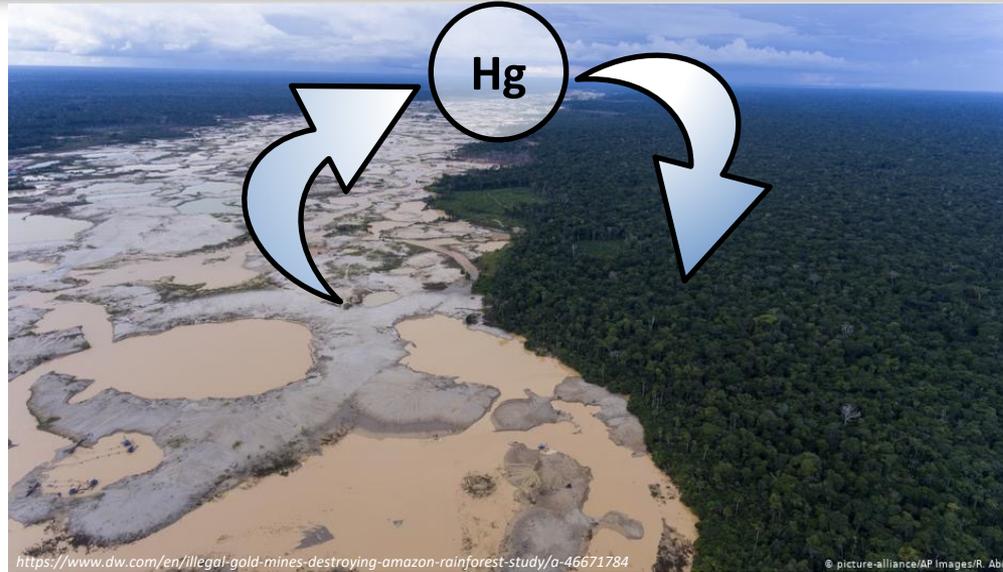


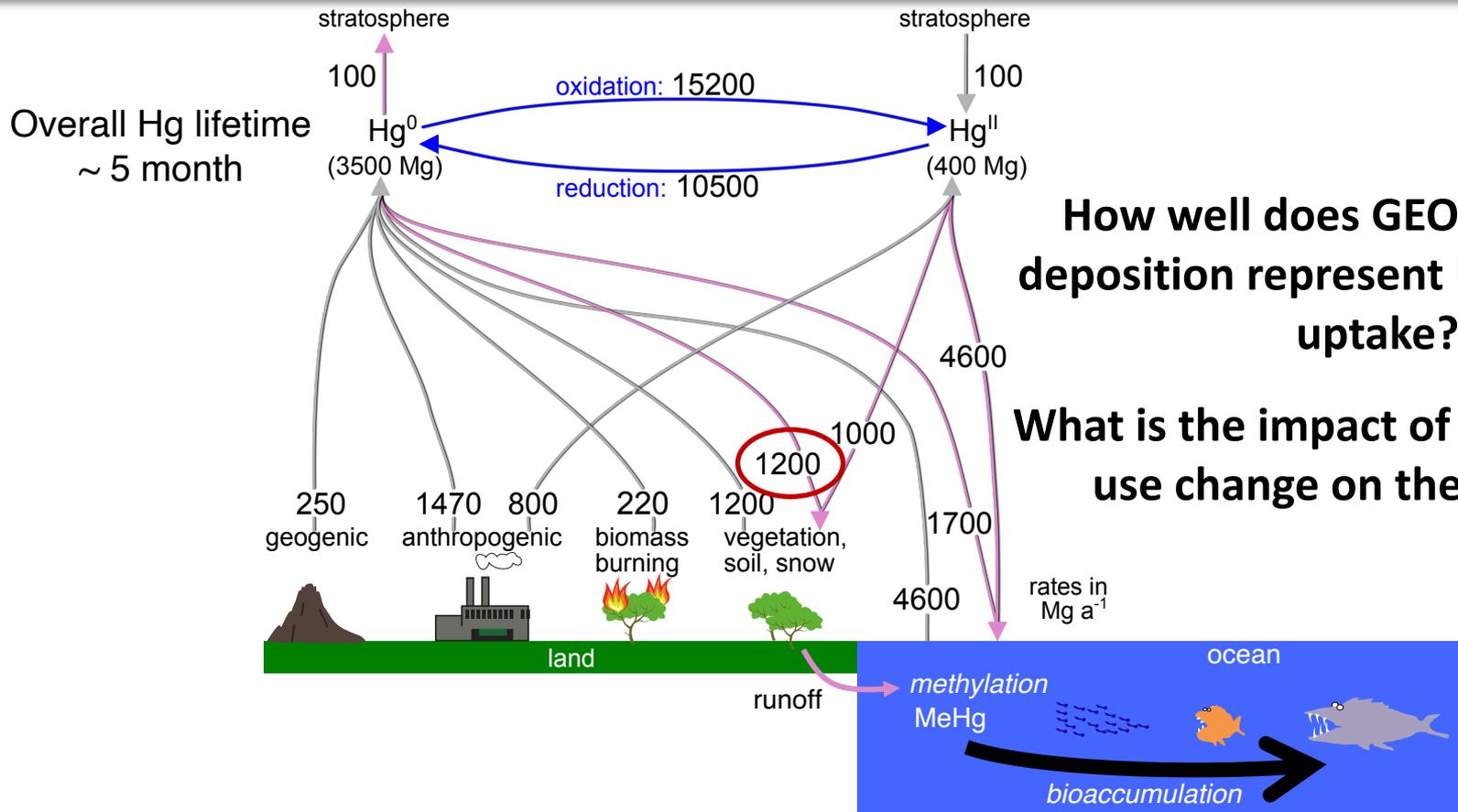
Modelling the Impact of Amazon Land Use Changes on the Vegetation Sink of Atmospheric Mercury



