From Pole to Pole

the new challenges in ice core sciences

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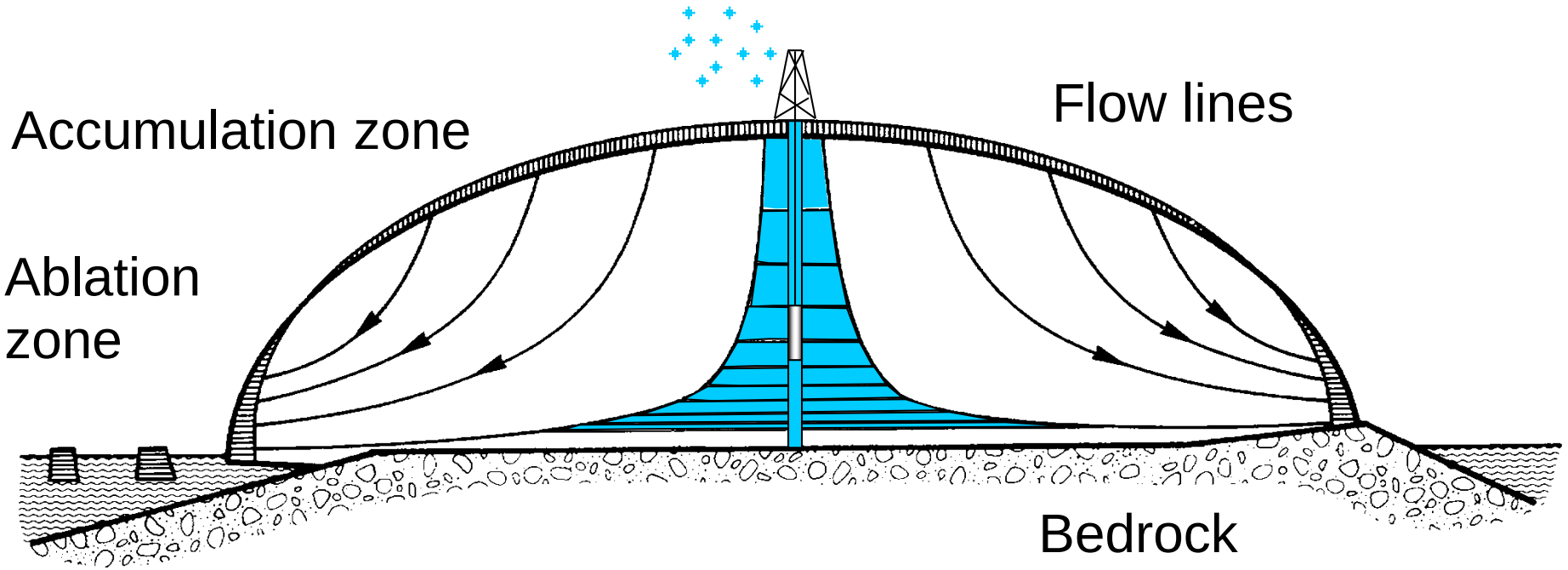
Specific research themes

- **Environmental and climatic change** and their interactions and effects on civilisation
- Climate and environment: study of processes **in polar, remote and polluted environments**
- Strategies for the **evaluation and valuing of local georesources**
- **Definition of multi-risk scenarios** and support of emergency and disaster management (early warning systems)
- **Geodynamic processes and geological risks**: geological and geophysical multidisciplinary studies
- **Development of analytical chemistry methods** for the study of natural and artificial matrices

