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Interactive comment on “Nitrous oxide water column distribution during the transition from anoxic to oxic conditions in the Baltic Sea” by S. Walter et al.

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The authors describe a very interesting data set of N₂O, oxygen and nitrate concentrations measured during an untypical (dynamic) hydrographic situation in the Baltic Sea right after a salt water inflow. Samples from all major Basins and from shallow and deep sites were sampled and analysed. Furthermore the authors try to calculate production rates and explore the transport pathways and the mechanism of generation of the N₂O. These are crucial questions since N₂O can be generated from microbial nitrification as well as denitrification or it could have been imported to the Baltic with the inflowing water. Combined with the complex stratification of the water column at

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the time of sampling the interpretation of data is a real challenge. The authors try to explain which of the various processes may have caused the observed N₂O patterns and they have structured the manuscript in relatively short subchapters. A clear ranking whether the age of the water, the mixing, the microbial activity, or the environmental settings are responsible is hardly been made but would facilitate the major message. The scientific question the paper addresses is not formulated in the introduction and may be this is the reason why the paper lacks some clarity. Although a wealth of information is presented (or may be because of that) the paper esp. the discussion is a little difficult to read and aspects are repeated in different paragraphs with slightly different conclusions (e.g. on pages 741 and 745 the authors refer to Rönner 1983 but first the oxygen concentration second the nitrifiers are assumed to be more important). Finally, the authors conclude that according to previously published data the major generation pathway for N₂O in the Baltic Sea is nitrification. This information needs to be more clearly presented in the abstract, which gives a lot of information but is not concise to this point.

Since an inflow usually follows the deep basins from west to east and encircles Gotland clockwise it may be checked whether this can be confirmed by the available data and how this is mirrored in the N₂O profiles. The first part of the discussion tries to relate the concentrations to the water bodies and their age, but overall this seems not so well organized. The relationships between delta N₂O and NO₃ or O₂ as shown in the discussion are either logarithmic or linear and I have not understood why different functions have been chosen? Does this imply different generation pathways or different kinetics of the reaction?

Minor points are: The chapter 1.3 is entitled “Definition of water masses” but gives rather a description of the layers instead of water mass definitions. Overall this chapter should be shortened and become part of 1.2. Page 732 Study area: the first paragraph belongs to the methods and is no site description. Page 734, line 8 what are free-flow bottles? Page 735 line 9, salinity is not measured by a CTD sensor. Page 736, line

5, how was H₂S measured and O₂ and NO₃? Line 16, it must have been station 271 instead of 272. 3.1 the well mixed stations can hardly be called basins, since they are so shallow. Page 741, line 10 and 13, Figs 6 and 7 show different relationships between $\delta^{15}\text{N}$; N₂O and nitrate or oxygen. Page 746, line 22 “N₂O production by the inflow” is hardly possible, it is rather nitrification. Page 748, line 14, comparable to what? The conclusion is more a summary and could be omitted.

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