AGU 100 FALL MEETING

Abstract C23B-1535

Projection of the Antarctic surface mass balance by 2100 using MAR

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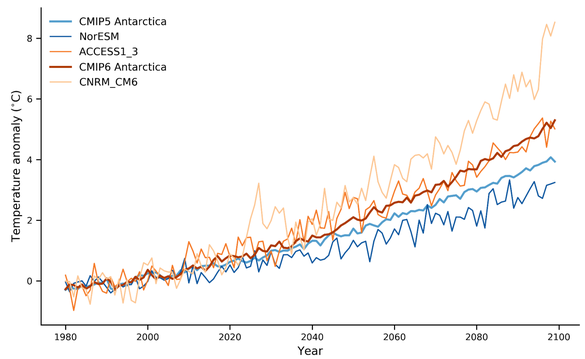
Introduction

While the next IPCC report on the Antarctic Ice Sheet (**AIS**) contribution to sea level rise will be based on CMIP5 models, the **new generation of CMIP6 models suggests an even stronger warming** for the end of the century.

This study investigates the sensitivity of the Antarctic surface mass balance (**SMB**) components to different intensities of global warming.

Air temperature warming over Antarctica



Despite being a CMIP5 model, ACCES1.3 projects a warming similar to the CMIP6 mean and is therefore considered as a model representative of the mean warming suggested by CMIP6.

Conclusion

In the context of global warming, the Antarctic SMB is projected to increase due to enhanced snowfall. However, **projections based on a stronger warming reveal a significant increase in runoff** that compensates the increase in snowfall.

The significant increase in melt, especially over the ice shelves could lead to more numerous ice shelf collapses through hydro-fracturing processes before the end of this century.

Data availabil

Monthly and yearly outputs from both MAR(ERA5) and projections can be downloaded on:
ftp://ftp.climato.be/climato/ckittel/MARv3.10/
while the daily outputs can be requested by contacting the authors.

Methods

Model

We use the polar-oriented Regional Climate Model **MAR(v3.10)** to downscale 6-hourly GCM outputs.

Simulations (1980-2099)

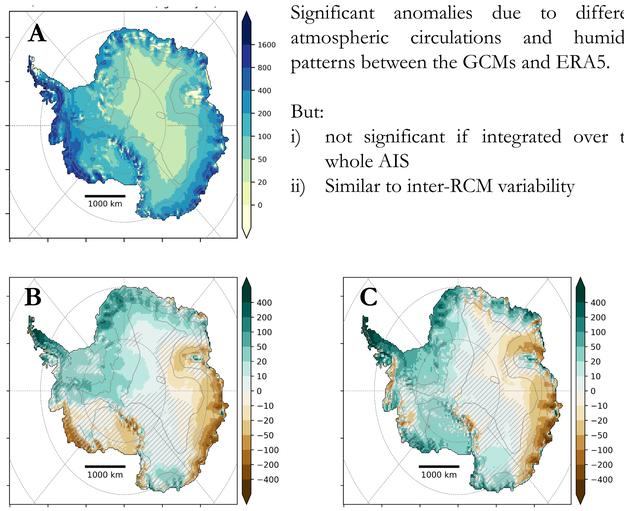
MAR(NOR): MAR forced by NorESM1-M using RCP8.5
Representative of a **moderate warming**

MAR(ACC): MAR forced by ACCESS1.3 using RCP8.5
Representative of a **mean CMIP6 warming**

MAR(CN): MAR forced by CNRM-CM6 using SSP58.5
Representative of a **strong warming**

Work in progress

Evaluation over the historical period (1980-2005)



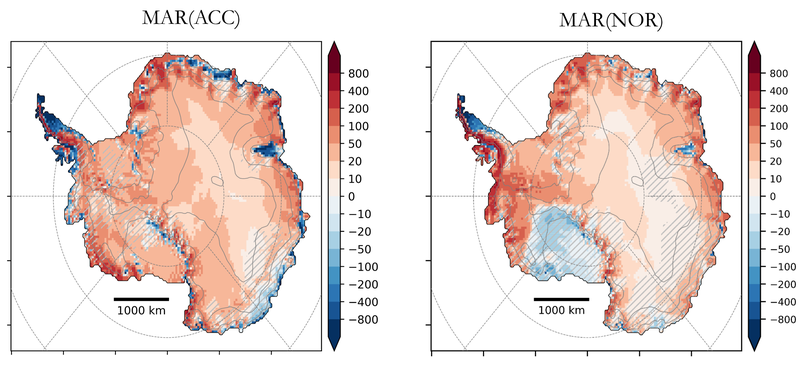
Significant anomalies due to different atmospheric circulations and humidity patterns between the GCMs and ERA5.

But:
i) not significant if integrated over the whole AIS
ii) Similar to inter-RCM variability

Mean MAR SMB forced by ERA5 *(A)*, anomalies of MAR(ACC) *(B)* and MAR(NOR)*(C)* mean annual SMB compared to the Mean MAR SMB forced by ERA5 *(Units: : kg.m^{-2}.yr^{-1})*. Hatched area denote non-significant anomalies.

Results

Projected SMB changes (2075-2099) vs the historical period (1980-2005)

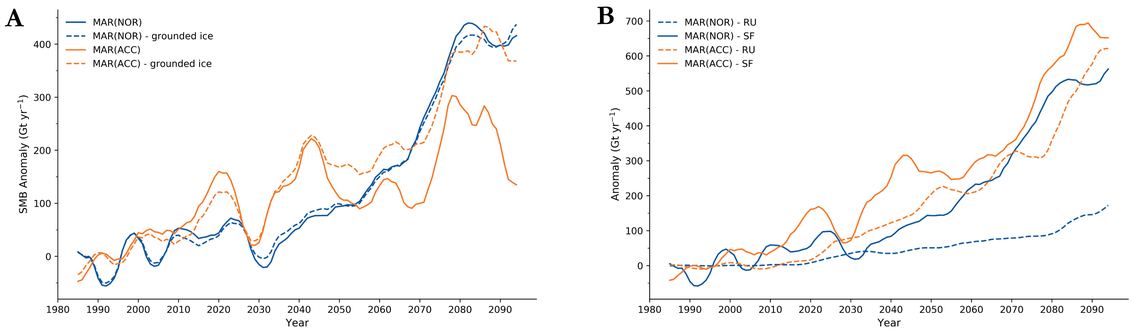


Significant decrease over all the *small* ice shelves

Significant increase in the Amundsen sector

General **significant increase in SMB** over most of the grounded ice.

Evolution of the Antarctic SMB and its components



Time-series evolution of the anomalies of the SMB over the Antarctic ice sheet including the ice shelves and only over the grounded ice (A) and its main components (Runoff and Snowfall) over the whole Antarctic ice sheet (B) compared to 1980-2005. A 21-year running mean has been applied to the original annual values.

While both grounded and ice shelf SMB are projected to increase in MAR(NOR) with a similar rate, the SMB simulated by MAR(ACC) suggests a decoupling between the ice shelves and the grounded starting around 2045.

Despite a similar increase in snowfall for both simulations, the strong increase in runoff over the ice shelves in MAR(ACC) will nearly compensate the increase in snowfall.