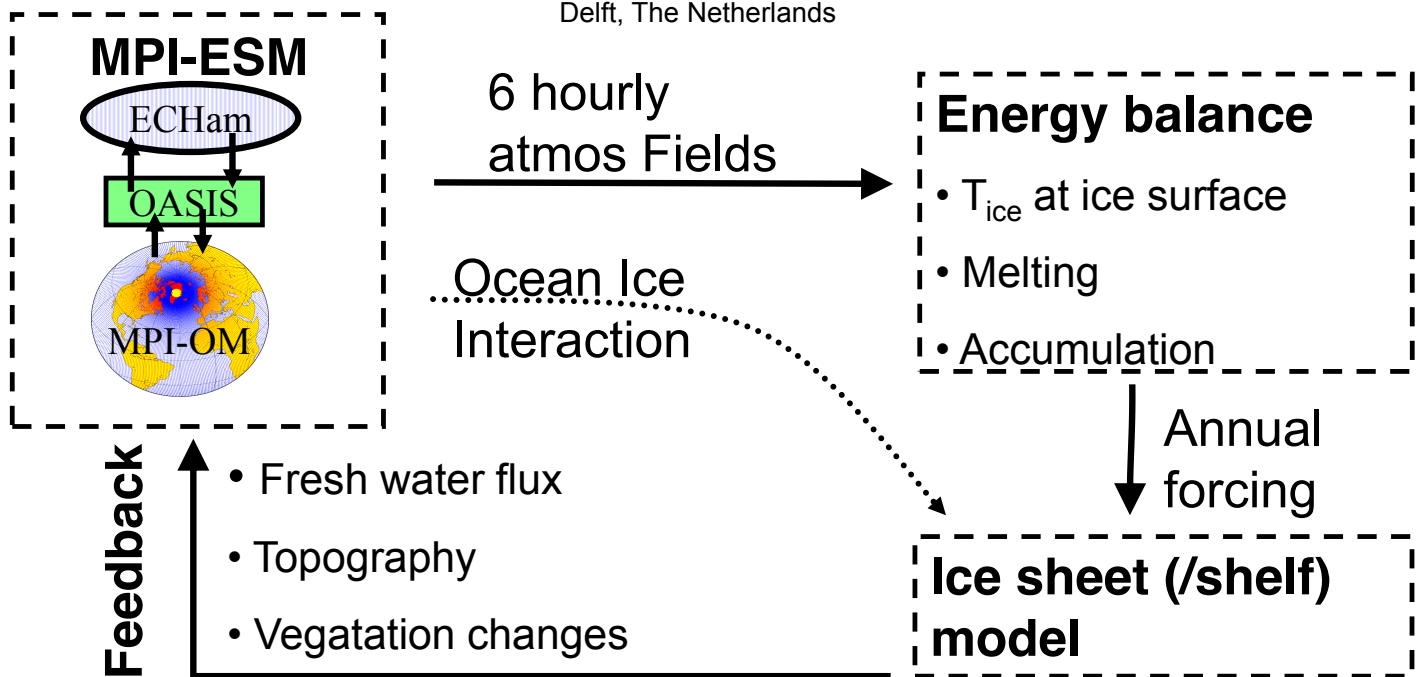


Two-way coupled ice sheet-earth system simulations: ... [Under raising CO₂] ...

