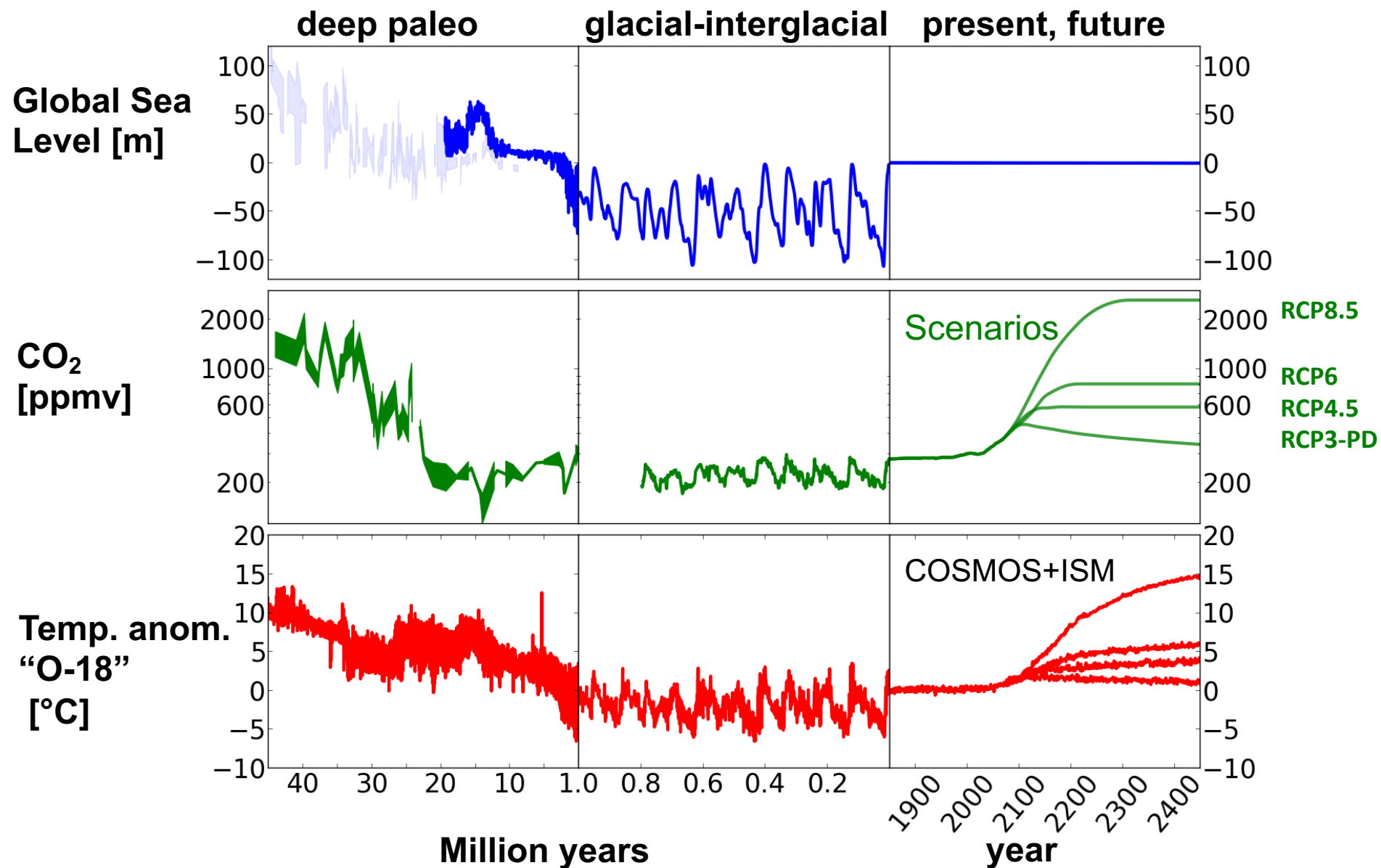


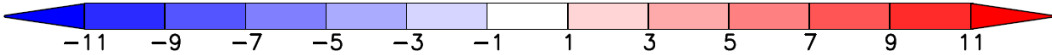
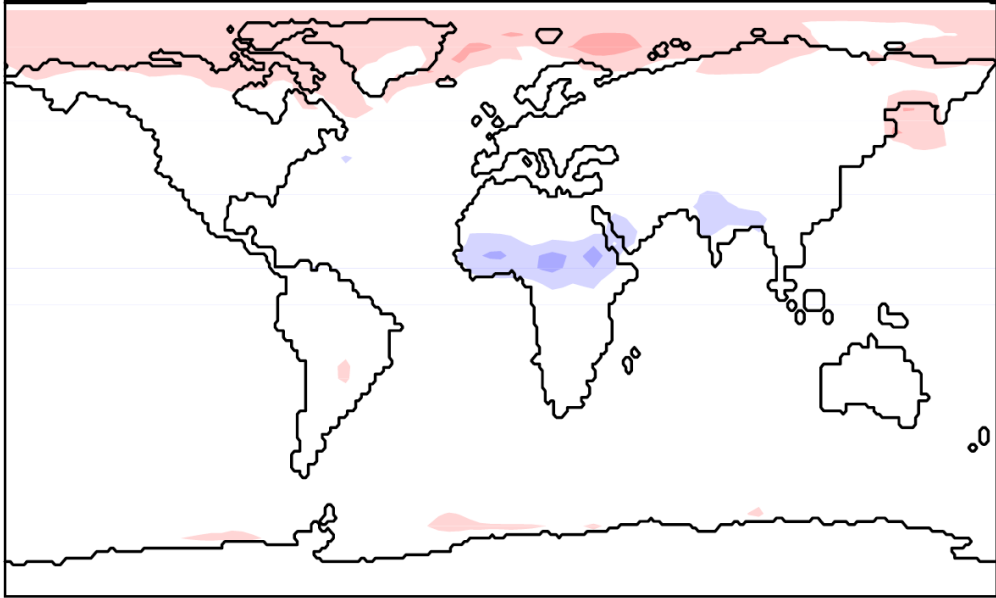
# Natural variability and perturbed climate



