

# Extreme climate conditions in Sweden in a 100,000 year time perspective

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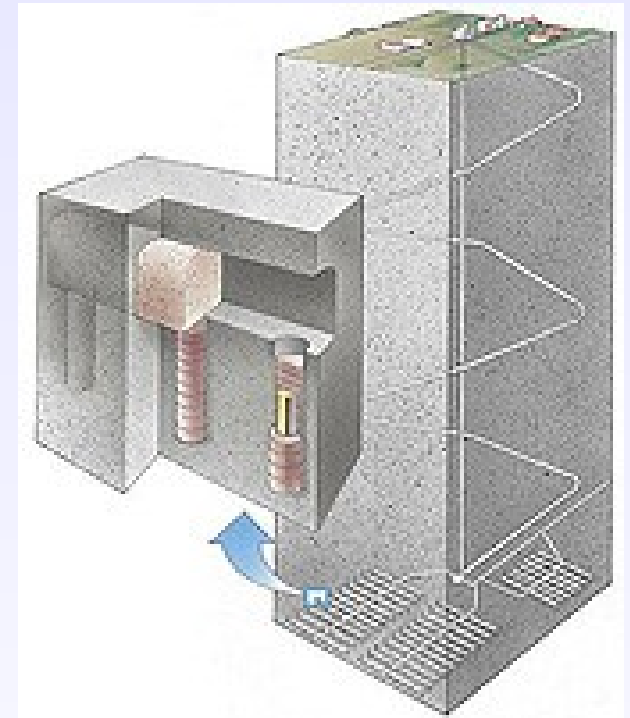
# The project

## Motivation

- The Swedish Nuclear Fuel and Waste Co (SKB) are planning for a final repository for nuclear fuel waste.
- After 100,000 years the radioactivity of the waste has decreased to enriched uranium levels.

## Climate modelling

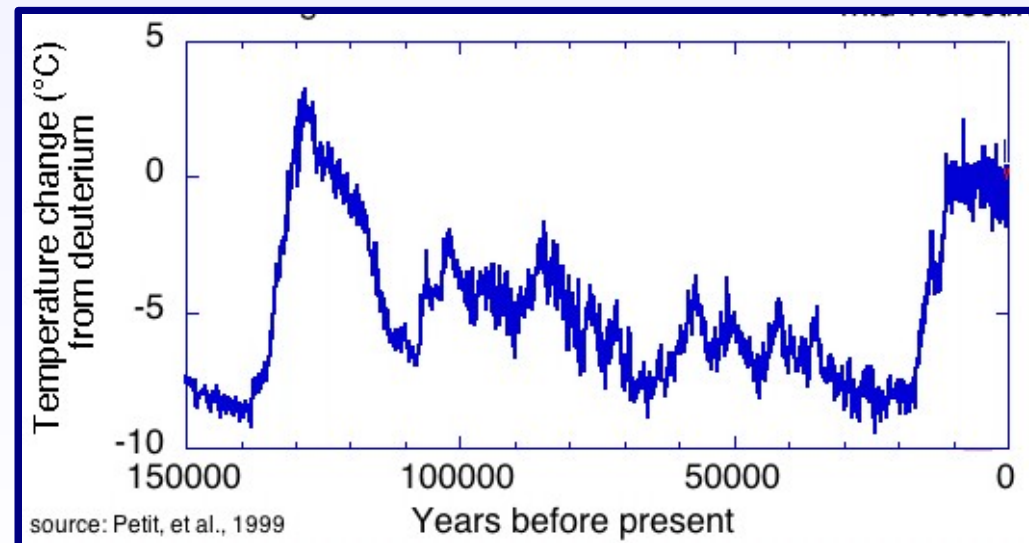
- Identify extreme climate conditions that may occur during the coming 100,000 years.



