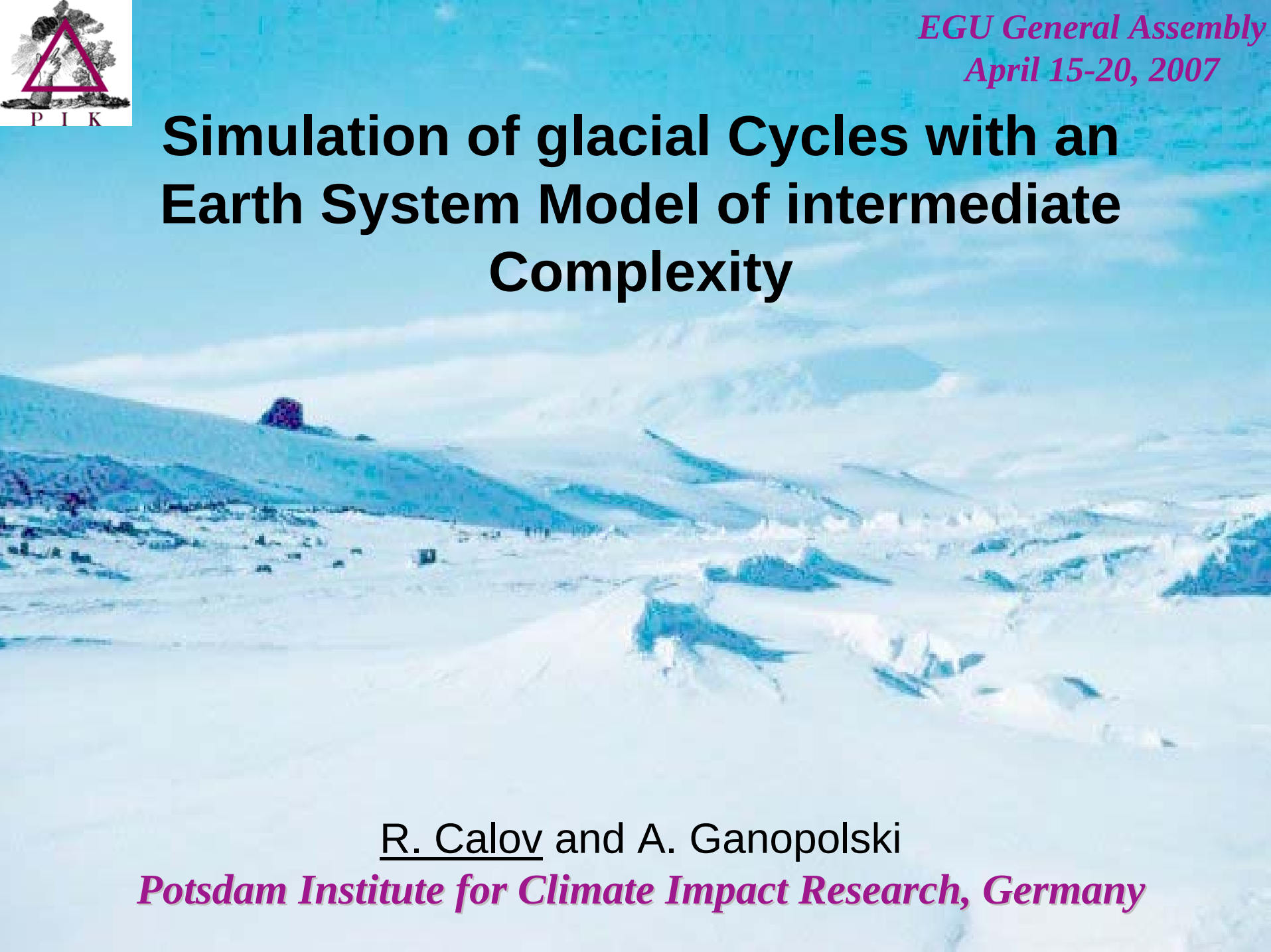


EGU General Assembly
April 15-20, 2007

Simulation of glacial Cycles with an Earth System Model of intermediate Complexity

R. Calov and A. Ganopolski
Potsdam Institute for Climate Impact Research, Germany

Outline of presentation

- **The model and experimental setup**
- **Simulation of four glacial cycles**
- **Ice The role of CO2, glacial erosion of dust and thermohaline circulation**
- **Conclusions and outlook**

