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# Moving beyond Q10 representation of soil respiration; new modelling approaches.

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The flux of carbon to the atmosphere via heterotrophic respiration is currently parameterized using first order decay rates that respond to temperature and is functionally indistinguishable in all soils at all times in every coupled-GCM simulation used for the most recent and forthcoming IPCC reports.

This flux of respired carbon is an order of magnitude larger than all annual anthropogenic $CO_2$ sources. Given such a size, it follows that even small misrepresentations in simulations will cascade into large errors. We will first explore the inadequacies prevalent in the current Q10 methodology. Chiefly, measuring the direct response of respiration to temperature in the field is not possible with existing technology: thermally heterogeneous soil strata and an immeasurable provenance of the $CO_2$ recorded within a chamber mean that temperature ascription is fairly arbitrary; secondly, but no less important, the parameterization of respiration with decay rate functions is strictly statistical; there is no scientific reason to assume it will be accurate outside the conditions under which it is derived, which, incidentally, is exactly the purpose of climate modelling.

With this in mind, alternative modelling pathways at the state-of-the-art are highlighted and our new model is presented. We focus particularly on second-order processes; size and composition of decomposer microbe pools. Recent empirical evidence suggests a sensitivity of microbial abundance and composition to predicted environmental changes, such as N deposition, precipitation regime and warming. If these changes leave a signature on biogeochemical cycling, then the incorporation of this second order process is justified.