CESM – CISM for Paleoclimate

Bette Otto-Bliesner, CCR
Long-term Future Change

- **CO₂ emissions**
  - Graph showing emissions from 2000 to 3000, with different scenarios represented by lines with shaded areas indicating uncertainty.
  - Labels for RCP 8.5, RCP 6.0, RCP 4.5, and RCP 2.6.

- **Atmospheric CO₂**
  - Graph showing atmospheric CO₂ levels over time.
  - Lines for different RCP scenarios.

- **Surface air temperature change**
  - Graph showing temperature change over time.
  - Lines for different RCP scenarios.
Global mean sea level relative to present:
- Last Interglacial: 5 to 10m
- Pliocene: >present up to 20m
- Last deglaciation: -120m to present

IPCC AR5, Chapter 13
Last Interglacial (128 to 116 thousand years ago)

- Different **orbital forcing** than today

- **High-latitude surface temperature**, averaged over several thousand years, **at least 2° C warmer** than present.

IPCC AR5, Chapter 5
During the last interglacial period, the Greenland ice sheet very likely contributed between 1.4 and 4.3 m to the higher global mean sea level ...
... implying with medium confidence an additional contribution from the Antarctic ice sheet.
‘Proof-of-concept’ with CESM-CISM1 (one-way coupling)

Preindustrial (1850AD)

CESM(CAM4) – FV1x1

CESM(CAM5) – FV2x1

Vizcaino et al., 2013
‘Proof-of-concept’ with CESM(CAM5)-CISM1(one-way coupling)

Last Interglacial (128 kyr BP) minus Preindustrial
Mid-Pliocene (3.3 to 3.0 million years ago)

- Atmospheric CO₂ 350 to 450 ppm
- Global mean surface temperatures 1.9°C to 3.6°C higher than for pre-industrial climate
- Sea level greater than present up to +20m

Haywood et al., 2010
Supplementary Video V1.

Simulated ice sheet change for the last 400 kyr with IcIES-MIROC model