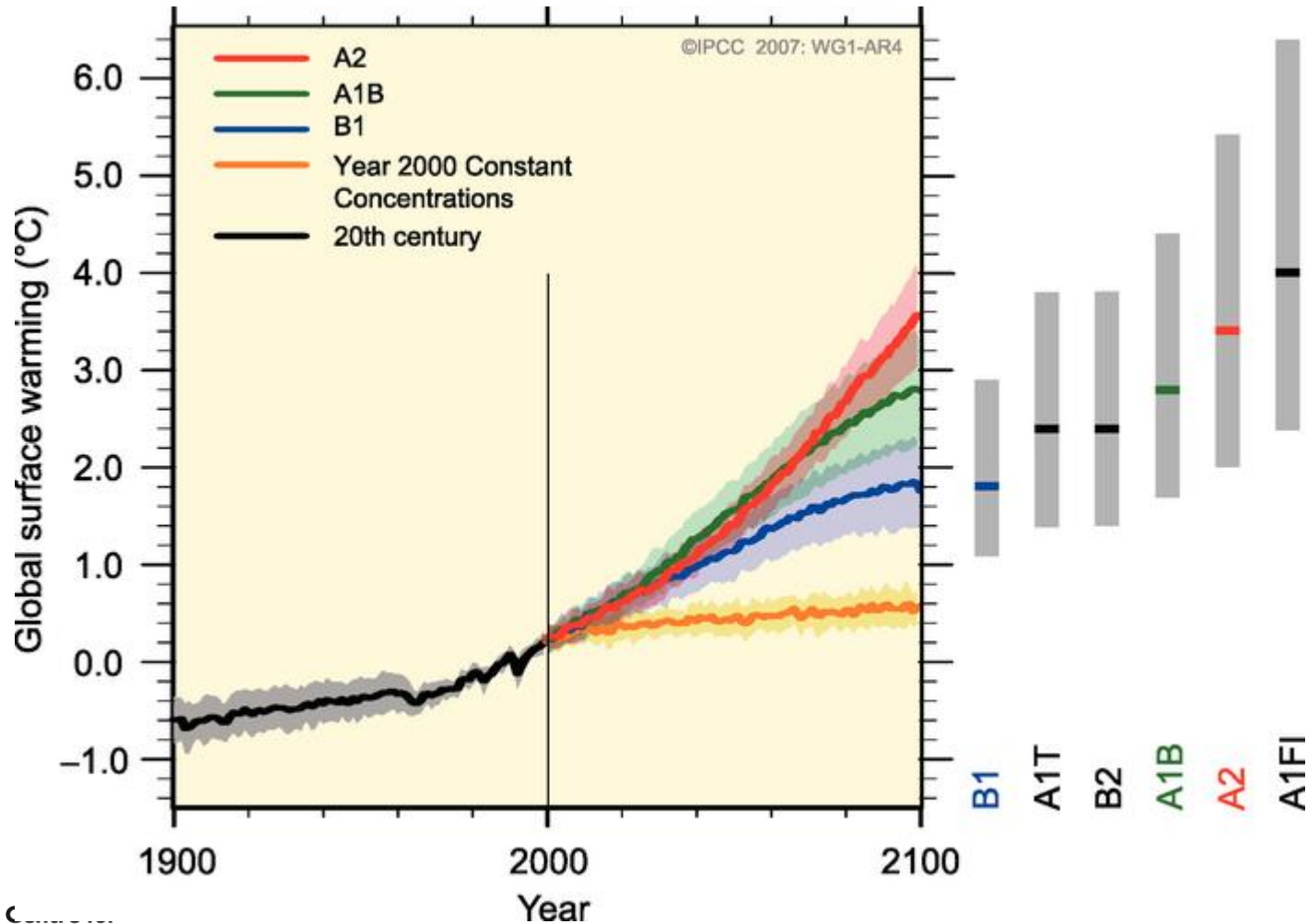


“FUTURE OF AFRICAN RAINFORESTS UNDER CLIMATE CHANGE”

