

Beyond Benchmarking:

Evaluating model assumptions with experimental manipulations



Will Wieder

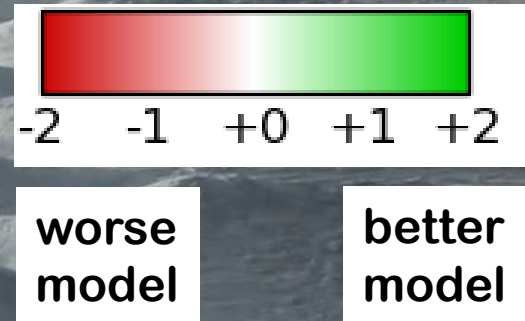
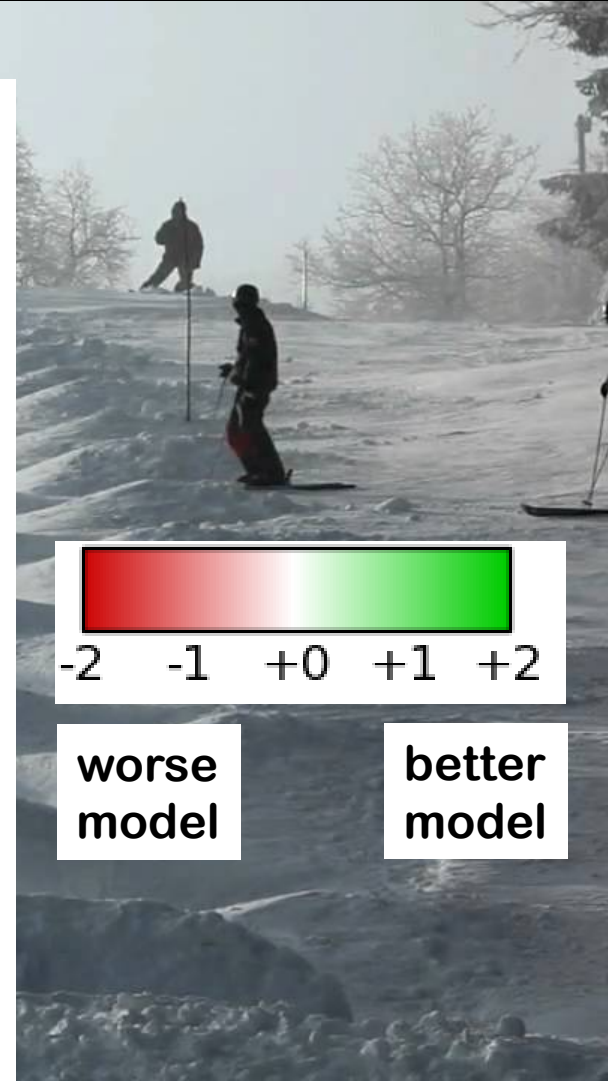
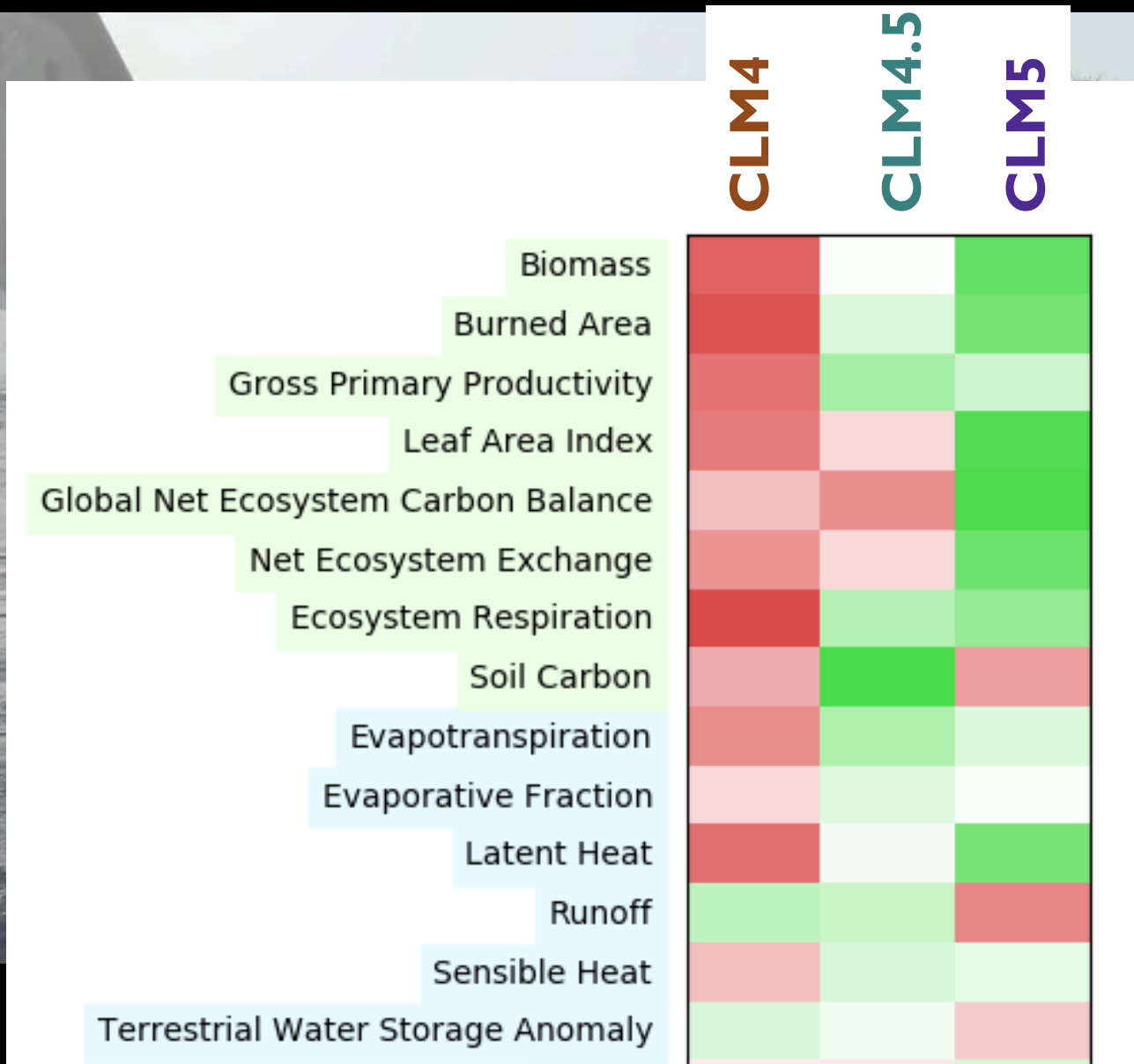
D. Lawrence, R. Fisher, K. Oleson & many more



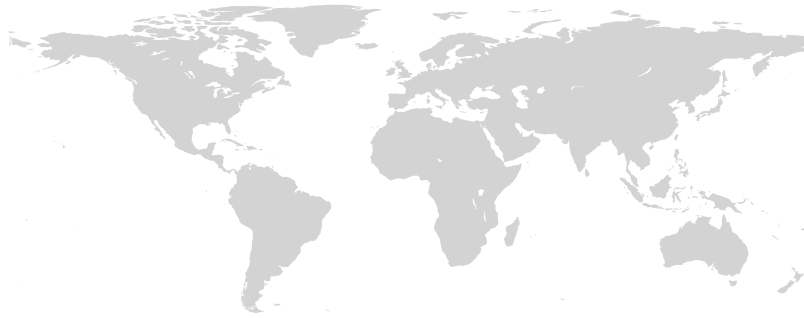
ILAMB Olympics



ILAMB Olympics



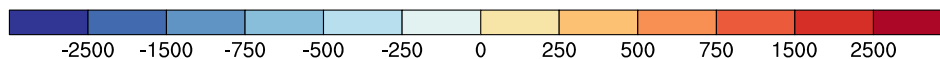
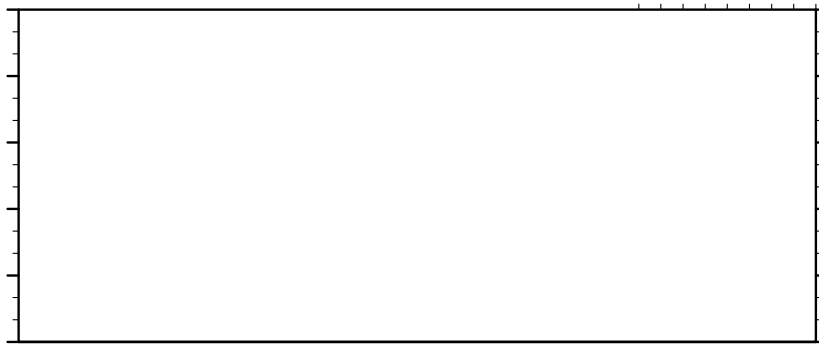
GPP Bias (Fluxnet MTE)