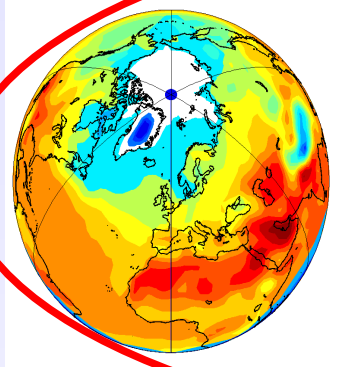
# Three periods

- **Glacial climate:** period with an extensive ice sheet covering large parts of Northern Europe
- **Permafrost climate:** cold period with relatively small ice sheet covering the Scandinavian region
- **Warm climate:** high atmospheric greenhouse gas concentrations and complete loss of the Greenland ice sheet

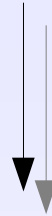
(Petit et al, 1999)



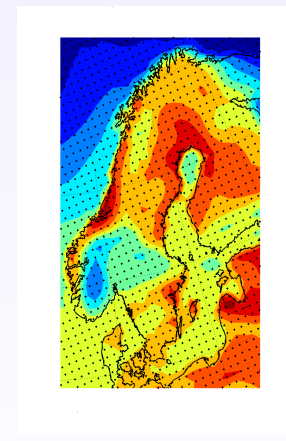
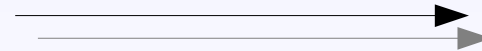
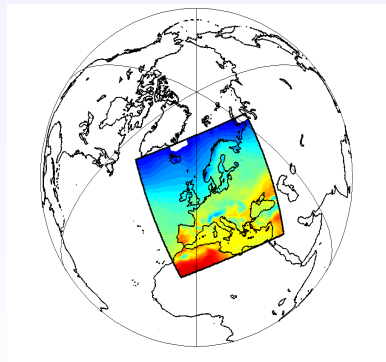
# Global and regional modelling



Global modelling: CCSM  
(at T42gx1v3)



Regional modelling:  
Rossby Centre Regional  
Climate Model (RCA)