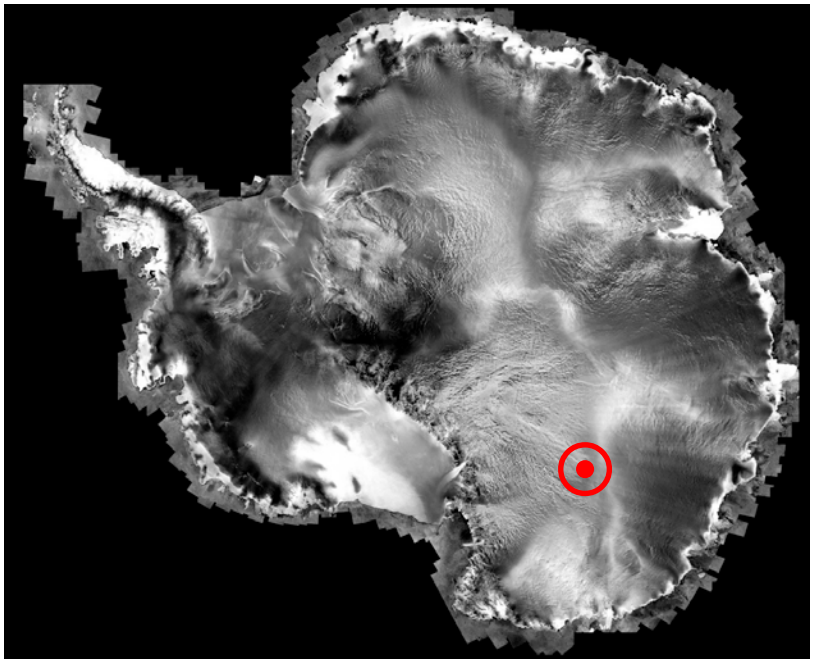
The ice core record

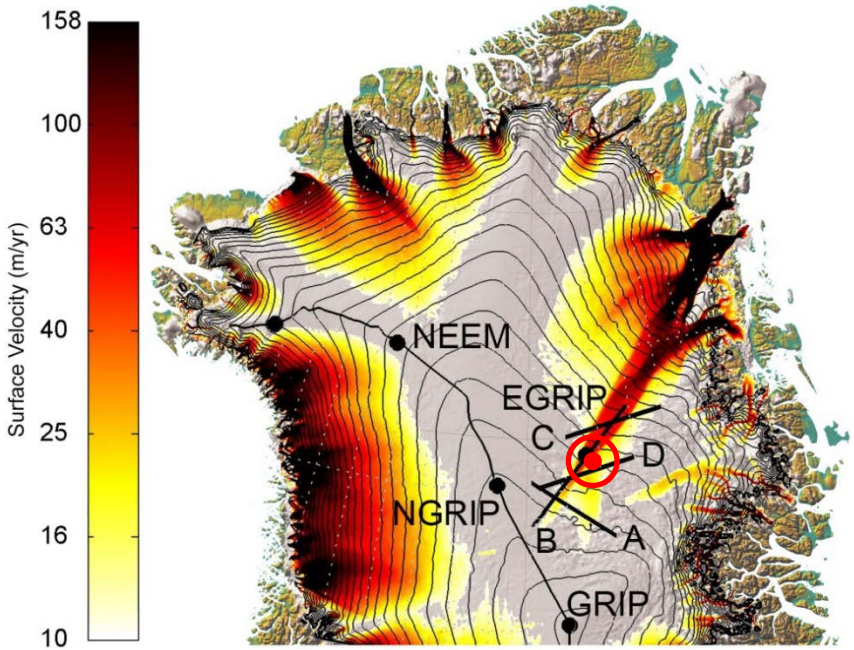
- One of many sedimentary records
- Very good at recording the atmosphere
- 800,000 years (Antarctic) and 128,000 years (Greenland)



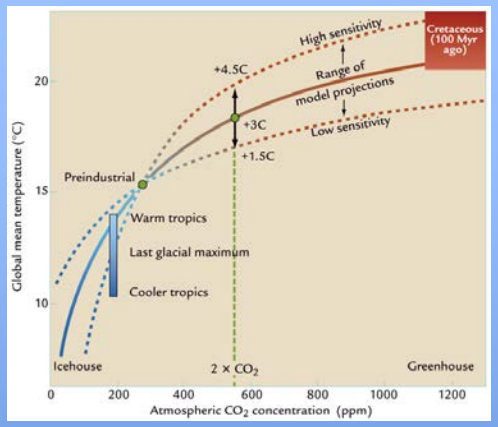
Beyond EPICA & EGRIP

- The new ice core drilling challenges
- Different objectives
- 1,500,000 years (Antarctica) and 50,000 years (Greenland)





