Geophysical Research Abstracts
Vol. 14, EGU2012-9949, 2012
EGU General Assembly 2012
© Author(s) 2012

The future coastal ocean: the impact of increased stratification on biological production and carbon cycling

Z. Lachkar and N. Gruber

Swiss Federal Institute of Technology ETH Zurich, Environmental Physics, Institute of Biogeochemistry and Pollutant Dynamics, Environmental Sciences, Zürich, Switzerland (zouhair.lachkar@env.ethz.ch)

Eastern boundary upwelling systems (EBUS) are regions of intense biogeochemical cycling and air-sea CO_2 exchange. EBUS are particularly sensitive to changes in vertical stratification induced by upper ocean warming. However, neither the biological response to such physical perturbation nor the extent to which air-sea CO_2 exchange might be altered under increased stratification are well understood. Here, we investigate the vulnerability of EBUS to such changes by conducting eddy-resolving simulations with the Regional Oceanic Modeling System (ROMS) coupled to a state-of-the art ecosystem model for the California and the Canary Current Systems. We examine how potential changes in stratification might affect the productivity in both upwelling systems and explore related changes in air-sea CO_2 fluxes and biological pump efficiency. A particular focus of our analyses is on the role of local vs large scale changes in stratification. Overall, our initial results show for both EBUS a substantial increase of the CO_2 outgassing with only a relatively modest change in productivity. We also found that identical changes in the vertical stratification lead to contrasting biological responses within and between these two EBUS characterized with only modestly different physical and environmental conditions. This is essentially due to varying initial temperature and nutrient conditions in addition to factors associated with the nearshore-offshore exchange timescales such as the shelf topography and the level of mesoscale eddy activity which differ substantially between the two EBUS. Finally, our results show that the depth of the maximum warming as well as the vertical penetration of the warm temperature anomaly play a key role in controlling the magnitude of the biological response in each EBUS.