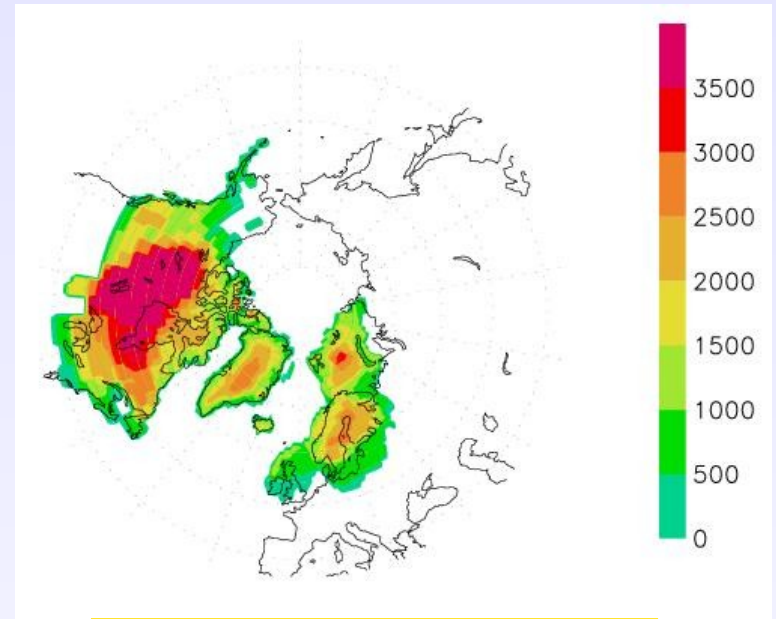


Regional comparison  
with paleodata

# Glacial climate (LGM)

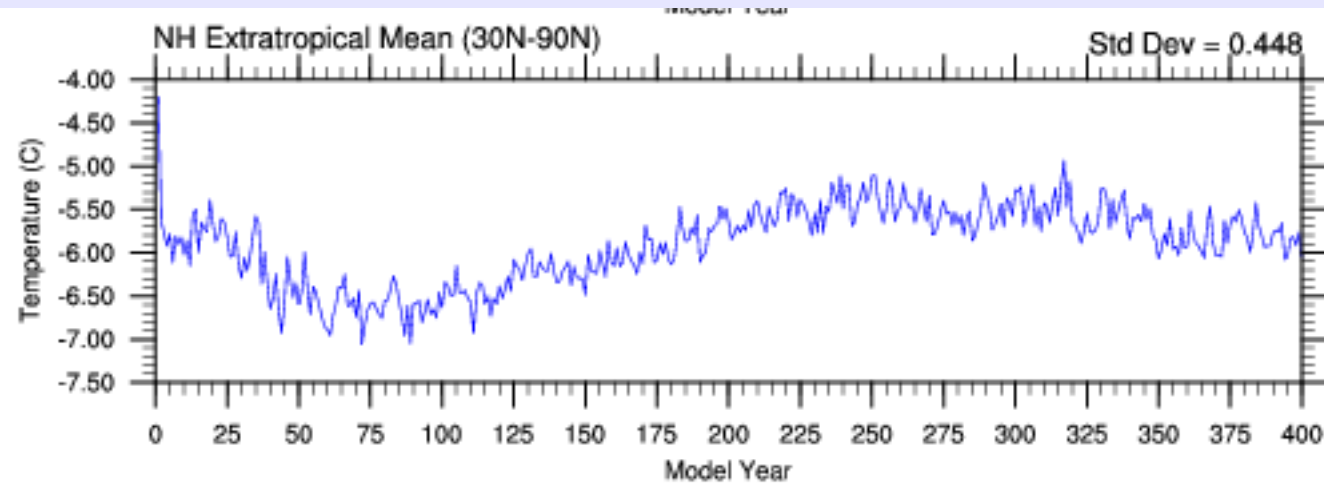
## Forcing and boundary data:

- Insolation: 1365 W / m<sup>2</sup>
- Orbital year: 21ka BP
- Atmospheric GHG conc.
  - CO<sub>2</sub> 185 ppmv
  - CH<sub>4</sub> 350 ppbv
  - N<sub>2</sub>O 200 ppbv
- Ozone: preindustrial conc.
- Sulfates: preindustrial conc.
- Dust & salt: preindustrial/ simulated for LGM (Mahowald)
- Ice sheets: ICE5G
- Topography+bathymetry: ICE5G
- Vegetation: preindustrial/ simulated vegetation (Mahowald)
- Sea level: ca -120 m



