

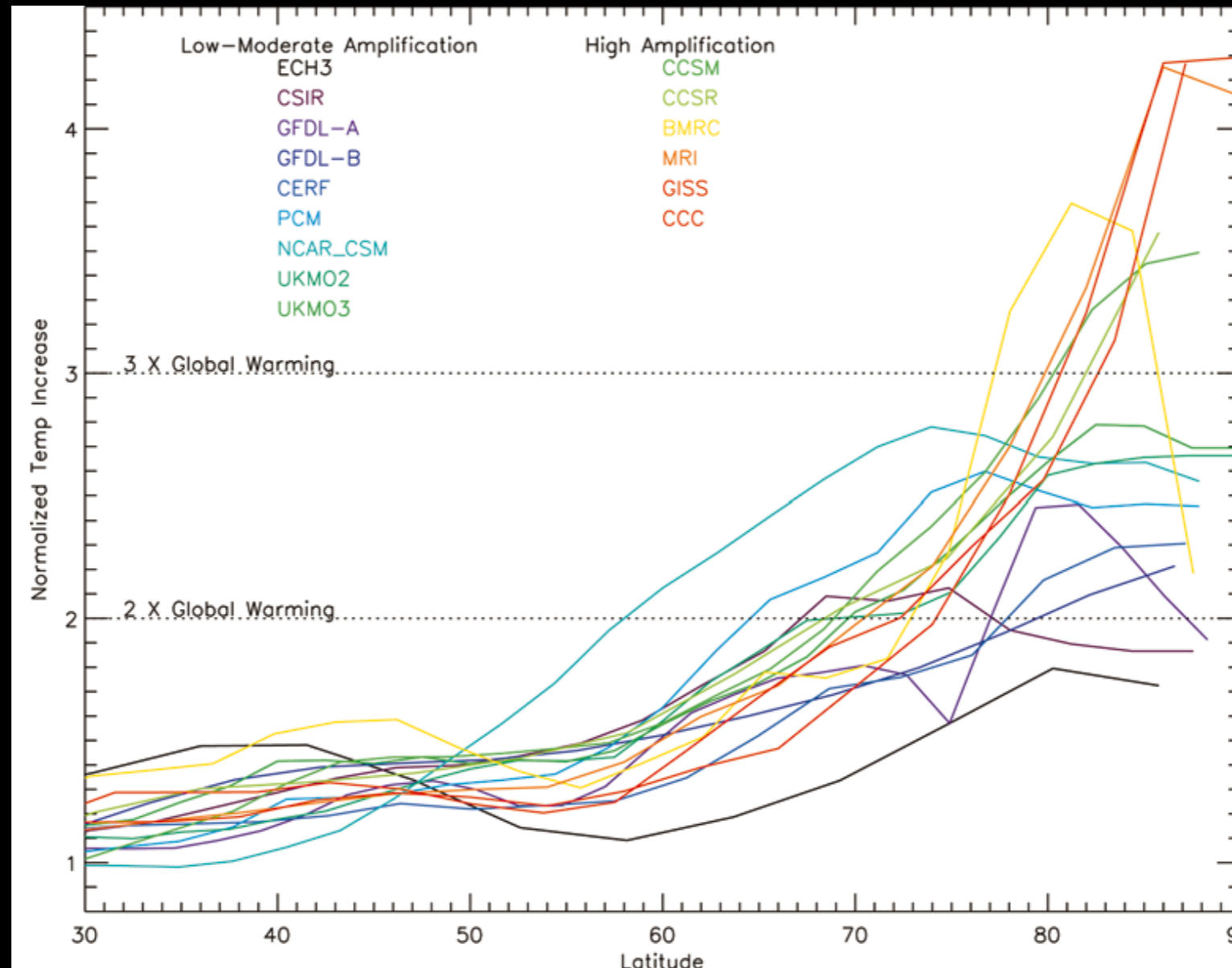
The relative roles of radiative feedbacks in causing Arctic amplification of climate change

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Rune Graversen, *Stockholm University*

