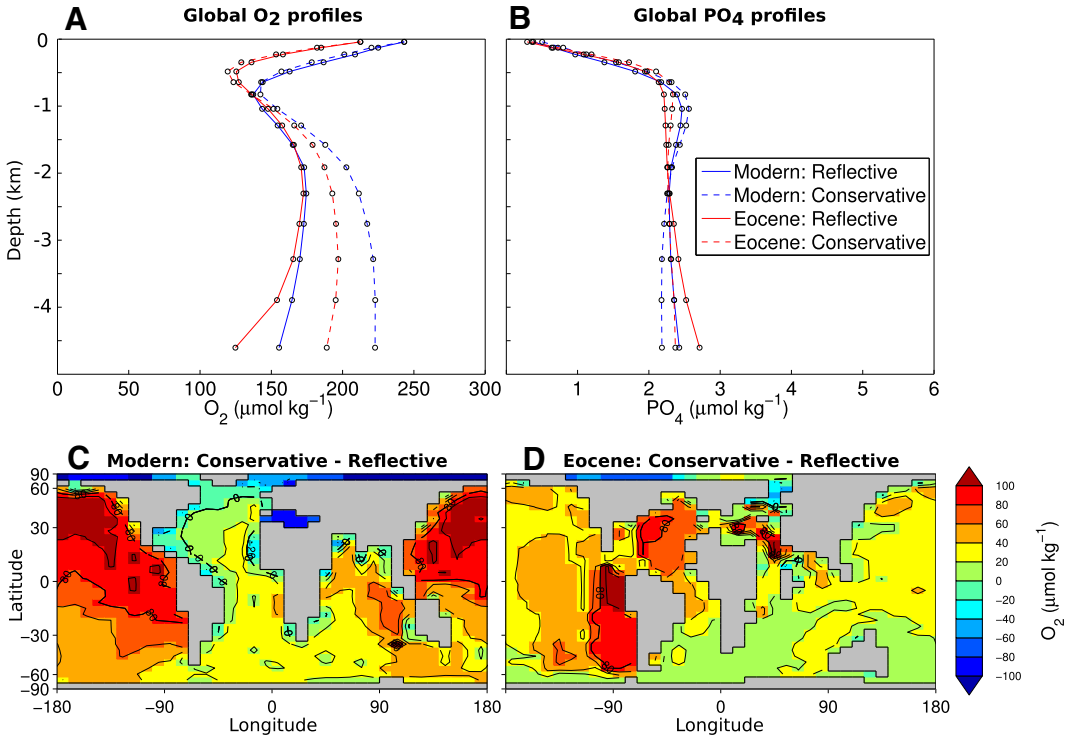

Fig. 16. Model comparison of marine biogeochemistry with GENIE configurations using the Conservative and Reflective sediment approach for the modern and Eocene world. Modelled global oxygen (A) and phosphate (B) profiles. (C + D): Anomaly plots (Conservative minus Reflective) of bottom water oxygen concentration for modern (C) and Eocene (D) world.

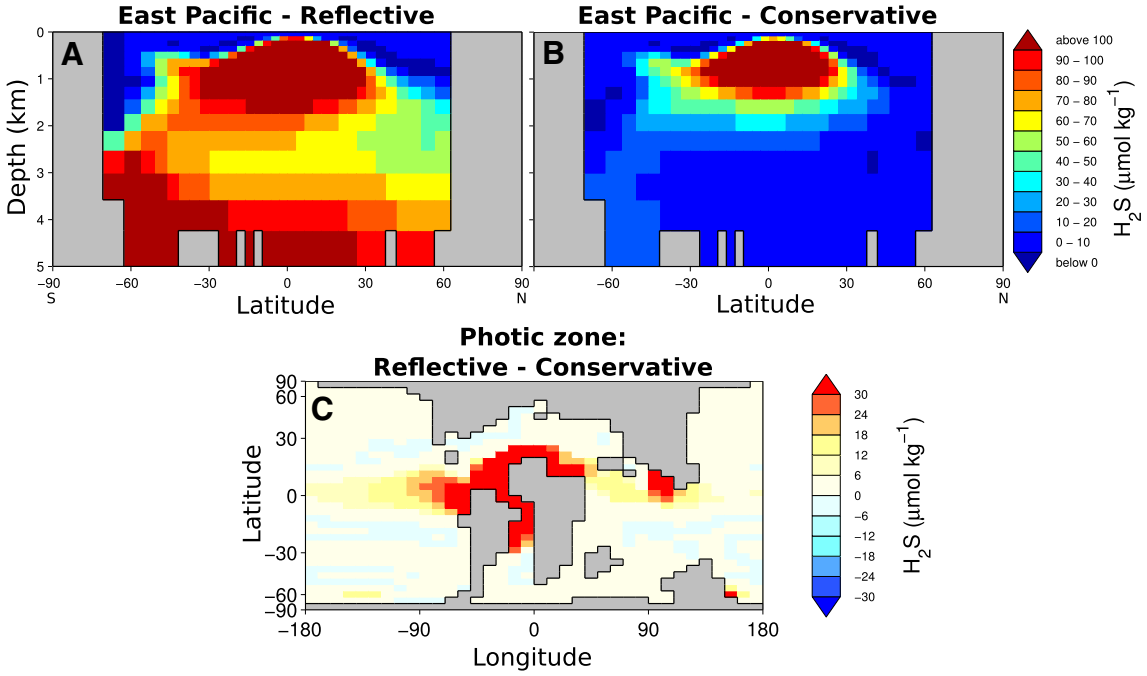

Fig. 17. Model comparison of H_2S concentration during OAE2 with GENIE configurations using the conservative and reflective sediment approach. (A + B): Vertical profile of H_2S in the East Pacific Ocean (−90° longitude). (C): Anomaly plots (Reflective minus Conservative) of photic zone euxina (i.e. H_2S concentration for 80–200 m depth).

where a constant part of POC and PIC is preserved (Goosse et al., 2010). The conservative nature of this approach does not violate mass conservation and accounts for the retention capacity of sediments. Nevertheless, it neglects (or oversimplifies) the degradation of POC and the dissolution of PIC in marine sediments and thus overestimates (or crudely approximates) the burial fluxes. In addition, such a simplified approach does not represent the time-delayed recycling of nutrients and dissolved carbon and the impact of these fluxes on the biogeochemical functioning of the ocean-atmosphere system. Another important caveat of this approach is that it cannot account for a change in speciation. Generally, the composition of the benthic return fluxes is fundamentally different from the composition of the deposition flux (e.g. Soetaert et al., 2000). In marine sediments, the coupled redox-reactions, mineral precipitation/dissolution or equilibrium reactions control the speciation. The exact composition of the total dissolved carbon flux, for instance, strongly depends on the vertical distribution of