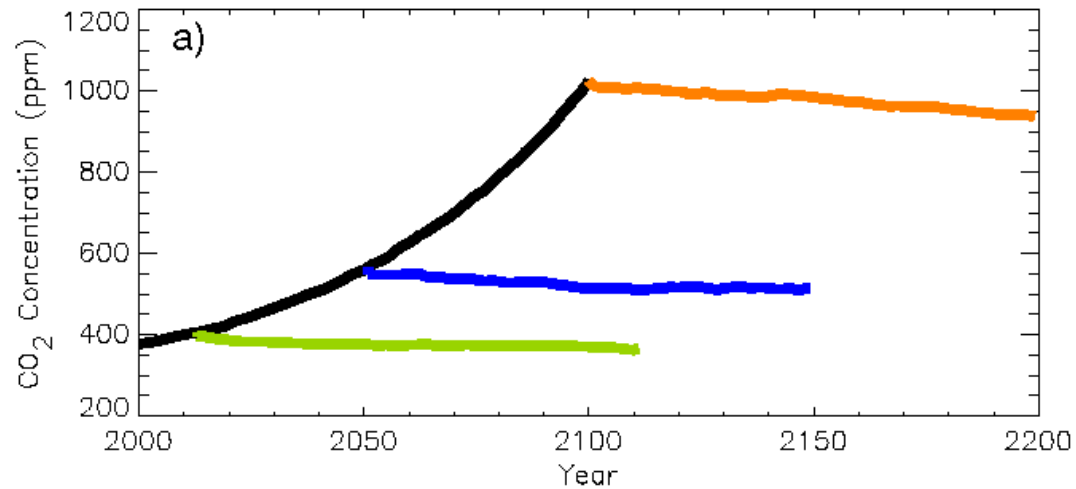
Chris Huntingford, PRZEMYSŁAW ZELAZOWSKI, LINAM MERCADO, STEPHEN SITCH, DAVID GALBRAITH, ROSIE FISHER, MARK LOMAS, ANTHONY WALKER, CHRIS D JONES, BEN B B BOOTH, YADVINDER MALHI, PETER M COX, DEBBIE HEMMING, GILLIAN KAY, PETER GOOD, SIMON LEWIS, OWEN ATKIN, JON LLOYD, MANUEL GLOOR, JOANA ZARAGOZA-CASTELLS, PATRICK MEIR AND RICHARD BETTS

(Oriel College, Oxford, 5th January 2012).