CLM 4.0
+14 Pg C y⁻¹

CLM 4.5
-2.9 Pg C y⁻¹

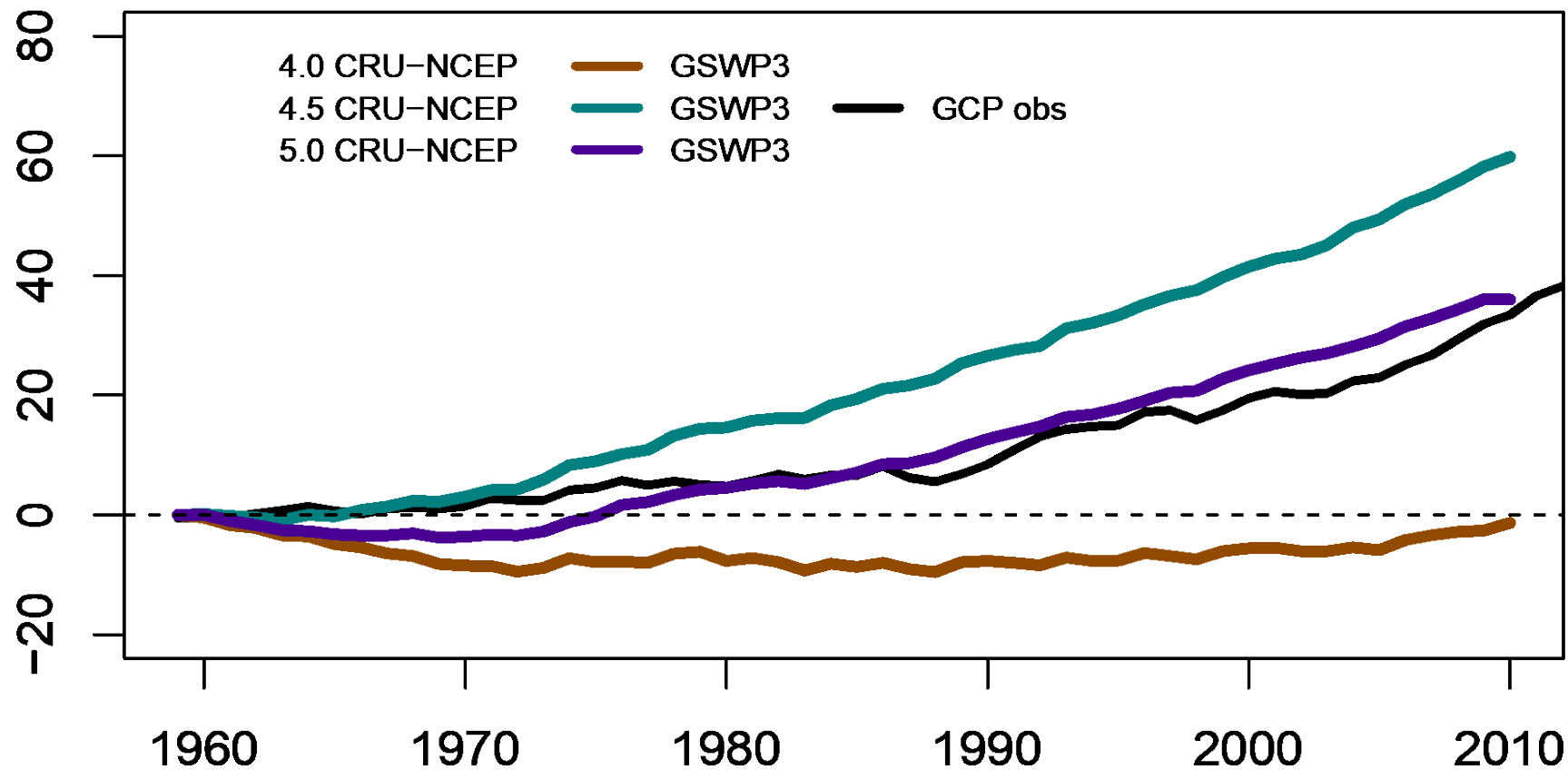
CLM 5.0
+2.4 Pg C y⁻¹

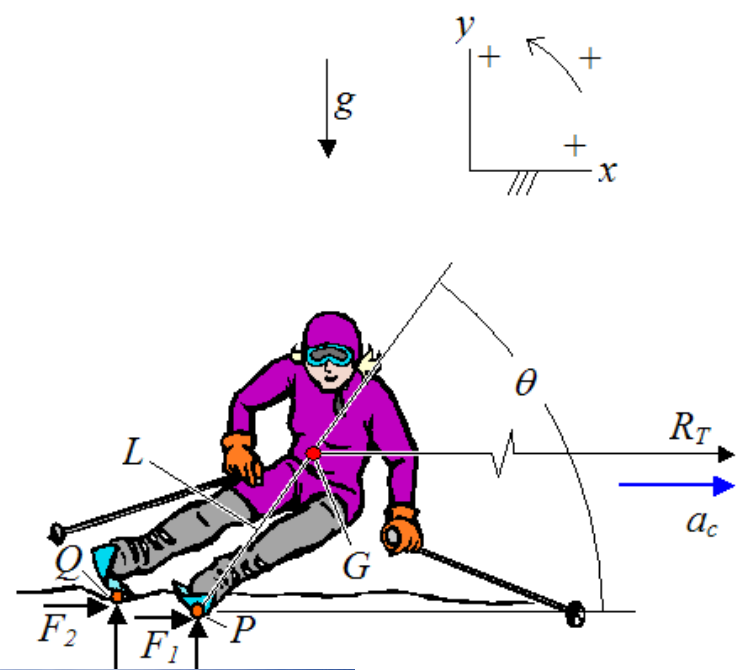


ILAMB Olympics



Cumulative Land Sink (Pg C)