The Model

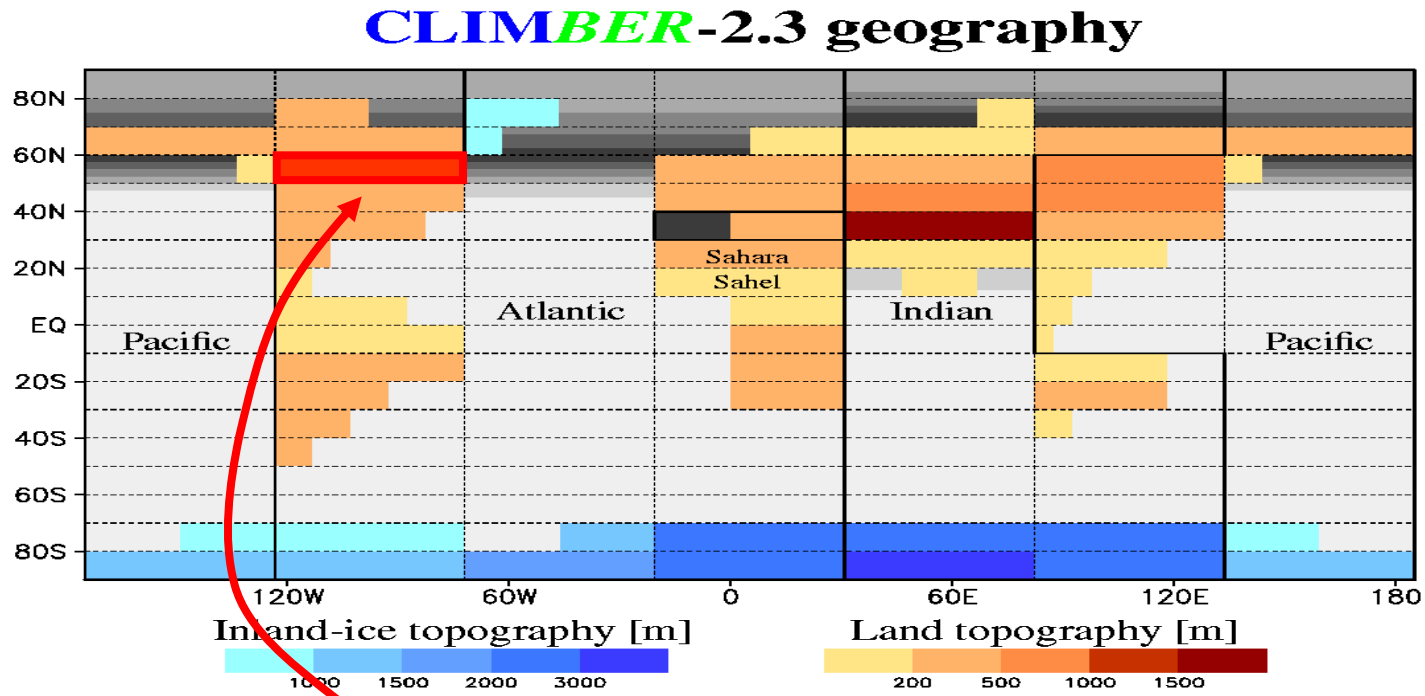
- **Earth system model of intermediate complexity CLIMBER-2**
Petoukhov et al. (2000), Ganopolski et al. (2001), Calov et al. (2005)