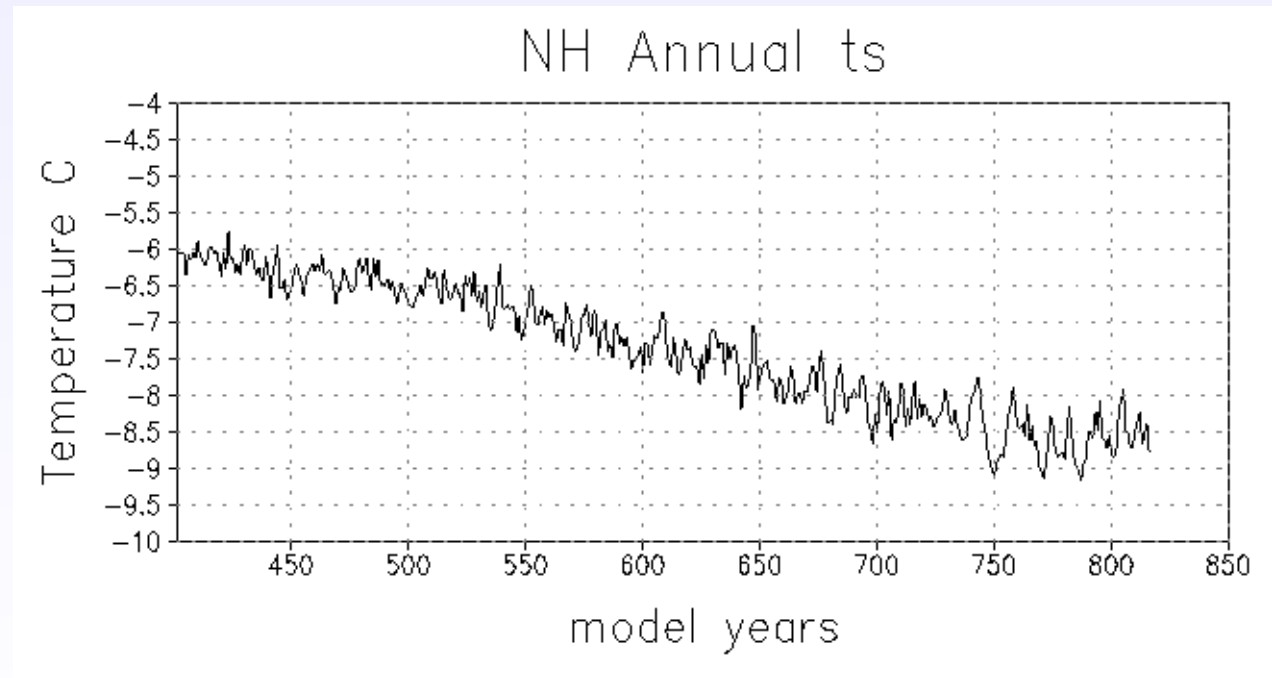
ICE 5G, Peltier, 2004

# Northern hemisphere Ts



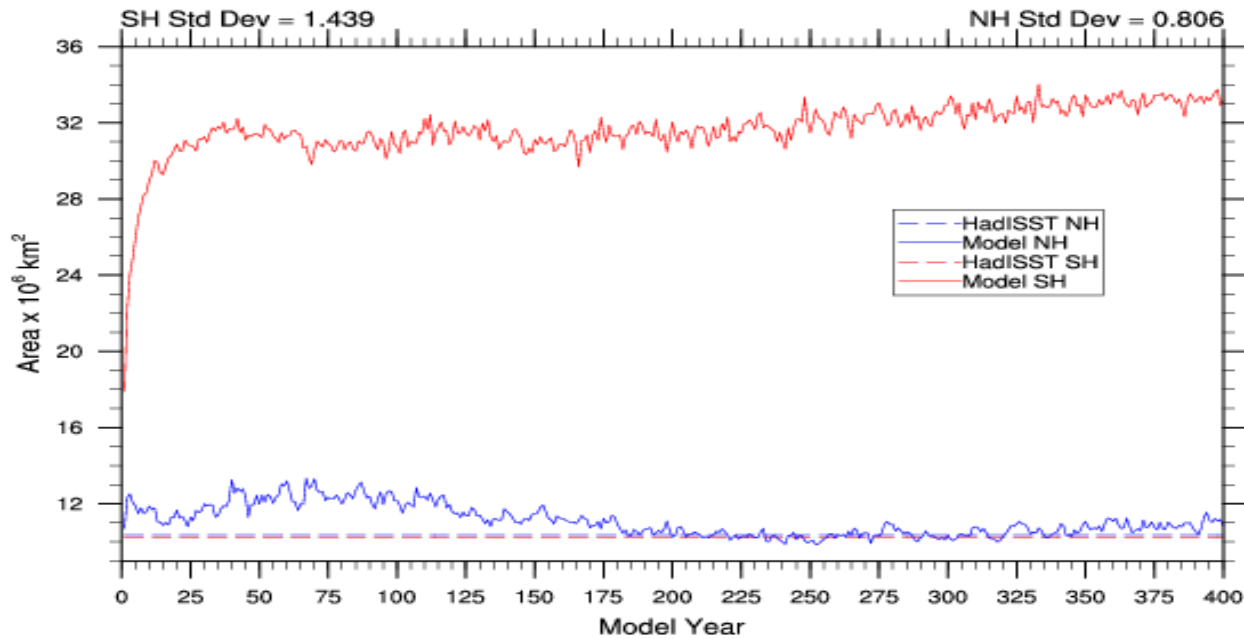
NCAR year 1-400