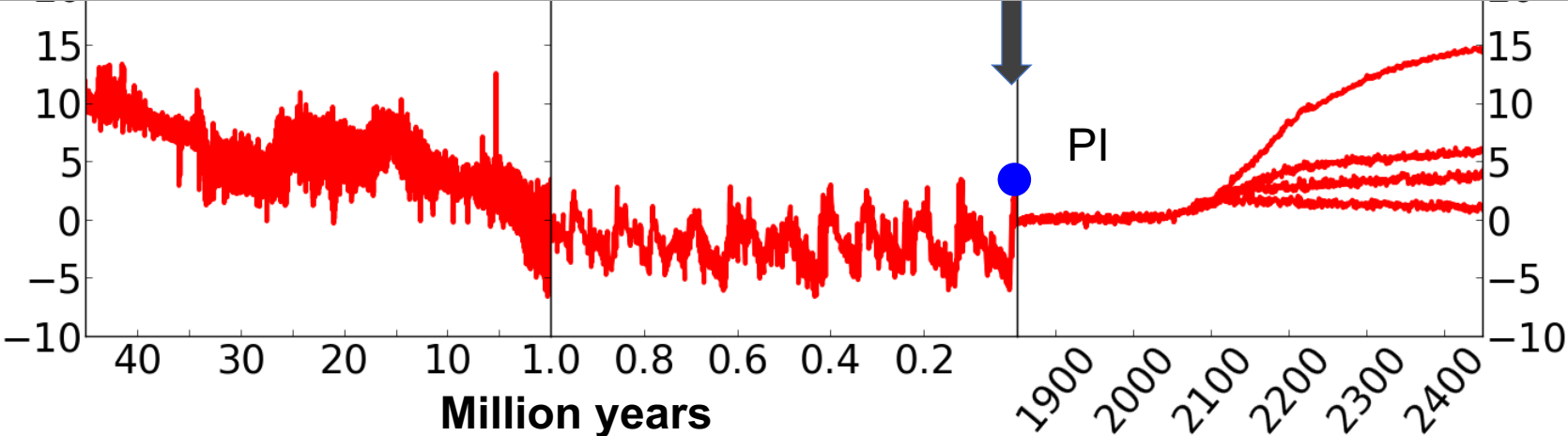
# Time Journey: Range of Variability

Temp. anomaly to pre-industrial time  
COSMOS  
(Wei et al., 2012; Lohmann et al., 2013)

