Assessing global biogeochemical models used in ocean acidification research

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The biogeochemical component of coupled carbon-climate models is difficult to evaluate because of the mapping of errors in the physical transport on the distribution of tracers. Employing an efficient transport matrix method for the fast spin-up of passive tracer distributions, we present a comparison of several marine biogeochemical models of varying degrees of complexity coupled to transport fields taken from different ocean circulation models. A number of metrics, all based on the observed distributions of nutrients, oxygen, dissolved inorganic carbon and alkalinity, are used to evaluate the biogeochemical models. Our findings illustrate that increases in biogeochemical model complexity do not necessarily lead to improved model performance. We discuss the implications of typical model uncertainties for simulated carbon-climate feedbacks in global-warming and OA scenario simulations. We also identify systematic deficiencies in the models investigated, particularly in modeled oxygen and alkalinity distributions, which may help to guide future model improvement.