Ari Feinberg, Martin Jiskra, Thandolwethu Dlamini, Jagannath Biswakarma, Pasquale Borrelli, Viral Shah, and Noelle E. Selin



Mercury (Hg), a neurotoxic contaminant, spreads globally in atmosphere

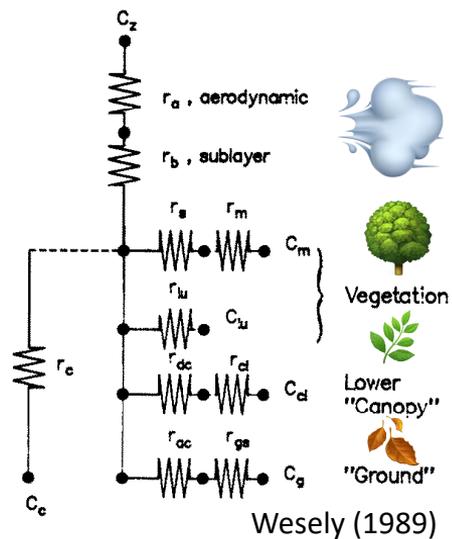


How well does GEOS-Chem dry deposition represent Hg vegetation uptake?

What is the impact of Amazon land-use change on the Hg cycle?

Comparing modelled and measured dry deposition velocities

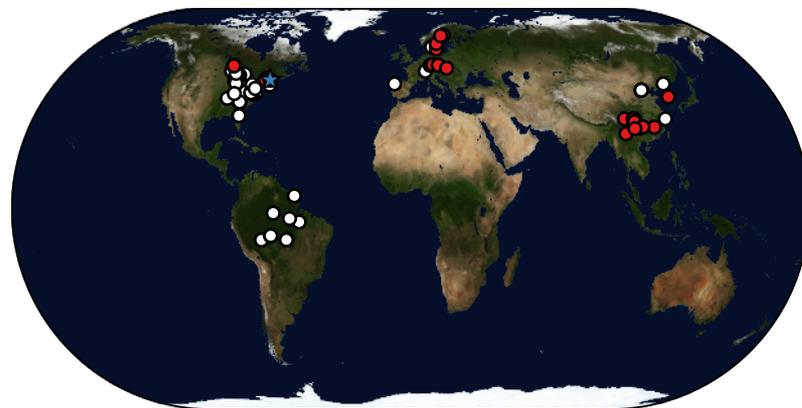
Resistance-based scheme in GEOS-Chem



Depends on T , wind, LAI, land type
Species: reactivity (f_0) and solubility

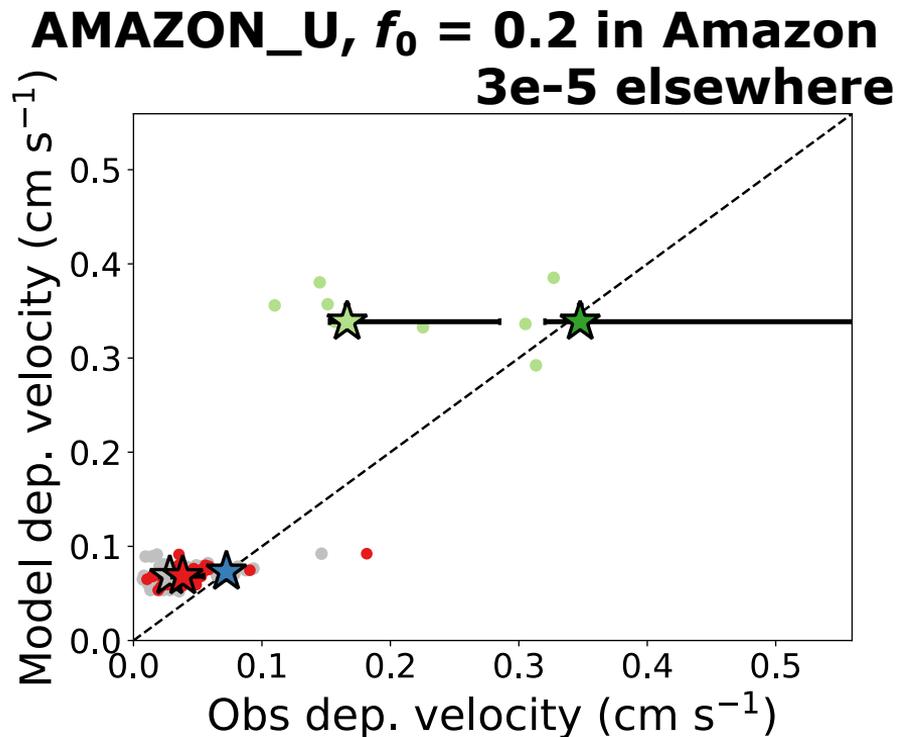
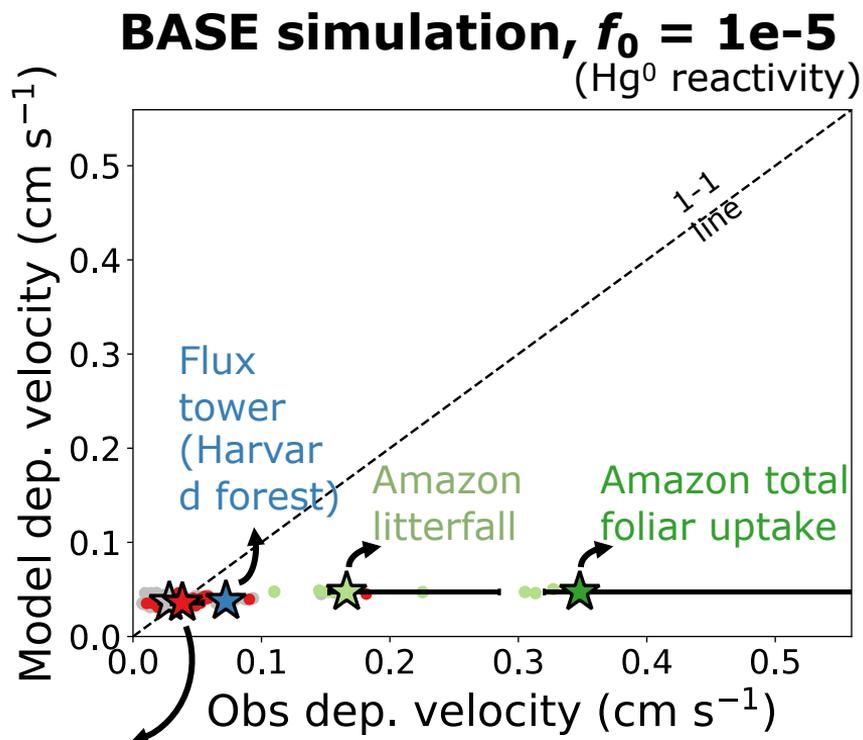
Compiled measurements (93 forest sites)