## Validation of the models



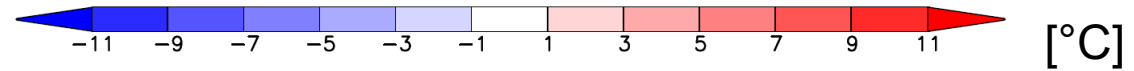
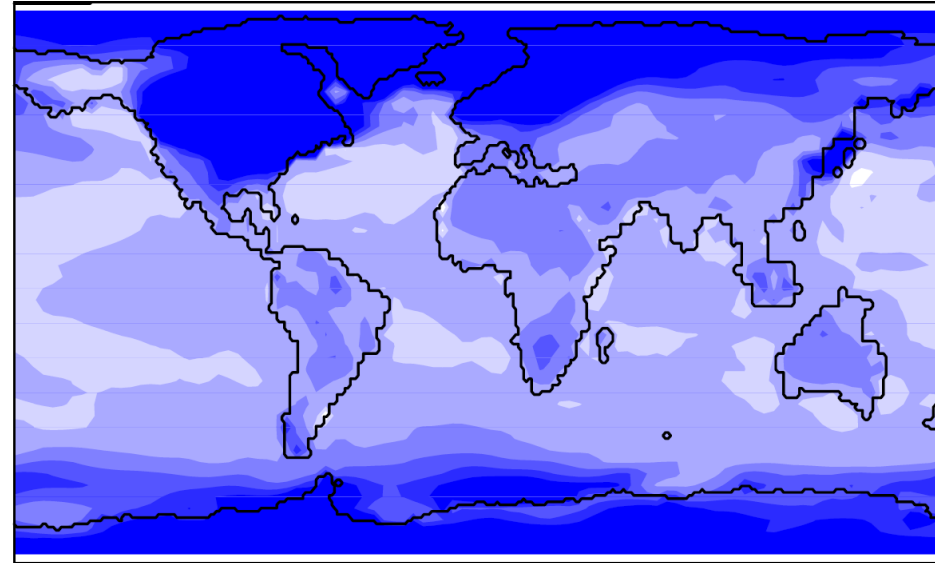
## Mid-Holocene (6000 years Before Present)



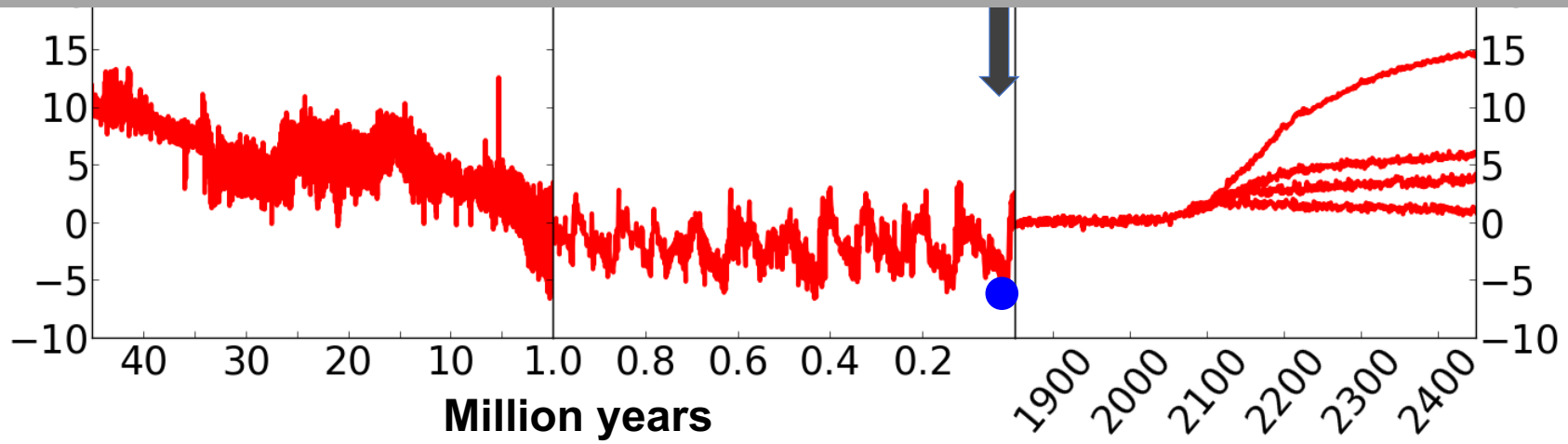
# Earth System from a polar perspective

Temp. anomaly to to pre-industrial time  
COSMOS  
(Zhang et al., 2012)