CLM 4.0



CLM4.5



CLM5.0



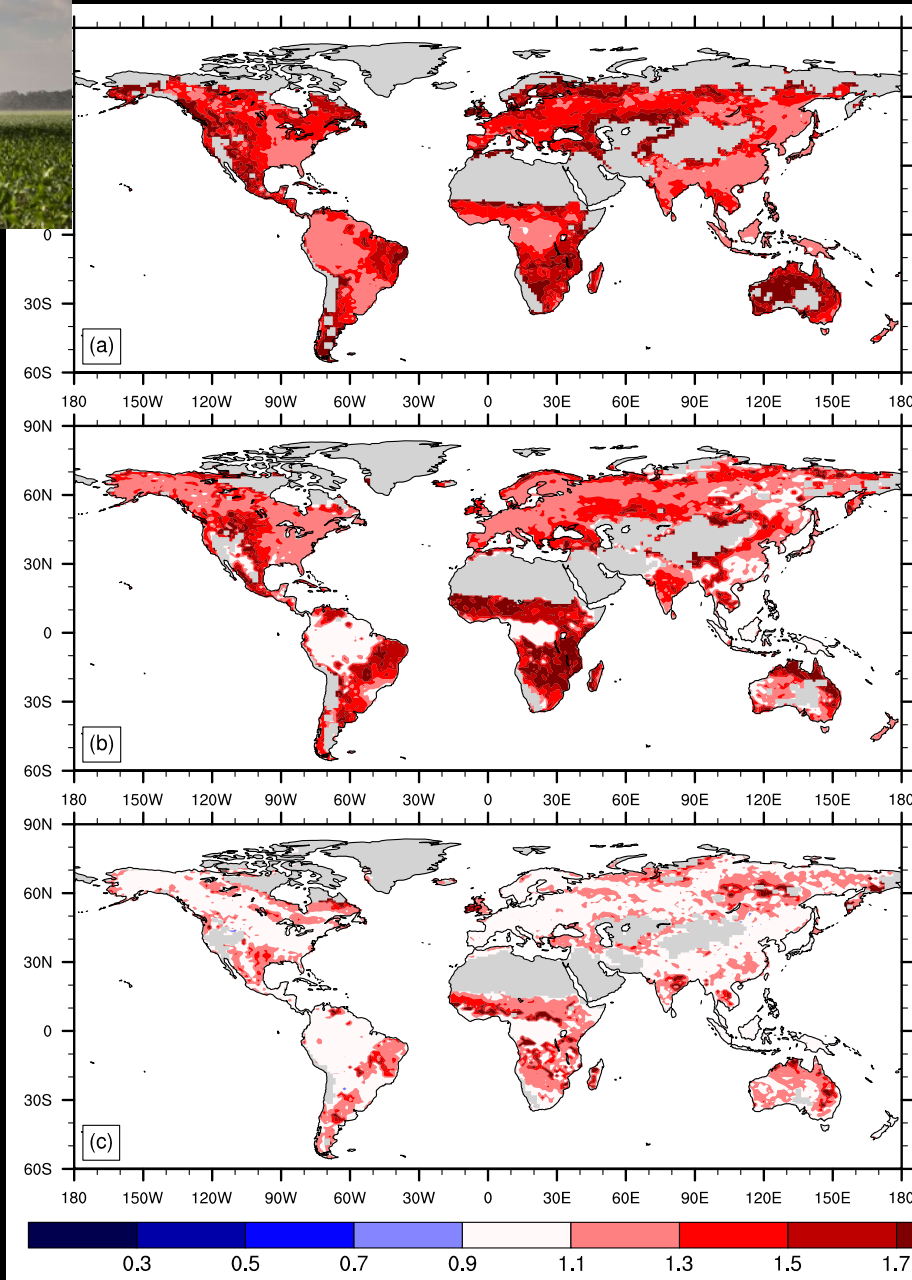


Control (GSWP3)
+N (50 kg N ha⁻¹ y⁻¹)
+CO₂ (200 ppm)
(treatment / control)



Medlyn et al. 2015 *Nature Clim. Change*
Wieder et al. Inprep

GPP Response to +N (treatment / control)



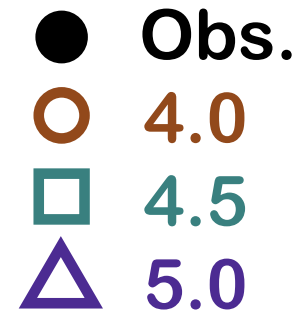
CLM 4.0

CLM 4.5

CLM 5.0



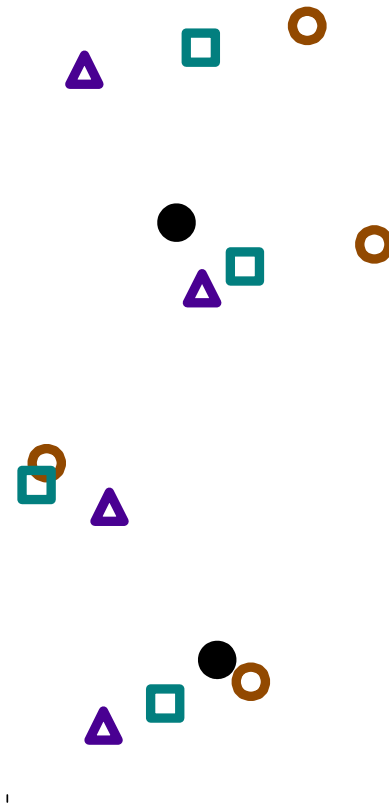
Response to +N



Nitrogen effect (treatment / control)



Response to +N



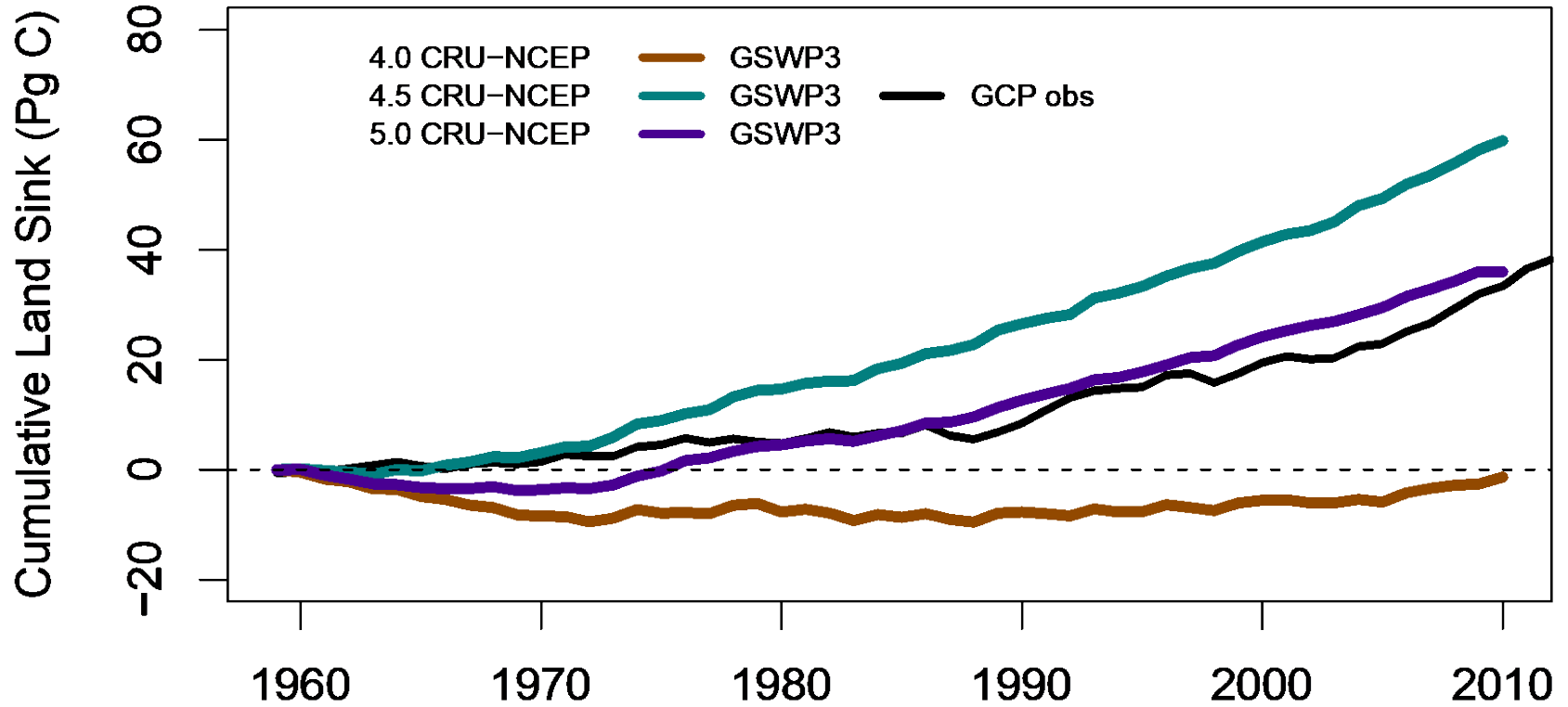
- Obs.
- 4.0
- 4.5
- △ 5.0

Nitrogen effect (treatment / control)



LeBauer & Treseder 2008
Liu & Greaver 2010
Lu et al. 2011

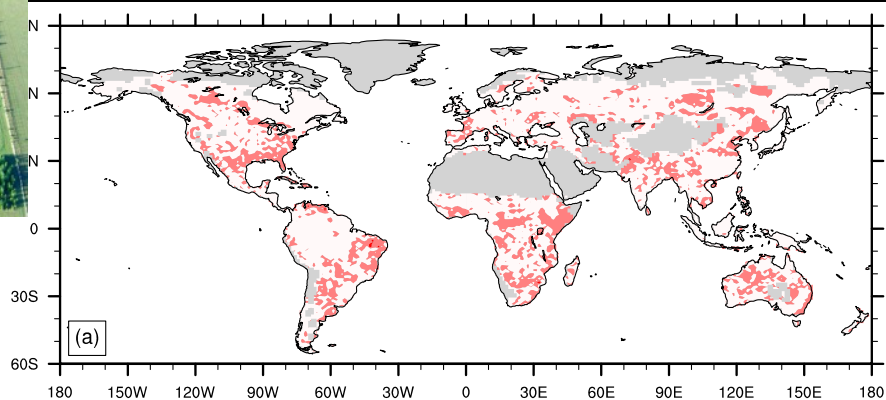
GPP Response to +CO₂?