- Litterfall
- Total foliar uptake
- ★ Flux tower (Obrist et al., 2021)



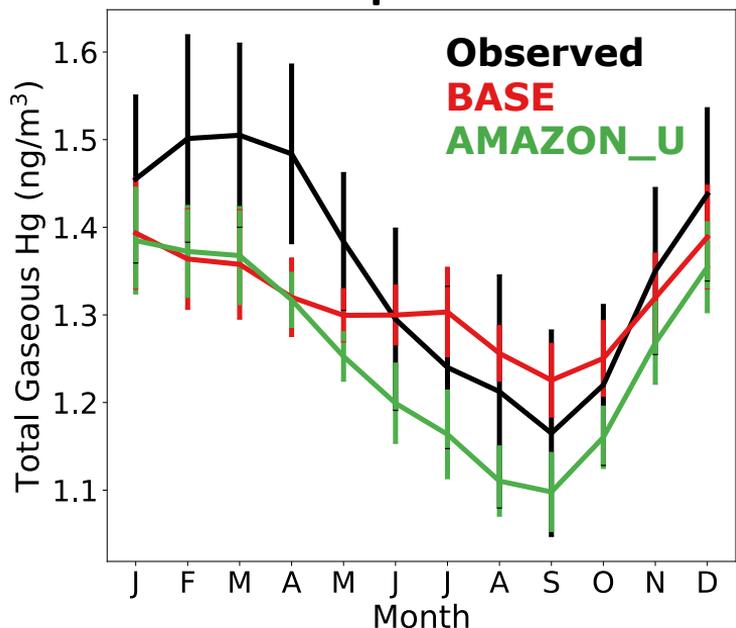
Compare model sub-grid cell with
observed land type (Silva and Heald, 2018)

GEOS-Chem underestimates Hg, especially in Amazon



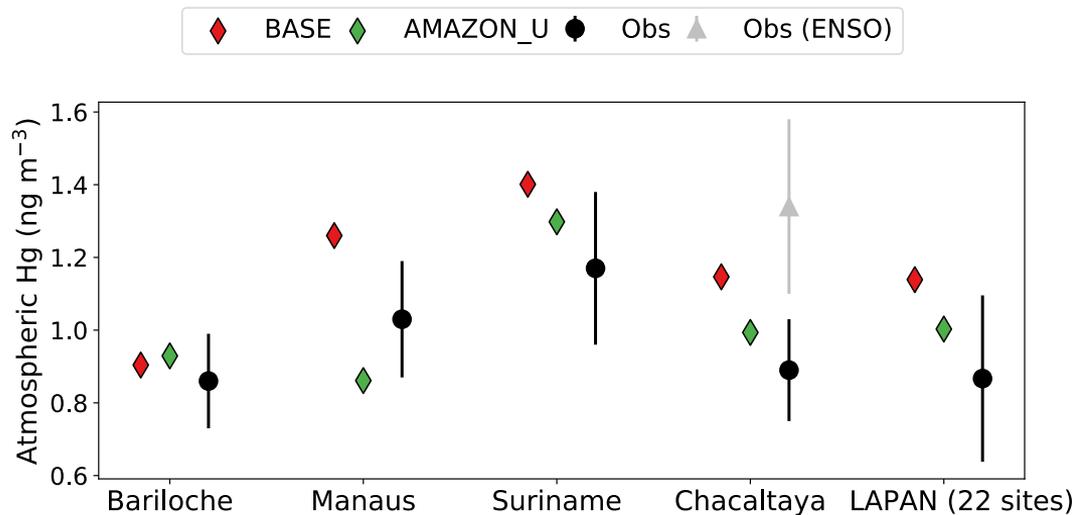
New f_0 better agrees with other atmospheric Hg observations