**Polar amplification**



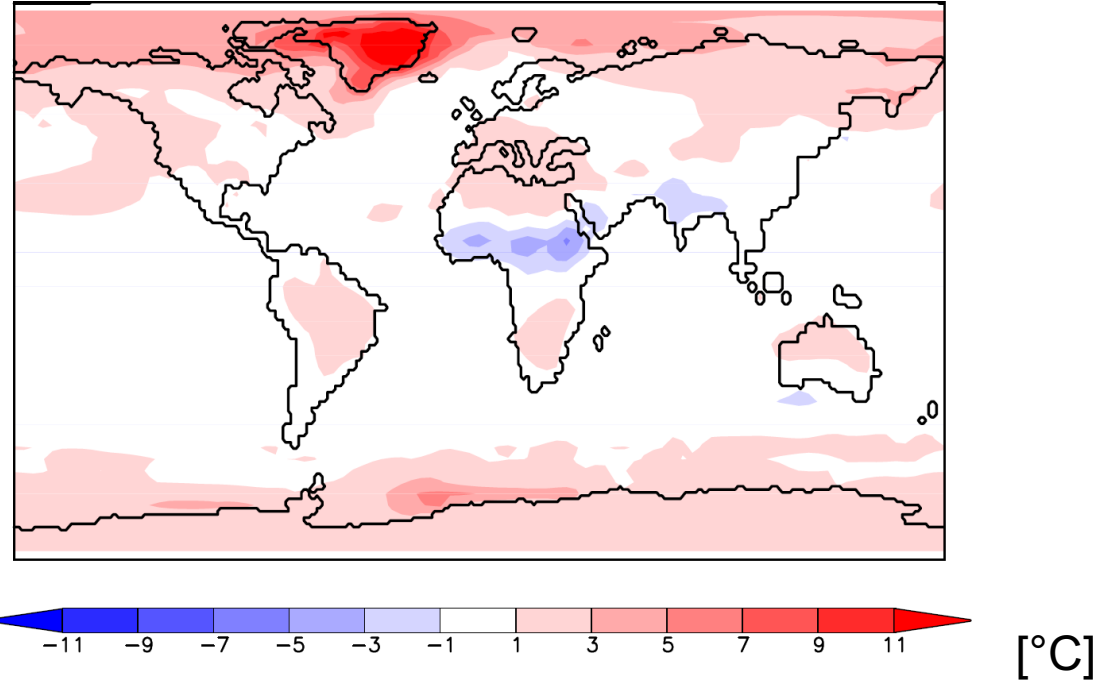
## Last Glacial Maximum (21,000 years BP)