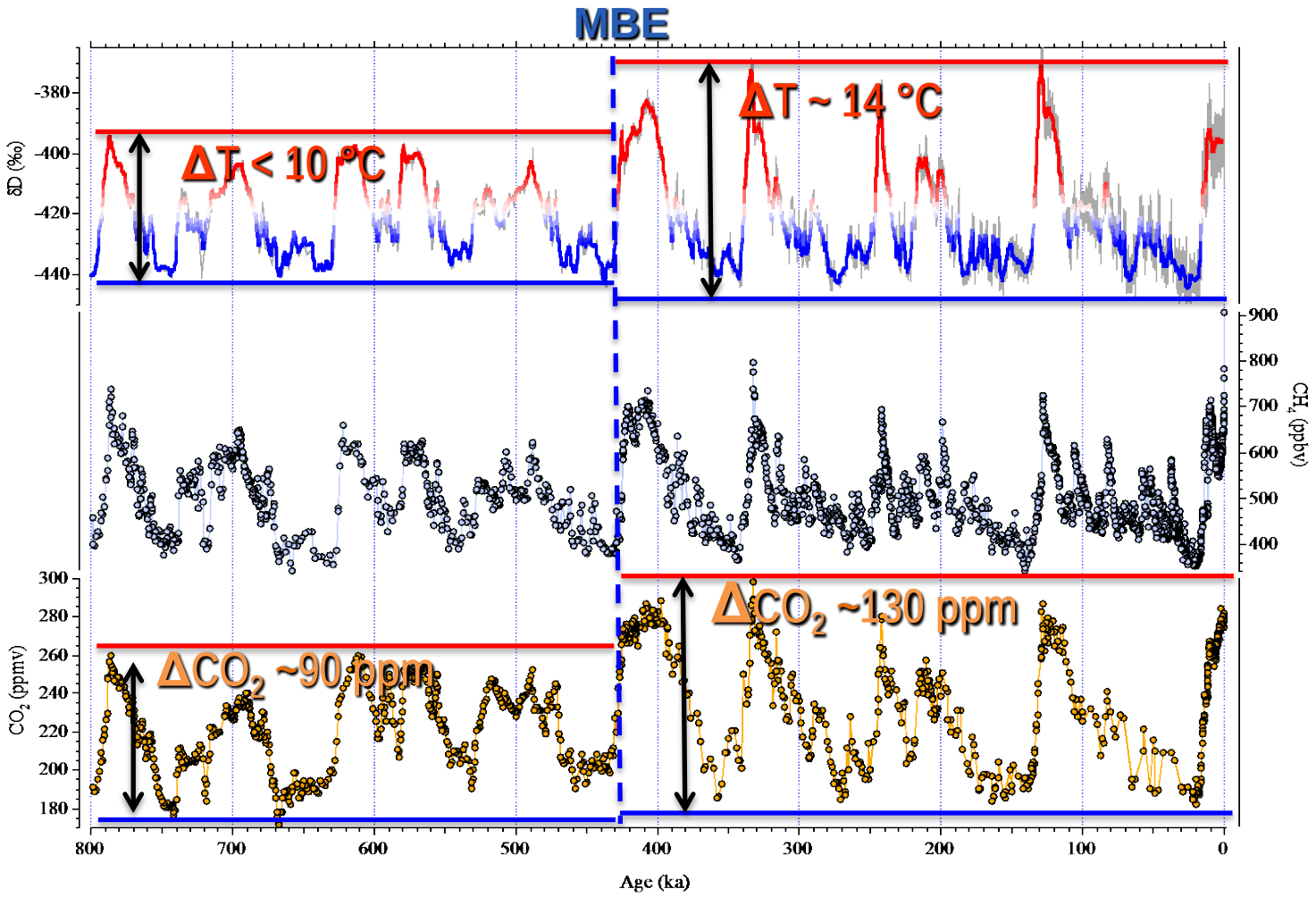
Beyond EPICA & EGRIP



What is the The transient climate response to cumulative carbon emissions ?

What is the stability of the Greenland Ice Sheet in a changing climate ?

Temperature and GHG – the long-term perspective



Jouzel et al., 2007, Petit et al., 1999, Lüthi et al. , 2008, Loulergue et al., 2008, Schilt et al., 2009; Stenni et al., 2001, 2010

- ~100 ka cycles of warm and cold (warm is short)
- Tendency to stronger cycles in later part of period
- Every warm period is different!
- Temperature and GHG are in phase