Peter Langen, *Copenhagen University*

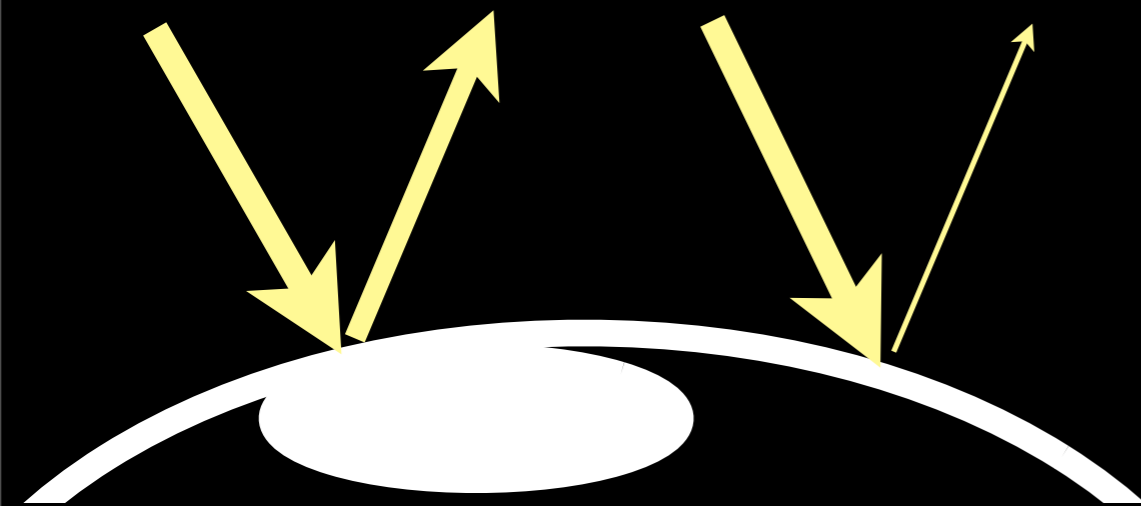
Arctic amplification debate



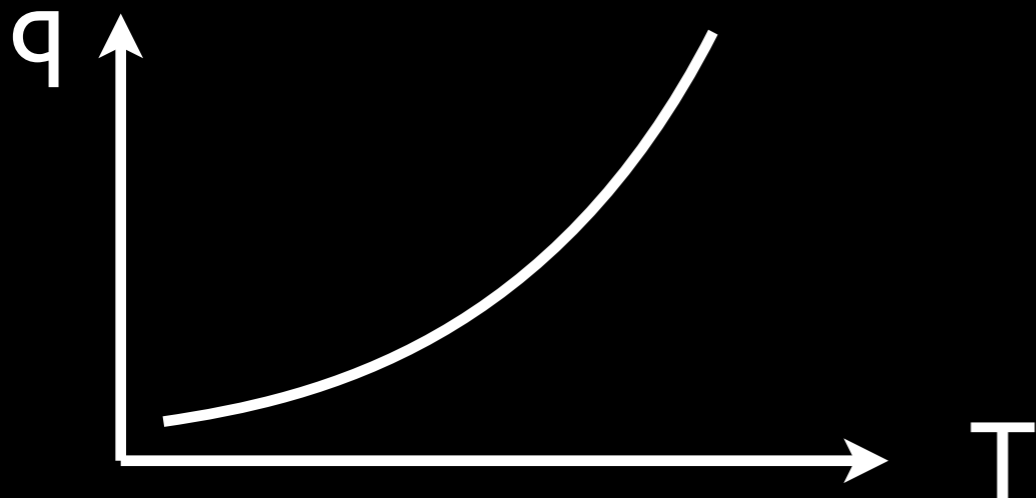
From Holland & Bitz (2003)