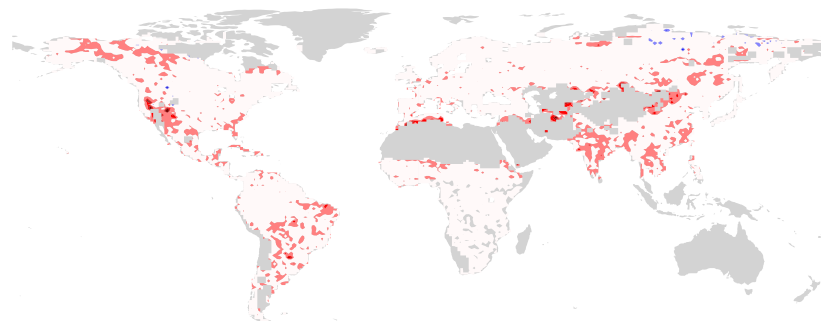


GPP Response to +CO₂

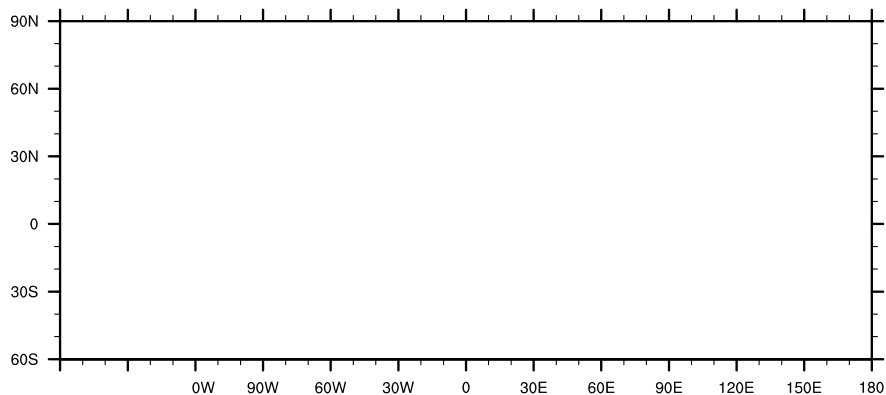
(treatment / control)