- **Very low resolution and extremely computationally efficient model**

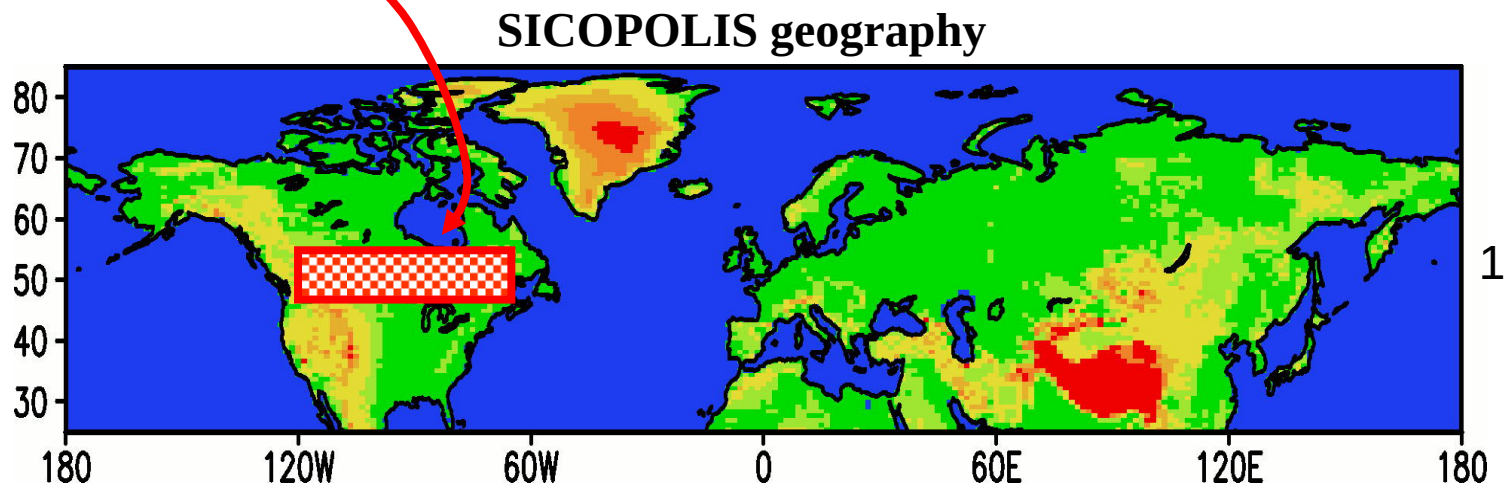
- **Components of CLIMBER-2: atmosphere, ocean, terrestrial and marine biota, land surface, ice sheets**

- **Ice sheet component: SICOPOLIS** (Greve, 1997)
3-D polythermal ice-sheet model (Northern Hemisphere only)

