



Comparison of the surface mass and energy balance of CESM and MAR forced by CESM over Greenland: present and future

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We have compared the surface mass (SMB) and energy balance of the Earth System model (ESM) CESM (Community Earth System Model) with those of the regional climate model (RCM) MAR (Modèle Atmosphérique Régional) forced by CESM over the present era (1981 — 2010) and the future (2011 — 2100 with SSP585 scenario).

Until now, global climate models (GCM) and ESMs forcing RCMs such as MAR didn't include a module able to simulate snow and energy balance at the surface of a snow pack like the SISVAT module of MAR and were therefore not able to simulate the SMB of an ice sheet. Evaluating the added value of an RCM compared to a GCM could only be done by comparing atmospheric outputs (temperature, wind, precipitation ...) in both models. CESM is the first ESM including a land model capable of simulating the surface of an ice sheet and thus to directly compare the SMB of an RCM and an ESM the first time.

Our results show that, if the SMB and its components are very similar in CESM and MAR over the present era, they quickly start to diverge in our future projection, the SMB of MAR decreasing more than that of CESM. This difference in SMB evolution is almost exclusively explained by a much larger increase of the melter runoff in MAR compared to CESM whereas the temporal evolution of snowfall, rainfall and sublimation is comparable in both runs.