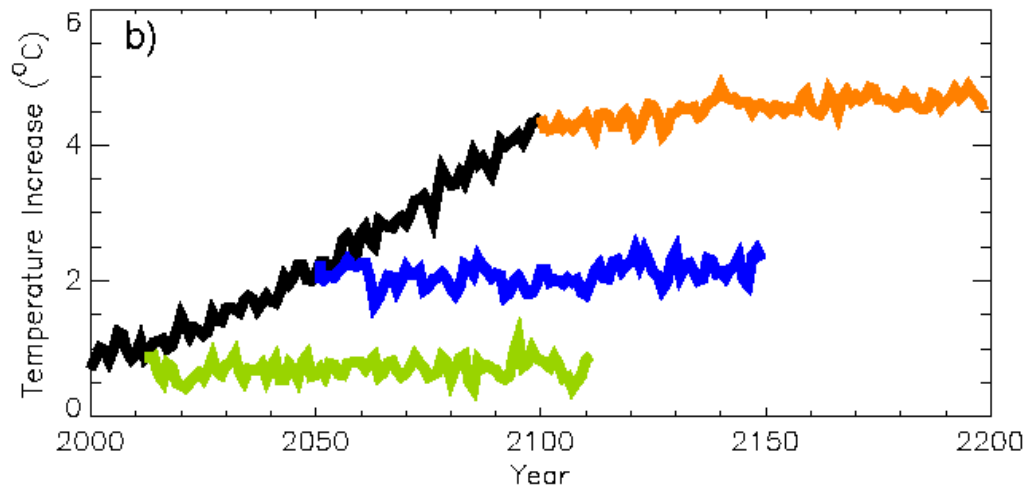
IPCC assessment – 22 GCMs submitted



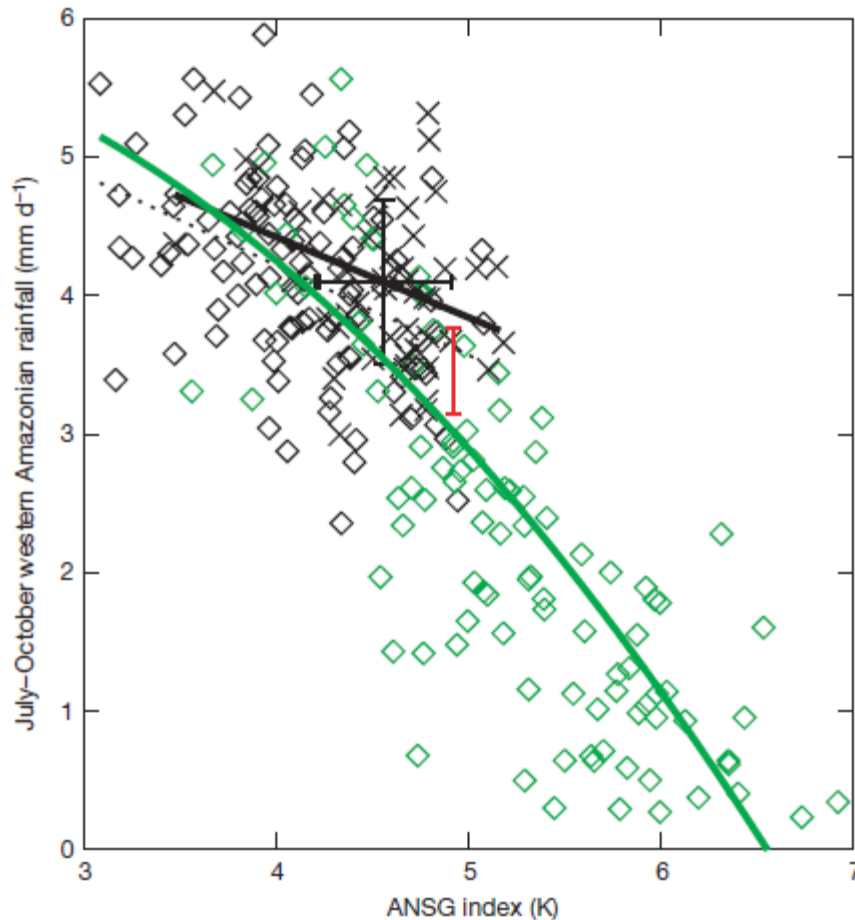
Getting back isn't easy....



Lowe et al (2009)
Environ. Res. Lett. **4**
L014012



Amazon potentially at risk of “die-back”



