Eocene carbon cycling and climate interactions

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The Eocene (56-33.9 Ma) is the most recent greenhouse to icehouse transition in Earth's history. Recently, it was demonstrated that atmospheric carbon dioxide (CO_2) decline was likely responsible for driving the Eocene long-term cooling [1]. Here we utilise recent analytical and methodological developments to generate a record of surface seawater pH (pH_{sw}) and CO_2 using the boron isotope composition of planktonic foraminifera from sites ODP 865, 1258, and IODP 342, generating the first continuous multi-site compilation of Eocene atmospheric CO_2 at an unprecedented temporal resolution (on average 1 sample per 200 kyr). These data agree with the previous sparse estimates of [1], but allow for a more thorough comparison between CO_2, climate indices (e.g. benthic foraminifera carbon and oxygen records [e.g. 2,3]), and Li [4] and S [5] isotope compilations. These comparisons provide new insights into the links between weathering, volcanism, circulation, and organic carbon burial and their respective roles in driving Eocene CO_2 variations and climate. Furthermore, these data support the tight coupling between CO_2 and global temperature, while also revealing the evolving relationship between Equilibrium Climate sensitivity and background climate state.

[1] Anagnostou et al. 2016, Nature, [2] Zachos et al. 2008, Nature, [3] Westerhold et al. 2018, Paleocean. Paleoclim. [4] Misra & Froelich 2012, Science, [5] Rennie et al. 2018, Nat. Geo.