Anonymous Referee #2:

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 by the results. This paper requires only minor revisions.
Thanks to Referee #2 for this careful and helpful review.

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.
The discussion of partial correlations at the end of the methods section has been updated to provide a bit more description of the approach: "In essence, to compute the partial correlation of wind speed (W) and SST, controlled for air-sea flux (Q_{net}), we first remove the component of the W,SST correlation that could be explained because both W and SST are individually correlated with Q_{net}."

The paragraph identified by the reviewer has also been revised following the first-reviewer's comments, so that it now presents results first and discusses them subsequently. The relevant sentence now states, "We correlate wind speed and SST (Figure 2a), using the method of partial correlations to control for the impact of surface heat fluxes (Baba et al., 2004)." We have also added a bit of detail to the Figure 2 caption to indicate that the NCEP/CFSR surface heat fluxes are used.

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 negatvie and postive 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 enhance 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.

We have extended our review of the KEOPS-1 literature and have read some of the KEOPS-2 papers that are being submitted for this particular Biogeosciences collection. This has allowed us to expand our discussion of iron sources, both in the introduction and in the discussion. The introduction now states:

> These processes [that influence iron availability] include oceanic transport processes (which might vary the sediment content of water advected away from the island shelf) (e.g. Park et al., 2008b; van Beek et al., 2008; van der Merwe et al., 2014), and processes that influence lithogenic sources of iron from Kerguelen Island (e.g. Sanial et al., 2014), as well as local orographic influences on winds. For example, Kerguelen, which stands 1850 m tall, produces a substantial wind shadow, which in turn modifies the wind-stress curl (Chelton et al., 2004).

In Section 4, in relation to Ekman upwelling, we now comment on the presence of a sub-surface iron maximum in the region:

> KEOPS-1 observations indicate the presence of a sub-surface iron maximum at the depth of the shelf around 500 m (Blain et al., 2008)....

In Section 5, we note that the rate of Ekman upwelling, "is too slow to bring iron-enriched water to the surface either from the shallow 200-m plateau or from the sub-surface iron maximum that occurs near 500 m depth (Blain et al., 2008; van der Merwe et al., 2014) but could help bring water to the surface from the base of the spring or summer mixed layer, where the sub-surface Chl-a maximum is often found (Carranza et al., 2014).." Finally, in the last paragraph we identify the KEOPS-related papers that have considered sources of iron in the region:

> Both horizontal advection (van Beek et al., 2008; Zhou et al., 2014; Sanial et al., 2014; van der Merwe et al., 2014) and turbulent diapycnal mixing (e.g. Park et al., 2008a, 2014) are also expected to play key roles in controlling iron and macronutrient availability and biological productivity in the euphotic zone.

In addition, the original text did not always clearly distinguish between macronutrients and iron. Throughout the revised manuscript we have been more careful to use the words iron and macronutrients and to specify that iron is likely the key variable for the development of a bloom.

(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 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.
We have re-examined our figures. There is little evidence that Chl-a is directly correlated with Ekman pumping. This is not surprising, since Chl-a is governed by a complex range of factors, and

it has a sub-surface maximum in most of the Southern Ocean, as we now note in the introduction: “Sub-surface Chl-a maxima are nearly ubiquitous in the Southern Ocean, so satellite ocean color measurements may not be representative of total mixed-layer Chl-a (Charrassin et al., 2010; Guinet et al., 2013; Carranza et al., 2014).”

However, we do see clear evidence that the locations of Chl-a maxima shift with changes in wind direction. We have added a new Figure 6, which shows satellite-derived Chl-a concentrations (with seasonal variability removed), bin-averaged by wind direction. High Chl-a occurs in the negative wind-stress curl part of the wind-stress curl dipole. The text now draws attention to the links between the positive side of the wind-stress curl dipole an high Chl-a values:

> Negative wind-stress curl is predicted to induce upward vertical Ekman pumping velocities. While numerous factors influence Chl-a in addition to wind forcing, nonetheless Chl-a anomalies, sorted by prevailing wind direction (Figure 6), indicate higher Chl-a in the upwelling-favorable areas on the northern sides of the wind-stress curl dipoles shown in Figure 5. To the northeast of Kerguelen, a shallow plateau extends along 48°S in a region where the eddy coupling is weak (Figure 3f) but the Ekman pumping from the predominant winds is negative, leading to persistent upwelling (Figure 5c) and consistently high Chl-a blooms (Figure 1, Figure 6c).

Given the presence of a sub-surface Chl-a maximum near the base of the mixed layer, we now also suggest that Ekman upwelling may bring Chl-a to the surface where it is detected by ocean color sensors:

> KEOPS-1 observations indicate the presence of a sub-surface iron maximum at the depth of the shelf around 500 m (Blain et al., 2008) and recent profile data indicate the presence of sub-surface Chl-a maxima near the base of the mixed layer (Carranza et al., 2014). We suggest that the persistent wind-induced upwelling may bring sub-surface iron-rich or Chl-a-rich water towards the surface, particularly in the region of the shallower plateau to the northeast of Kerguelen.

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.
Thanks for this suggestion. The panel labels for all three figures have been moved to appear above the panels.

Figure 3f. The grey shading mentioned in line 9 of page 8382 is not visible.
This was inadequately explained in the text. The shading is the middle range of the color bar and may appear white in some print outs or screens. The text has been modified to state, “correlation coefficients less than 0.37 appear white or pale gray.”

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