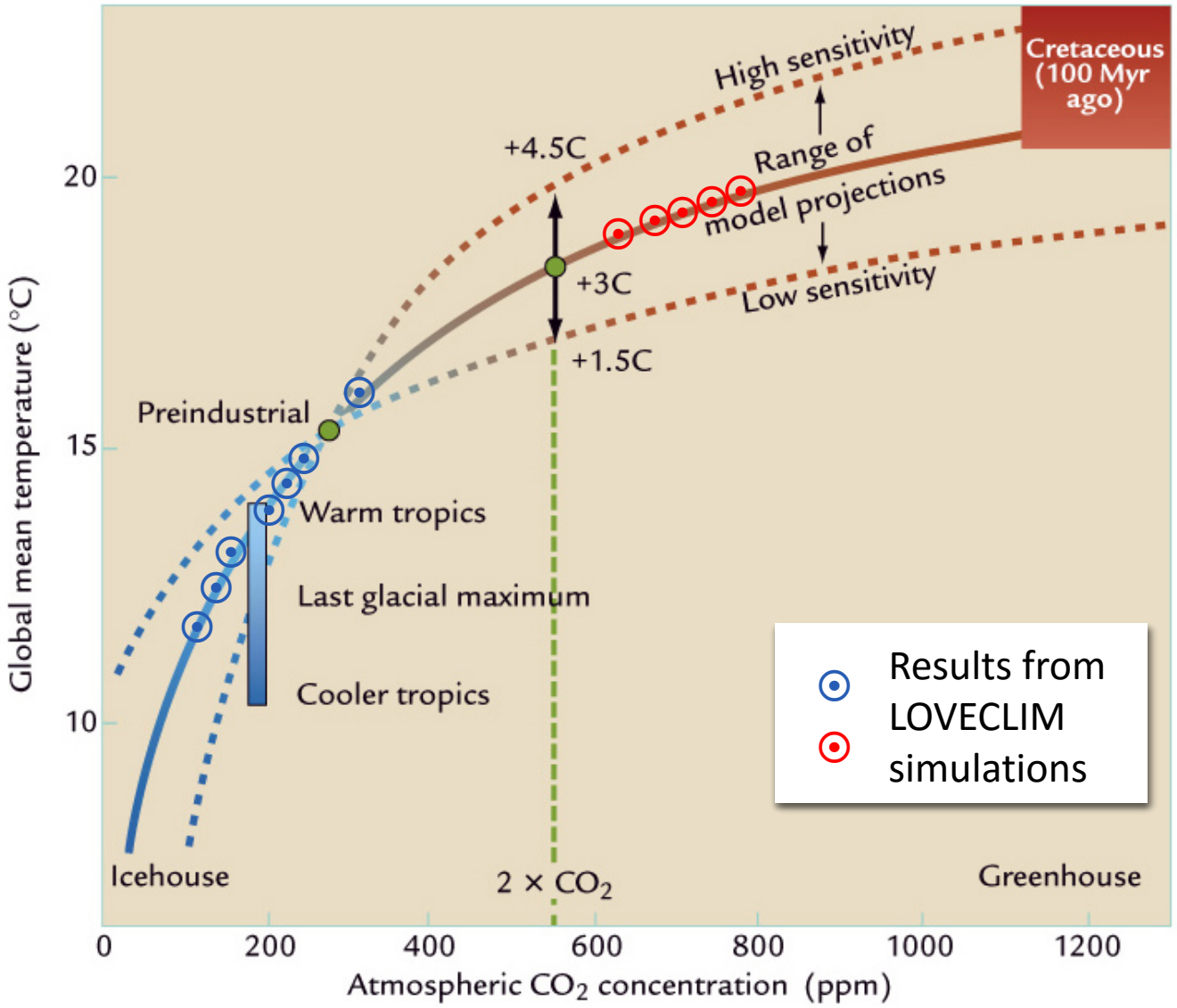
EPICA Dome C, Vostok

The CO_2 record

The concentrations of CO_2 have increased to levels unprecedented in at least the last 800,000 years.