The Coupling

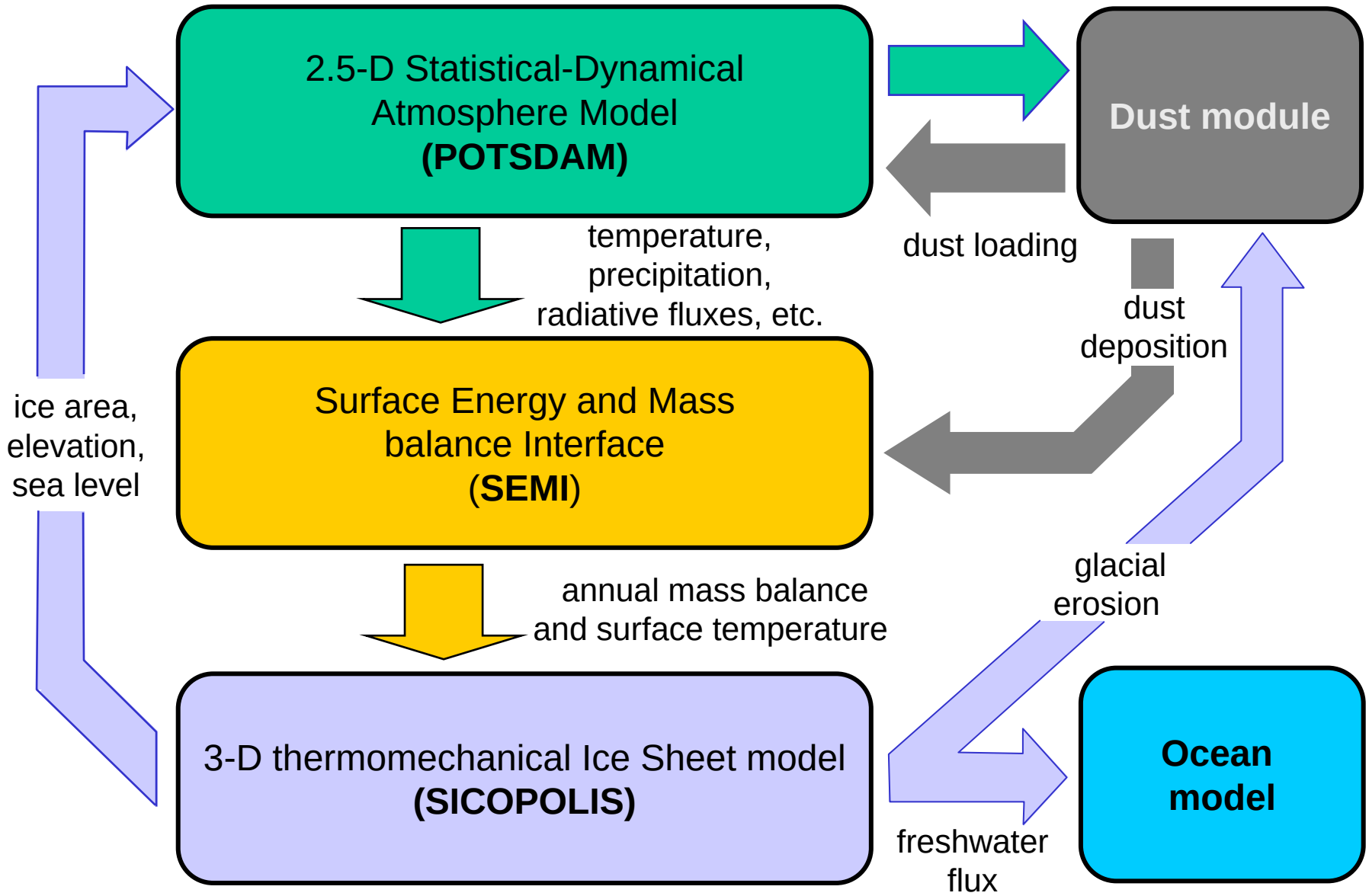


10°x50°



1.5°x0.75°

CLIMATE-ICE SHEET COUPLING



Model Setup

- **Forcings**

  External: orbital
