Response to referee, GMD revised submission, PLASIM-GENIE, Holden et al.

Many thanks for additional useful comments. Please find our responses in red.

I appreciate the authors' response to my previous comments and the response is satisfactory overall. I have some minor comments as below. I recommend the manuscript to be published in Geoscientific Model Development after some minor revision.

Line 80&167: What does "slab sea-ice" mean? This term is not commonly used in literature and needs some description.

New footnote page 3: "The GENIE slab sea-ice module assumes a fixed thickness (2m), heat capacity and albedo (0.6). A grid cell becomes completely ice covered when the surface temperature falls below -2°C, with surface temperature evolving according to the energy flux balance. Sea-ice dynamics are neglected and there is no interaction with the hydrological cycle."

New footnote page 6: "The PLASIM sea-ice model is based on the thermodynamic model of Semtner (1976). It neglects dynamics. Spatio-temporal energy flux corrections are diagnosed from comparison with observed present-day sea-ice thickness."

Line 135: How about specific humidity?

Corrected (the spectral transform is also formulated for specific humidity).

Line 150: The land surface scheme was modified from what?

Clarified (from SimBA)

Lines 160-163: I did not understand whether carbon density is simulated as a diagnostic variable, prescribed externally or else. Thus, it is unclear what "In this coupling" really means.

Clarified (carbon densities are simulated)

Line 180: Why not describe the modification in the description paper?

Now described "modified equation of state that includes a density adjustment for thermobaricity given by $2.5 \times 10^{-5} Tz\ kgm^{-3}$, where T is temperature (°C) and z is height i.e. negative depth (m)."

Line 370: Space needed between "rho_0(z)" and "is".

Corrected

Line 616: What does "wind-driven AMOC variability" mean? It appears that this phrase represents any (thermal, haline, or stress) forcing to the AMOC variations

as long as the atmospheric dynamics is included. However, it is slightly confusing as the term wind-driven circulation is commonly used to describe circulation forced by only stress. More careful phrasing may be desired?

Corrected: "The lower panel of Figure 7 illustrates high-frequency AMOC variability driven by atmospheric dynamics, behaviour that is absent from GENIE-1 (Balan-Sarojini et al 2011)."

Other comments: Although not required to include, I am curious about how well the wind-driven gyre circulation is simulated (as I commented in the previous review) and how well the oceanic meridional energy transport is simulated.

We have added a new Figure 7 (which also incorporates the AMOC variability plot previously in Figure 6) with accompanying text:

"The upper panel of Figure 7 plots the PLASIM-GENIE barotropic streamfunction. Simulated gyre strengths are 24Sv/-26Sv North/South Atlantic, 53Sv/-41Sv North/South Pacific and 5Sv/-32Sv North/South Indian Ocean. For comparison, the gyre strengths of climatological wind-forced 64x32 GENIE-1 were simulated at ~20Sv/-20Sv North/South Atlantic, ~30Sv/-30Sv North/South Pacific and ~3Sv/-40Sv North/South Indian Ocean at (Figure 19d, Marsh et al 2011). Stronger gyres in the PLASIM-GENIE simulation compared to the GENIE-1 simulation are likely to be related to larger values of wind-stress scaling in the PLASIM-GENIE case, given that the simulated wind forcing is relatively close to climatology. The observed Gulf Stream strength is estimated at 32Sv, while simulated strengths ranged from 13 to 48Sv in the multi-model comparison of Balan-Sarojini et al (2011). The Antarctic Circumpolar Current (ACC) is weaker in PLASIM-GENIE (30Sv) than GENIE-1 (47Sv), presumably reflecting the weak simulated Southern Ocean zonal winds (see Figure 3). Note that both models significantly understate the ACC strength compared to observations of 140±6Sv (Ganachaud and Wunsch, 2000)."