Chr. Rodehacke[#], F. Ziemen, M. Vizcaino^{*}, U. Mikolajewicz

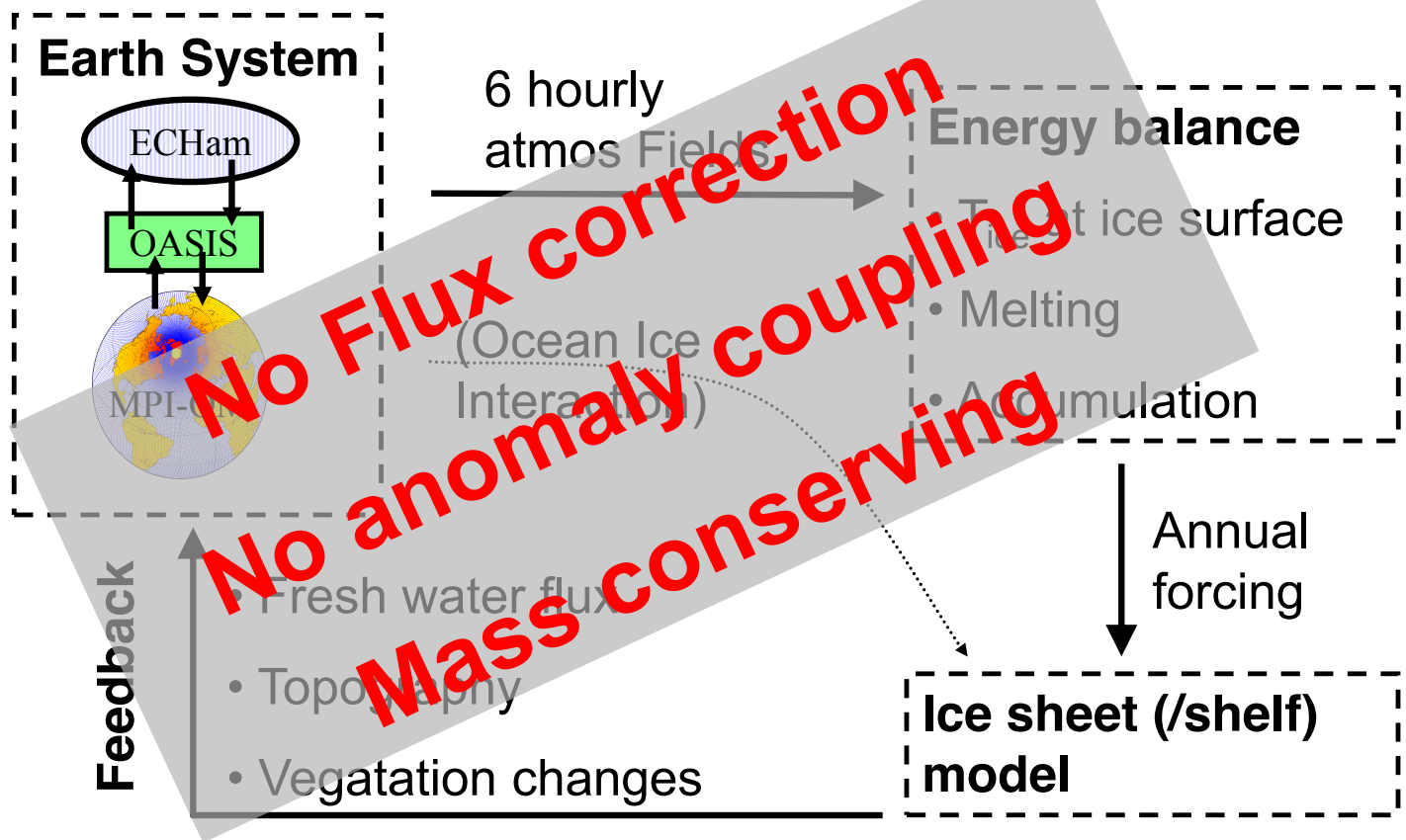
Max Planck Institute for Meteorology Hamburg, Germany; [#]now at Danish Meteorological Institute, Copenhagen, Denmark, ^{*}Department of Geoscience and Remote Sensing, Delft University of Technology, Delft, The Netherlands



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Ocean-Ice 3Eqn.: Holland and Jenkins 1999

