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Biogeosciences Discussions

Interactive comment on "Air-sea exchange of CO_2 at a Northern California coastal site along the California Current upwelling system" *by* H. Ikawa et al.

Anonymous Referee #1

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The authors studied air-water exchange of CO2 in a coastal upwelling site by using eddy covariance technique in summer 2007 and fall of 2008, and a SAMI-pCO2 sensor in November 2010 and March to July in 2011. They then discussed the effects of upwelling on CO2 fluxes, and concluded that the coastal area off the Bodega Bay was a source of CO2 to the atmosphere. Overall, the paper is very well written, and the discussion seems to be reasonable. Unfortunately, I am struggling to find any major contributions of this paper to the study of carbon cycle except for the method of using eddy covariance technique to study air-water exchange of carbon dioxide itself.

Traditionally, air-water exchange of carbon dioxide is calculated based on the gradients

of pCO2 between the atmosphere and the water, and the gas transfer velocity. The problem is that even though pCO2 gradients can be determined reasonably accurately, the gas transfer velocity has to be derived roughly based on wind speeds. The eddy-covariance technique, on the other hand, is more of a direct CO2 flux measurement. It calculates vertical turbulent fluxes based on parameters within the atmospheric boundary layers. However, after reading the manuscript, I have a feeling that this technique will bring about large uncertainties. As an oceanographer who knows little about eddy covariance technique, I hope the manuscript will also be reviewed by at least one atmospheric scientist, to make sure the authors get an unbiased review.

Other comments:

1) SAMI-pCO2 sensors have some known issues and suffer from biological fouling. Please provide more details of the calibration, and its uncertainties.

2) Derivation of DIC based on pCO2 that was calculated from SST, salinity (ignoring the biolgical processes), and pH that was measured in another area (Central California coast) will bring about tremendous uncertainties. Ideally, the two parameters that are used to calculate DIC need to be measured accurately, and from the same body of water.

3) West coast of the United States features strong CO2 sinks. The conclusion that the upwelling site is a CO2 source is not necessarily wrong, but extrapolation of data from one longitude latitude point to a large area needs to be done very carefully.

4) The conclusion that the ocean is leaning more towards a source of carbon dioxide during early upwelling period than during upwelling relaxation period is nothing new. The early upwelling period is mainly a physical warming process, where the cold high CO2 deep water is warmed up in the surface, raising pCO2. The relaxation period is mainly a biological uptake process, where the high nutrient upwelled water, combined with light in the stratified surface layer, generates strong biolgical activities, lowering down pCO2.

Interactive comment on Biogeosciences Discuss., 9, 17707, 2012.