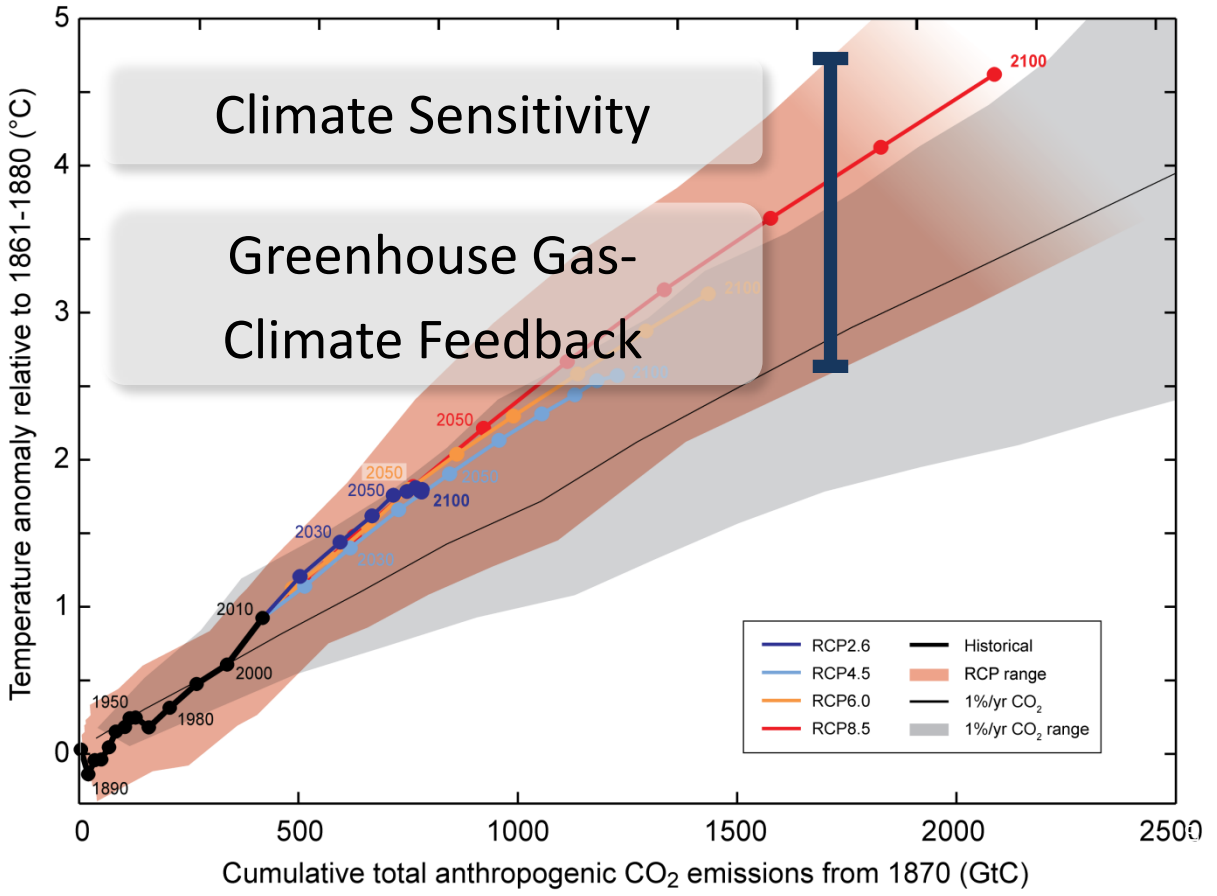
Lüthi et al.,2008, NOAA

Earth's Sensitivity to GHG



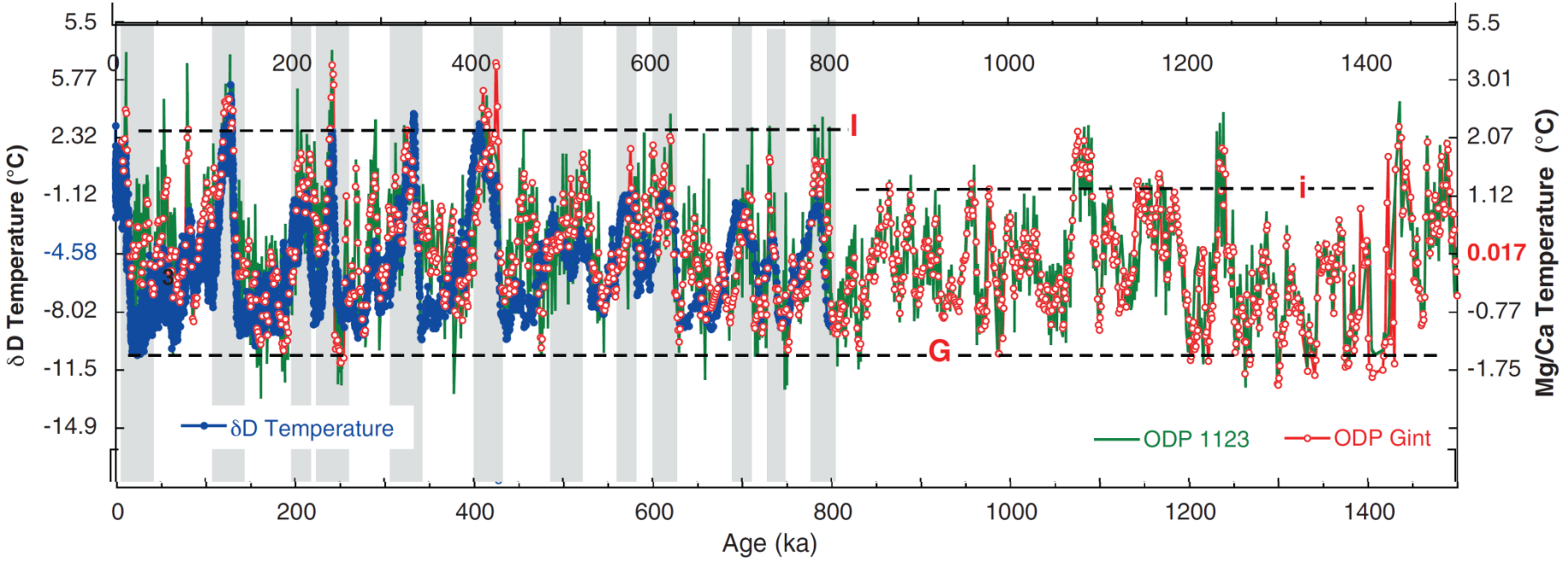
A. Berger, pers. comm. 2015

Cumulative CO_2 Emissions



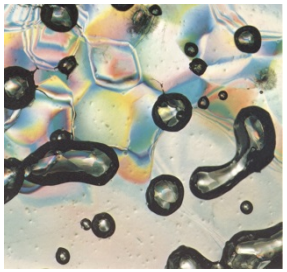
Looking beyond the boundaries of the Earth System:

