Projection of long-term changes in pCO2 within the Coral Sea

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The present study investigates the possible long-term changes in pCO2 and pH within the Coral Sea using the coupled regional model ROMS-PISCES. As a result of increased atmospheric pCO2, oceanic geochemistry has already significantly changed since 1880, with pH levels in the surface ocean having decreased by 0.1 units as a result of higher pCO2. The effects of higher atmospheric pCO2 will likely be further aggravated by shallower mixed layer depths as a result of reduced upper ocean mixing due to warmer sea surface temperatures. Various IPCC scenarios for predicted atmospheric pCO2 were used to determine likely changes in the geochemistry of the Coral Sea during the 21st century. Increases of atmospheric pCO2 to 650-1000 ppm results in a decrease of sea surface pH by 0.15-0.38 units within the Coral Sea in the model. The difference between atmospheric and upper ocean pCO2, in turn, would generally decrease by 0-50 ppm, resulting in the Coral Sea changing from a predominant sink of pCO2 to a seasonal source (mainly during summer and autumn months). Concurrent with increased ocean acidification and pCO2, the saturation state of aragonite and calcite will decline significantly, which would have wide-reaching effects on the coral calcification rates and the general health, and structural strength, of calcifying organisms. To this date, there has been surprisingly little effort to monitor the changes in biogeochemistry within the Coral Sea and, specifically, within the GBR as a result of increased atmospheric pCO2. Further large-scale studies are required throughout the entire Coral Sea in order to accurately determine the long-term trends in oceanic pCO2, CO32-, saturation state and pH.