

Earth System Models are not capturing present-day tropical forest carbon dynamics

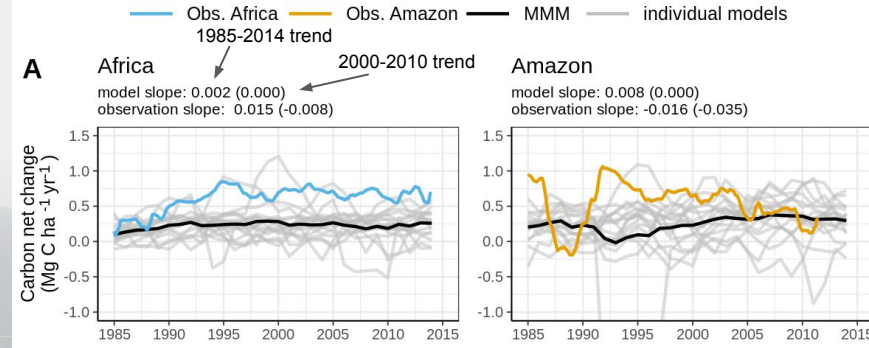
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We compared

long-term **forest plot data**^[1,2] and **CMIP5/6 models**^[3,4]

- 1985-2014 **net carbon sink, carbon gains and losses**
 - 2015-2040 projected net carbon sink, carbon gains and losses
 - their putative **drivers** - CO₂, temperature, drought
- from structurally **intact tropical forests** in South America, Africa, and Southeast Asia



- CMIP6 pantropical net carbon sink 2000-2010 is half the observed sink (0.45 Pg C yr⁻¹ vs 0.99 Pg C yr⁻¹)**
because CMIP models reproduce magnitude of C gains but overestimate C losses
- CMIP5/6 models show increases in sink strength over 1985-2014, observations show a saturation & decline**
because CMIP models reproduce observed increase in C gains but not the greater increase in C losses
- Future CMIP6 carbon sink increases, observationally projected sink declines**
(2015-2040: 0.01 Pg C decade⁻¹ vs -0.02 Pg C year⁻¹, both SSP2-45)
because temperature and drought-induced C losses are offset by CO₂-driven C gains in CMIP models

[1] Brien et al. (2015). Long-term decline of the Amazon carbon sink. Nature, 519(7543), 44–348.
[2] Hubau et al. (2020). Asynchronous carbon sink saturation in African and Amazonian tropical Forests. Nature, 579(7797), 80–87.
[3] Taylor, K. E., Stouffer, R. J., & Meehl, G. A. (2012). An Overview of CMIP5 and the Experiment Design. BAMS, 93(4), 485–498.
[4] Eyring et al. (2016). Overview of the Coupled Model Intercomparison Project Phase 6 (CMIP6) experimental design and organization. GMD, 9(5), 1937–1958.

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