Arctic amplification debate

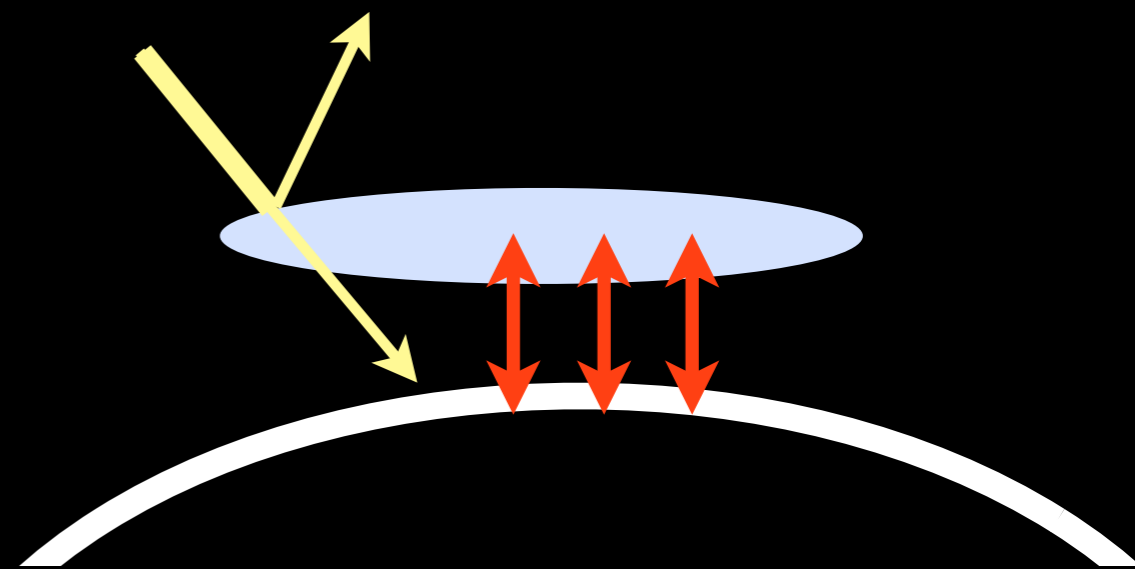
1) Surface albedo feedback



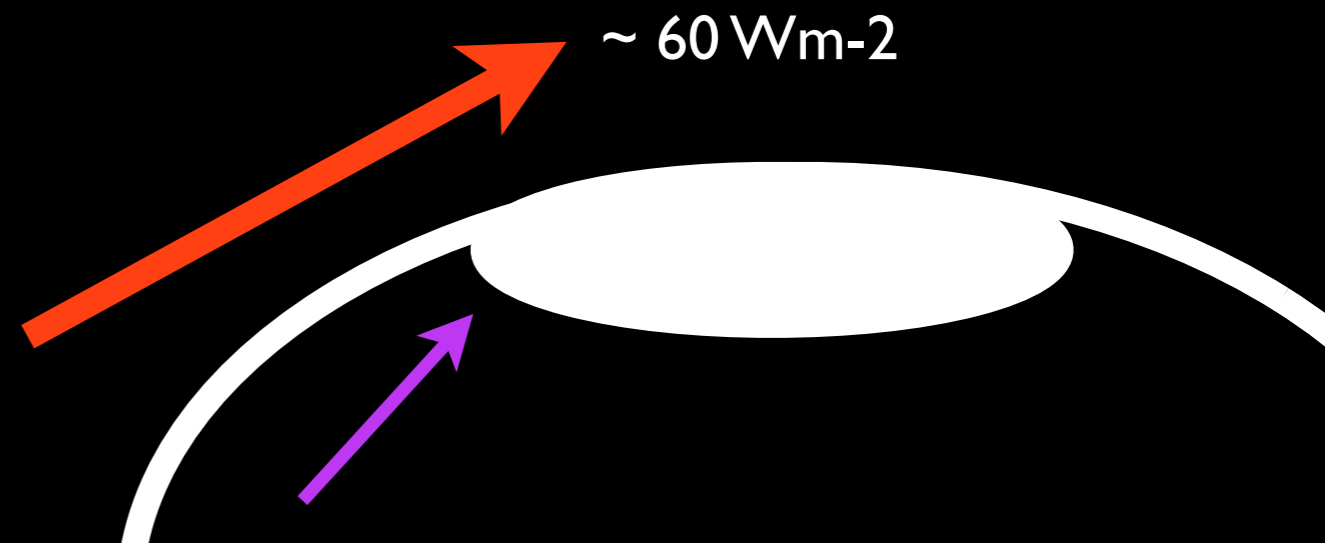
2) Water vapor feedback



3) Cloud feedbacks



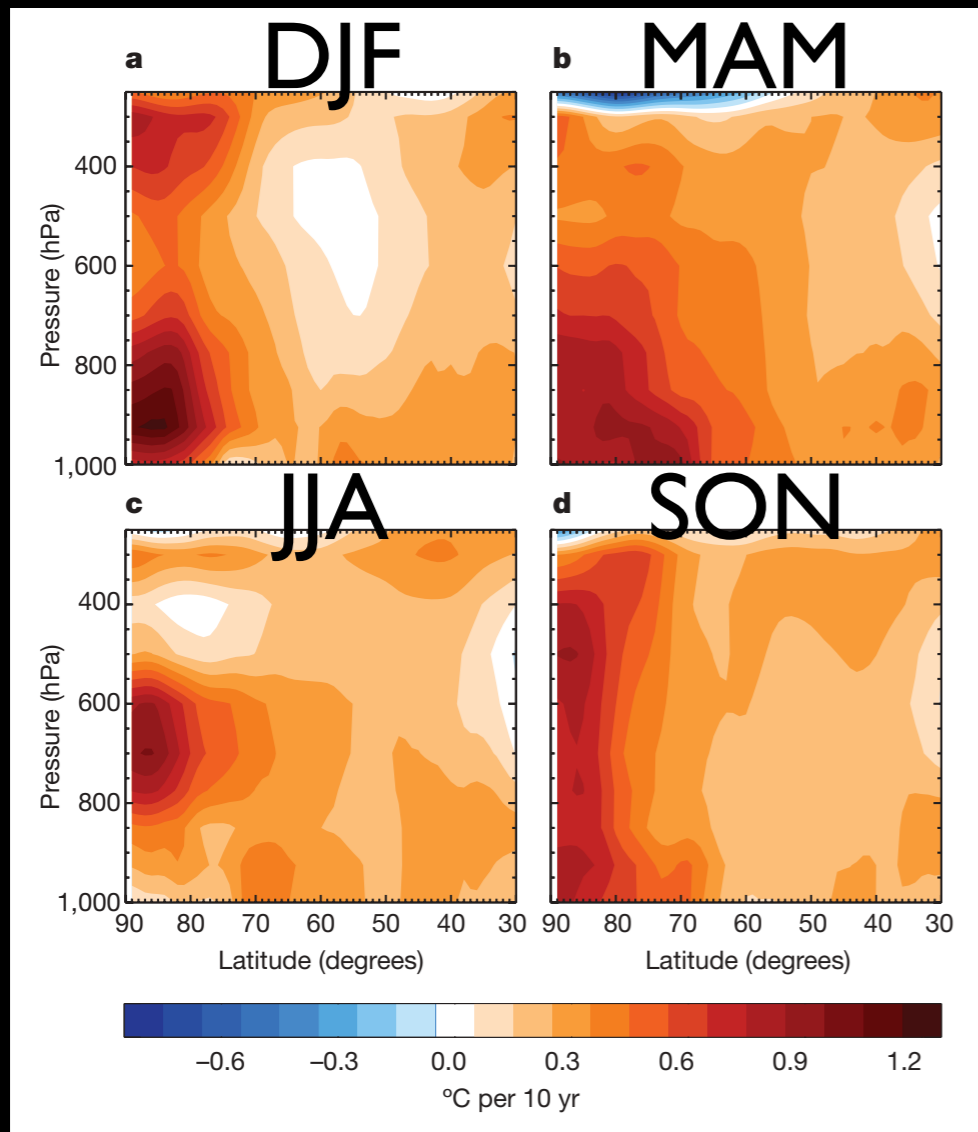
4) Energy transport



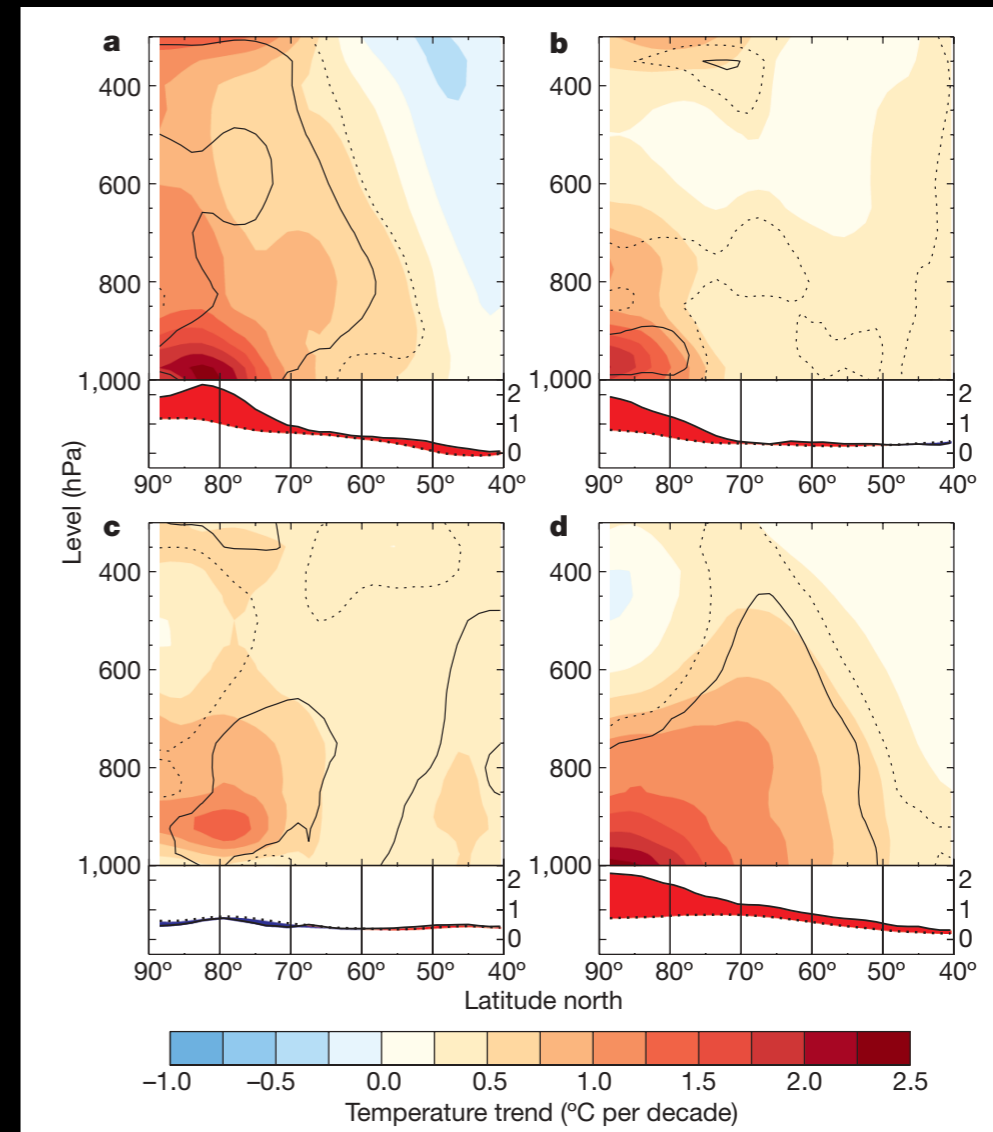
Arctic amplification debate

Graversen et al. (2008):