Northern Hemisphere midlatitudes



**Seasonal amplitude improved
when include stronger veg. uptake**

South American [Hg] observations

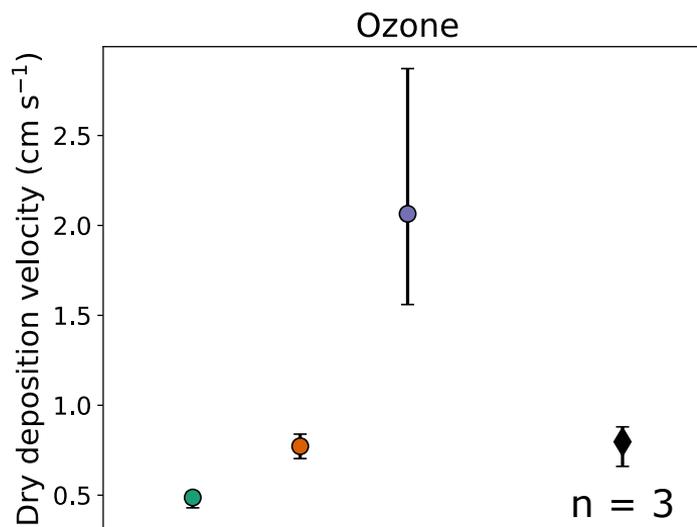
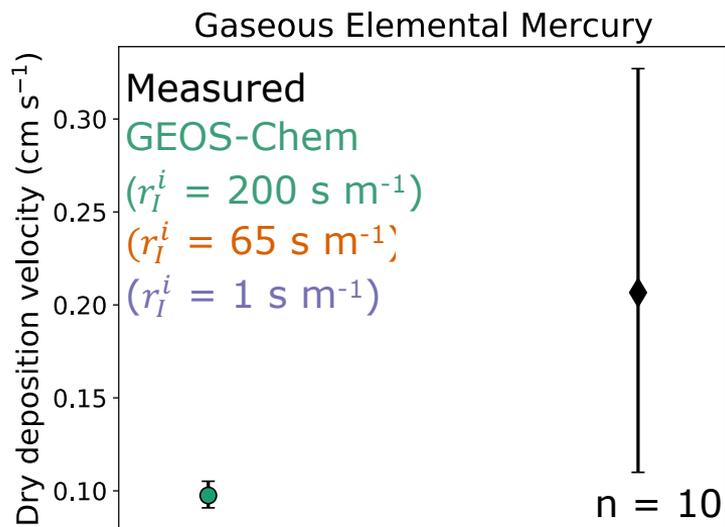


**Bias reduced from +0.21 ng m⁻³ to
+0.05 ng m⁻³**

Can we fix Amazon underestimation with land-type resistances?

Stomatal resistance Eq. $r_I^i = r_I^{i'} \times g(T, LAI^i, \theta, C_F) \frac{D_{H_2O}}{D_{Hg^0}} + \frac{1}{\frac{H^*}{3000} + 100f_0}$

Land-type specific \swarrow Compound specific \searrow



O₃ measurements compiled by Silva and Heald (2018)

Ozone deposition is also underestimated in Amazon

→ multi-compound assessments of dry deposition scheme?

