Preface

The global biogeochemical cycling of carbon is fundamental for life on Earth and thus of critical importance to science. After vapour, carbon dioxide is the most important greenhouse gas in Earth's atmosphere. Ocean plays a key role in its cycling as the largest carbon dioxide reservoir. More than 98 % of carbon dioxide from the coupled atmosphere-ocean system is dissolved in seawater, where unlike other gases such as nitrogen or oxygen, it further reacts. When carbon dioxide invades to or evades from the ocean it changes the delicate equilibriums that exist between the dissolved species that form the marine carbonate cycle. Although only few components comprise the carbonate system (principally aqueous carbon dioxide, bicarbonate, carbonate ion, free hydrogen ions and hydroxide), its behaviour may not always be foreseeable and even lead to re-organisation of life on our planet as witnessed from the geological record. Controlled experiments, where seawater parameters can be precisely constrained and manipulated permit us to understand the turning points of these balances and its impact on marine calcifiers. We can also use these experiments to calibrate geochemical signals preserved in fossil shells that will offer us a window to the past. Providing that we can constrain two of the six carbonate quantities (note that here I refer to the carbonate variables that can be measured, these are aqueous carbon dioxide, bicarbonate, carbonate ion, dissolved inorganic carbon and total alkalinity), we can unveil the rest and with it track and quantify the response of the global climate system (climate sensitivity) to a specific carbon dioxide forcing. Understanding past variations has become a particularly pressing issue due to the increasing anthropogenic influences on the carbon cycle. In order to make future predictions, we must strive to understand the past changes and how biota will respond to them.