氷床モデルの様々な不確定性によるグリーンランド温暖化応答実験への影響

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Impact on the simulated projection of Greenland ice sheet by variation of structural uncertainties in ice-sheet models

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Numerical modeling is an important technique for prediction of the responses of ice-sheets to climate changes. All processes simulated (or not simulated) in ice-sheet experiments have a certain degree of uncertainties, thus the final output may sometimes have significant diversion among possible combination of the methods in numerical models. This study revisits the future surface-climate experiments of Greenland ice sheet proposed by the SeaRISE (Bindschadler et al., 2013). Series of the sensitivity experiments are reexamined using an ice-sheet model ***I$_C$IES***with replacing one or more formulation of the model to those adopted in other model(s). The results show that the main sources of the diversion in the projection of SeaRISE participants are difference in the initialization methods and that in the surface mass balance methods, and both two aspects have almost equal impacts on the results. Treatment of ice-sheet margin in the simulation has secondary but significant impact on the diversion. Performance of an initialization technique, which spinning-up the ice-sheet topography with fixed through the time while temperature is allowed to be evolved according to the surface temperature history, is indirectly evaluated. It is concluded that this initialization method is not a bad representative, at least for the experiment configuration in the present paper such as time-scales. A benchmark experiment set-up is proposed for future intercomparison, which may most of the numerical model can perform, in order to evaluate the uncertainties relating to pure ice-sheet model flow characteristics. This study extends the discussion those presented in this Symposium last-year, with including more sensitivity experiments.

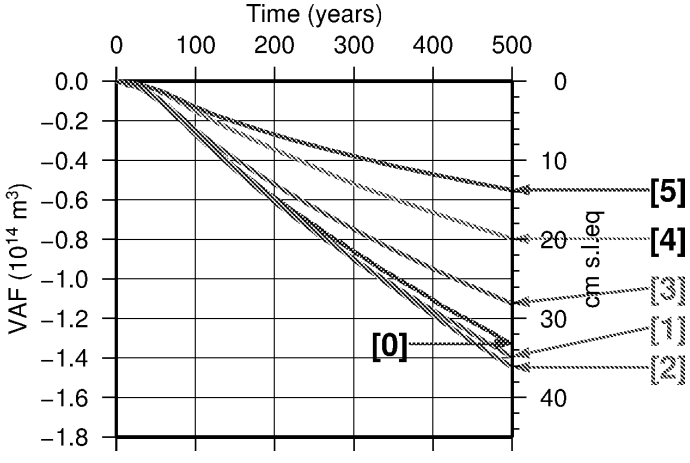

Fig. 1. Time series of simulated ice-sheet volume under a global warming scenario relative to the control climate. Climate forcing scenario as well as other boundary conditions follow SeaRISE configuration(Bindschadler et al., 2013). Similar experiments are performed with replacing the scheme in the model: bedrock topograpy (0 to 1), submelt parameterization (1 to 2), surface mass balance scheme (2 to 3), initialization scheme (3 to 4), treatment of margin advance (4 to 5).