1.5 Myr Greenhouse Gas History



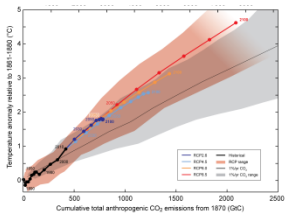
Beyond EPICA:

Past greenhouse gas concentrations are *the* key observation of Earth System changes



Beyond EPICA:

Quantifying the planetary boundaries requires knowledge of different dynamical regimes

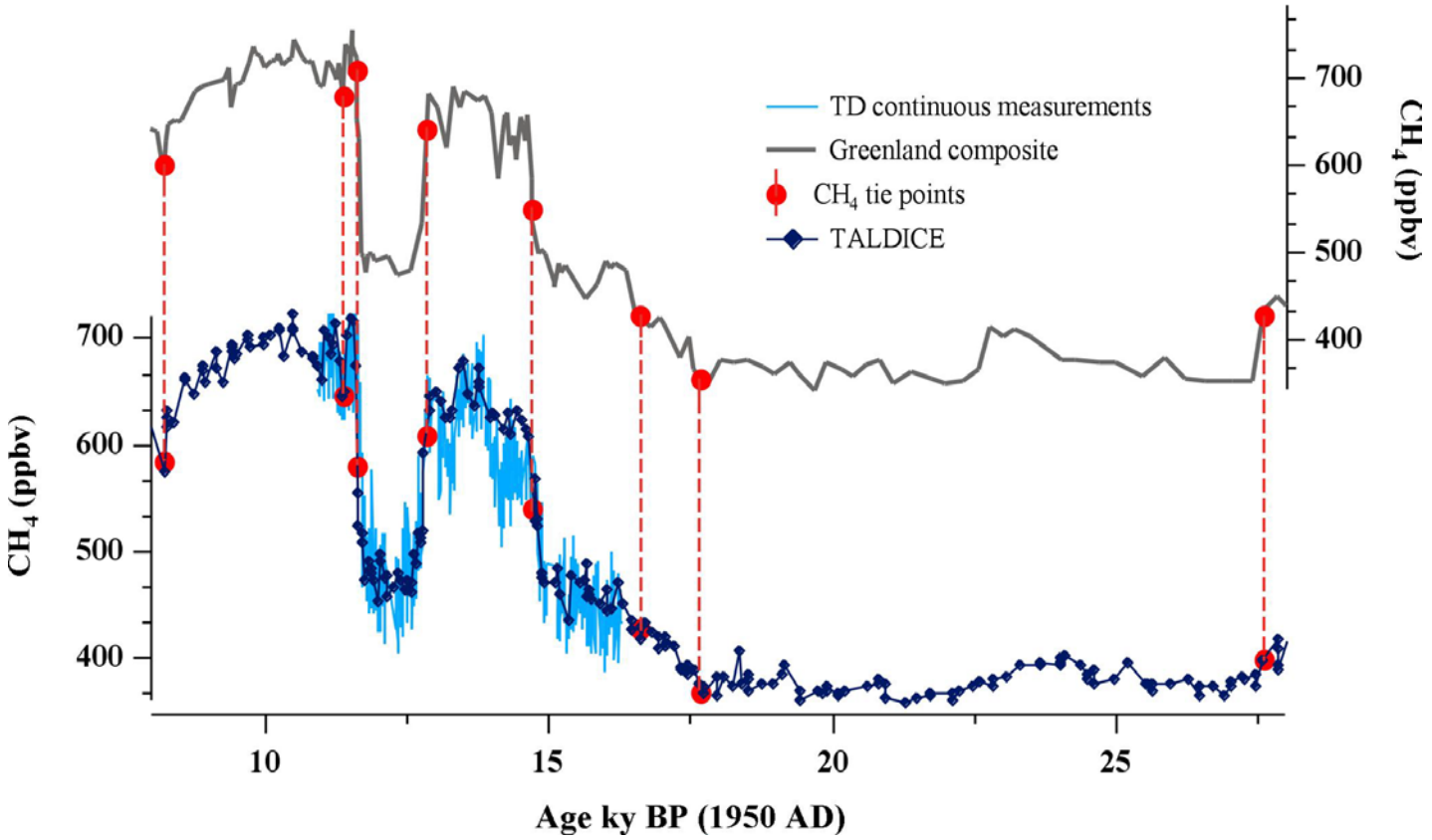


Beyond EPICA:

