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Geoscientific Model Development Discussions

Interactive comment on "^{14}C-age tracers in global ocean circulation models" *by* W. Koeve et al.

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Review Koeve et al.

Scientific Significance: Excellent Scientific Quality: Excellent Scientific Reproducibility: Good Presentation Quality: Excellent

This paper examines the relation between radiocarbon (D14C) and age in a new, interesting, and useful way by introducing the concept of preformed 14C-age. Scientists have long known that the c14 age and the real age of a subsurface water mass are not the same due to finite air-sea gas exchange. But I haven't seen such a clear presentation of the issue before.

The paper is useful for climate modelers and paleoceanographers working with radiocarbon. I recommend publication as is, or, if a revision is undertaken, with consideration

of my minor comments listed below.

Page 7035: Observationalists could object to caling models "the method of choice".

Line 18: I think capital Deltaˆ14C is usually refered to after correction for d13C.

Page 7040: Definitions of 14C-ageˆpre and 14C-ageˆdecay: Line 18: I don't understand why DICˆpre is in the denominator. Using the decay function C(t)=C(t=0)*exp(-t/tau), where tau is 8033 years and solving for t=-tau*ln(C/C(t=0)) it seems to me that C(t=0) should be in the denominator, which, in this case should be 14C-DICˆpre at the surface. Do I miss something?

Line 23: Those ratios must have completely different orders of magnitude. 14C-DICˆpre/DICˆpre $\sim$ Rstd$\sim$10ˆ-12, while (DIC + 14C-DICˆdecay)/DIC $\sim$ 1. Am I missing something ?

Page 7042: line 24: "background mixing coefficients" are these in addition to a tidal mixing component? Please specify. If so, I suggest to refer to k_bg rather than k_v.

Page 7045: line 18 "two water masses of different age": Which values were used in Fig. 5? 0 and 2000 years?

Page 4047: lines 15-17: "for CO2 the equilibration time is governed by the product of the time scale of gas exchange (order of one month) and the ratio CO2$-$3 /COaq2 (10–15 in the surface ocean)" Why?

Page 7048 line 12: I don't see negative ages in Fig. 1b

Page 7049 lines 23-25: I suggest to add "except at the surface."

Page 7053 lines 10-15: I suggest to discuss Schmittner (2003, EPSL 6702 1-10) who examines sea ice effects on bottom water radiocarbon.

The above review was not influenced by reading reviewer #1 and #2's comments. With regard to reviewer #1's comments I don't agree with him/her that there is nothing new

here. To my knowledge the concept of preformed c14-age has not been proposed nor used before. This is therefore, in my opinion, a new contribution, even if much of the text sounds like “trite textbook points”. I also think that the paper is appropriate for GMD since it proposes a new way to analyze model output.

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Interactive comment on Geosci. Model Dev. Discuss., 7, 7033, 2014.