**Coupling BISICLES to E3SM**

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As an ES3M NGD project, we are coupling the BISICLES ice sheet model into E3SM as an alternate ice sheet model. One of the dynamical cores developed by the PISCEES and ProSPect SciDAC Application Partnerships, the BISICLES model is a natural fit with the E3SM project for many reasons.

Built on the SciDAC-supported Chombo framework, BISICLES uses block-structured adaptive mesh refinement (AMR) to dynamically and adaptively deploy very fine spatial resolution where needed to accurately resolve the dynamics of features like grounding lines and ice streams. Work by Cornford, Martin, et al (2016) demonstrated that very fine (sub-km) resolution is essential to accurately resolve the dynamics of the marine ice sheets which dominate the West Antarctic Ice Sheet. Without such fine resolution, models may compute solutions which are qualitatively and quantitatively incorrect. Uniformly resolving the entire Antarctic ice sheet at such fine resolution would be prohibitively expensive, with an enormous amount of unnecessary computational effort. Because the fine resolution must follow grounding lines as they retreat, BISICLES is an ideal tool for investigating the response of the Antarctic Ice sheet to marine forcing and the consequent grounding-line retreat and contribution to sea level rise (SLR). AMR enables the required resolution while also maintaining a reasonable time to solution.

Adding BISICLES to E3SM will enhance E3SM’s predictive capability for understanding the role of ice sheets in the fully-coupled climate system and the resulting contributions to SLR, while also providing a useful companion to the current MALI model for V&V purposes.