  Internal: CO_2

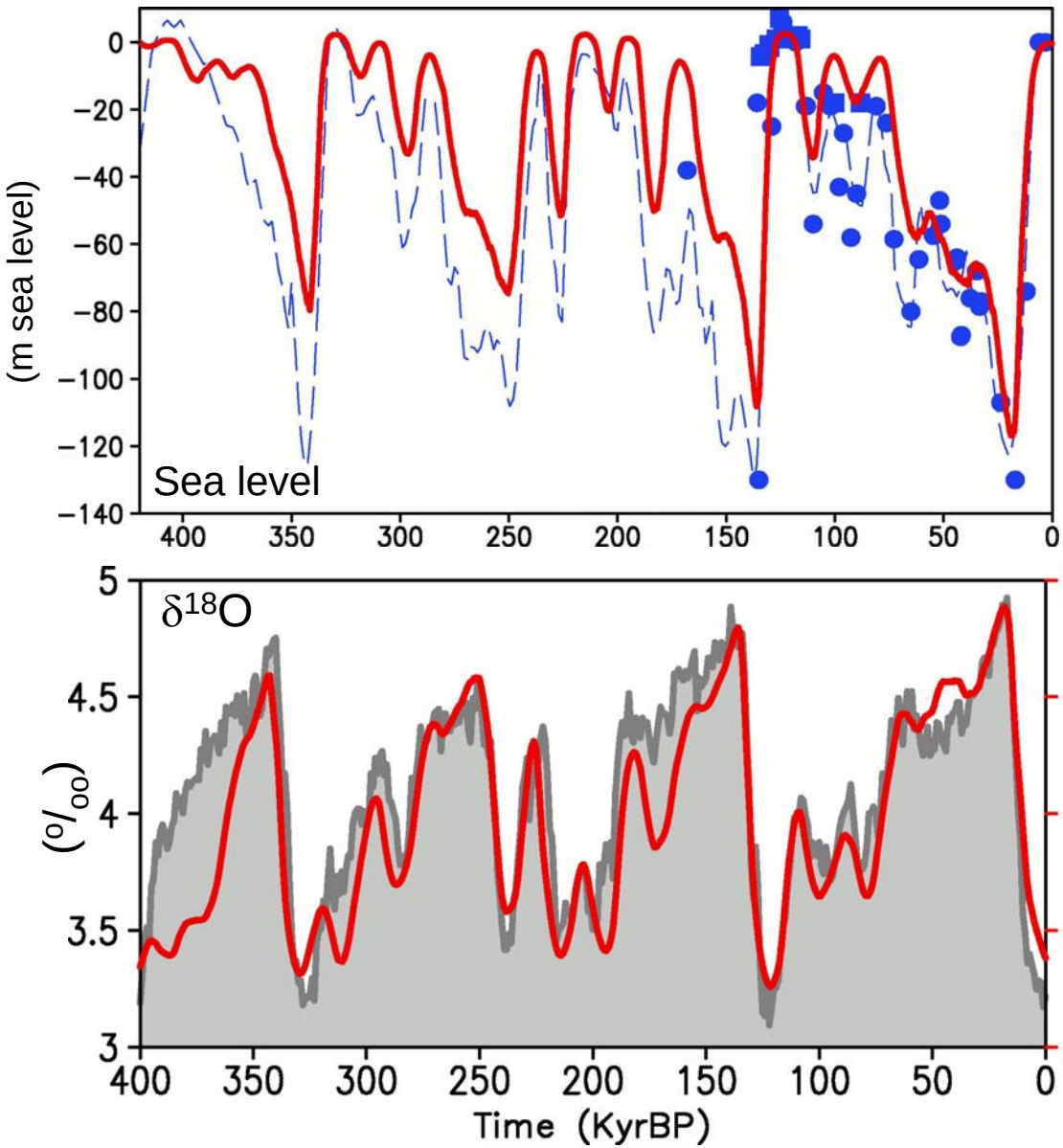
- **Initial conditions**

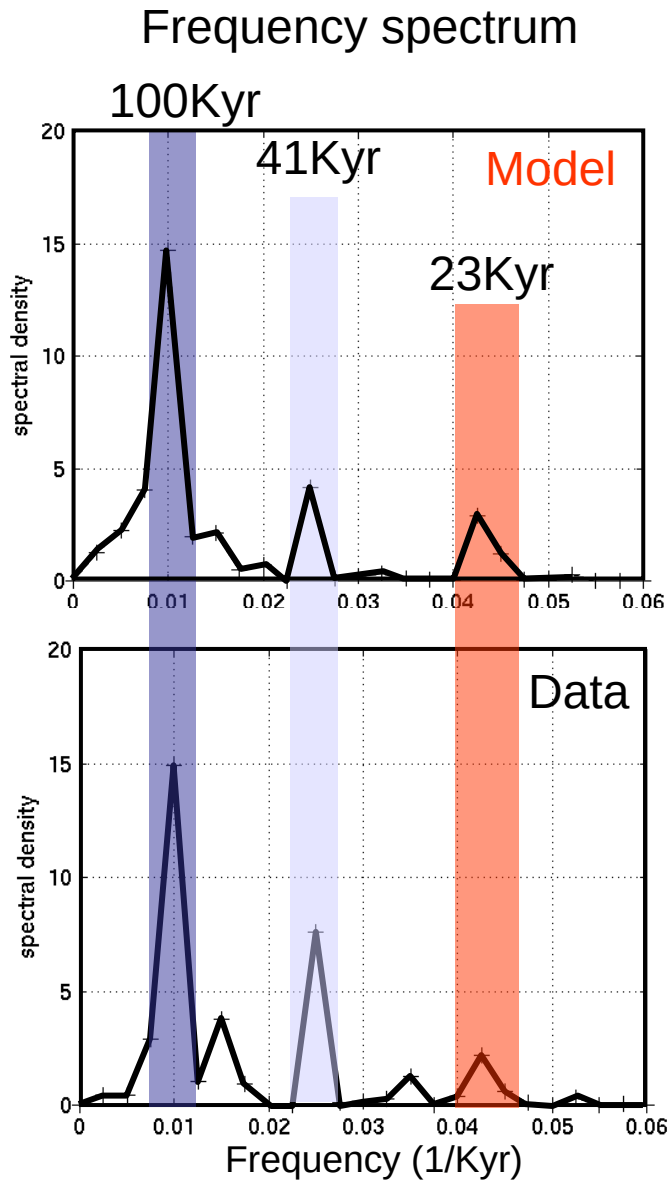
  Equilibrium interglacial climate state

