ACCESS-NRI ice sheet model coupling approach

The role of the Cryosphere WG is to coordinate the national cryosphere community and is initially primarily focussed on providing expert advice on how best to include ice sheets (Greenland and Antarctica) into ACCESS-NRI, with consideration to the objectives of ACCESS-NRI; other roles as per terms of reference from ACCESS.

We have requested confirmation from ACCESS-NRI of the following primary objective: enabling decadal to centennial scale climate projections (sea level rise and climate impacts from freshwater flux, etc.) that include the role of Antarctica and Greenland, coupled with the oceans and atmosphere, and how best each ice sheet should be included, recognising Antarctica is a national research focus and Greenland is not yet.

Secondary objectives: include other cryosphere relevant processes such as paleo simulations; solid-Earth-climate interactions (not otherwise needed e.g. in sea level projections); adjoint capabilities; coupled interactions with fast ice; glaciers; permafrost changes.

We seek endorsement of the approach we recommend to be adopted, as follows:

1. Continued consultation with the community about what Ice Sheet Model (ISM) candidates and approach to coupling should be considered, and include
    - Candidates used by the Australian community
    - Candidates used in ESM-ISM coupling by other international modelling centres, that align with other ACCESS-NRI components
    - Other candidates
    - Note: any candidate ISM should be excluded only on the basis of it obviously not being fit for purpose (e.g. not passing community-agreed benchmarking experiments). If so, needs a strong justification of why
2. Develop an overview of ISM candidates capabilities for further consideration by
    - Seeking input from international ISM developers by developing and soliciting input with a questionnaire of international ISM developers and the potential for ongoing support and collaboration, given there are no ice sheet model kernel developers based in Australia. This is the preferred approach rather than asking the Australian community to provide assessment of capabilities because developers: (1) know the models best; (2) can provide details on the capabilities of the models to meet the primary/secondary objectives; (3) can provide advice on capacity of models to couple within ESMs of components of the ESM being proposed within ACCESS-NRI, especially which models have already been successfully coupled with ESMs or other component models; (4) can provide advice on upcoming developments that might not already be in the literature/code base
    - Primary objectives are identified by ACCESS, and ISM core capabilities should include the extent to which they can meet the primary objective, and over what timeframe
    - Secondary objectives should be considered, with particular focus on the existing or anticipated future needs of the ACCESS/other modelling community within Australia

3. Community-wide invitation to rank ISMs based on suitability against ACCESS-NRI objectives
    - The whole Australian community, including cryosphere WG members, all ACCESS members, and other interested parties are provided opportunity to rank ISMs based on their fit to purpose
4. Special group to score ISMs
    - Composed of 6-12 “experts”, including Australian ice sheet specialists, ACCESS-NRI Director, and independent chair, and 2 international panel members who have expertise in this area and *are able to be objective*.
    - Assess community-wide feedback and ranking, and bring their expertise to provide a more objective overview of whether ISMs are fit for purpose
    - Should include 1-:
    - Other potential considerations: How should Antarctica and Greenland be considered and what is the best development timeline? Should developing a new model or supporting multiple models be considered? What coupling frameworks are available? How will pathways to other Australian ice sheet research activities be supported? What models will progress coupled climate-ice sheet modelling best in Australia?What models will work best with other components in UM/MOM6? Are any potential candidates *unable* to be successfully coupled with the climate model components within the timeframe?Why did different modelling centres choose the ISMs that they did?
    - Provide key recommendations to ACCESS-NRI including potential activity timeframe and risk and benefits for different scenarios, and estimates of effort required.