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North Atlantic production of nitrous oxide in the context of changing atmospheric levels

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In order to better quantify the oceanic N2O source, we use transit time distributions (TTD) to estimate the concentrations of biologically produced N2O (excess N2O) and its production rates in the central North Atlantic Ocean. Using SF6 and CFC-12 depth profiles from the Meteor cruise M60/5 in April/May 2004 and the atmospheric history of N2O, we calculated N2O equilibrium concentrations using the TTD method and compared them to N2O depth profiles measured at the same time. Comparing our results to those obtained by using previous approaches to determine excess N2O, we find that they significantly overestimate the oceanic equilibrium N2O concentrations and thus underestimate the strength of N2O sources in large parts of the water column. Due to this, the quantitative characteristics of the excess N2O/AOU relationship used as an indicator of nitrification and to model N2O in the ocean are probably distorted. We developed a new parameterisation of N2O production rates in terms of AOU and temperature/depth, which can be used in biogeochemical models. Our parameterisation can be applied to the entire ocean including oxygen minimum zones.