Reviewer 2

The paper by Steinsberger et al presents interesting results on the role of dissolved fluxes from sediment in the oxygen consumption in lakes with oxic hypolimnion. It fits perfectly one of the scopes of the journal, linking mainly chemical and physical aspects of the cycle of chemical substances, organic matter, and sedimentation rates. The paper presents new data from fives Swiss lakes with different trophic status. Results, interpretation and conclusion seem coherent, however my main comment concerns i) the lack of clarity in the presentation of the results, and their use in figures. For instance 8 cores were collected in Lake Geneva with corresponding Fred, but only one point plotted (and discussed?) on figure 2 and 3 (average value, deepest point?).

We thank the reviewer for mentioning the problem. We measured the porewater concentrations in eight different cores in Lake Geneva but no cores for TOC measurements nor dating were retrieved. Therefore we relied on the cited data to calculate one average TOC-MAR value for the deep basin of Lake Geneva (P3 Line 31 – P4 line 5). As F_{red} was rather similar at all sampling stations (below >0.1 gO_2 m^{-2} d^{-1}) and varied only between 0.02 and 0.09 gO_2 m^{-2} d^{-1} we decided to plot only one averaged F_{red} value with that average TOC-MAR value. However, we agree with the reviewer that this is unclear and therefore propose to plot all F_{red} values of Lake Geneva into Fig2 and Fig3. But we will not discuss the individual points in the text, as F_{red} was similarly low at all sampling stations.

I have the general feeling that a large set of data has been produced, but partly discussed; and ii) how the variability in the observed fluxes is taken into consideration in the final assessement. On page 5 line 14 and following, the authors correctly indicate that fluxes, at the same location, show variations due to local sediment heterogeneity and/or seasonal effect. Depending on the substances, values varies between 23% to 67%. However, only one value per lake /depth is given in table 2, without any uncertainty, either from the measurements themselves (including uncertainty in sediment accumulation rates) or from the replicates. Then how the values in table 2 are computed (simple average, time weighted)? What could have these uncertainties on the interpretation and conclusion? From a quick evaluation it seems that the main trends are still significant, but this should be discussed in the manuscript to improve the strength of the conclusion.

In table 2, we show average values of all flux measurements at a single sampling station. We agree that it makes sense to present the variability of observations, and therefore propose to add the standard deviations of the flux measurements and F_{red} for Lake Baldegg and Lake Aegeri. Only in these two lakes enough measurements were conducted to justify the calculation of a standard deviation. We also propose to modify the text accordingly. As no duplicate sediment cores were taken, it is not possible to show the variability of the individual flux measurements.

We further propose to add all F_{red} values to Fig.2 to show the encountered variability and to modify the text accordingly. The uncertainties, although considerable, do not change the interpretation or conclusion of the data. At the moment, we are preparing a paper in which we try to explain the encountered seasonal variations with a modelling approach. We believe that incorporating a discussion about the seasonal variations would be beyond the scope of this manuscript and would dilute the main findings of this study.

More detailed comments:

Page 2 line 31. From the classical reference (Wetzel 2001), Lake Geneva is meso-eutrophe (10-30 mg/m3) based on phosphorus content (20 mg/m3), but also on chlorophyll (.

We agree and propose to change this to "meso-eutrophic".

P4 line 23. I don't understand why the sedimentation rate (SR) is calculated based on a depth scale, and then at each layer a TOC-MAR (mass accumulation rate) is calculated, including porosity and dry density. This way is correct if the porosity is relatively constant downcore. But in general in recent sediment porosity vary strongly with depth, and this variation should be taken into account before the computation of the sediment rate. For instance a SR of 2 mm/y correspond to 0.05g cm/2/y with 90%porosity, but 0.1 g/cm2/y with 80% porosity.

We agree that sedimentation rates likely vary downwards. Yet the sedimentation rates over the range of 2-10 cm sediment depth do not change drastically. Based on the characteristic ^{137}Cs peaks of 1986 and 1963 the sedimentation rate of the top 10 cm can be well established. In Lake Hallwil, no variation in the sedimentation rate over this part of the sediment can be seen. In Lake Aegeri and Lake Baldegg additional to ^{210}Pb and ^{137}Cs dating, varve counts over that sediment range were also evaluated and agree well with sedimentation rates previously published (e.g Lotter et. al (1997).
The porosity was calculated for each sediment interval separately with the individual water content and density. The density itself was calculated by the empirical relationship between TOC content and pure geogenic material (Och et. al (2012). We propose to add a section to clarify this and further add the equations for dry density and porosity calculations.

P4 line 24. It is not clearly explain here (but discussed later) why the surface sediments are excluded from the computation.

We explain this in the ensuing sentence P4 line 25 : "The first two centimeters were excluded to neglect freshly deposited matter". We exclude this most of the times very fluffy material, as it possibly reflects just the most recent input to the sediments without any control over long-term deposition to the sediment record. We propose to add the statement : "as this material probably still passes through intense and rapid degradation".

P6 line 28. Not clear here the difference between TOC-MAR and OC (or TOC?) gross sedimentation rate.

We use same nomenclature as the paper cited “OC gross sedimentation rate” by Sobek et. al (2009). We define TOC-MAR on P4 L 21-26 as the organic carbon that is accumulated in the sediments while OC gross sedimentation rate is the deposition rate of OC onto the sediment surface (Sobek et. al 2009) often calculated by sediment trap data (see P6 L29 and Supplement Table S1). We propose to add a sentence to clarify this : “(deposition rate of OC onto the sediment surface)”

P9 line 22. Not clear what is meant by "accessibility of hypolimnetic O2 to the sediment surface"

We mean the O_2 flux to the sediments and will change the sentence to : “A closer look on the fluxes of reduced compounds produced by the deposited organic matter in the sediment, however, revealed that they as well depend on the concentration of O_2 that the material was exposed to.”

Table 1. Units of Hypolimnetic volume is (Mm3) and not (m3).

We will change this to 10^6 m^3.

Sampling depth in Lake Baldegg 40m but 38m on table 2, Lake Geneva 40m but 45 on table 2.

We will make sure that sampling depths are consistent in the revised manuscript.

Fig S2. Concentrations in Lake Geneva at 310m are much lower throughout the year, varying between 2 and 5 mg/L (Barbier and Quetin 2016). To what year do these profiles correspond

We used the most recent data set we had from 2012 from CIPEL. We are now aware that apparently 2012 was one rare year in which O_2 levels became high in the deep basin. We will now use data from 2011 which more likely reflect the average O_2 concentrations in the deep basin and we will acknowledge CIPEL and INRA for the O_2 data of Lake Geneva.