Screen & Simmonds (2010):

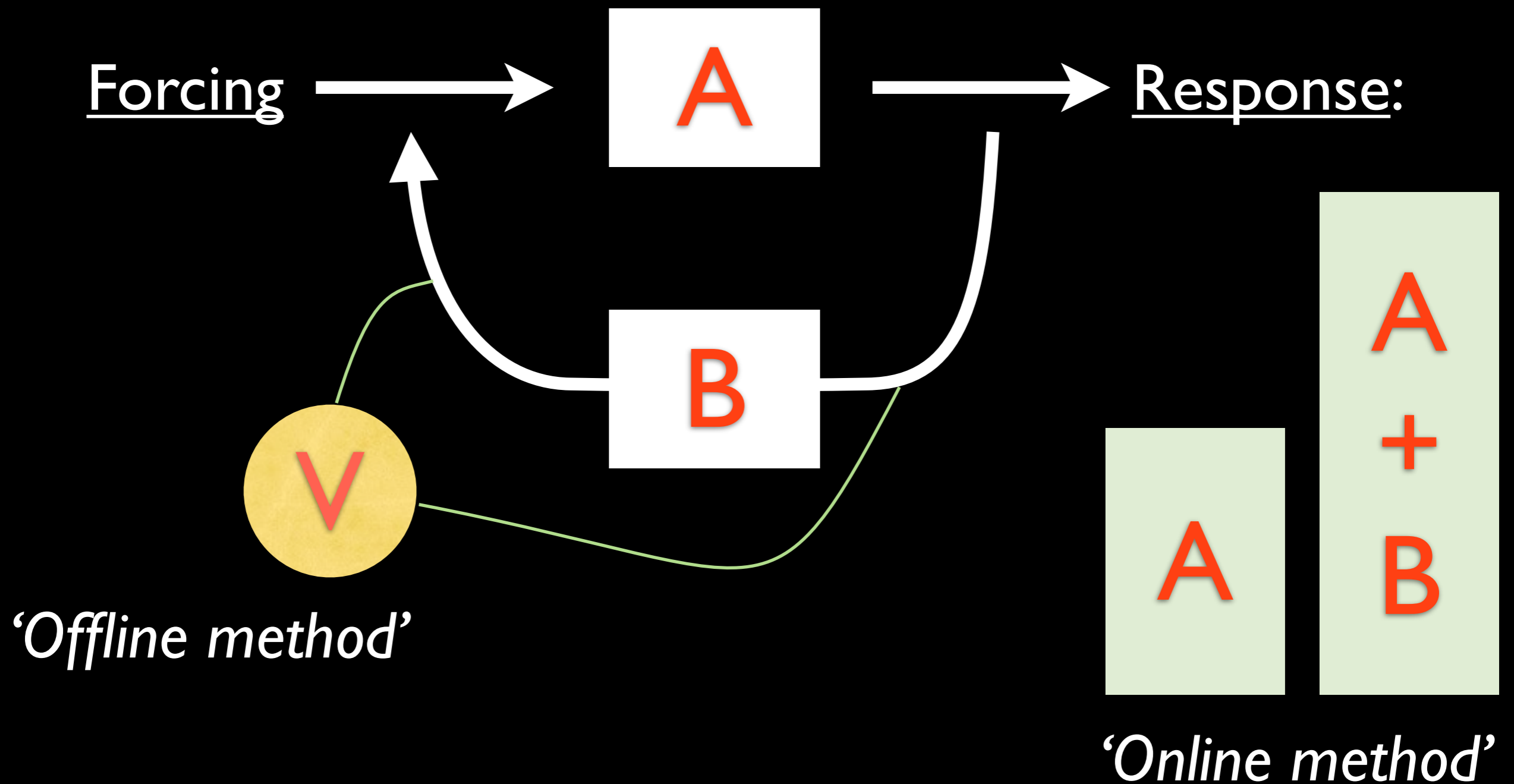


ERA-40 (1979-2001)



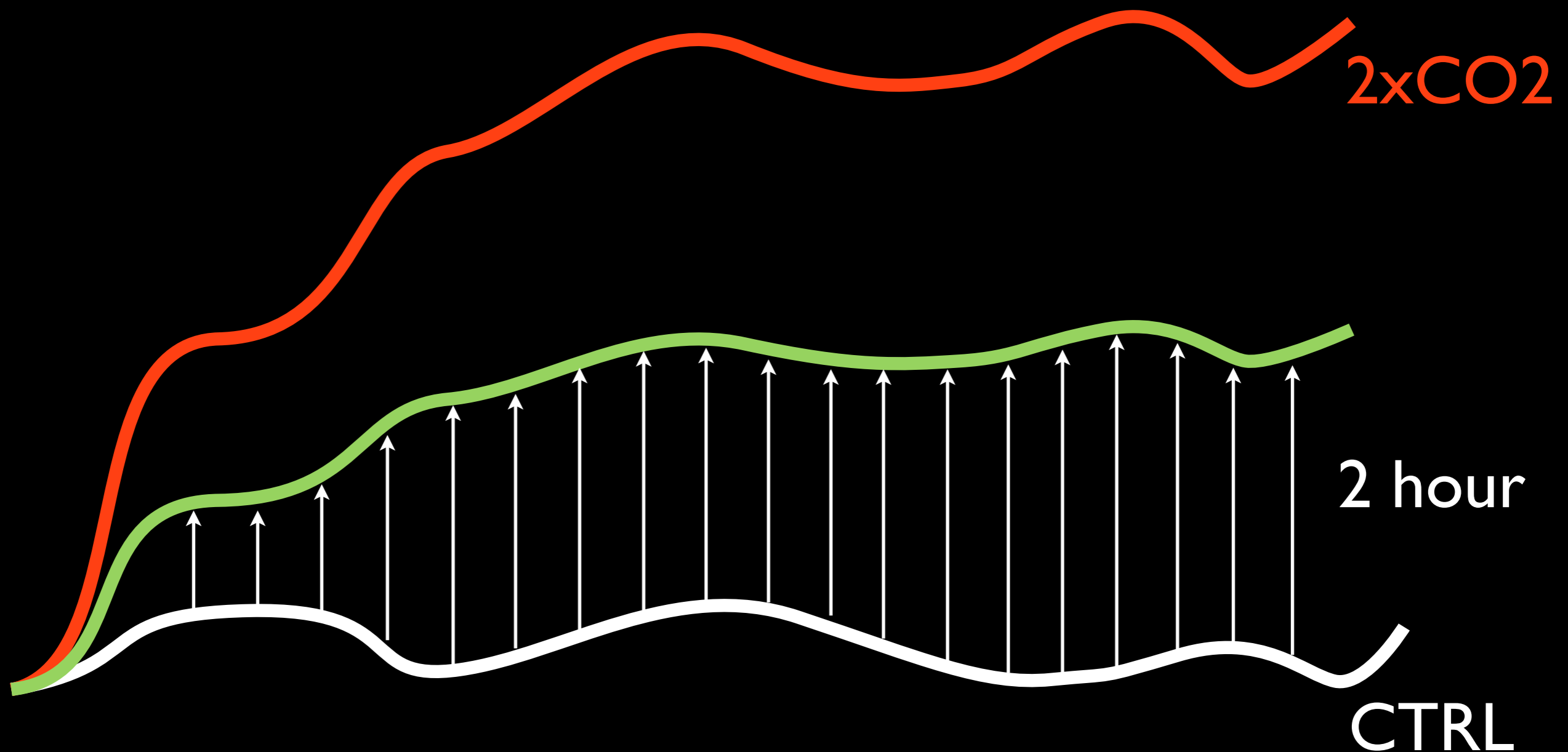
ERA-Interim (1989-2008)