Climate sensitivity and GHG-climate feedback ultimately determine feasibility of climate targets

From Pole to Pole

CH_4 synchronization with Greenland



From Buiron et al., 2011

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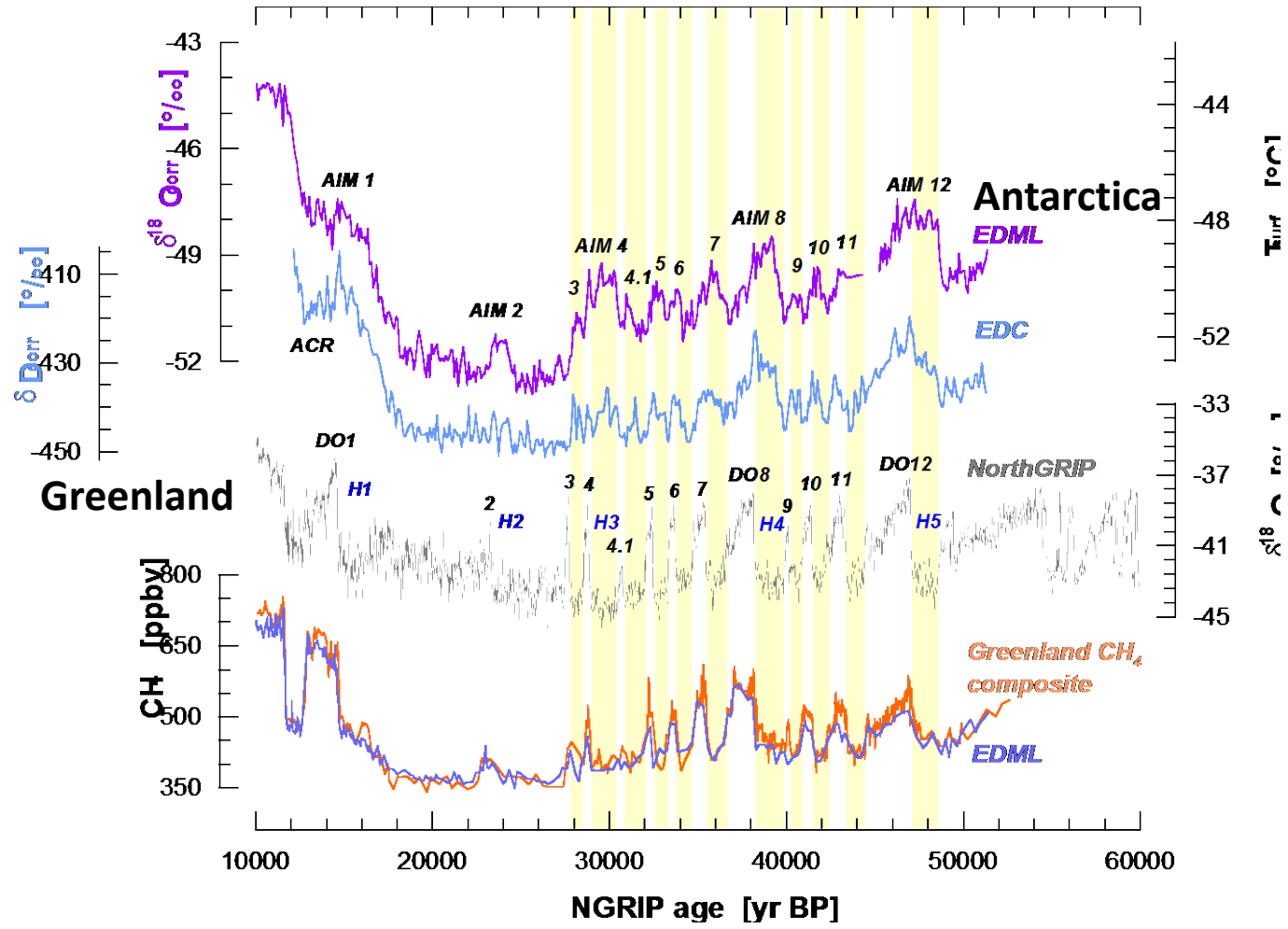
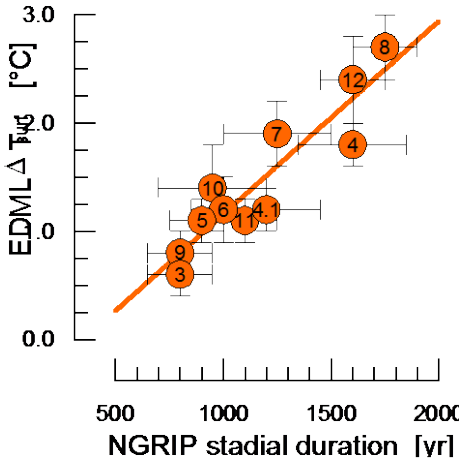