Tornado year 401-813



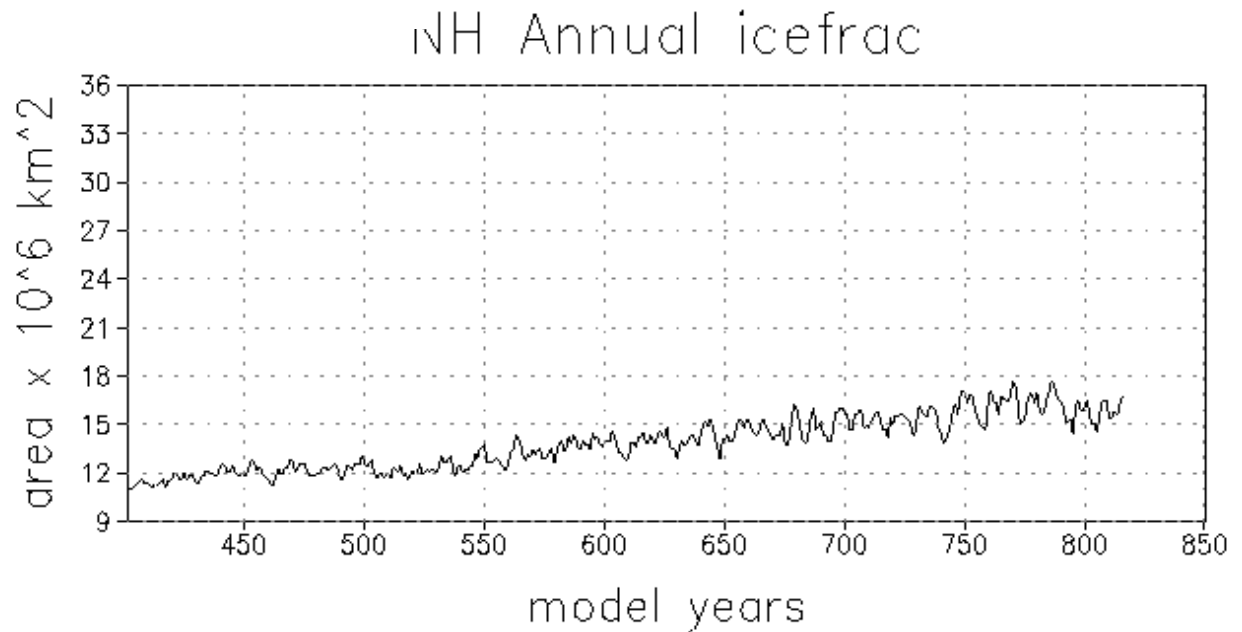
# Northern hemisphere sea ice

b30.104 Annual Sea-Ice Area [Nov 9 2004]