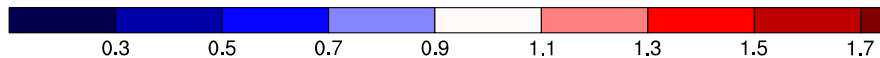
CLM 4.0



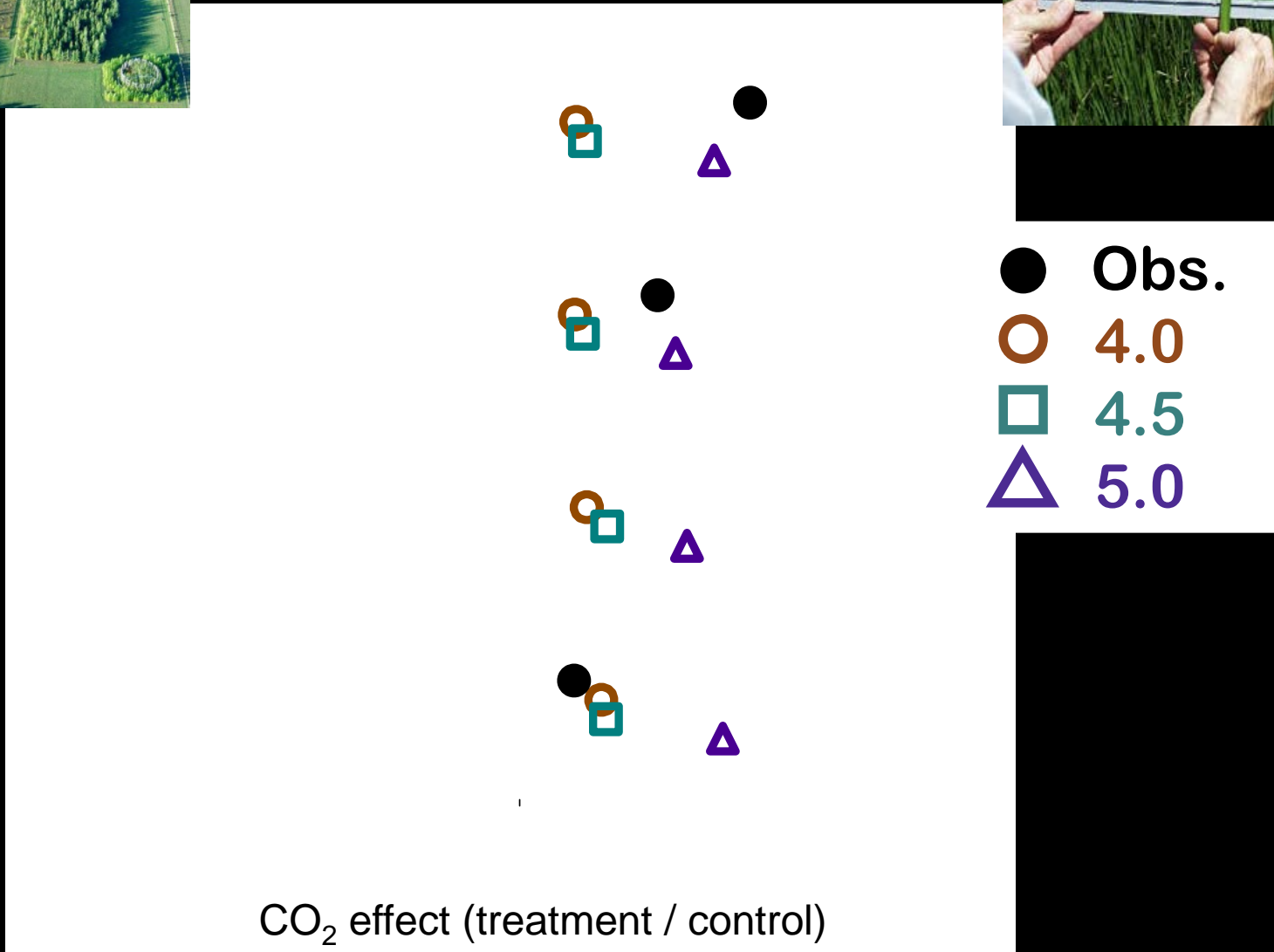
CLM 4.5



CLM 5.0



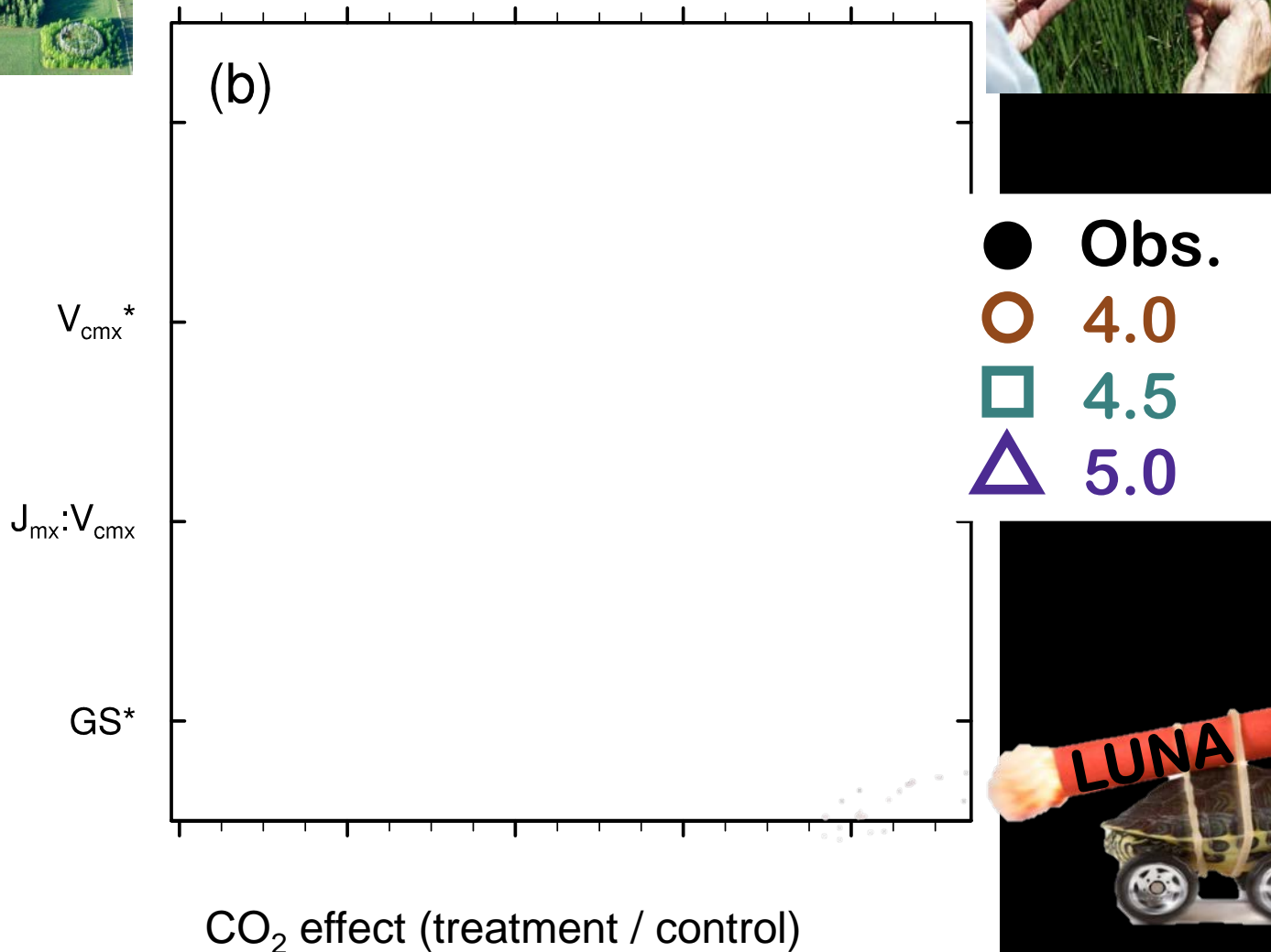
Response to +CO₂



* Monthly mean of maximum daily values

Obs from Ainsworth & Long 2005

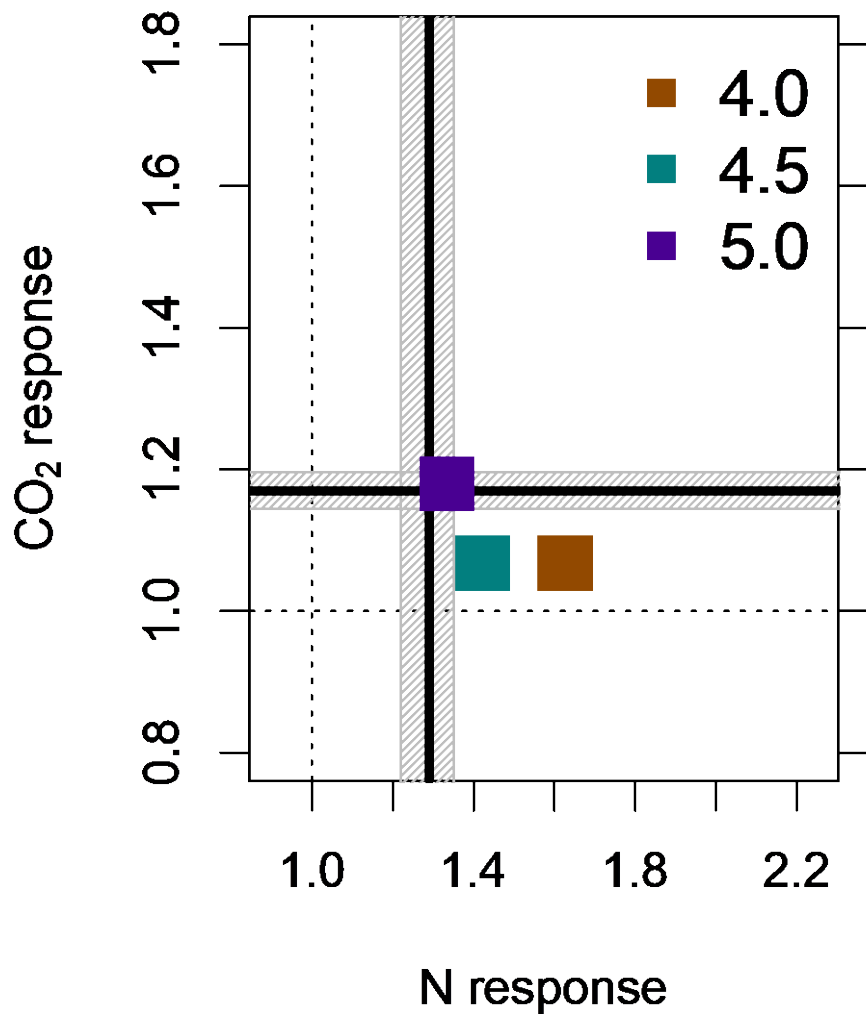
Response to +CO₂



* Monthly mean of maximum daily values

Obs from Ainsworth & Long 2005

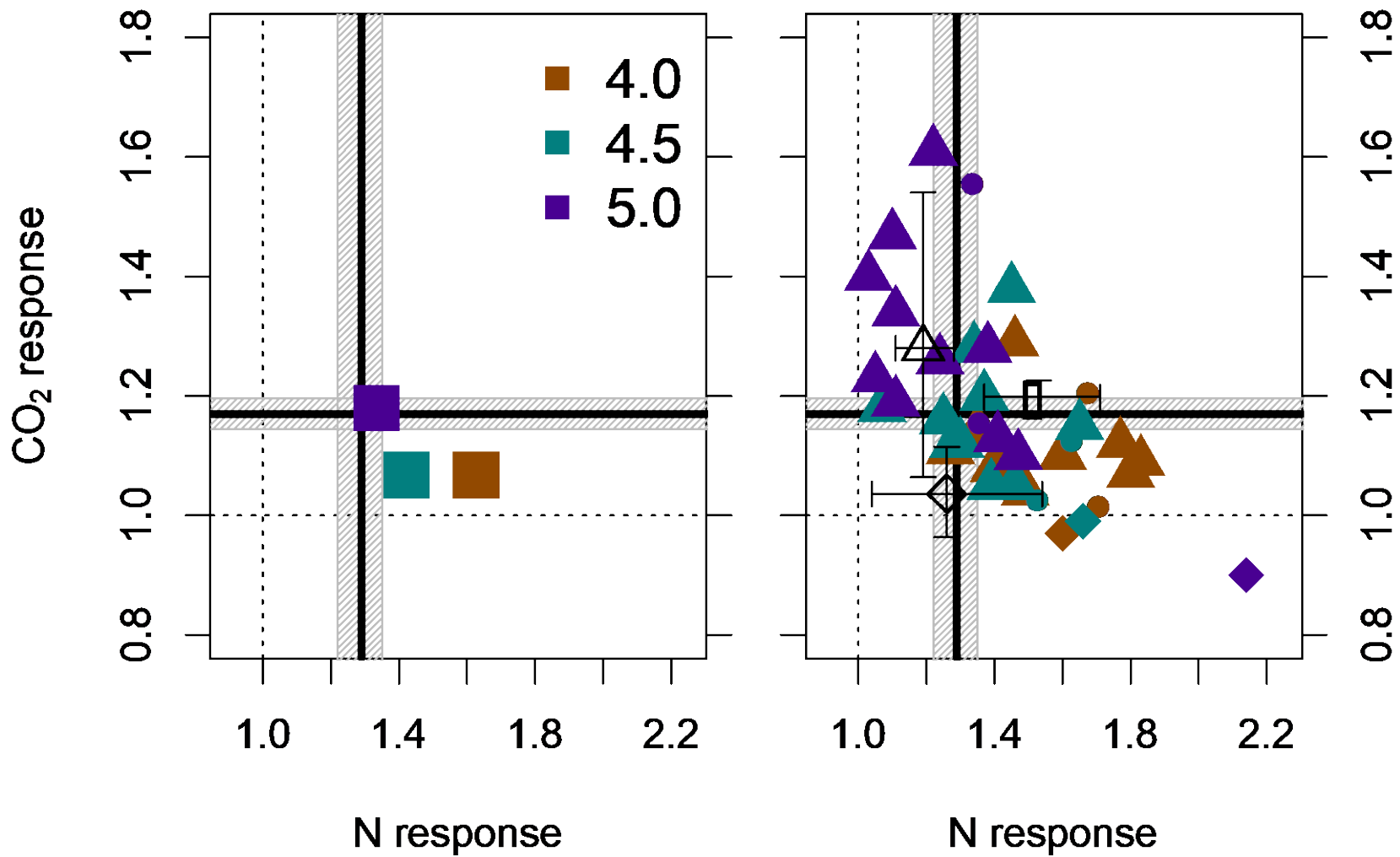
