Paleo-CO$_2$ reconstructions are integral to understanding the evolution of Earth system processes and their interactions given that atmospheric CO$_2$ concentrations are intrinsically linked to planetary function. Furthermore, past periods of major climate change provide unique insights into the response of land-atmosphere-ocean interactions to warming-induced climate change, particularly for times of pCO$_2$ comparable to those projected for our future. How well the past can inform the future, however, depends on how well paleo-CO$_2$ estimates are constrained. CO$_2$ estimates exist for much of the past half-billion years (the Phanerozoic), but proxies differ in their assumptions and degree of understanding, and there is substantial uncertainty and inconsistency in existing paleo-CO$_2$ estimates. Here, we introduce a community initiative, CO$_2$PIP, focused on advancing the science of paleo-CO$_2$ reconstruction through critically evaluating and modernizing existing records and building a statistically robust multi-proxy atmospheric CO$_2$ record for the Phanerozoic. CO$_2$PIP builds on the previous work of the Cenozoic CO$_2$ Proxy Integration Project (CenCO$_2$PIP) Consortium (Hönisch et al., 2023) and takes a multi-step approach to building the next generation Phanerozoic CO$_2$ record. We are building a standardized paleo-CO$_2$ proxy data repository that includes all metadata and updated chronology and meets FAIR (findable, accessible, interoperable, reusable) data standards. Existing terrestrial-based CO$_2$ estimates are being modernized through additional analyses and measurements, and a set of forward proxy system models are being developed to provide a quantified representation of proxy sensitivities to environmental and ecophysiological conditions and processes that govern the CO$_2$ signals. Ultimately, statistical inversion analysis of the simulated and modernized proxy datasets will be used to produce quantitative, data-driven CO$_2$ reconstructions for individual records and to generate a robust, quantitative reconstruction of atmospheric CO$_2$ concentrations through the Phanerozoic. Digital infrastructure for presenting and archiving the CO$_2$ compilation and project
outputs (https://paleo-co2.org/) ensures full accessibility to the scientific community and the public.