# Spatial and temporal patterns of ocean acidification during the end–Permian mass extinction – An Earth system model evaluation

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The trigger for the greatest biodiversity loss event in the Earth history, known as the end-Permian extinction event, is the subject of continuing debate. Recent analyses of calcium isotopes of marine sediments and the pattern of extinction selectivity suggest ocean acidification caused by a large quantity of volcanic $CO_2$ is a possible kill mechanism for the event. However, the potential of ocean acidification is poorly known due to the lack of knowledge of the amount and rate of carbon injection from the presumed source. Here we present a sensitivity analysis of the spatial distributions and extent of ocean acidification using an earth system model of intermediate complexity (EMIC) inverted from the carbon isotope record of the event and assuming a range of potential sources with distinct carbon isotope compositions. We find that the Siberian volcanism seems to have released $CO_2$ in two major, multimillennial pulses at a rate that is dependent upon the $\delta^{13}C$ of the source and the initial saturation state. Ocean acidification is most severe for a plume-related $CO_2$ release, and polar regions develop undersaturated conditions at the lowest level of perturbation. We find that the initial buffering capacity of the ocean is quickly overwhelmed for many of the plausible scenarios for C release. However, for smaller releases (i.e. <30,000 Gt C over many thousands of years), the buffering capacity of the ocean is capable of mitigating against severe ocean acidification in response to $CO_2$ release.