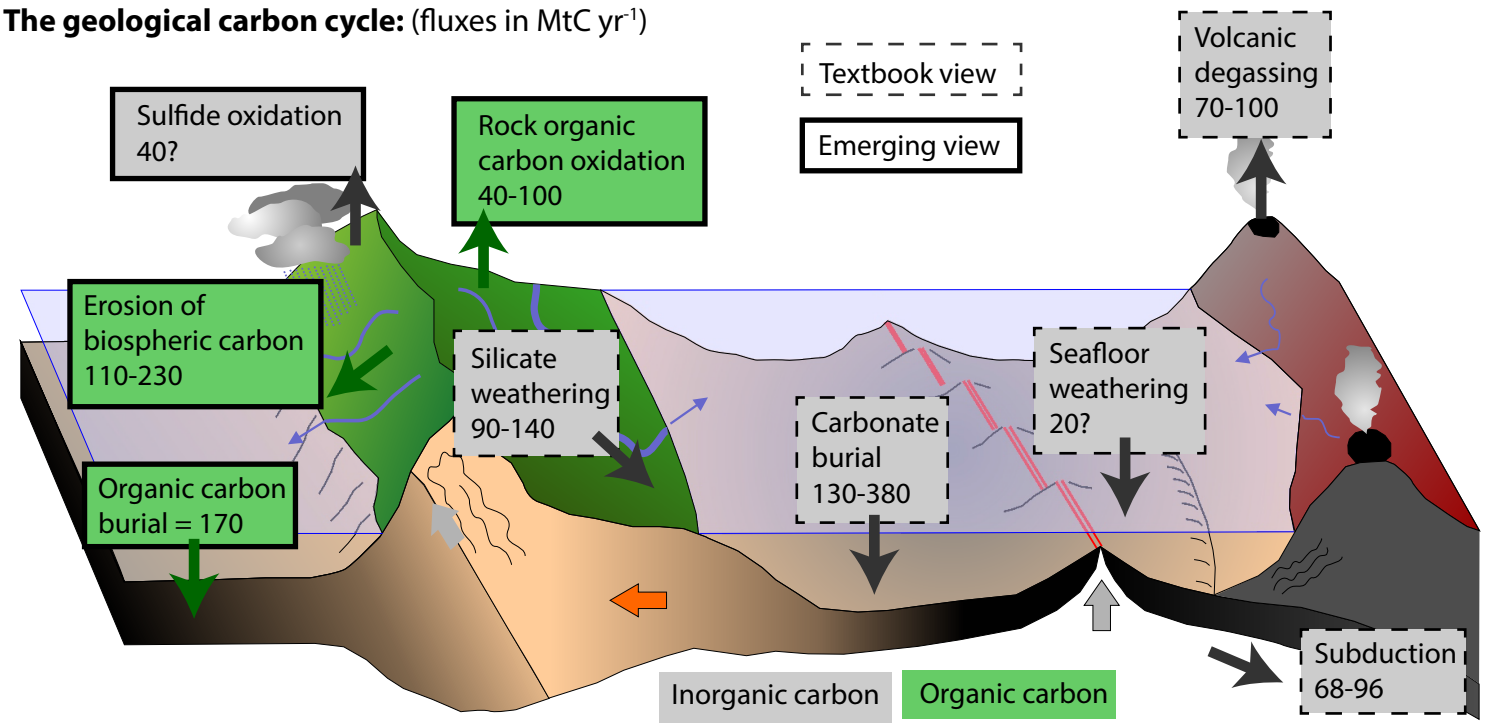
EGU2020-5624

A Shifting View of Erosion and the Carbon Cycle

Robert G. Hilton - Durham University, UK
A. Joshua West - University of Southern California, USA