GCM feedback estimates

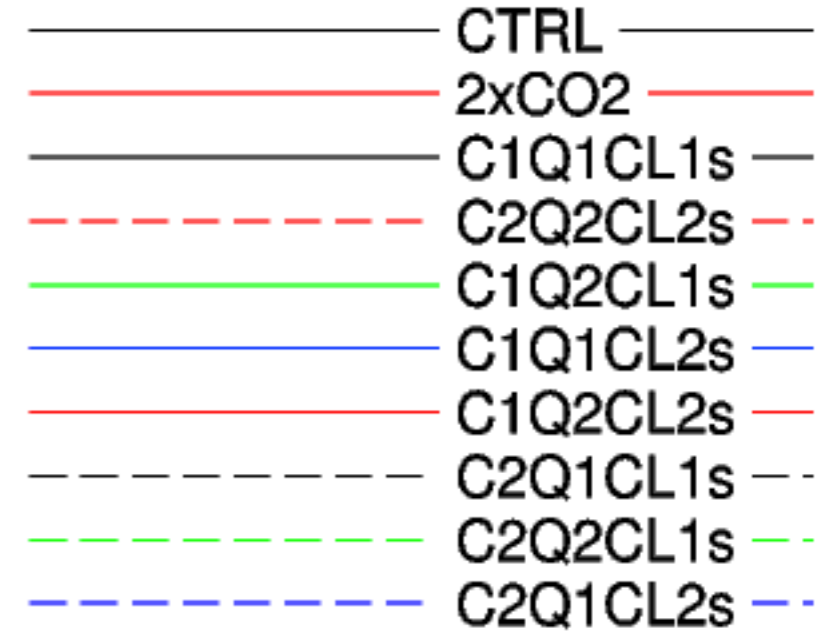
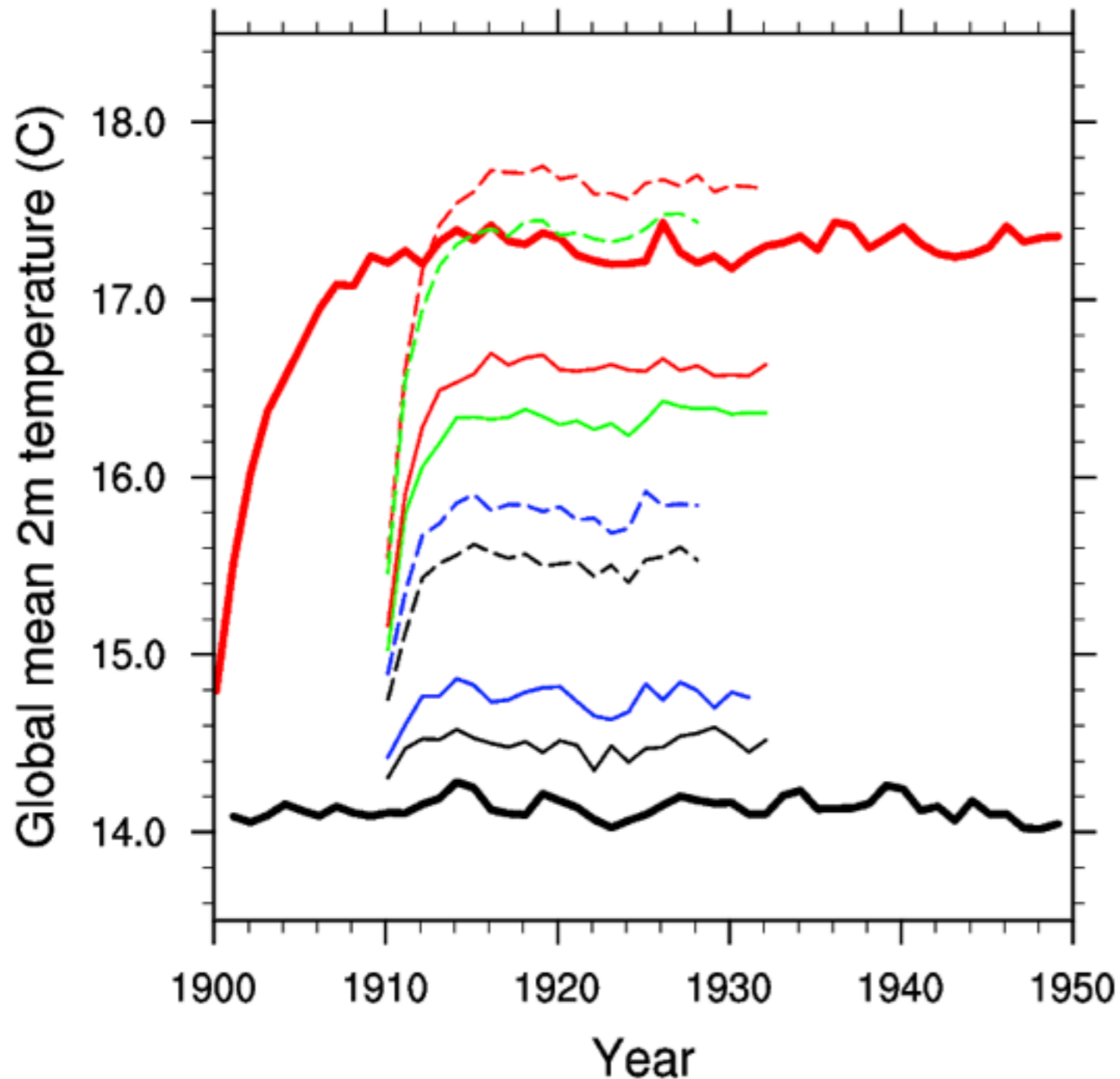


