Geophysical Research Abstracts
Vol. 13, EGU2011-7805, 2011
EGU General Assembly 2011

Temporal variability versus long-term trends of ocean acidification in the California Current System

Claudine Hauri and Nicolas Gruber
ETH Zurich, Environmental Sciences, Switzerland (claudine.hauri@env.ethz.ch)

The California Current System (CCS) is naturally more acidic than the global mean surface ocean and is thus more sensitive to ocean acidification, but it is also a region characterized by high temporal variability. Since the response of marine ecosystems to ocean acidification may depend on what level of variability these systems are exposed to, it is crucial to fully characterize natural variability and contrast this to past and future trends. We investigate this question by conducting time-slice and transient simulations with a CCS set up of the Regional Oceanic Modeling System (ROMS) at eddy-resolving 5km resolution. For the preindustrial time-slice integration (∼1750), the model's atmospheric CO2 concentration is kept constant at 280 ppm. For the period from 2000 until 2050, the model is forced with transient atmospheric CO2 concentration according to the IPCC SRES A2-scenario. The model tends to overestimate the mean observed aragonite saturation state (Ωarag) and pH in near-shore regions and underestimate the short-term variability recorded in a 7 year time-series from Santa Monica Bay, while reproducing the seasonal mean variations well. Our simulations reveal that the Ωarag of CCS waters has decreased by about 0.4 and pH by about 0.1 since ∼1750. These long-term changes straddle the range of natural seasonal variability (Ωarag ∼0.4 and pH ∼0.2) in the North, but have already exceeded the range of natural variability in the South (pH ∼0.05 and Ωarag ∼0.15). The transient simulations up to 2050 demonstrate how quickly ocean acidification is progressing in the CCS, particularly in the North. By 2050, the Ωarag horizon has shoaled by 180m and is located at an annually averaged depth of 40m. The drivers and magnitude of the temporal variability of Ωarag and pH differ regionally. The high temporal variability of Ωarag and pH in the North is mainly driven by changes in salinity due to freshwater input and a combination of upwelling of DIC rich subsurface water and interaction of photosynthesis and respiration. In the Central CCS the magnitude of Ωarag variability is similar, but is driven by upwelling and biology only. As the drivers of the short-term variability are regionally different it is expected that consequences of global change, such as stronger winds and stronger upwelling or changes in precipitation will enhance ocean acidification in some areas and dampen it in others. The wide range of natural variability of pH and Ωarag in the northern and central CCS might have selected for organisms with a greater physiological plasticity and thus may make them more capable of dealing with the current trend of ocean acidification. However, it also implies that organisms of the northern and central regions of the CCS face Ωarag undersaturation a lot sooner than in the South.