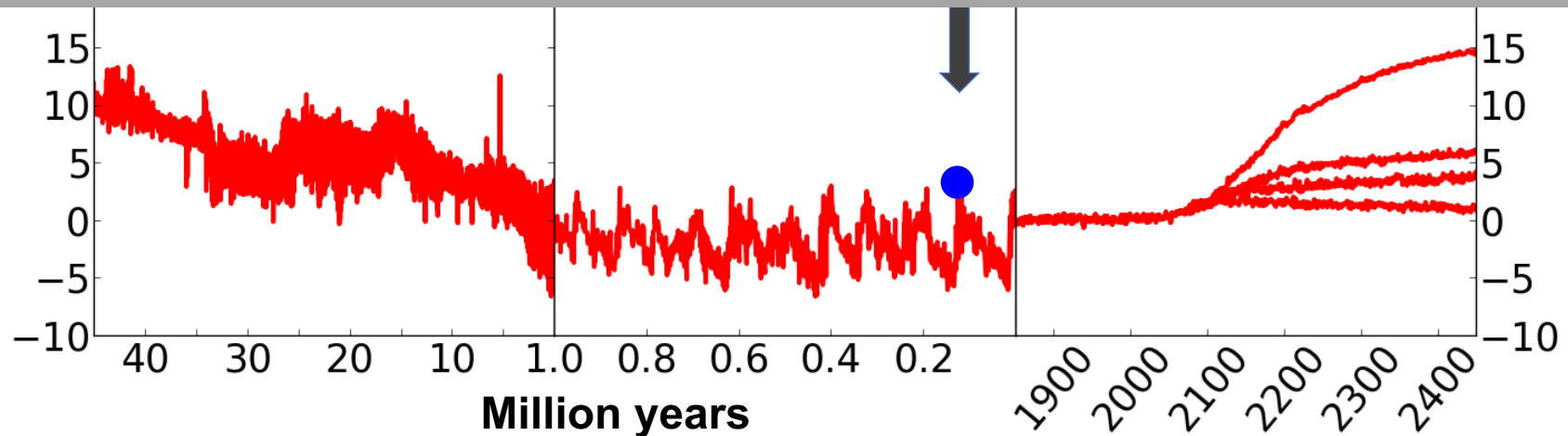
# Earth System from a polar perspective

Temp. anomaly to to  
pre-industrial time  
COSMOS  
(Pfeiffer & Lohmann, 2016)

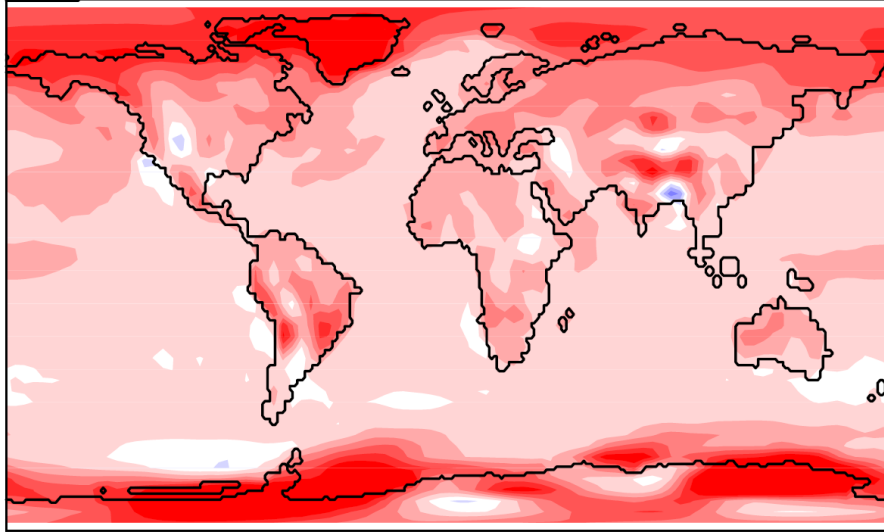
**Warm climates**  
**Polar amplification**  
**Sea level**