NPP Response



LeBauer & Treseder 2008

Ainsworth & Long 2005

NPP Response





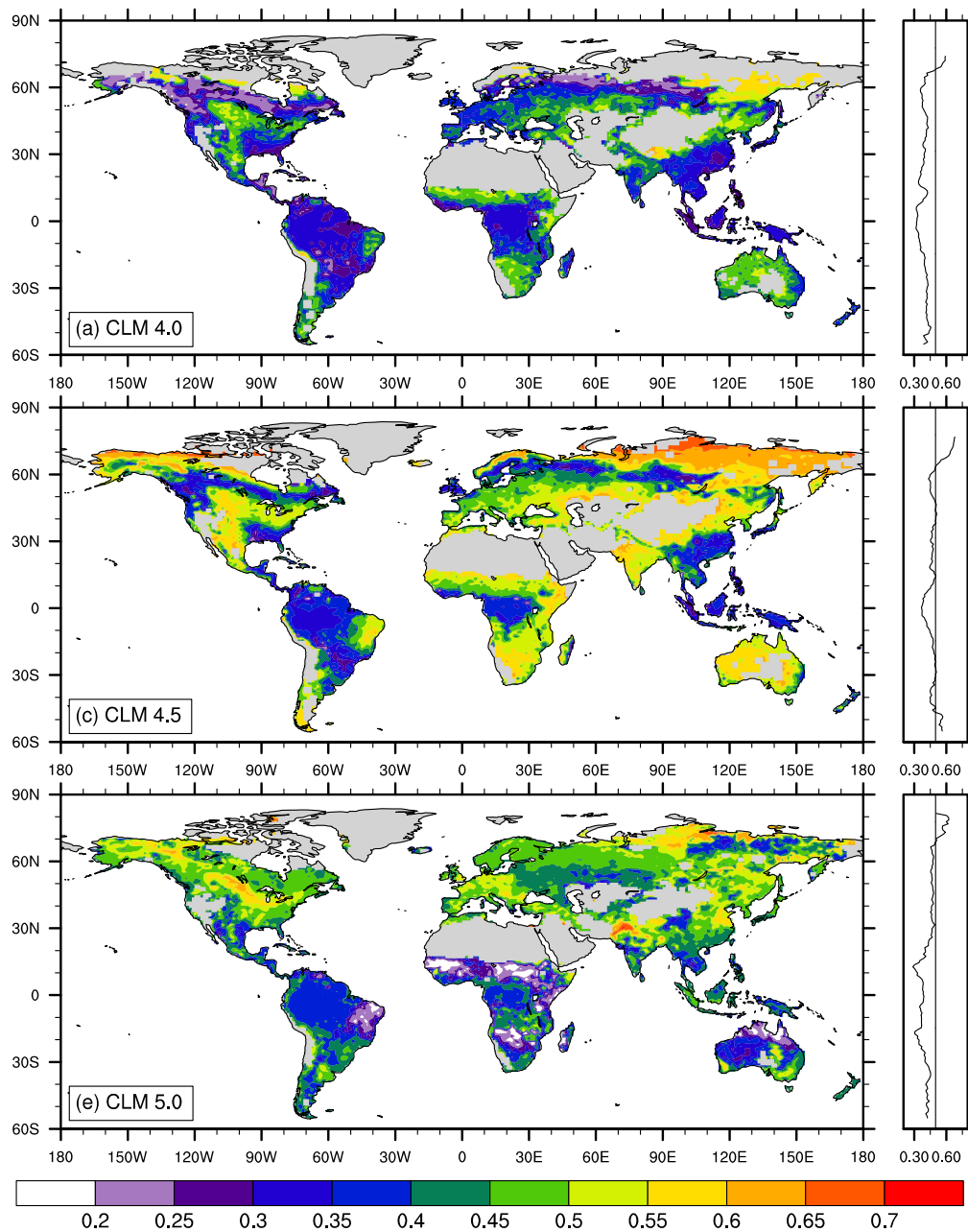
CLM5 has:

- Better ILAMB scores
- Poleward shift in productivity
- Lower N sensitivity
- Increased CO₂ sensitivity
- Greater ecological realism

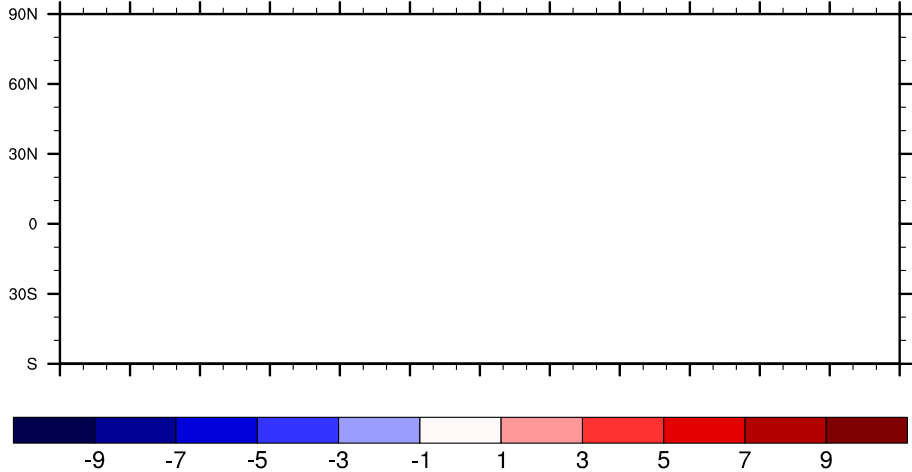
CLM5+ needs:

- Revisions to allocation scheme
- Adjustments to FUN costs
- Real competition for inorganic N

