

Interactive comment on “Wind-induced upwelling in the Kerguelen Plateau Region” by S. T. Gille et al.

Anonymous Referee #2

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The manuscript titled “Wind-induced upwelling in the Kerguelen Plateau Region” by lead-author Dr. Sarah Gille details an analysis of estimates of surface stress, sea surface temperature and near-surface CHL made from satellite observations. The study draws the following conclusions: (1) The wind stress magnitude and surface stress curl are influenced by both air-sea interaction and orographic effects in the Kerguelen Plateau region. (2) Enhanced wind stress acts to cool the oceans surface through increased vertical mixing. (3) Enhanced wind stress and Ekman pumping can bring nutrients from the oceans interior into the sunlit surface ocean, potentially generating the observed spring-time CHL bloom.

The manuscript is well written and clearly describes how the analysis was carried out. The results appear to be robust and overall the conclusions are concise and supported

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by the results. This paper requires only minor revisions.

The following suggestions and clarifications are provided to help the reader understand the analysis procedure and to help strengthen the suggested link between Ekman pumping and enhanced CHL.

Page 8380, line 20: The authors describe that the cross correlations are computed and “controlled for the impact of surface heat fluxes.” Some description of how the surface heat fluxes were accounted for and removed from the correlations is warranted in this section. Clarification of this method would also help to support a similar statement made at line 8 on page 8381.

Page 8384. It is suggested that enhanced CHL during the spring bloom could be fueled by nutrients upwelling by Ekman pumping. In support of this, the regions of relatively high and low seasonally-averaged CHL shown in Figs. 1 a-c are related to regions of negative and positive surface stress curl in Figs. 5 b and c. There are 2 issues that come to mind with how the authors try to link CHL and Ekman pumping.

(1) The region around Kerguelen is a HNLC area, therefore, as the authors point out, phytoplankton growth is not limited by macro-nutrients. For Ekman pumping to influence CHL, upwelled isopycnals would have to be associated with enhanced iron, the limiting nutrient in this region. The authors need to explain how Ekman upwelling could bring iron to the surface by describing some of the work that has been done in the sources of iron to the region.

(2) Attributing changes in CHL to changes in Ekman pumping by pointing out that regions of enhanced and suppressed CHL are associated with negative and positive surface stress curl, respectively, is not sufficient to convince me that Ekman pumping influence CHL in this region. As the authors point out, starting at line 13 on page 8384 “numerous other processes [besides Ekman pumping] may also influence biological production on and downstream of the Kerguelen Plateau, ...” It would help their argument if they were to show that CHL was correlated with Ekman pumping. I would

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suggest that the authors remove any low-frequency (seasonal) variability from the CHL and Ekman pumping fields before computing this cross correlation. If maps of this cross correlation, similar to Fig. 2, are positive in the regions described in the text in paragraph 1 of page 8384, then their suggested relationship between Ekman pumping and CHL would be supported.

Figures 1 - 3. The panel labels (a, b, c, etc..) along with titles are overlay on the figures. This makes it very difficult to read the labels and titles, especially on Fig. 3. I suggest that all labels and title be placed above the individual panels.

Figure 3f. The grey shading mentioned in line 9 of page 8382 is not visible.

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