- **Two classes of model runs**

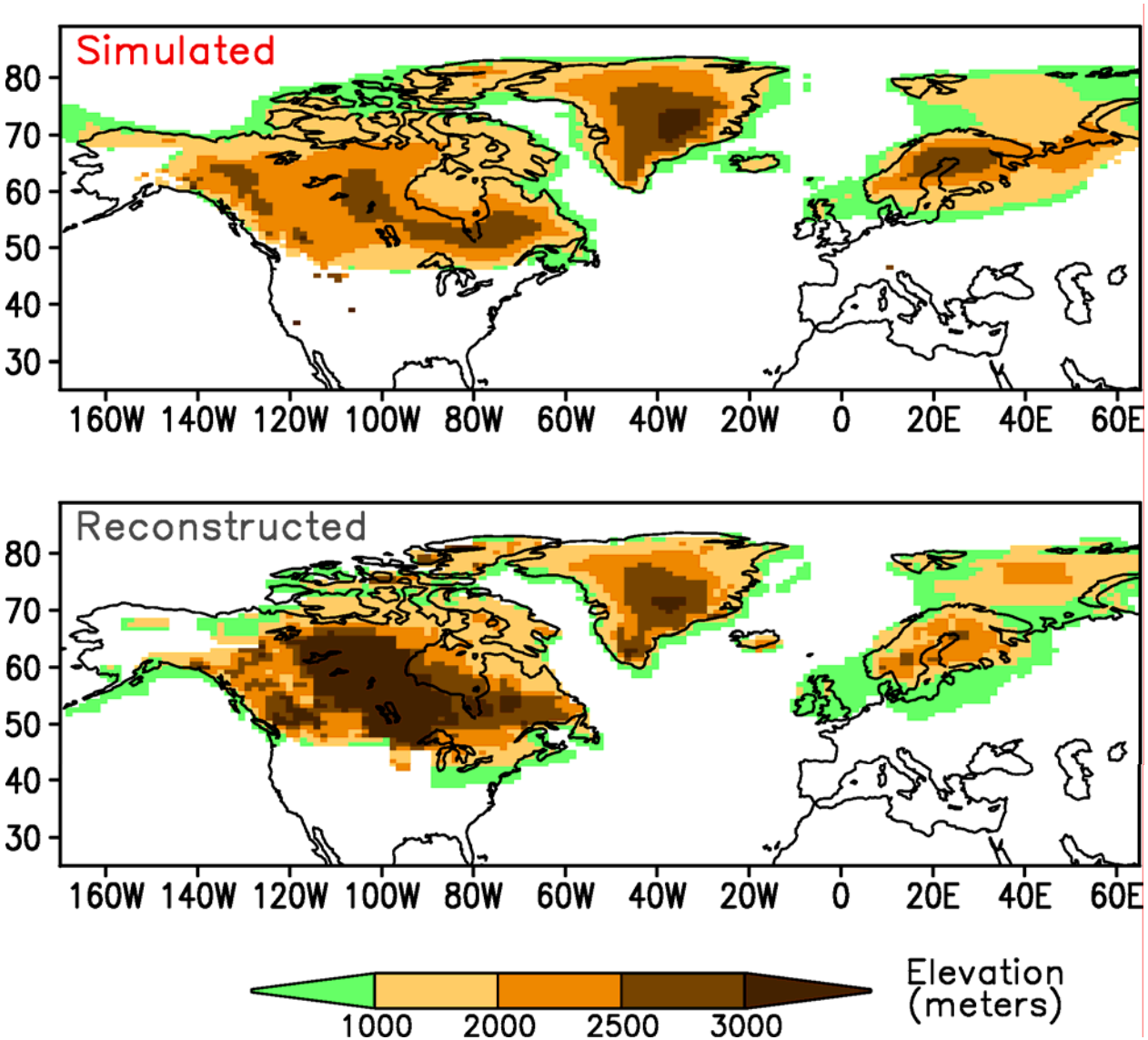
  1) 420,000 yrs (starting from MIS 11)
  2) 125,000 yrs (starting from MIS 5e)