Online feedback estimate

The response to a feedback is estimated by running with the property in question held fixed during radiation call

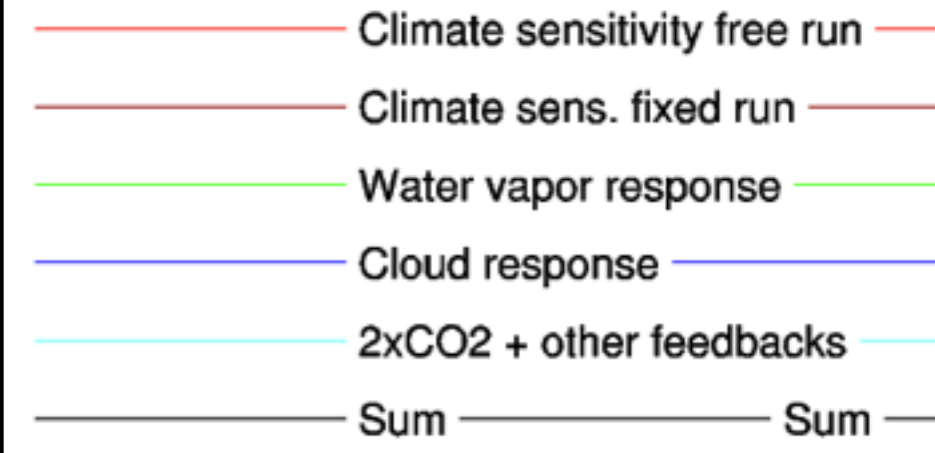
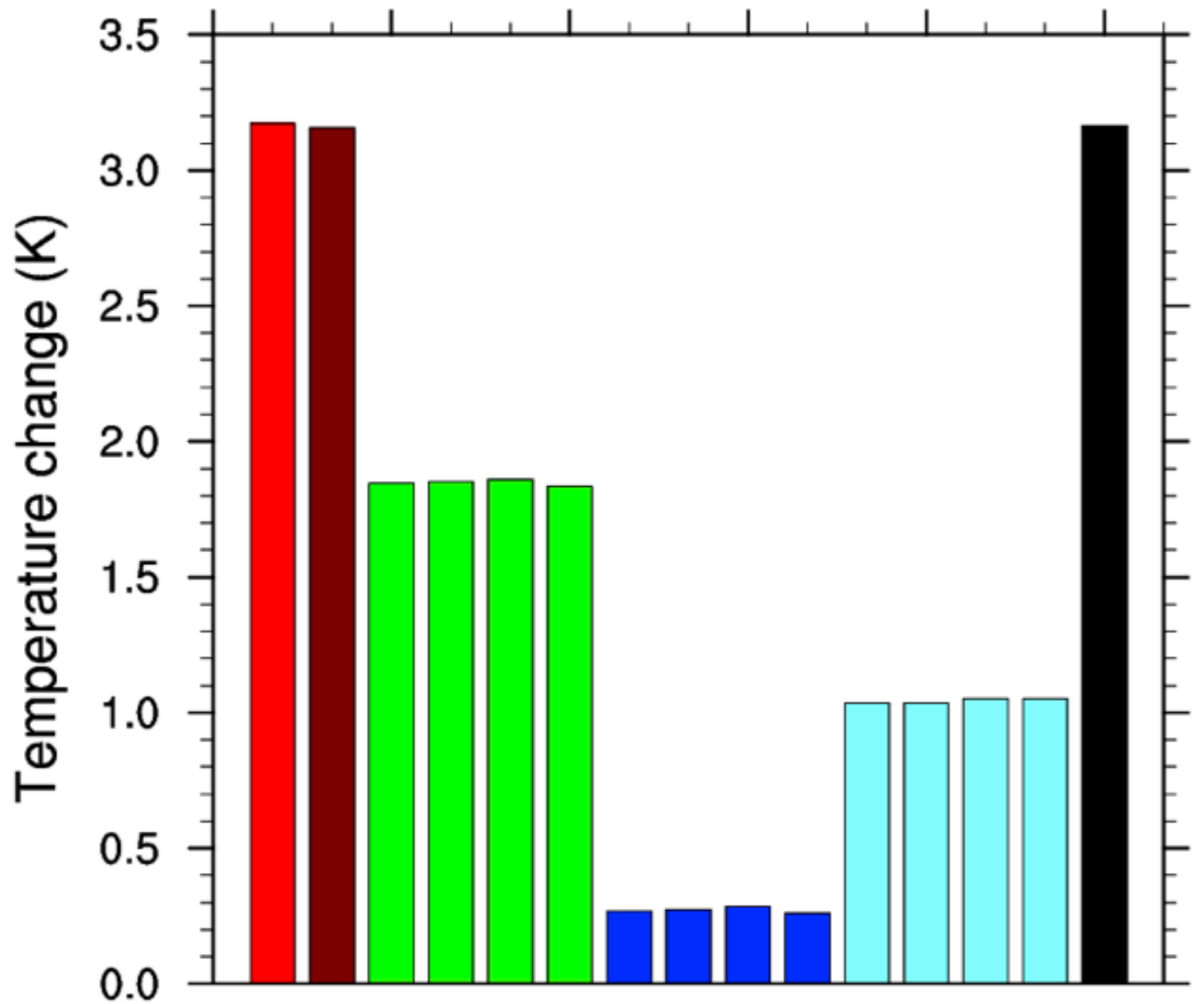