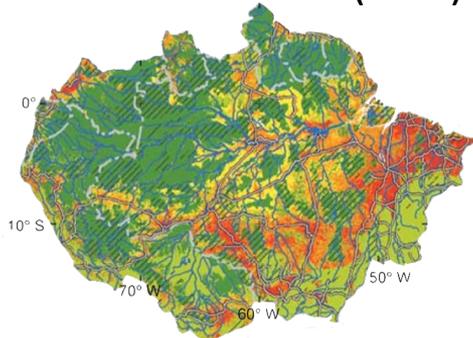
How does Amazon deforestation impact Hg cycle?

Deforestation scenarios

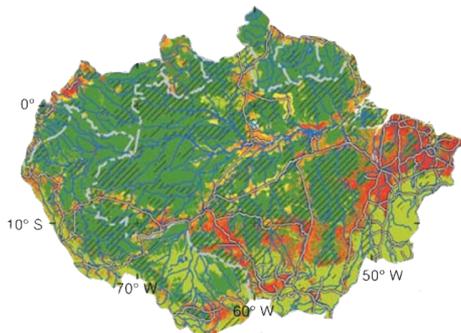


Models

Business as Usual (BAU)



Governance (GOV)



GEOS-Chem

- deposition
- biomass burning
- soil emissions

GloSEM

- soil erosion

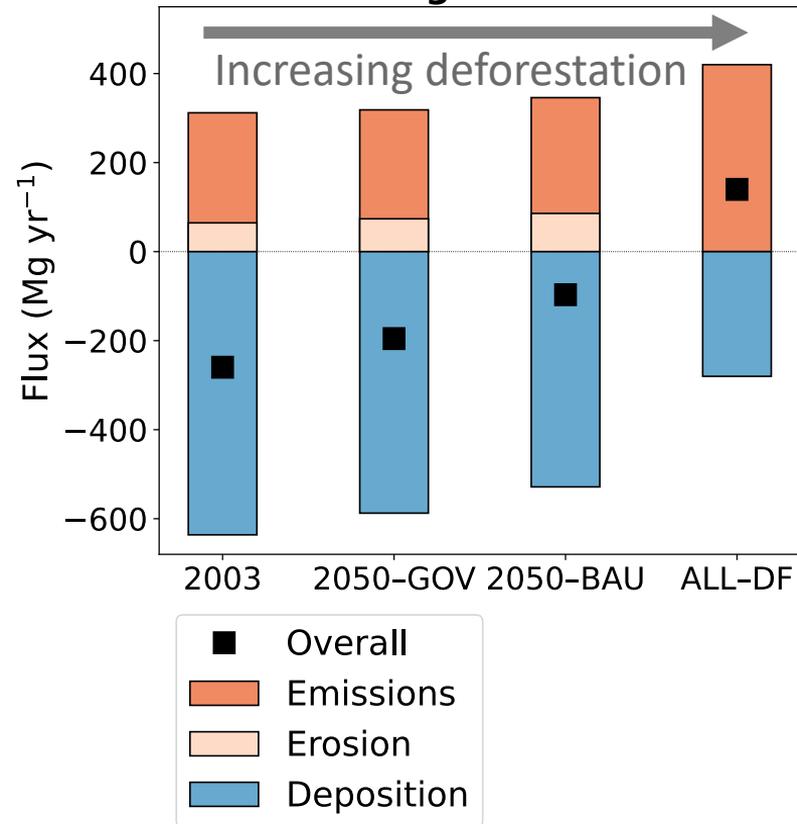


The Guardian

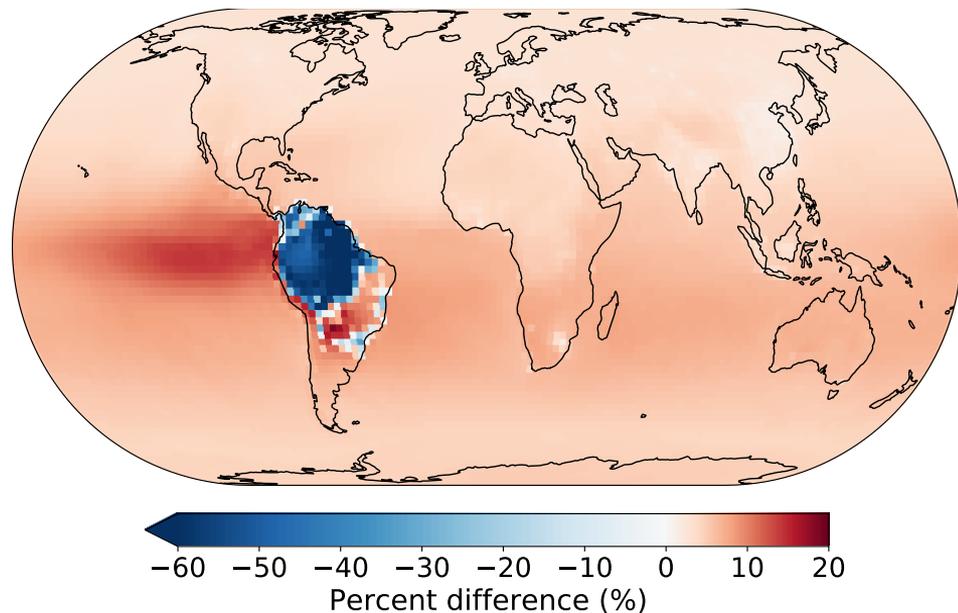
Fire in Pará State, Brazil (Carl de Souza/AFP)

