

Interactive comment on “Submesoscale CO₂ variability across an upwelling front off Peru” by Eike E. Köhn et al.

Anonymous Referee #2

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This paper offers valuable insight into the impact of eastern boundary upwelling systems on CO₂ fluxes. The data is unique and the analysis potentially very useful to the community. I recommend publication after the authors address the comments below.

There is ambiguity and uncertainty with the wind speed and flux estimates that I believe the authors should address:

The authors state that the wind speed was recorded at 35.3 m (Figure 6) and at 35.5 m (section 2.1). Which is it?

The authors state that they followed Smith (1988) to calculate U10 (section 4.5) and also state that Garratt (1997) is used to standardize the wind speed to 10 m height (section 2.2). If the authors are using two different methods, it should be justified. The

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method used will certainly impact the estimated 10 m wind speed.

The authors use U10 to determine the wind stress, the Eckman velocity, and the air-sea CO₂ fluxes, therefore accurate estimation of the 10 m wind speed is essential to this paper. However, many studies have shown that the boundary layer profile is impacted by the swell/wind sea conditions and their relationship to the wind direction (e.g., Nilsson et al. 2002). Therefore, there is inherent uncertainty in U10 when not accounting these conditions. With a difference between measured U and U10 of over 20 m, there is certain to be error in the U10 estimate which will feed into the parameterizations previously mentioned. This should be addressed.

There is significant uncertainty in the parameterization of the drag coefficient, especially at low wind speeds, i.e. < 5 m/s (e.g., Figure 7 of Pan et al., 2005). During this experiment, wind speeds dropped below 5 m/s on several occasions. Therefore inherent uncertainty in estimates of wind stress (Eckman transport) must exist. This should be addressed.

Finally, I wonder if the authors explored flow distortion on the R/V which may also have impacted measured wind speed and therefore U10. This would feed into parameterized variables already mentioned. While the wind direction was generally constant, the R/V travel direction changed throughout the experiment, this would have impacted flow around the R/V, potentially impacting the measured wind speed. This should be addressed.

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