Water Vapor and Clouds, *only*

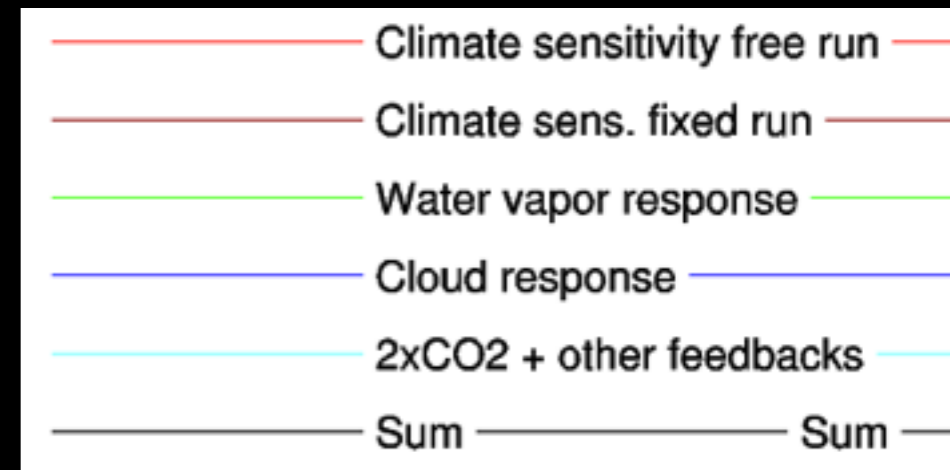
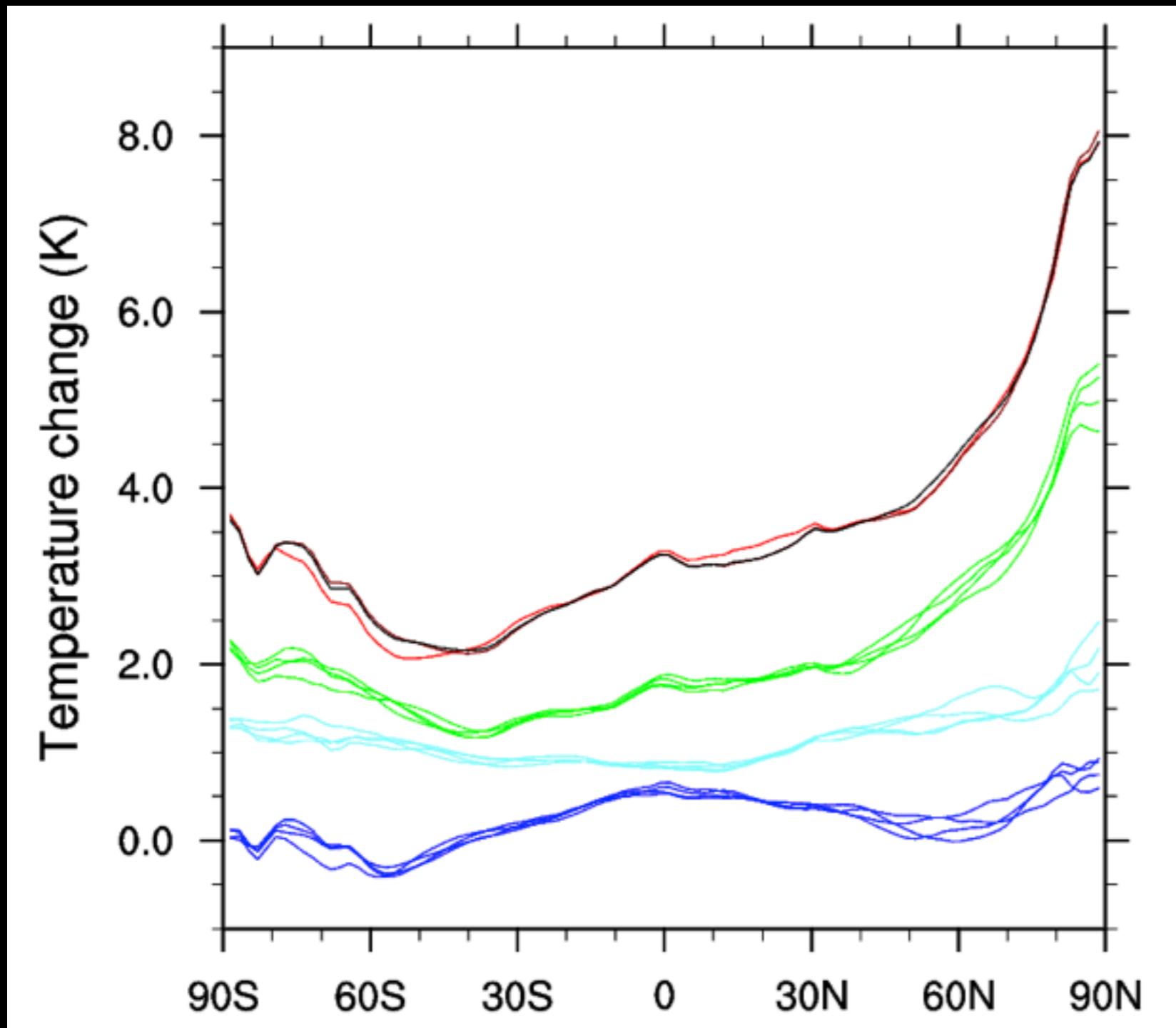