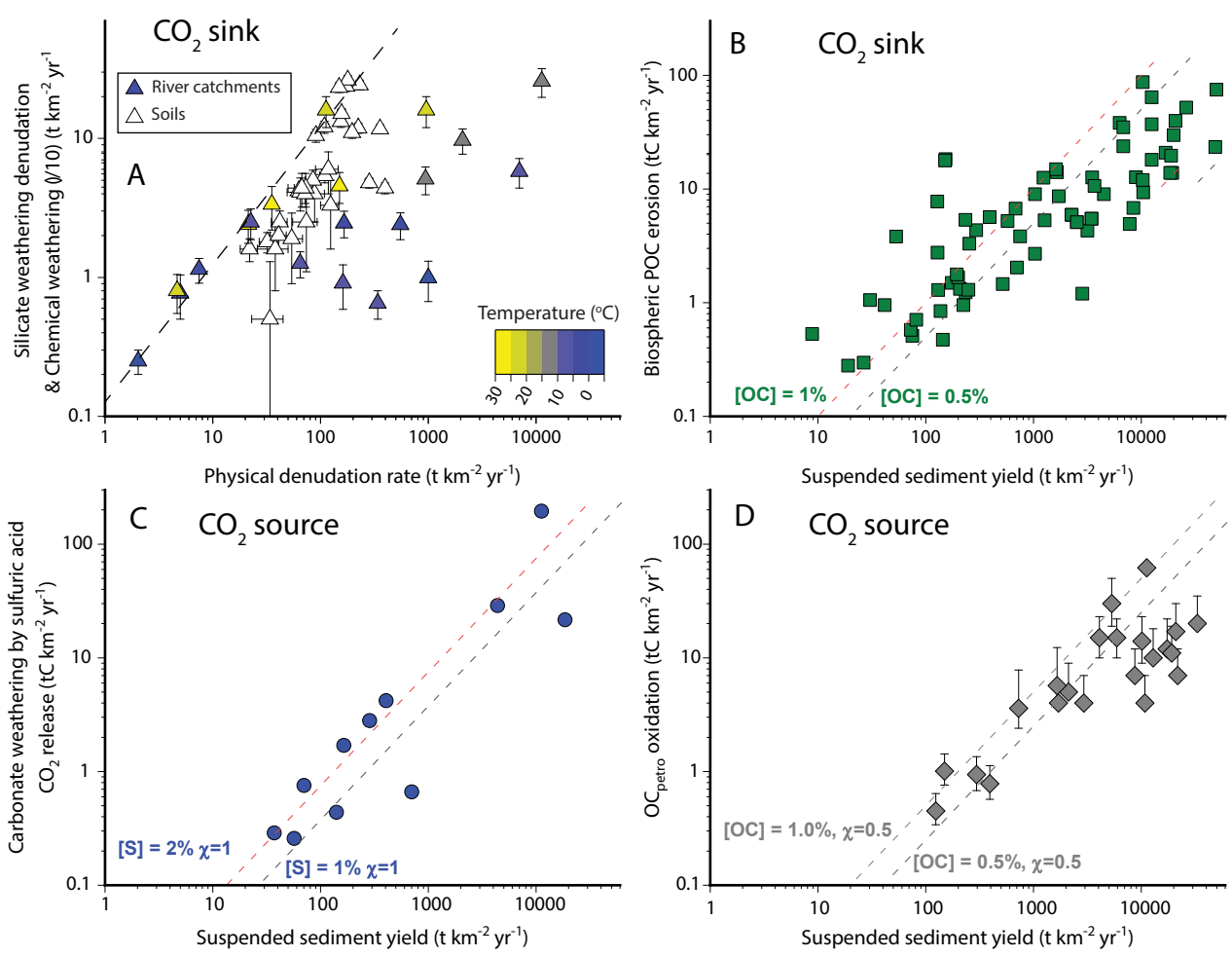
The geological carbon cycle: (fluxes in MtC yr^{-1})



Globally, the traditional view has pitched volcanic CO_2 release, versus silicate weathering CO_2 drawdown.

We now recognise the importance of CO_2 drawdown by organic carbon burial, in addition to CO_2 sources from oxidative weathering of sulfide minerals and rock organic carbon.

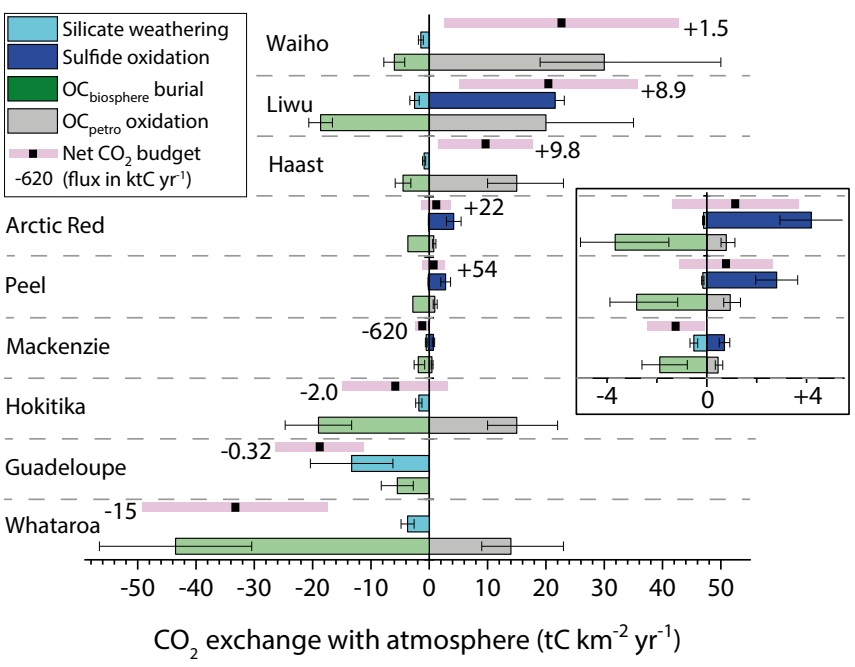
Erosion and carbon transfers by weathering and erosion:



Generally, increased erosion impacts all the main geochemical carbon transfers, both: CO_2 sinks from the atmosphere by: a) silicate weathering; and b) erosion of biospheric organic carbon; and the CO_2 sources from c) sulfide oxidation; and d) rock organic carbon (OC_{petro}) oxidation.

The scatter reflects important role of varying climate, lithology, geomorphic setting.

Net "rock to atmosphere" CO_2 transfers by erosion and weathering:



For a few catchments, the net **"rock to atmosphere"** carbon transfer can now be quantified.

There is a important role of erosion rate (increases fluxes), climate (moderates weathering fluxes) and lithology in setting the magnitude of CO_2 source or sink.

Erosion and weathering of mountains made of shales = CO_2 neutral? or even CO_2 source?

References and Acknowledgements:
RGH was funded by a European Research Council Starting Grant (project #678779, ROC-CO2) and a Natural Environment Research Council, UK, Standard Grant NE/P013538/1. AJW was funded by US National Science Foundation grants EAR-1455352 and EAR-1640894. Thanks to many stimulating discussions with colleagues, including at AGU, EGU and Goldschmidt conferences, and by numerous contributions from students, postdocs, and collaborators. For extended discussion please see: Hilton and West, (forthcoming) *Nature Reviews Earth & Environment*

Calmels, D., et al., (2007). *Geology.* https://doi.org/10.1130/G24132A.1; Calmels, D., et al., (2011). *Earth and Planetary Science Letters.* https://doi.org/10.1016/j.epsl.2010.12.032; Dixon, J. L., et al., (2012). *Earth and Planetary Science Letters*. https://doi.org/10.1016/j.epsl.2012.01.010; Galy, V., et al., (2015). *Nature,* 521(7551), 204–207. https://doi.org/10.1038/nature14400; Hemingway, J. D., et al., (2018). *Science.* https://doi.org/10.1126/science.aao6463; Hilton, R. G., et al., (2008). *Global Biogeochemical Cycles*. https://doi.org/10.1029/2006GB002905; Hilton, R. G., et al., (2014). *Earth and Planetary Science Letters*, 403, 27–36. https://doi.org/10.1016/j.epsl.2014.06.021; Hilton, R. G., et al., (2015). *Nature*. https://doi.org/10.1038/nature14653; Horan, K., et al., (2019). *American Journal of Science*. https://doi.org/10.2475/06.2019.02; Horan, K., et al., (2017). *Science Advances.* https://doi.org/10.1126/sciadv.1701107; Jacobson, A. D., & Blum, J. D. (2003). *Geology*. https://doi.org/10.1130/G19662.1; Lloret, E., et al., (2011). *Chemical Geology*. https://doi.org/10.1016/j.chemgeo.2010.10.016; Lloret, E., et al., (2013). *Chemical Geology*, 351, 229–244. https://doi.org/10.1016/j.chemgeo.2013.05.023; Maher, K., & Chamberlain, C. P. (2014). *Science.* https://doi.org/10.1126/science.1250770; Millot, R., et al., (2003). *Geochimica et Cosmochimica Acta*. https://doi.org/10.1016/S0016-7037(02)01207-3; Norton, K. P., & von Blanckenburg, F. (2010). *Geochimica et Cosmochimica Acta.* https://doi.org/10.1016/j.gca.2010.06.019; Torres, M. A., West, A. J., & Li, G. (2014). *Nature*. https://doi.org/10.1038/nature13030; West, A. J., et al., (2005). *Earth and Planetary Science Letters.* https://doi.org/10.1016/j.epsl.2005.03.020