Adding Coupling between Oceans and Ice-sheet Dynamics to Coupled Climate Models

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Coupled global climate models are useful for consistently projecting the response of the components that are included, but useless for considering omitted processes. While it is common to include the surface mass budget of ice-sheets in climate models, interactions between oceans and ice-sheet dynamics have been disregarded. This is a glaring omission, particularly because interactions between the ocean and ice sheet dynamics are the leading order source of uncertainty in projections of global-mean sea-level rise. This talk will give an overview of the steps that NOAA/GFDL is taking to incorporate dynamically active ice-sheet models into our coupled climate models, including in particular ice-shelves whose shapes and grounding line evolve continuously as a result of the interplay between the oceans and ice-sheet dynamics. These ideas have already been demonstrated to work well in an idealized context. In Greenland, many of the glacial outflows occur in narrow fjords. Although these fjords are typically too narrow to resolve in global ocean models, new techniques for systematically representing the sub-gridscale geometric constraints imposed by the topography may afford some credibility in the oceanic exchanges within these fjords. This talk will solicit ideas for how these global modeling efforts can best capitalize on understanding derived from regions studies of the ocean / ice-sheet interactions. It is hoped that this new global climate modeling capability will be useful for systematically addressing the climatic role of the ocean's interactions with ice-sheets.