pre-ECHAM 6
free surface albedo
T63L47 resolution
mixed layer ocean

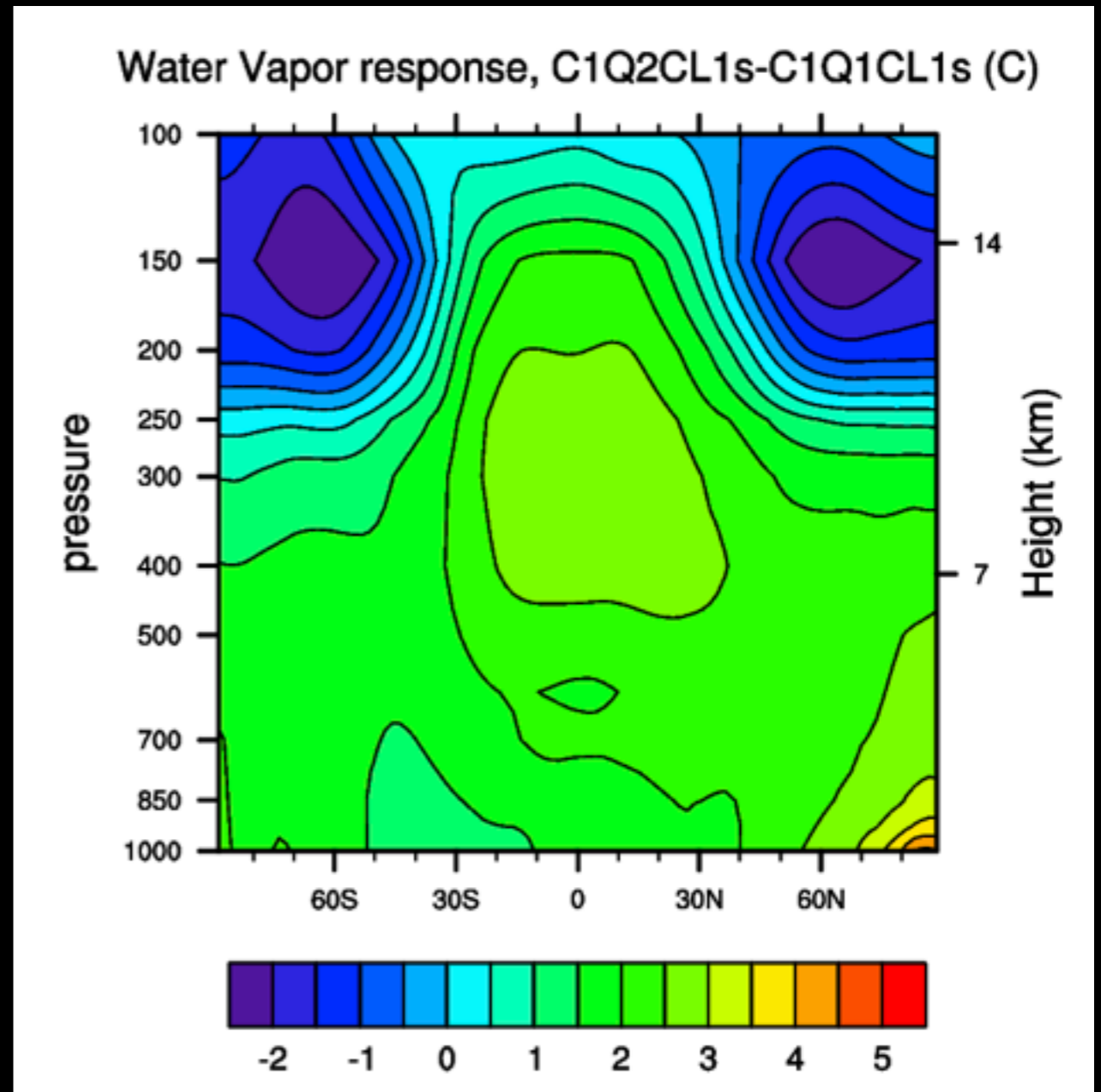
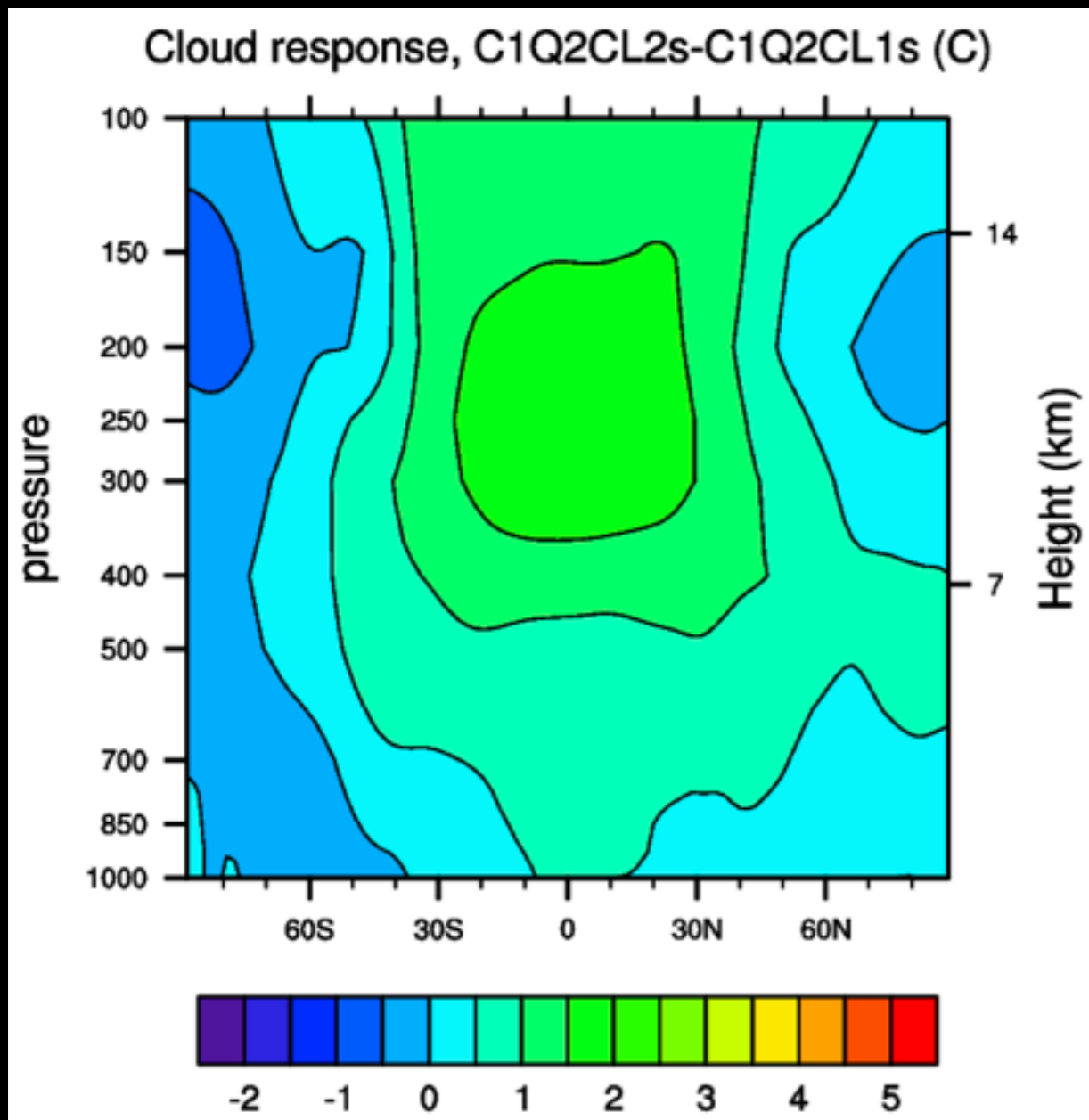
Water Vapor and Clouds, *only*



Water Vapor and Clouds, *only*



Water Vapor and Clouds, *only*



Outlook

- no conclusions, so far...
- ... except, the developed method provides exceptional linearity in the decomposition of the response to climate feedbacks
- experiments will be performed using final ECHAM 6.0, while including albedo, cloud and water vapor feedbacks
- exploitation of method in EUCLIPSE, whenever appropriate, is welcome