# Development of a numerical library for coupling between ice-sheet and climate models

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Ice sheet evolution is often described as responses to variation of other climate systems such as atmosphere and ocean, however, it is well known that there is interaction between the systems and the changes in ice-sheet do feedback on the other systems. Therefore development of coupling models, which simulate the climate components simultaneously, is an important subject in order to compute the evolution of ice-sheet with high accuracy.

The model domain of global climate models is typically defined on longitude-latitude grid system on a (true) sphere, while that of ice-sheet component is typically defined on regional cartesian grid on polar stereographic projection of a ellipsoid.

Exchanges of information between climate and ice-sheet models such as the surface mass balance require a function to absorb the difference of the model structures and, in particular, not to break the conservation. In addition, as already discussed by Fischer et al. (2014), the different structure of the models may cause the projection errors and geometric errors.

In this study, the module adopted in the climate model MIROC to exchange the information between the atmosphere and ocean components (Suzuki et al. 2009) is extended, such that the regional model component of polar stereographic projection can be available. Fischer et al. (2014) presented a numrical library for regridding between climate and ice-sheet models using polygons to compute the overlapping area of two model components, while the method of present study is simply use tiny rectangle cells as a unit of the overlaping area.

In the present study, the peformance of the library will be presented in terms of numerical efficiency and also influence of the projection errors and geometric errors on ice-sheet simulation.

**References**

Suzuki et al., Coupling procedures of heat and freshwater fluxes in the MIROC (Model for Interdisciplinary Research on Climate) version 4, JAMSTEC Report of Research and Development,9(1),1-9, 2009.

Fischer et al., A system of conservative regridding for ice–atmosphere coupling in a General Circulation Model (GCM), Geosci. Model Dev., 7, 883–907, https://doi.org/10.5194/gmd-7-883-2014, 2014