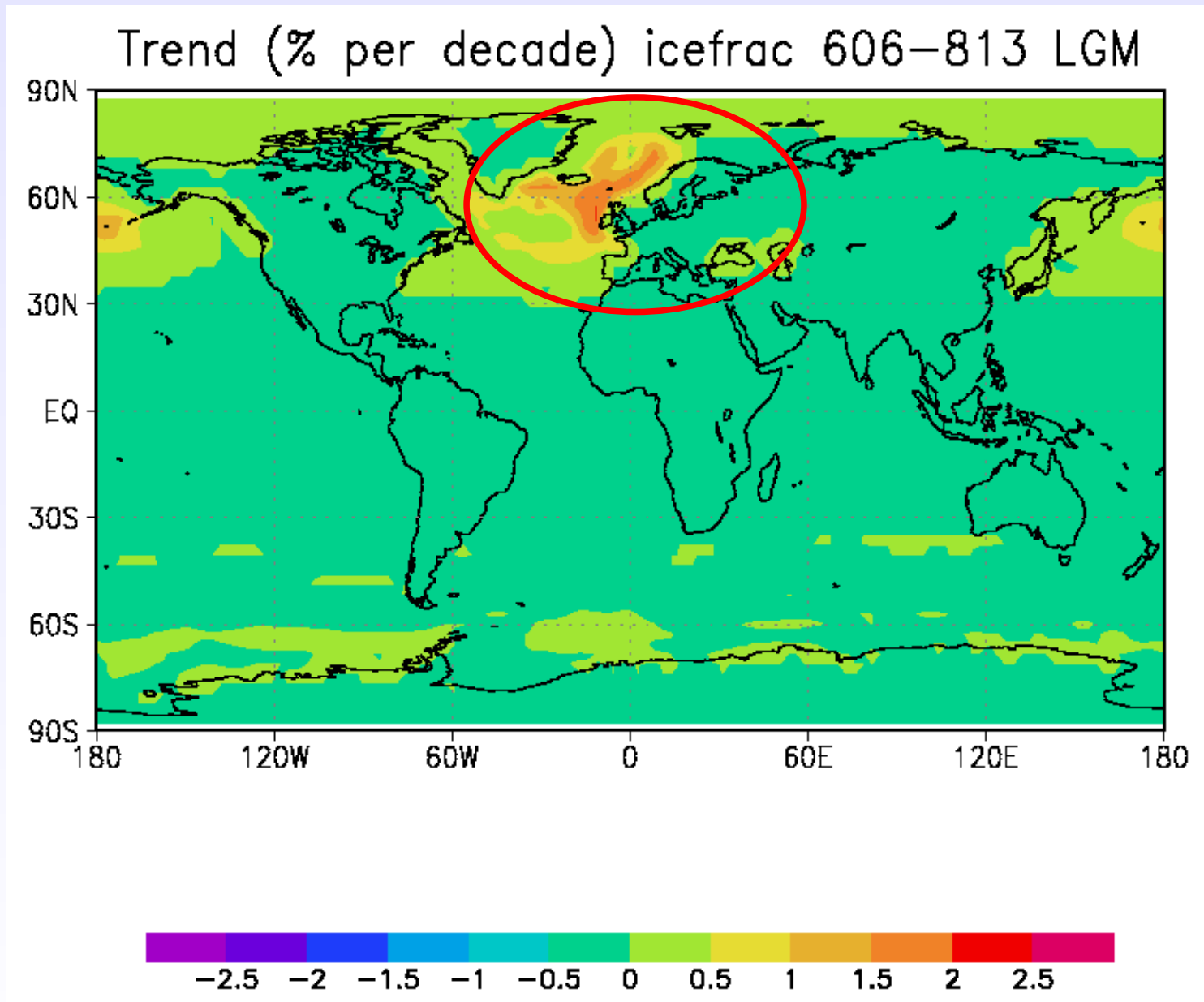


NCAR year 1-400

Tornado year 401-813



# Northern hemisphere sea ice

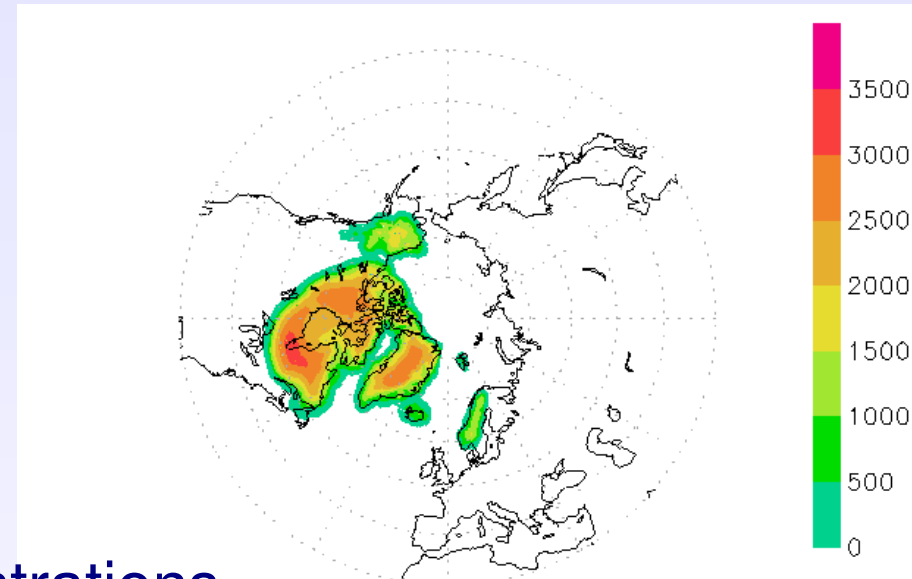




# Permafrost climate (GIS8)

## Forcing and boundary data:

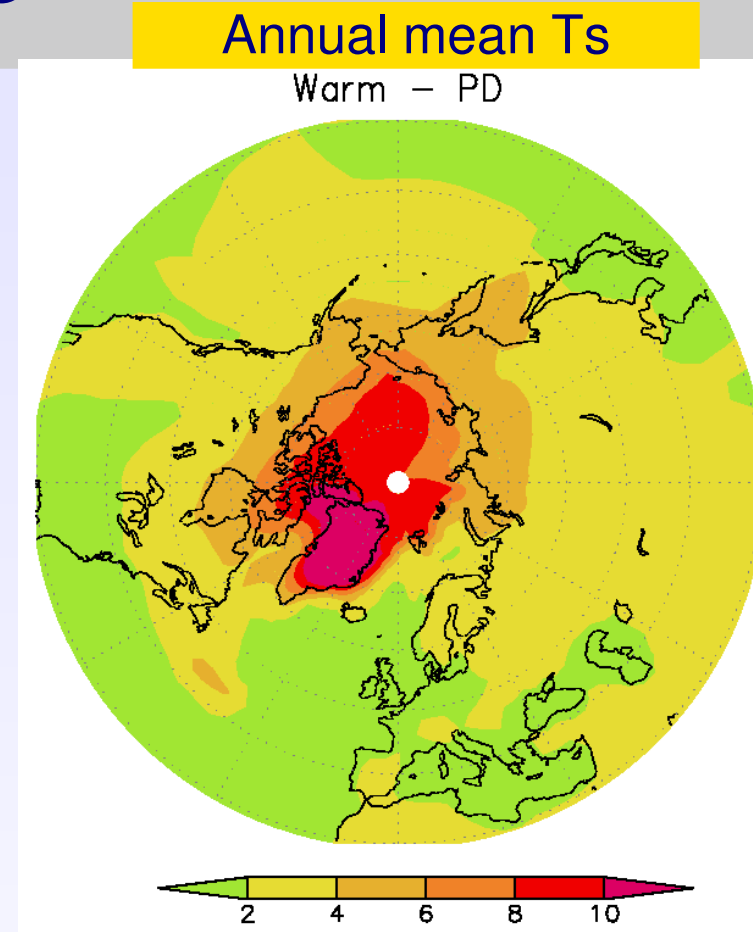
- Insolation: 1365 W / m<sup>2</sup>
- Orbital year: 37 ka BP
- Atmospheric GHG.:
  - CO<sub>2</sub> 210 ppmv
  - CH<sub>4</sub> 575 ppbv
  - N<sub>2</sub>O 245 ppbv
- Ozone: preindustrial concentrations
- Sulfates: preindustrial concentrations
- Dust & salt: preindustrial / scaled LGM
- Ice sheets: Combination of simulated ice sheets
- Topography, bathymetry: From isostatic model
- Vegetation: preindustrial / LGM simulated
- Sea level: ca - 70 m



# Warm climate

## Forcing and boundary data:

- Insolation: 1365 W / m<sup>2</sup>
- Orbital year: 1990
- Atmospheric GHG conc.:
  - CO<sub>2</sub> 750 ppmv
  - CH<sub>4</sub> present day
  - N<sub>2</sub>O present day
- Ozone: preindustrial
- Sulfates: preindustrial
- Dust & salt: preindustrial
- Ice sheets: present day **without Greenland**
- Topography, bathymetry: present day
- Vegetation: present day / simulated a1b (Scholze)
- Sea level: unchanged (+7 m in regional simulation)



# Results ....

**... at next years CCSM workshop!**