Simulation of the last four glacial cycles





LGM ice sheets

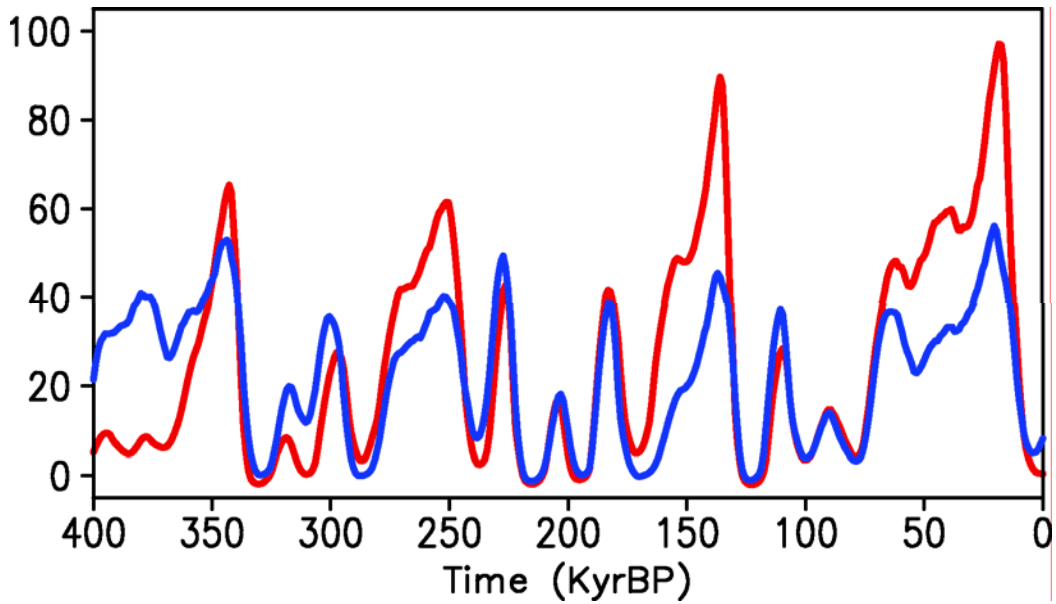


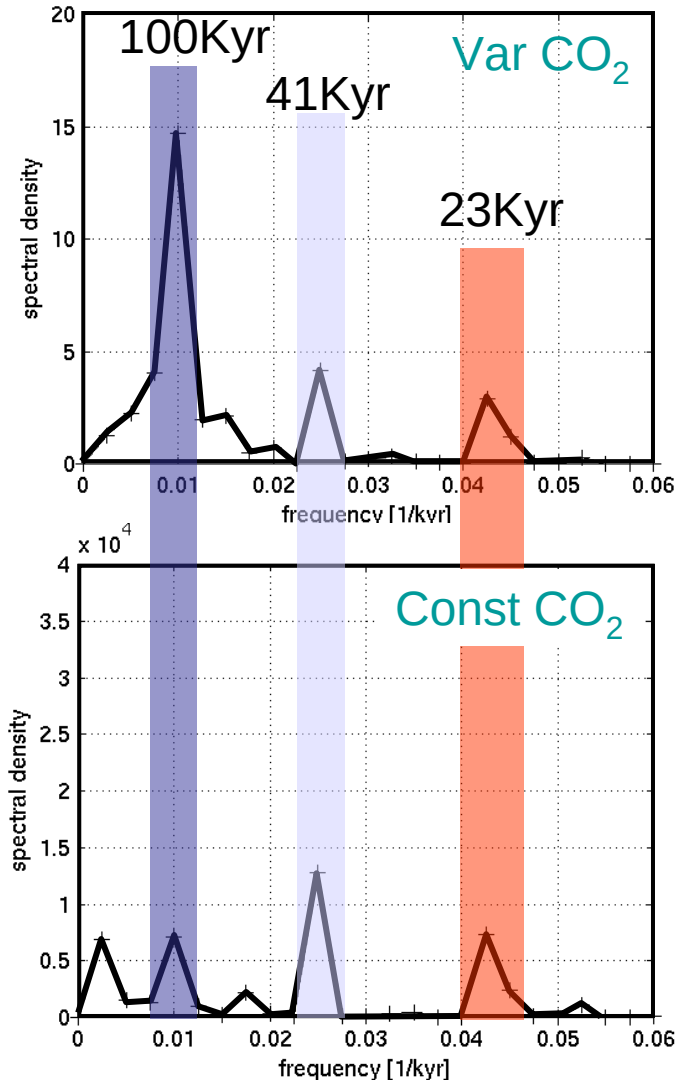
Animation of the last two glacial cycles