## Last Interglacial MIS5.5 (124,000 years BP)



# Earth System from a polar perspective

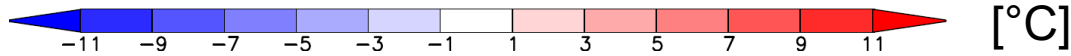


Temp. anomaly to to pre-industrial time

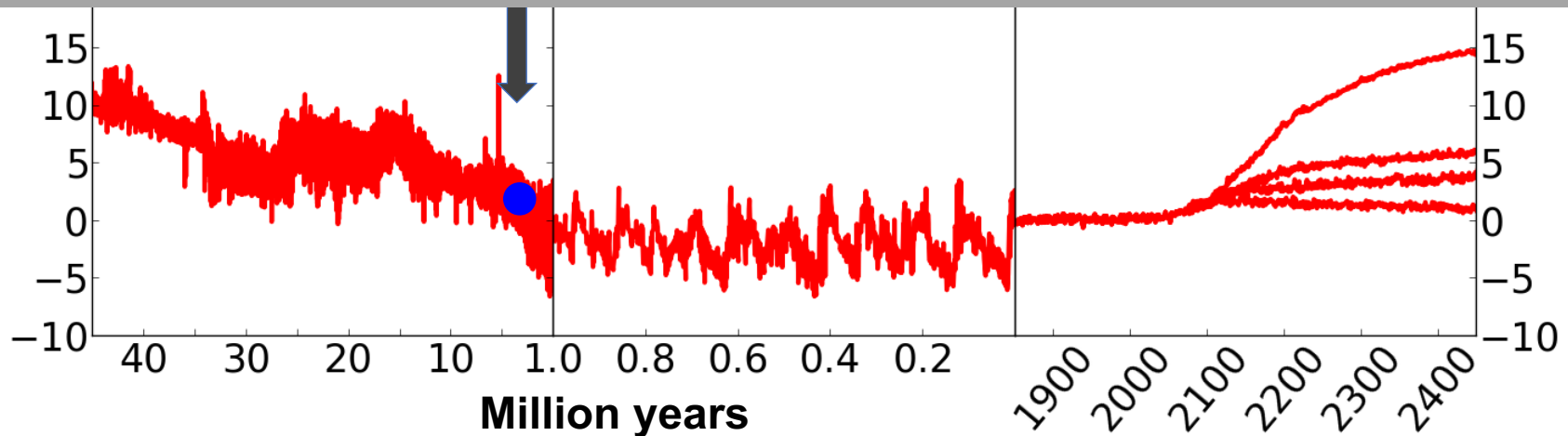
COSMOS

(Stepanek & Lohmann, 2012;  
Haywood et al., 2013)

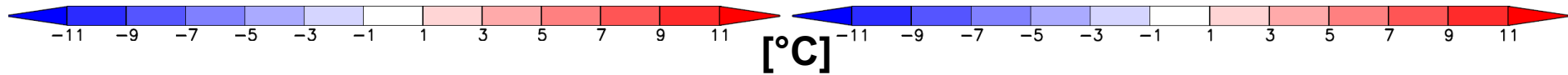
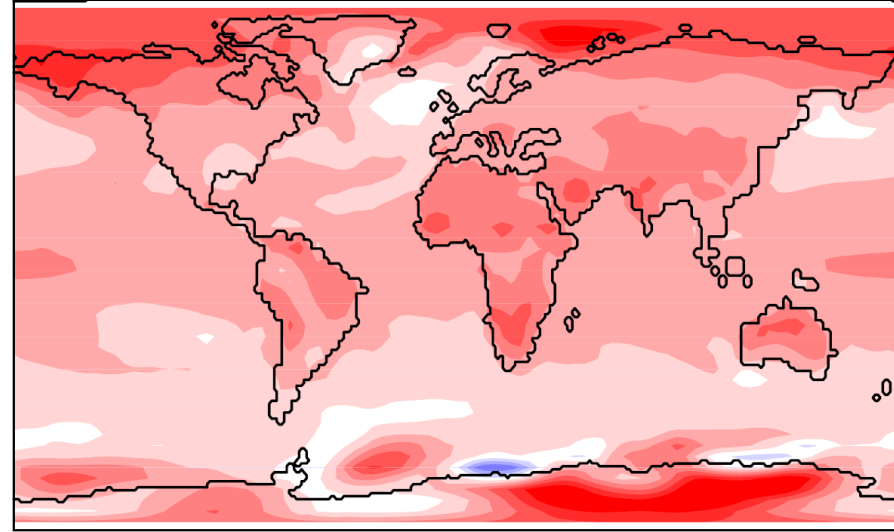
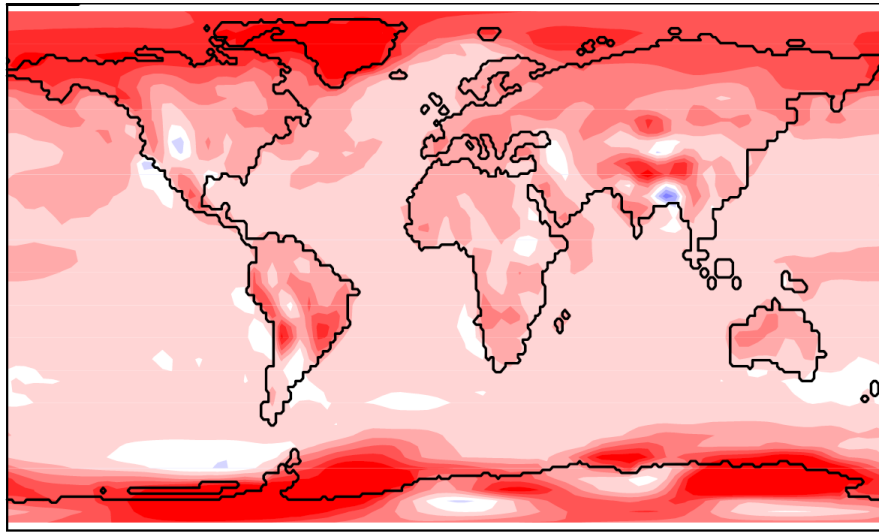
**Warm climates**  
**Polar amplification**



**Pliocene (3 Million years BP)**



# Earth System from a polar perspective



**Pliocene (3 Million years BP)**

**Scenario: years 2083-2133**

