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Climate of the Past Discussions

Interactive comment on "Modeling variations of marine reservoir ages during the last 45 000 years" *by* J. Franke et al.

Anonymous Referee #3

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General comments

This paper is a useful contribution to our understanding of marine radiocarbon reservoir variability. The database of modeled marine reservoir ages that accompanies it is a welcome tool for exploring potential spatial and temporal variability of marine reservoir ages. The reservoir age model could be extremely useful in deciding what reservoir age offset to use for samples from different regions and different depths at any given time. In addition the model could potentially be used to determine what reservoir ages and uncertainties to apply to marine data used in 14C calibration curves.

Specific comments

The implementation of the model is well documented and appears to reproduce the

pre-nuclear ocean data from GLODAP fairly well with the exception of upwelling areas. The model also accurately predicts atmospheric 14C changes from nuclear weapons testing production. It would have also been instructive to see how well the model surface ocean responded to the nuclear weapons testing spike in atmospheric 14C compared to existing coral records. This would add a degree of confidence in dealing with past rapid changes in atmospheric 14C concentration.

A brief discussion of how well the University of Victoria Earth System Climate Model compares to other models tested in the OCMIP-2 project (e.g. Friedlingstein et al. 2006).

An estimate of model reservoir age uncertainty would be extremely valuable especially in potential applications to 14C calibrations. Particularly in Figure 6 it would be very useful if there were error ranges on the temporal variations for at least one of the regions.

Technical corrections

p.87 Section 3.4

Line 10. Although on p. 91 the authors note that the 14C data used for the atmospheric forcing in the model comes from coral and foraminifera measurements with constant reservoir ages applied, it might be good to alert the reader at this stage.

line 15. "...through all the reconstructed data". Perhaps this should read "through the selected reconstructed data" since only the Hughen et al. 2006 and Fairbanks et al 2005 were used for 25 to 50 kyr BP.

Line 16. It might also be noted that due to the size of the marine surface ocean reservoir, variations in the marine records are generally attenuated, which together with the spline used to construct the atmospheric 14C forcing, are likely to have somewhat smoothed the 14C production variations such as that due to the "Laschamp" event.

Line 19. "As 14Catm reconstructions do not exist prior to 50 kyr BP...". A number of

CPD
4, S37–S40, 2008

14C records do extend beyond 50 kyr BP but the data is very scarce and variable (e.g. (Hughen et al., 2006; van Kreveld et al., 2000; Voelker et al., 2000)

p.93 Line 7 "Reservoir ages of more than 2000 years were reconstructed in the northern North Atlantic …" The maximum raw reservoir age from data in one of the papers referenced here (Bard et al. 1994) was 1600 years but when corrected for bioturbation the reservoir age average 700-800 years at the time of the Vedde Ash layer deposition.

p. 94 Section 5.4

It might be noted here that the reconstructions of Bondevik et al 2006 and Cao et al. 2007 prior to 12.4 kyr BP are based on comparison to the floating tree-ring 14C series of Kromer et al. 2004. A new positioning of the tree-ring data has recently been suggested (Muscheler et al 2008) which would decrease the reservoir age in the early portion of Younger Dryas in these reconstructions.

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Interactive comment on Clim. Past Discuss., 4, 81, 2008.