To view the animation please follow the link:

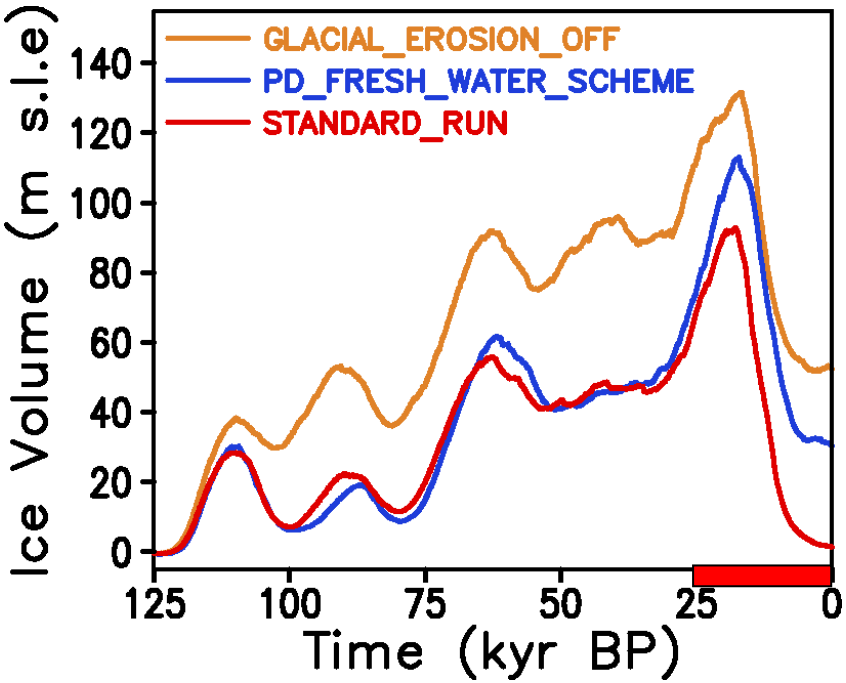
http://www.pik-potsdam.de/~calov/animations.html

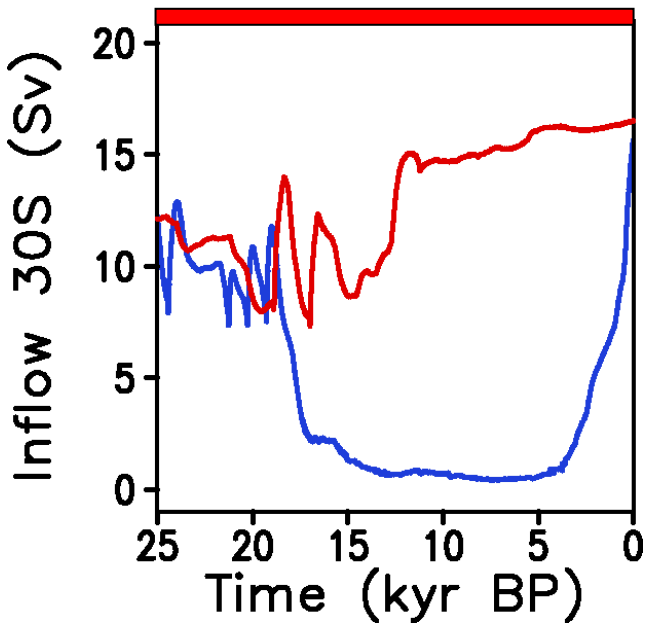
The role of CO_2





The role of the thermohaline circulation and glacial erosion





Conclusions

- Using orbital and CO_2 forcing the model successfully simulated glacial dynamics during the last 420,000 years.

- The modelled ice cover is in good agreement with the proxy-data: in geographical distribution as well as in temporal development of ice volume.

- The orbital frequencies are reproduced. The CO_2 is important to capture the 100 kyr cycle.

- Among other factors, glacial erosion and the time of resumption of THC are important to fully complete the glacial terminations.

Outlook

- Close the carbon cycle.

- Including dust in the radiative scheme.

- Fully interactive simulation of glacial cycles - “Milankovitch-only-run”.