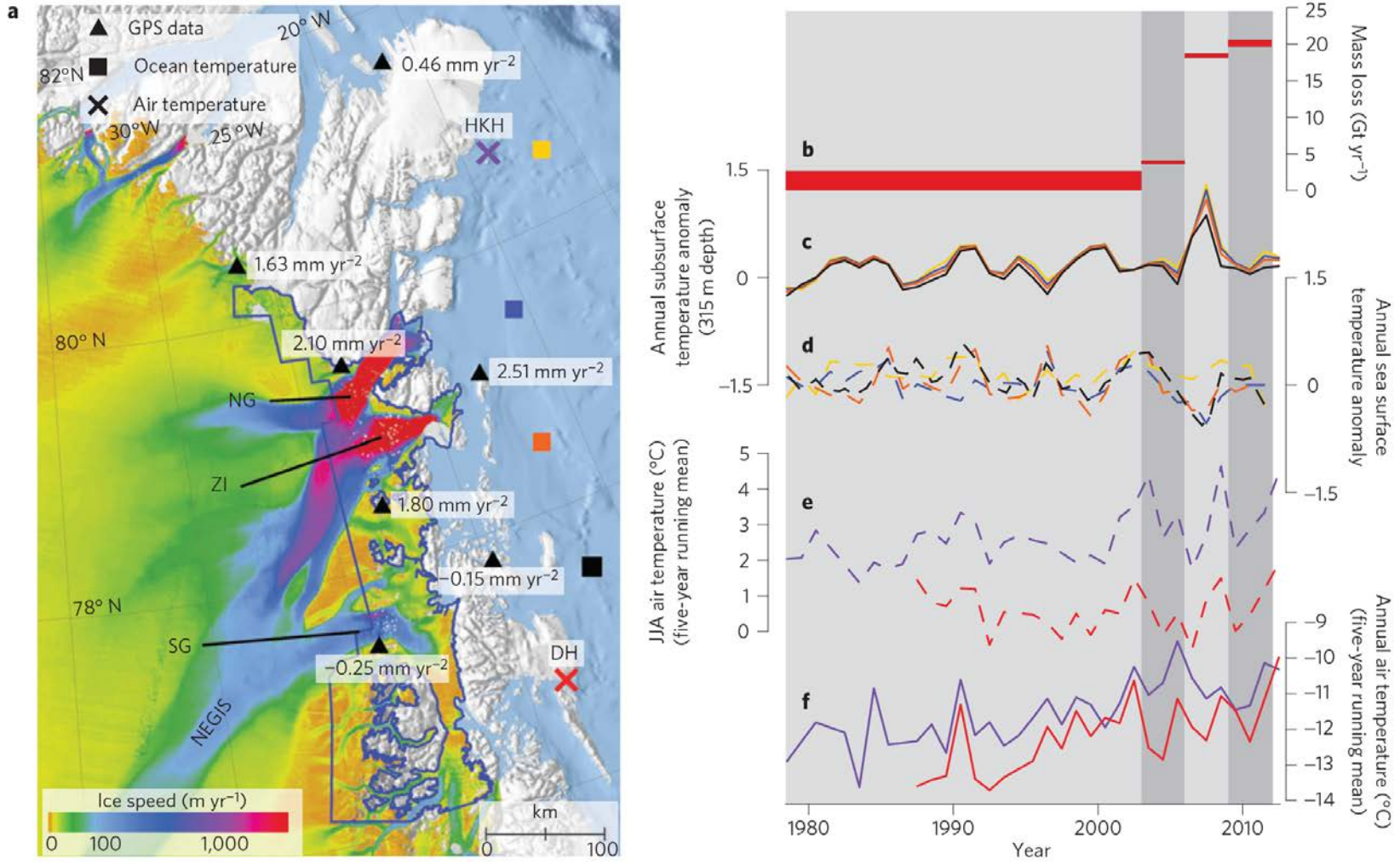


- Every rapid warming in Greenland (D/O) has a counterpart in Antarctica (AIM)
- Antarctica warms up when Greenland is cold and vice versa
- Antarctica (AIM) temperature amplitude linearly related to duration of subsequent D/O event

EPICA Community Members, 2006

EGRIP

This sector of the Greenland ice sheet is of particular interest,because the drainage basin area covers 16% of the ice sheet.



Abbas Khan, Nature Climate Change, 2014

Timeline

Beyond EPICA (40 ≈M€)

EGRIP (10 ≈M€)


Thank you for your attention