Coupling scheme



Experiments

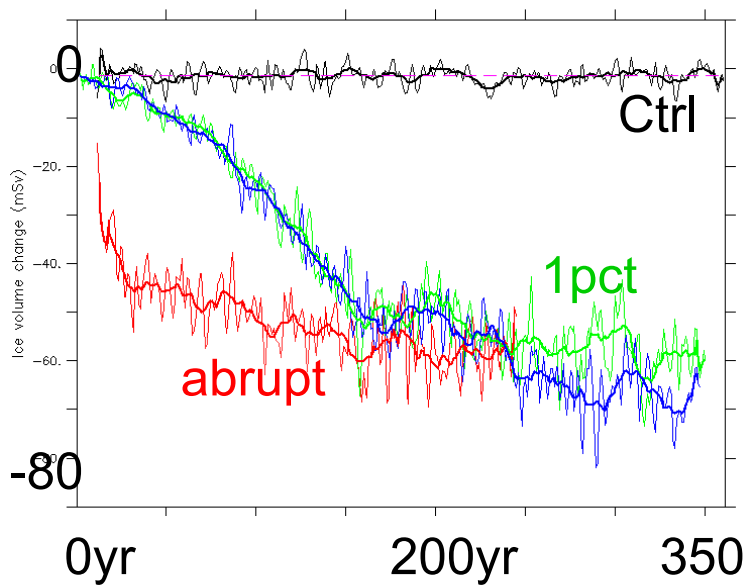
CMIP5 Generation

- **Ctrl**: Control Run
pre-industrial: $p(\text{CO}_2)=284\text{ppm}$
- **abrupt**: increase to $4\times\text{CO}_2$
- **1pct**: CO_2 increases 1% per year until $4\times\text{CO}_2$, then constant
- **1pct_noFB**: same as **1pct** *but* suppressed feedback



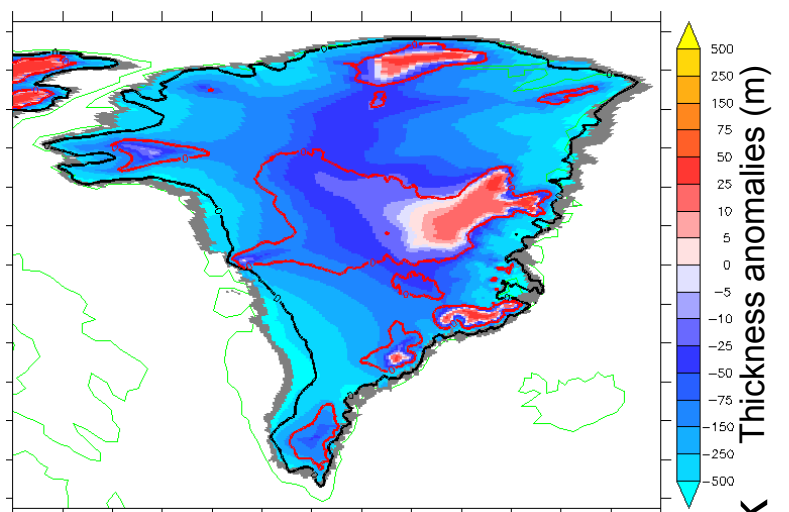
Ice volume under heat

Ice mass loss rate (mSv)



