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Greenhouse gas metrics for net zero targets in science and policy

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The treatment of non-CO₂ greenhouse gases is central for scientific assessments of effective climate change mitigation and climate policy. Radiative forcing of a unit of emitted short-lived gases decays quickly; on the order of a decade for methane, as opposed to centuries for CO₂. Metric selection for comparing the climate effect of these emissions with CO₂ thereby comes with choices regarding short- vs. long-term priorities to achieve mitigation. The global nature of the well-mixed atmosphere also has implications for the transferability of concepts such as global warming potentials from the global to the national scale.

Here we present the implications of metric choice on global emissions balance and net zero, with a particular emphasis on the consistency with the wider context of the Paris Agreement, both on the global as well as the national level. Stylized scenarios show that interpreting the Paris Agreement emissions goals with metrics different from the IPCC AR5 can lead to inconsistencies with the Agreement's temperature goal. Furthermore, we illustrate that introducing metrics that depend on historical emissions in a national context raises profound questions of equity and fairness, thereby questioning the applicability of non-constant global warming potentials at any but the global level. We provide suggestions to adequately approach these issues in the context of the Paris Agreement and national policy making.