? I cannot see H₂S Combine F7&8 F10 convert O₂ mg/L to μ M F11: can the influence of the mississippi plume be seen with

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salinity? F12 Caption Kessler not Kesseler F13 an "O2" is missing in panel (b)

END

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