Ctrl, abrupt, 1pct, 1pct_noFB

Ice thickness
1pct – Ctrl : 350yr



Equilibrium lines Ctrl — 1pct —

grow

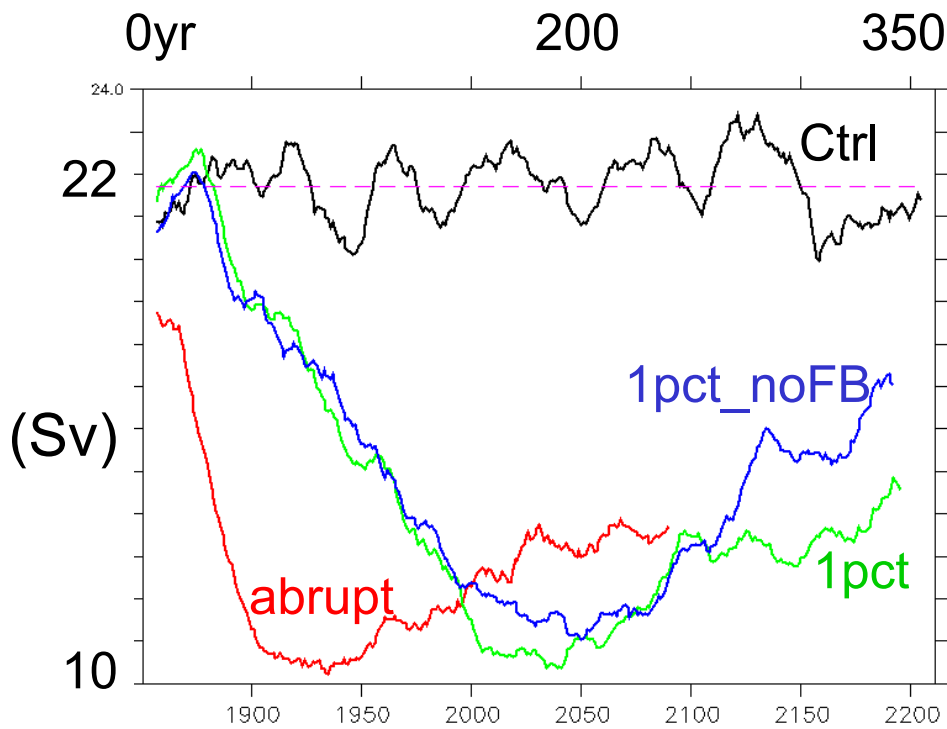
shrink



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Reduction in accumulation area
might be caused by ice transport

Is the AMOC affected?



- Stronger radiative forcing results ultimately in a weaker AMOC
- After 250yr the additional melt matters (1% scenario)

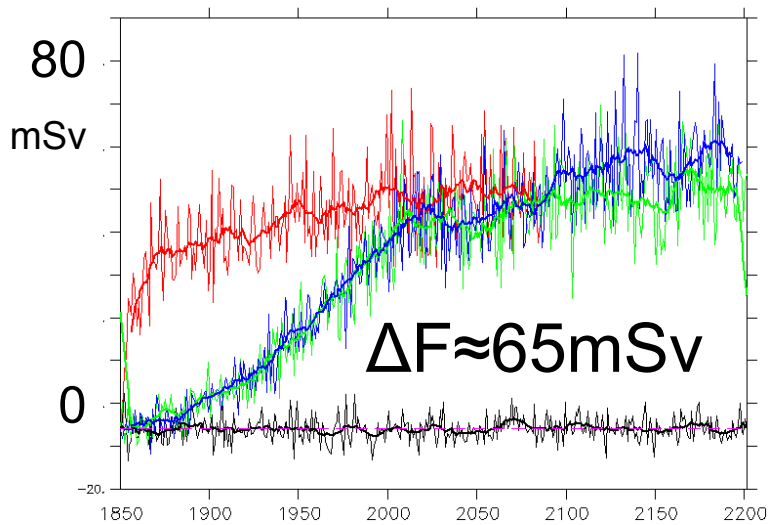
Ctrl, abrupt, 1pct, 1pct_noFB



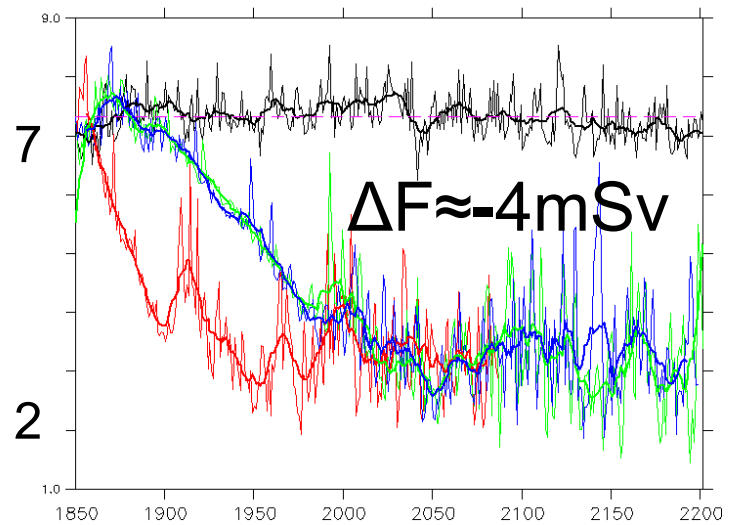
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Atmosphere vs Ocean