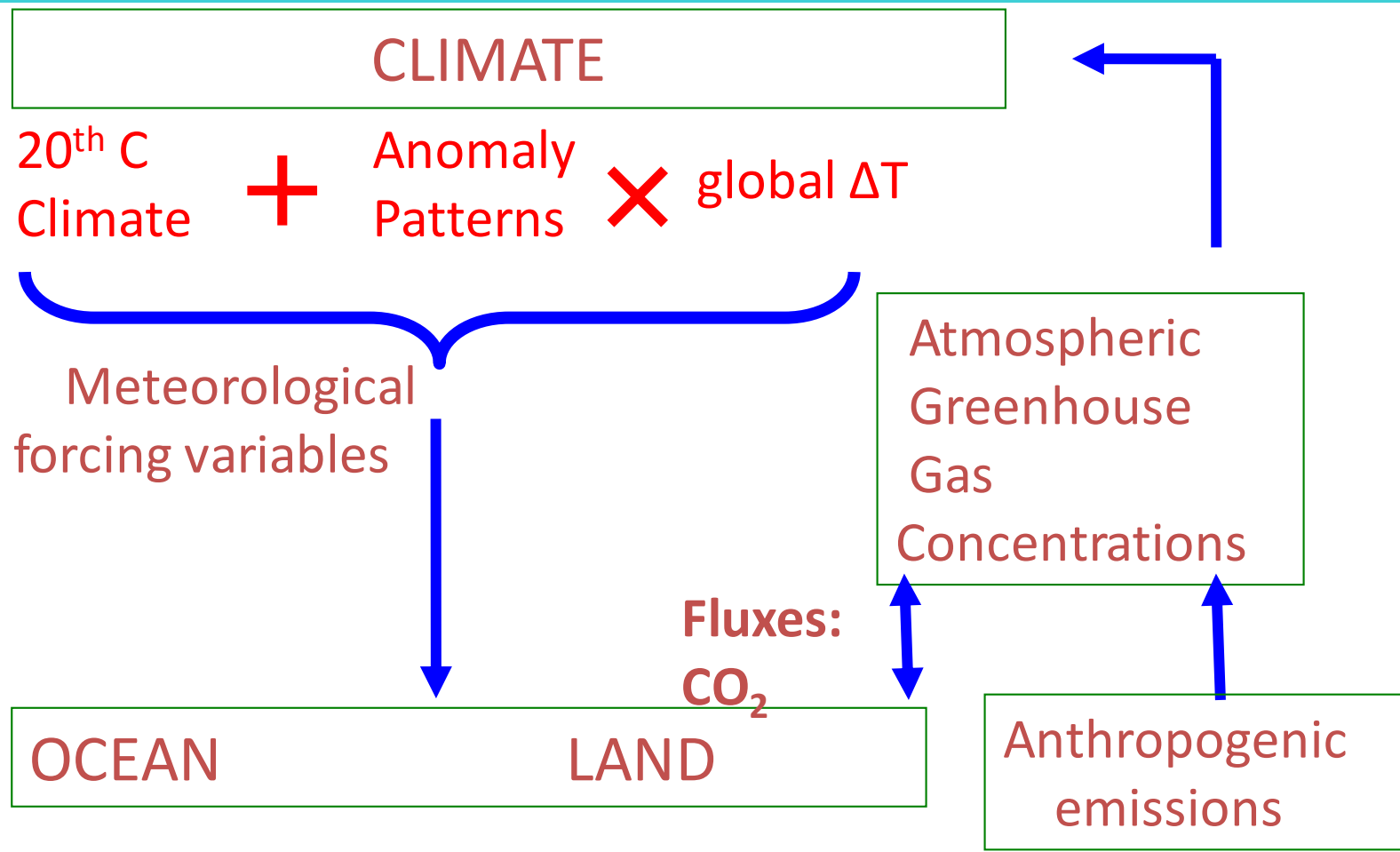
Cox et al (2000) showed the potential for “die-back” based on HadCM3 GCM.

This is not just a “continuous ElNino” in greenhouse-gas enriched environment.

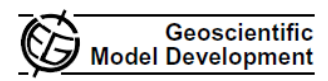
Here “ANSG=Atlantic North-South gradient”. (Cox et al, 2008, Nature, 453, 212-216.)

Are there similar concerns for the African rainforests?

IMOGEN as a tool to emulate GCMs

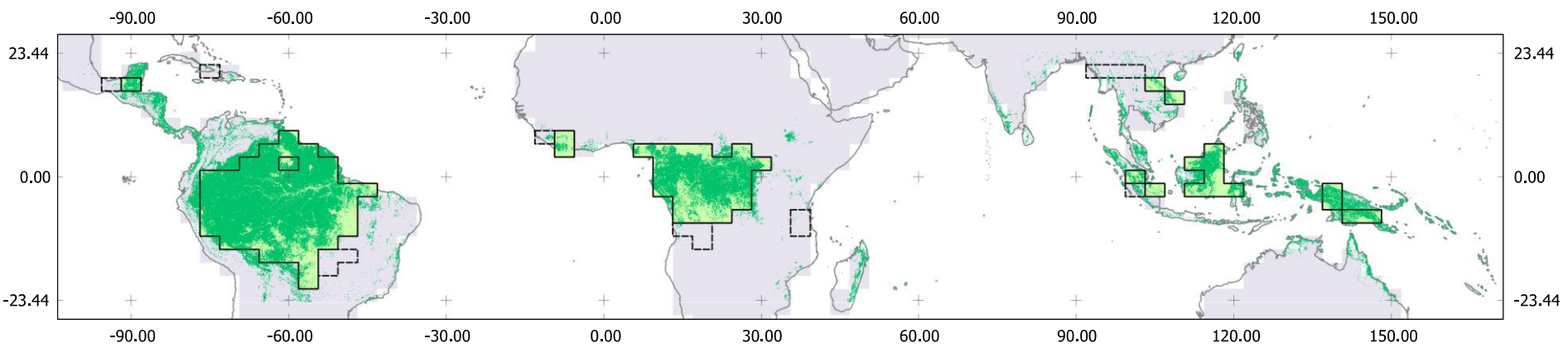


Geosci. Model Dev., 3, 679–687, 2010
www.geosci-model-dev.net/3/679/2010/
 doi:10.5194/gmd-3-679-2010
 © Author(s) 2010. CC Attribution 3.0 License.