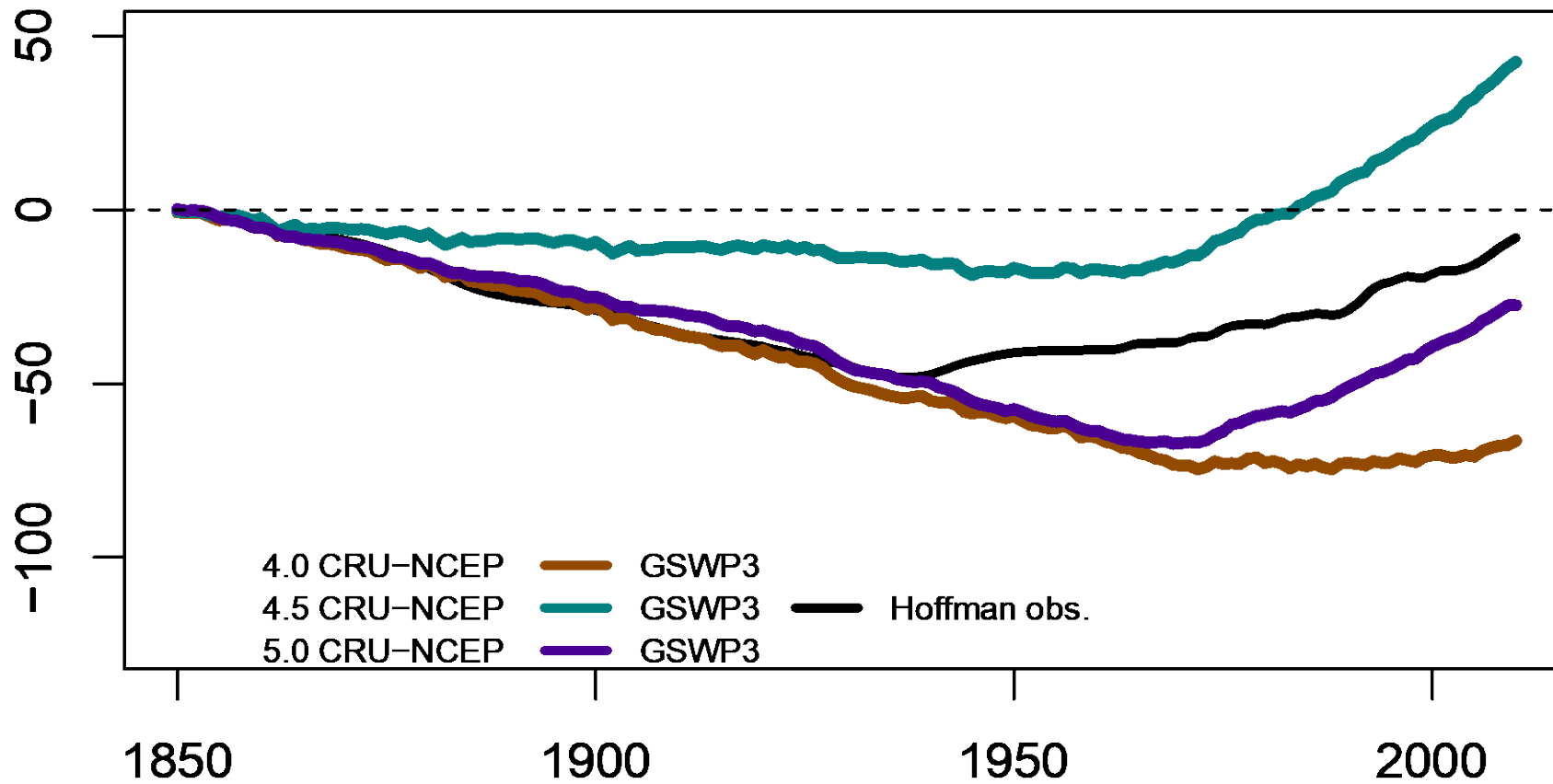
control CUE



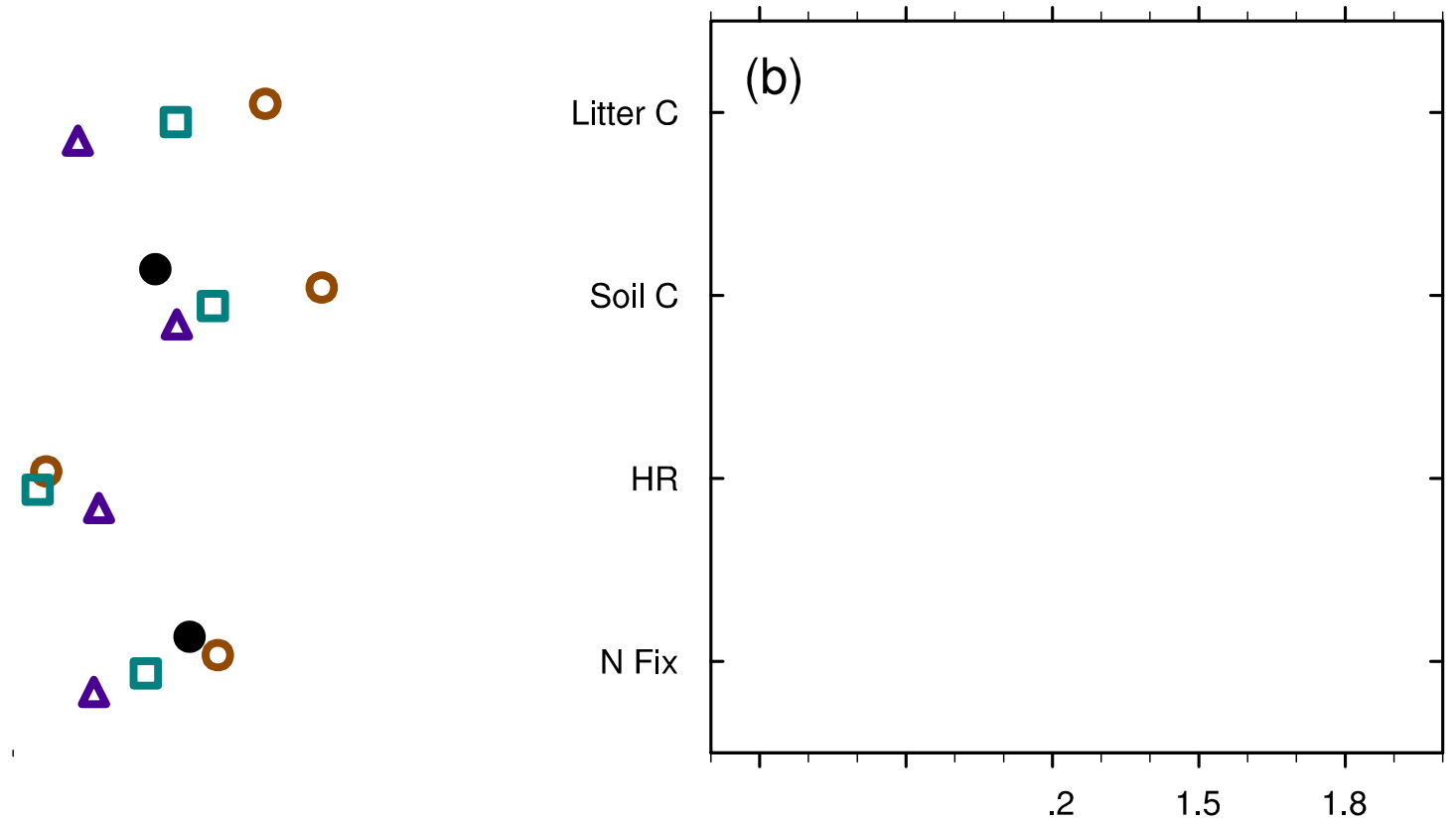
FACE difference LHEAT



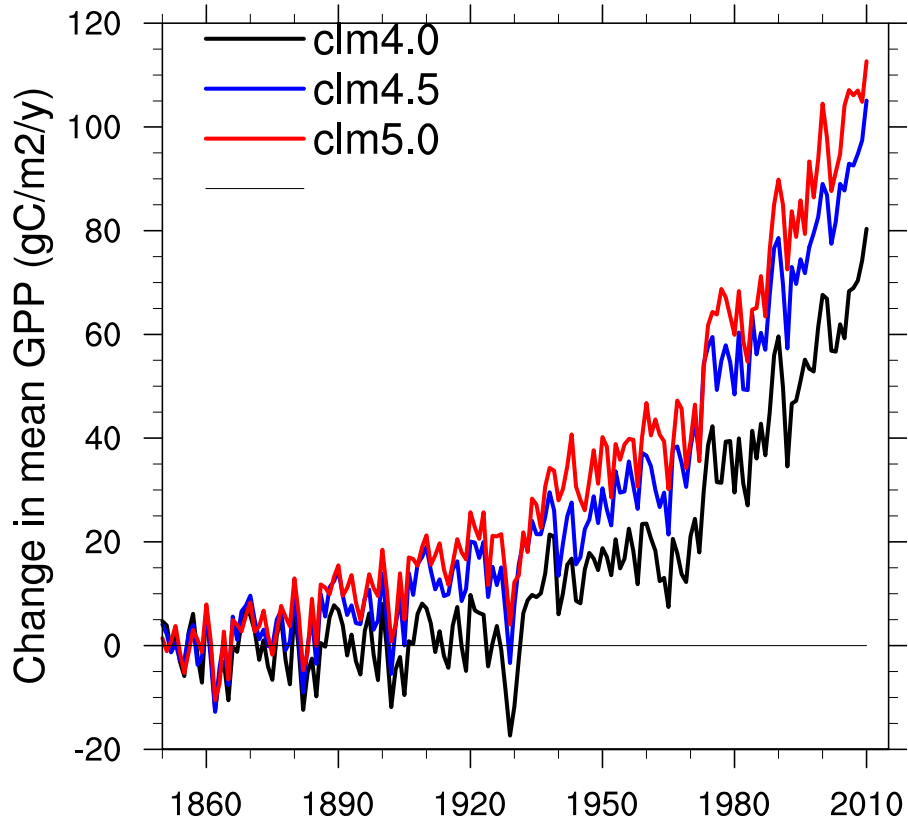
Cumulative Land Sink (Pg C)