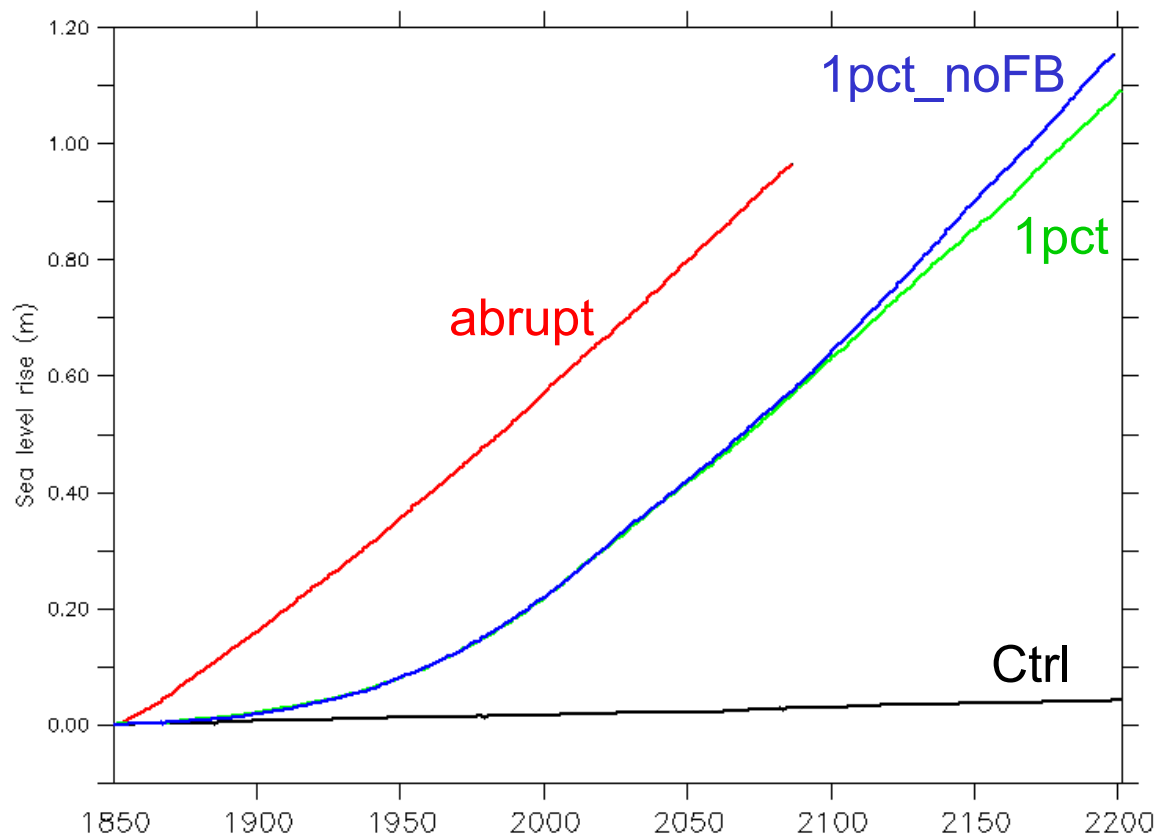
**Land: fresh water flux:
SMB and Basal**



**Ocean: fresh water flux
and heat subtraction:
Calving and Ocean**



Sea level rise



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Ctrl, abrupt, 1pct, 1pct_noFB

Summary

- In a warming world the additional melting offsets the accumulation at higher altitude
=> Greenland disintegrates
- The ice-ocean interaction decreases when the ice retreats from the coasts
- On the long-term feedbacks are important:
 - The AMOC is affected by the additional fresh water: initially warming is enough
 - Sea level rise estimates diverges

