Interactive comment on "Alkenone-based temperature patterns along the eastern South Pacific Coastal Ocean: the effect of upwelling and advection on the sedimentary alkenone unsaturation-index ($\frac{K'}{37}$)" by J. A. Placencia et al.

Anonymous Referee #2

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This paper presents alkenone-based sea surface temperatures (SST) reconstructions for surface sediments from the eastern South Pacific. The alkenone index Uk'37 is compared to annual mean se surface temperatures (maSST) and nutrient concentrations from three environments: the upwelling area (<50 km from the coast), a transition area (50-200 km from the coast) and an open-ocean area (>200 km from the coast). The possible impact of non-thermal effects like nutrient stress conditions on the Uk'37 index is invoked to the observed misfit with maSST in the complex upwelling boundary area. This is an interesting topic for the understanding of alkenone SST but the present

paper has some major flaws and therefore needs major revisions before publication.

It is crucial to add maps indicating the sample positions, the regional oceanographic settings (ocean currents. . .) the isotherms and nutrient & chlorophyll distribution (at least in summer and winter). In order to explain the observed deviations from a single linear UK37'-SST calibration, the authors should consider other possible factors such as seasonal SST variations and growth at depth coupled with vertical temperature gradients. The authors could also check the thickness of the seasonal thermocline (based on wind stress Atlas data). Indeed, nutrient concentration may be related to the thermocline depth and thus explain local deviations of the Uk'37-SST.

In such an upwelling zone, it is expected that SST, nutrient and chlorophyll contents are correlated with each other, which could lead to an apparent correlation between UK37' and nutrients that is not causal, but rather linked to the thermal effect on UK37'. The lack of precise correlation between maSST and UK37' could be due to spatial or temporal averaging effects, or other possible problem, due to the inherent simplification in using SSTs from the World Ocean Atlas. The authors should also make an attempt to calculate seasonal productivity weighted SST rather than mean annual SST (based on chlorophyll maps or better, a primary productivity atlas).

The discussion section (#4) is highly speculative when invoking subtle changes of upwelling conditions. The processes listed by the authors (summer productivity, deep chlorophyll maximum, ENSO oscillation, river inputs, mesoscale eddies, upwelling filaments. . .) are only considered for their impact on the nutrient availability, with an assumed impact on UK37'. However, all of these features have also direct effects on the local hydrology and hence on the growth temperature of alkenone producers. The authors should thus assess these local thermal effects before they claim the detection of non-thermal effects on observed UK37' data.

Overall, the authors should first study precisely the modern correlations between temperature, nutrients and productivity in order to demonstrate that they can separate the

direct effect of nutrient on UK37' by using a simple statistical approach.

On page 550, it is stated that the alkenone samples cover the Holocene period, which is a rather long period of non-negligible climate variability. The authors should thus provide information on the sedimentation rate for each individual core in order to demonstrate that observed deviations are not simply due to long-term warming at a particular site.

Introduction : add a paragraph about the oceanographic settings in the Peru-Chile system.

Page 548 line 13 : give references for lab experiences and field studies

Page 549, line 18 : replace 'longitude' by 'length'

Page 550, line 17 : show a plot of the overall relationship Uk'37 vs maSST Line18 : 'Moreover, the Uk'37/SST does not change seasonally...' This might only be true for the equatorial region but not for samples from > 10°S ?

Line 23 : what time interval is integrated by the maSST and nutrient NOAA Atlas datasets ? Do you use annual mean nutrients values ? Do nutrient concentrations show a seasonal variability ? In order to better constrain the growth period of coccolithophorids, you should consider à proxy for thermocline depth (wind speed Atlas data) in the three areas and at different latitudes.

Line 21, 22 : Fig. 3 shows important differences in the upwelling index between 30°–36°S and not 34-36°S.

Line 23-25 : to what correspond the black rectangles in Fig.3: samples from coastal upwelling and transition area (like described in the text) or >200 km offshore samples (like indicated in the legend of Fig. 3) ?