Policies determine whether Amazon remains a net Hg sink

Amazon Hg mass balance



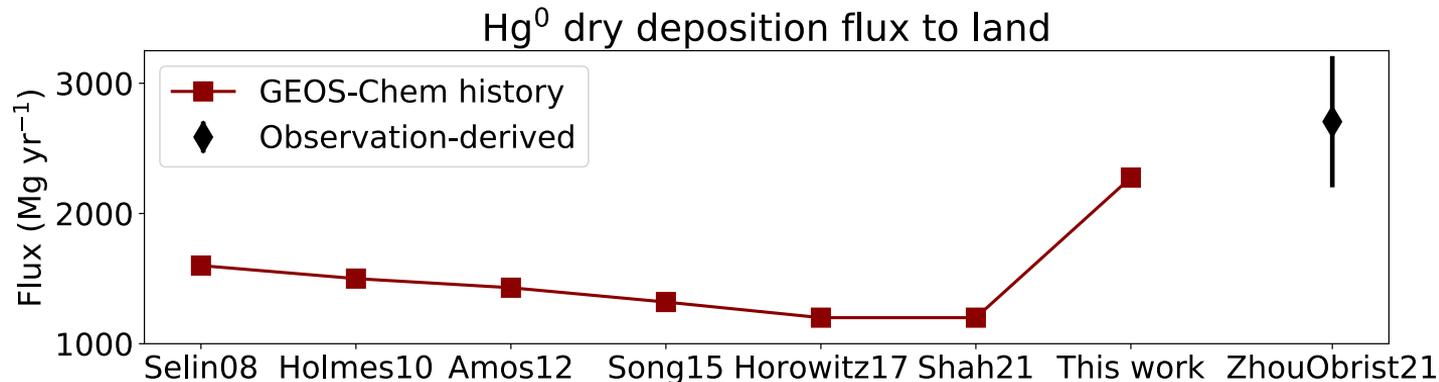
Atmospheric deposition increases over ocean



Complete deforestation case:

+337 Mg yr⁻¹ additional Hg deposited to ocean
(340 Mg yr⁻¹ gold mining emissions in S. America)

Conclusions and Outlook



Takeaway #1

Modelled Hg⁰ dry dep now agrees better with observed importance

Takeaway #2

Deforestation leads to substantial Hg mobilization