Geosci. Model Dev. Discuss.,
doi:10.5194/gmd-2017-7-RC2, 2017

Geoscientific Model Development Discussions

Interactive comment on "Stable water isotopes in the MITgcm (checkpoint 64w)" *by* Rike Völpel et al.

Anonymous Referee #2

Received and published: 21 March 2017

The paper Âń stable water isotopes in the MITgcm Âż from Völpel et al, is presenting the implementation of stable water isotopes in the MIT ocean general circulation model. The simulation is evaluated by comparison with seawater oxygen stable isotopes observations and data from planktonic foraminifera. This approach represents an unavoidable stage before using this proxy for assessing past-climate simulations. The manuscript describes the methodology adopted in their modelling approach, but some points are still confusing or not well defined. The analysis is too superficial to correctly assess the performance of the model. I then recommend major revision before publication.

Page 2, line 12. Many references are missing for stable water isotopes in oceanic models: for instance, Delaygue et al, 2000, Roche et al, 2004, etc.. Page2, Line 23. Please define "checkpoint 64w" Page 3 and 4, section 2.2 : This section describes the methodology used for implementing the water isotopes in the MITGcm model. The

simulation is forced with isotopic quantities derived from the NCAR IsoCam model , isotopic composition in precipitation and water vapor for evaporation. These quantities should be presented and discussed at least briefly in the manuscript, in order to allow further discussing the impact on oceanic model performance. Futhermore, it is also useful as the same isotopic oceanic MITGcm model could further be used with other atmospheric model forcing, it will offer the possibility to compare with the results from this study. Page 4, Line 24: value of Ce is not specified

Page 5; line 3: the presentation of the architecture of the code should be more explicit: Apparently, gchem represent the "source and sinks" module and "ptracers" the transport module. Page 5,line 7: Fw should be expilicitely defined as Evap - precip –Runoff

Page 5 line 17. The freshwater flux is balanced by adjusting the precipitation field (page 3 line 14). The adjustment applied to water isotopes simulation must be described and a discussion on how it can potentially affect 180-Salinity relation is necessary.

Page 5: what is the duration of the spin-up of the simulation?

Page 6 – results Section 3.1 presents model performance for temperature and salinity. Salinity anomaly should be analyzed considering the characterisctics of Evaporation and Precipitation forcing fields used in this study. This will also be useful for next analyzing the water isotopes simulations.

Page 6: figure 3 : color scale is not adapted. Range (-1, 1°/oo) is too narrow to represent the more elevated values of the observations.

Page 6and 7 and discussion: discussion of water isotope distribution in ocean water: the discussion is too superficial. Shortcomings in water mass isotopic composition is described but the causes are never analyzed in function of model dynamical performances (AABW, NADW, AAIW formation) or surface boundary conditions (precipitation, evaporation, isotopic composition in precipitation and water vapor). A minimum

more detailed analysis of the simulation is required to assess this modelling approach.

Pages 9-10: discussion - the discussion of the sources of errors are mainly focuses on rivers input and sea-ice melting for the Arctic Ocean. The discussion must also consider more quantitatively the shortcomings associated to surface boundary conditions (for instance, an analysis of the realism of the isotopic composition in precipitation of the forcing has to be presented and considered, see previous comment).

Page 11- discussion Planktonic Foraminiferal: Observation is a compilation of isotopic measurements derived on different species. The isotopic signal they register is then not obvious since the different species are living at different depth and differently affected by the seasonal cycle. A more sophisticated approach, taking into account the characteristics of some species would be more appropriate.

Interactive comment on Geosci. Model Dev. Discuss., doi:10.5194/gmd-2017-7, 2017.