IMOGEN: an intermediate complexity model to evaluate terrestrial impacts of a changing climate

C. Huntingford¹, B. B. Booth², S. Sitch^{3*}, N. Gedney², J. A. Lowe⁴, S. K. Liddicoat², L. M. Mercado¹, M. J. Best³, G. P. Weedon³, R. A. Fisher^{5,6*}, M. R. Lomas⁵, P. Good², P. Zelazowski⁵, A. C. Everitt¹, A. C. Spessa⁷, and C. D. Jones²



22-GCMs – calibration of patterns

$$\Delta X(i,j,k) = \Delta T(k) * P(i,j)$$

X = Variable of interest

ΔT = Global warming

i = geographical position

j = month

k = decade

Dark respiration peaks, and not as Q_{10} .

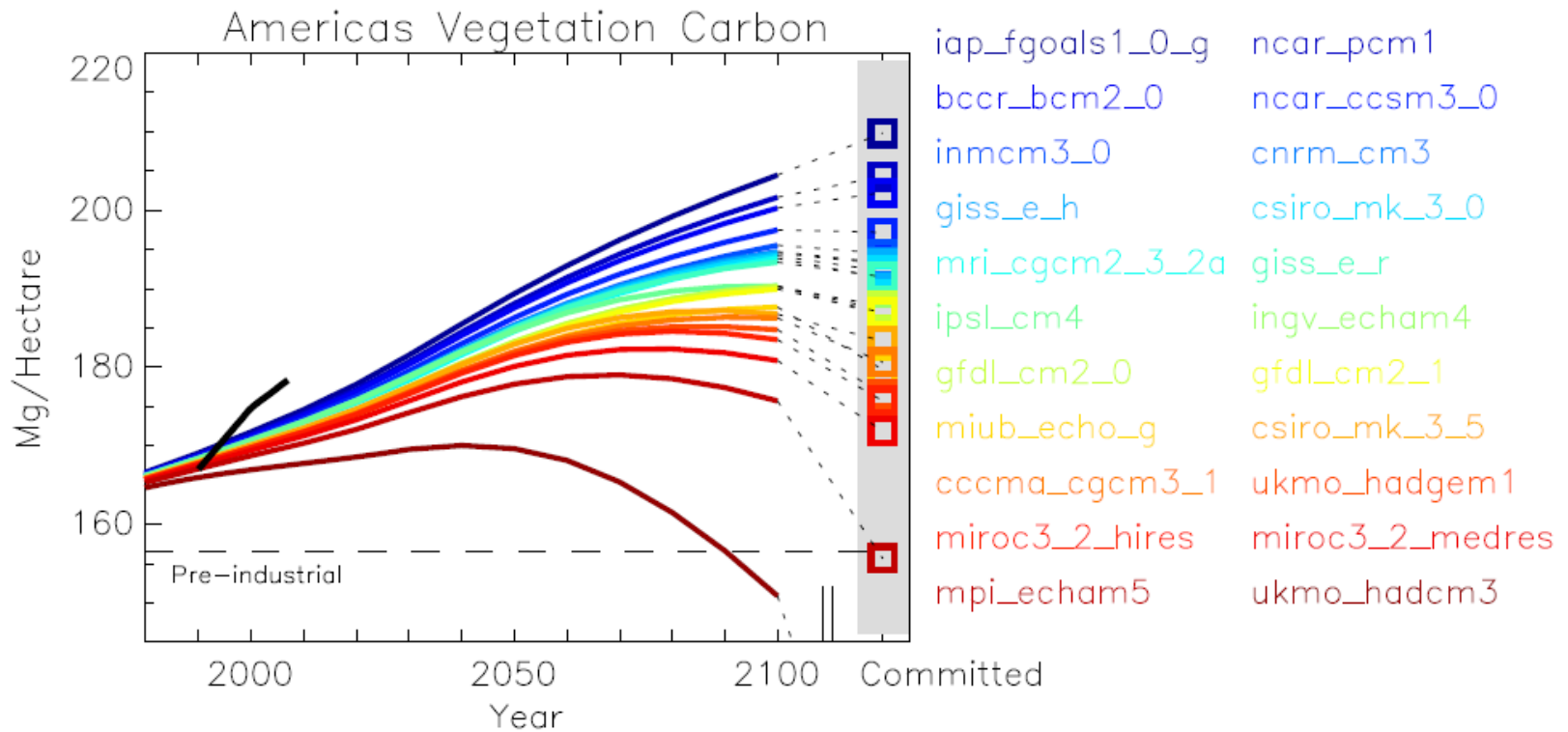
Forced with common CO_2 and non- CO_2 radiative forcing – based on SRES A2 and Bern model mapping for CO_2 concentrations.