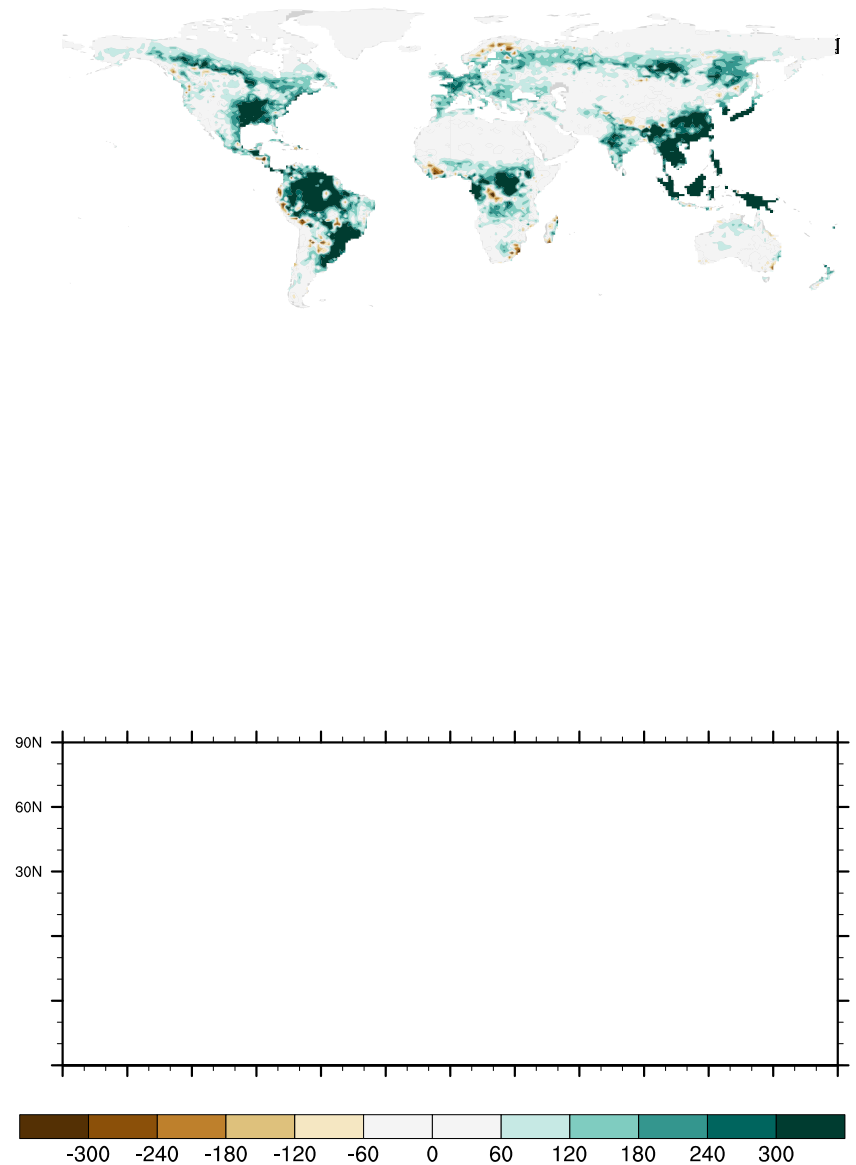
Response to +N



Δ GPP

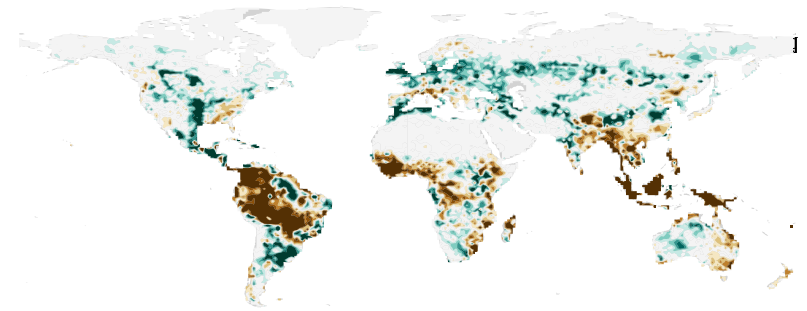
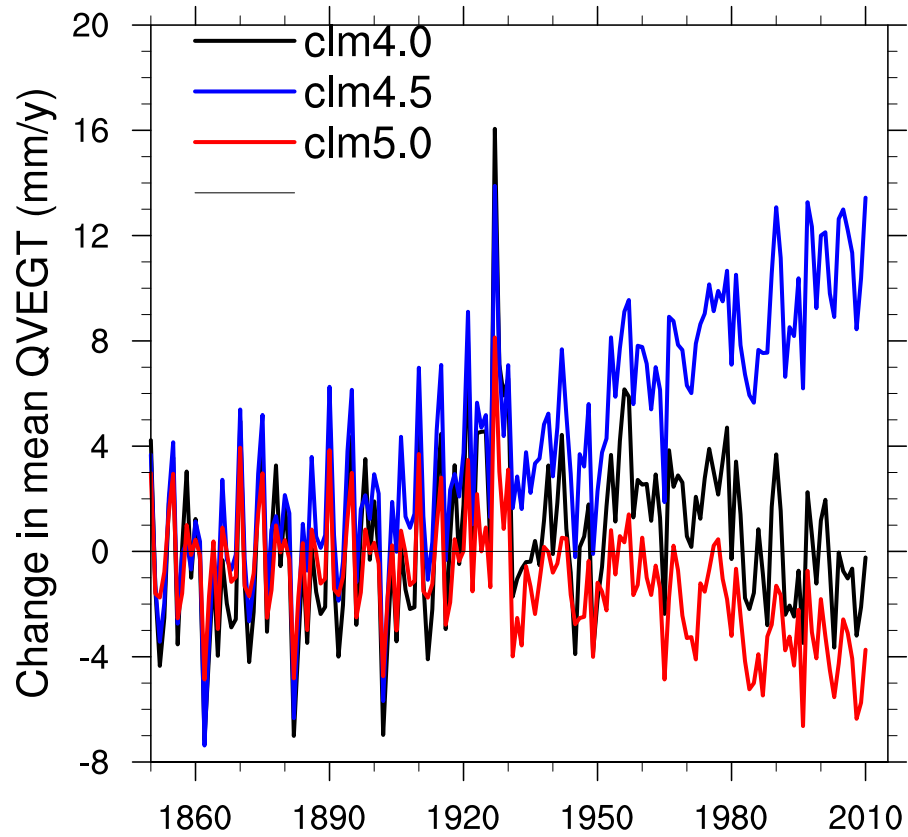


change GPP (GSWP3, 2010-1850, gC/m²/y)

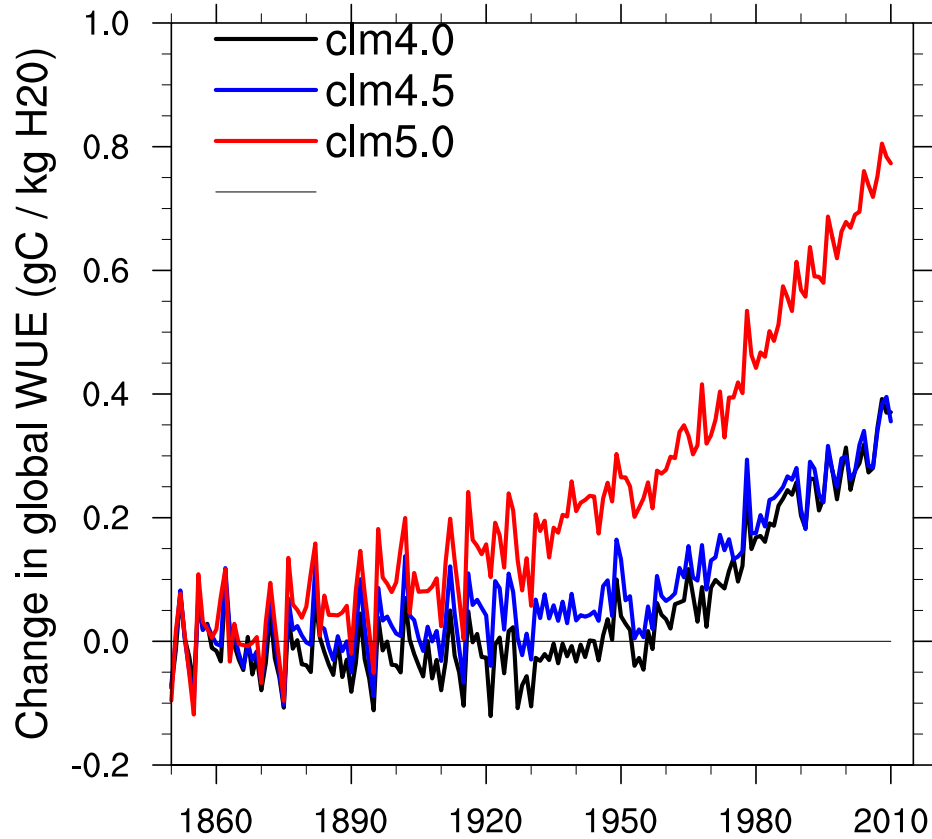


$\Delta QVEGT$

0, mm/y



Δ WUE



010-1850), gC / kg H₂O