CRU initial conditions (so GCM biases removed).

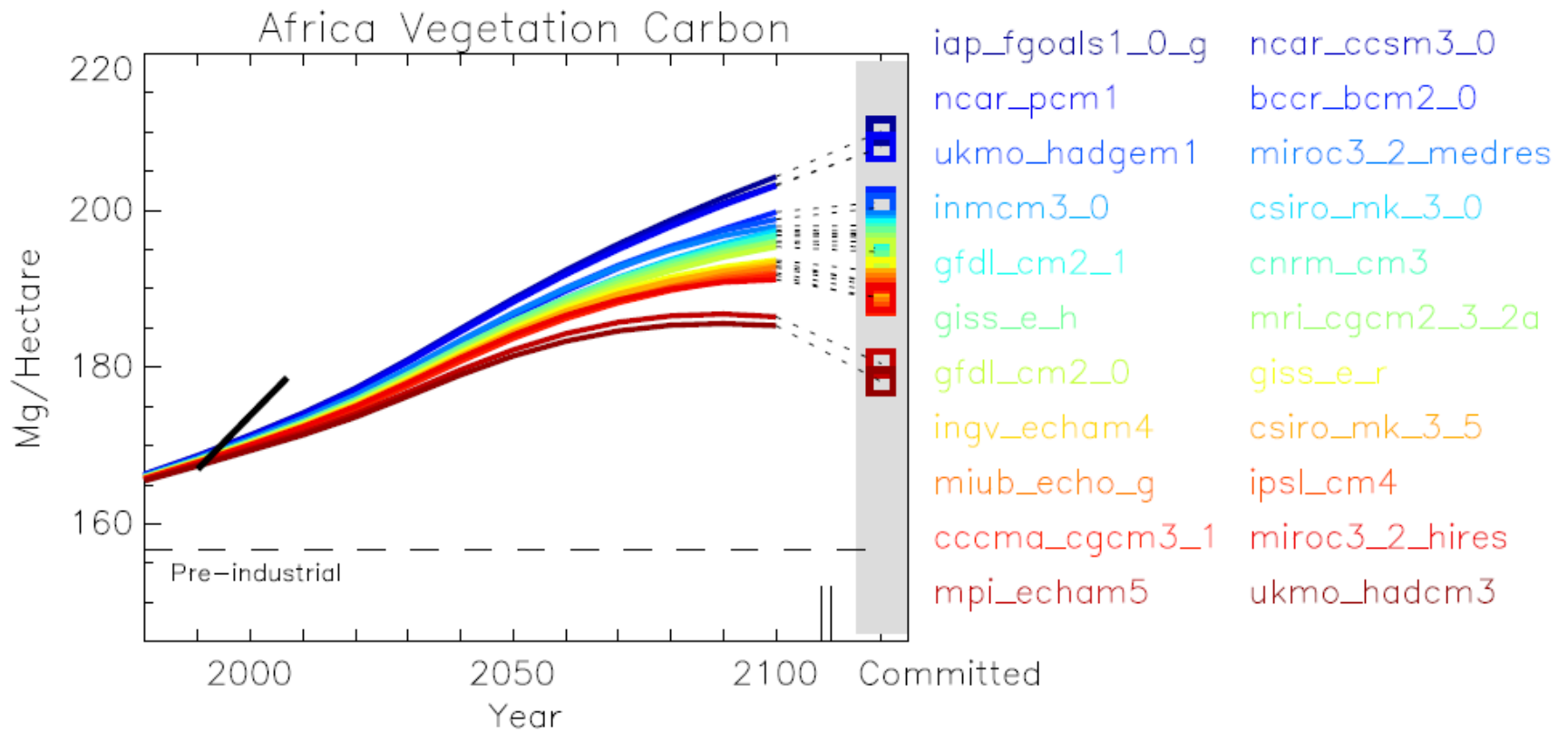
Variables needed to force MOSES/TRIFFID (now JULES) land surface model:

- Temperature
- SW down
- LW down
- Precip
- Windspeed
- Humidity
- Pressure

Amazon results

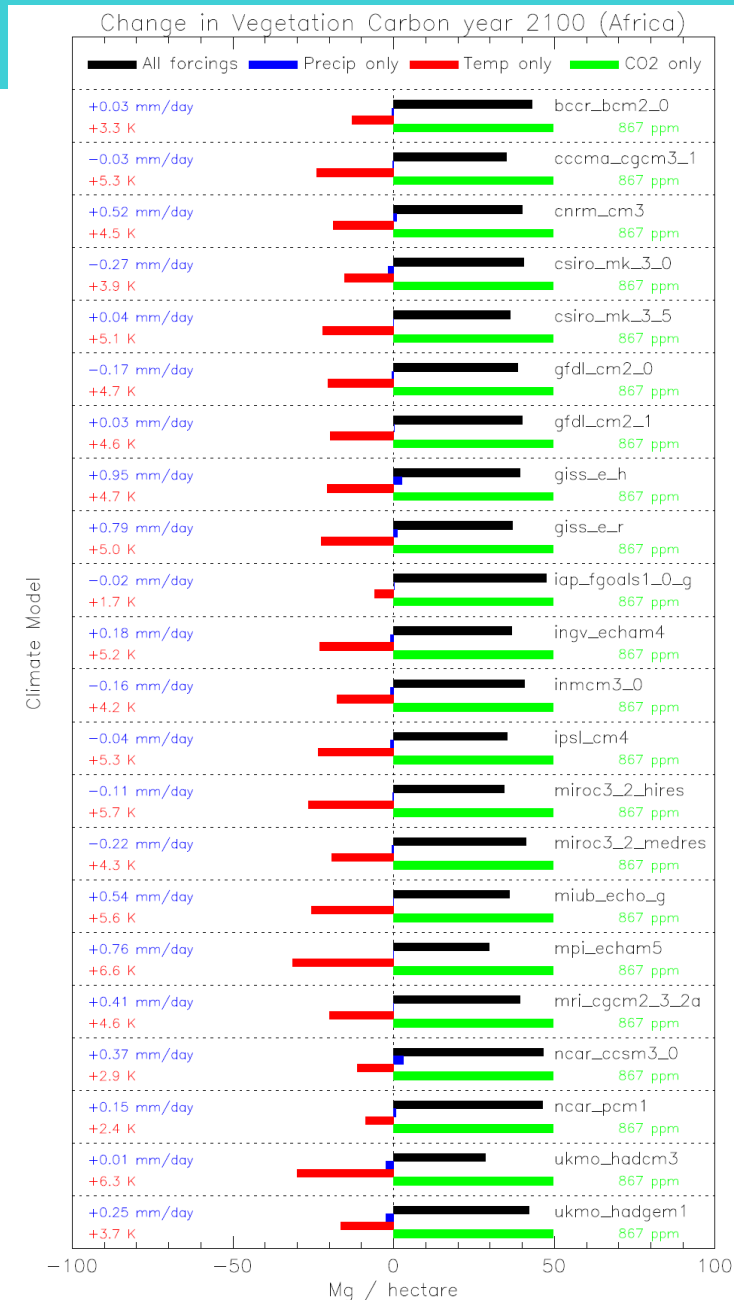


Africa results

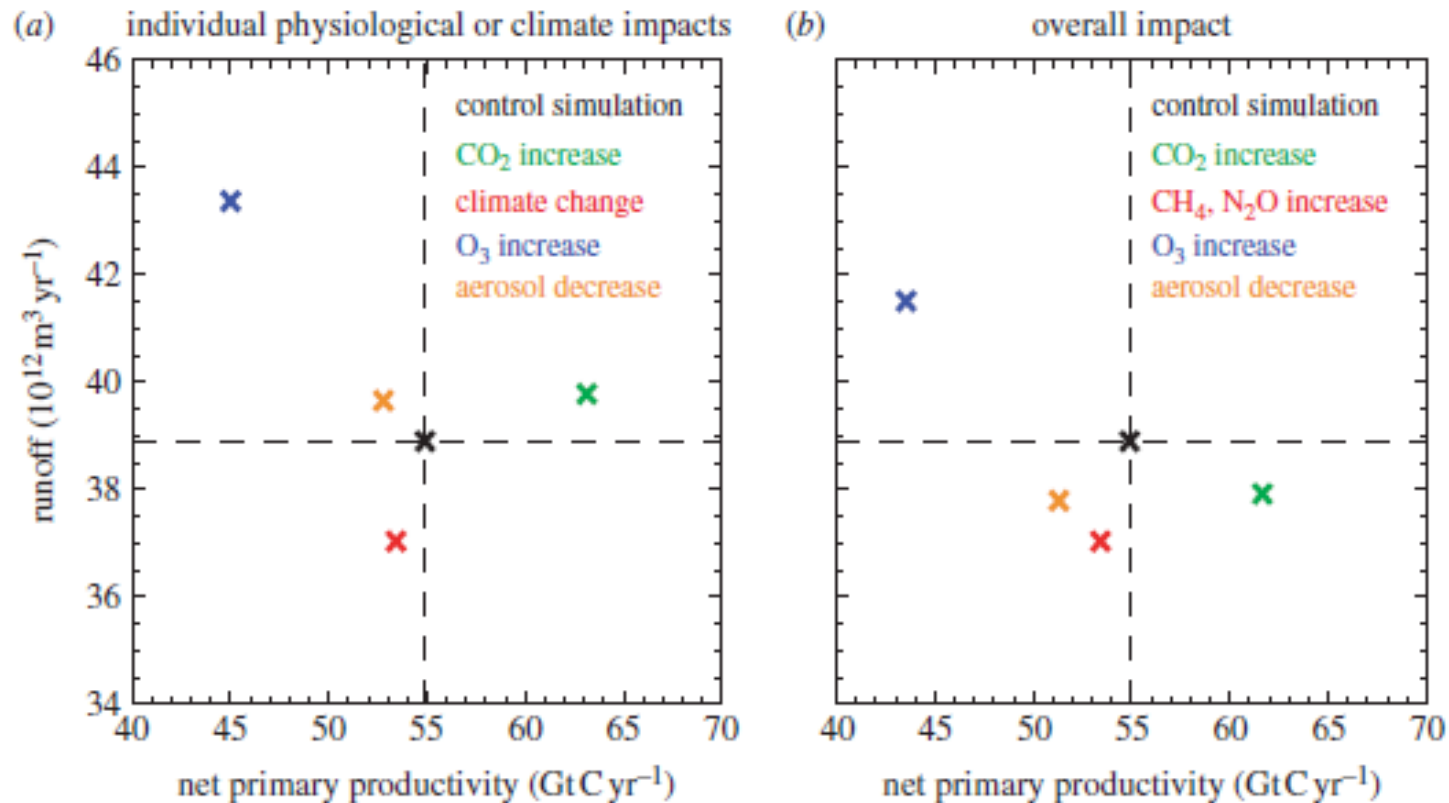


Drivers of change

- Temperature effects are generally detrimental.
- CO₂ main reason for positive uptake.
- Changes to rainfall have hardly any effect in any of the models.



SRES scenarios assume mainly CO₂ up



Highly contrasting effects of different climate forcing agents on terrestrial ecosystem services. Huntingford et al 2011. Phil Trans Roy Soc A – Vol **369**, p2026-2037.

What's missing from current models.

- Better descriptions of PFTs. Is it more of a continuum?
 - Temperature physiological responses correct?
 - Root functioning.
 - Geochemical cycle (N, P, others..). Can CO₂-fertilisation go on for ever?
-
- Climate models require weighting.
 - CMIP5 coming soon.
 - Detection/Attribution machinery applied to the analyses.