

Interactive comment on “Expressions of climate perturbations in western Ugandan crater lake sediment records during the last 1000 yr” by K. Mills et al.

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GENERAL COMMENTS

The manuscript “ Expressions of climate perturbations in western Ugandan crater lake sediment records during the last 1000 years “ by Mills et al. makes a good contribution to improve the knowledge of past hydrology and related climate in Eastern Africa (Uganda, Equatorial latitudes), and for the recent period of the last millennium. This period is known to be complex, and the understanding of the climate of the last millennium in this region is a challenging task, as neighboring sites not always indicate the same changes. The Little Ice Age chronozone for example remains a period still far

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from being well-understood in equatorial and intertropical regions of East Africa.

The authors based their work upon the study of diatom assemblages from sedimentary records extracted from two neighboring crater lakes, with different site and lake configurations. The originality of the manuscript is to suggest that : (i) the comparison between the two records on one hand, and especially (ii) a set of statistical treatments relating diatom data to various potential forcings (e.g. sunspot number, El-Niño frequency) and to some other records of changes from Uganda and from East Africa, on the other hand, should enable the authors to decipher diatom-based reconstructed changes in the two investigated lakes Nyamogusingiri and Kyasanduka. In particular, it should help to determine if they are likely related to climatic changes or not, to identify the different forcings that are involved, and to determine at which scale and to which extent the mechanisms that are behind the observed changes should be expected to operate (local, regional, East Africa, continental scale, ...).

The questions that were addressed, the site location, the paired-lake study, and the methods that were used to identify correlation between variables, makes of this work a highly valuable contribution to environmental changes understanding, in a region for which a complex pattern of climatic regimes, drivers, and past changes still remain poorly understood, for the period that is addressed of the last millennium.

The focus is undoubtedly within the scope of Climate of the Past.

The manuscript is clearly organized in its structure. It is however sometimes difficult to read. Of course, English language *sensu stricto* should rather be corrected by english-speaking referees. But however, some sentences are really very long and certainly would deserve rephrasing. See few examples in specific comments below.

The main drawback of the manuscript in its present submitted format is the difficulty in reading easily most of the main data, as they are presented. This often induces an (apparent?) inconsistency between data and the text commenting on them. Data presentation needs important revisions, since, in their present form, they sometimes

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come to contradict the results description, and therefore not often support discussion and conclusions. See specific comments below for several examples.

I recommend the publication of this important article, in a revised form. Revisions should include mainly an improved presentation of the main results -towards a fair legibility-, an accurate check of the coherence between the data and the text, a number of clarifications, and the response to corrections and comments, as mentioned in the specific comments below.

SPECIFIC COMMENTS

Abstract

Page (P.) 5184 Line (l) 18 - The LIA aridity over the whole period 1500-1800 AD is poorly supported by the data, in particular the reconstructed lake level (Fig.5), at least for lake Kyasanduka over most of the whole period, and for the end of the period (post 1700 AD), for lake Nyamogusingiri. See also other specific comments below.

1- Introduction

P.5186 l.18-20 - Depending on the formulation, this is ambiguously written, and should be clarified. Sensitivity in the sense that is used here refers to the response time. Another understanding is that lakes with high CA:L area ratio are amplifier lakes. They might therefore also be highly 'sensitive' to limited changes (e.g. precipitation), as the catchment area amplifies the effect of a (even small) precipitation change on the lake level response. Sensitivity might refer to several concepts : 1) - sensitivity = RAPID response to a perturbation, OR 2) - sensitivity = LARGE or amplified response to a perturbation, even if of small amplitude or intensity. Clarify the meaning of the sense that is used here. If not, the reader might be confused. Explicit that catchment : lake ratio refers to surface areas of each.

2 - Study sites

P.5187 l.7 - The reference Lock (1967) refers to quite old data, and show a large range
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of annual precipitation. Considering the most recent climatic changes that might be of large amplitude, are there any more recent data (even if not compiled over a large number of years) from meteorological service, or from recent monitoring on the lake, or neighboring meteorological station? Even very limited (in both space and time) should be mentioned (if any). Moreover, details on precipitation seasonality and interannual variability could be mentioned here. Link with ENSO variability could also be mentioned here?

P.5187 l.23 - What does mean here "long-term", in "long-term lower lake level"? This has really a highly relative signification.

3 – Materials and methods

P.5188 l.3-6 - At which depths were collected the cores ? The "central area" of lake Nyamogusingiri seems not to be the "deepest" part as the authors indicate (P.5187 l.17) a maximum depth of 12.5 in the WESTERNMOST part of the basin. Clarify core depth and coring site location. In relation to this, are the crosses in lakes Kyasanduka and Nyamogusingiri, from Fig. 1, indicating the core location? If so, a call to Fig. 1 would be appropriate here.

3.3.2 – Direct ordinations

P.5190 l.22-24 - It is fairly unclear how are determined the sample size? How was determined the number of groups? for each lake? Another issue is the total number of samples, as if considering i) the number of samples per group, and ii) the number of groups, for each of the two lakes. . . you do NOT reconstruct the number of samples diatom announced, 133 and 278 (P.5189 l.10) respectively for Nyamogusingiri and Kyasanduka. This needs a careful check, and/or clarification. Otherwise the reader might come away dissatisfied.

4- Results

P.5191 l.21-23 - The authors somewhat easily state that a ' small number of dates

were rejected ...' According to Table 1, two of the five 14C dates were rejected for lake Nyamogusingiri chronology, and three of the eleven 14C dates from Kyasanduka. The authors should rather point out to the fact that a discussion (?), is developed in Supplementary materials, and that for each rejected dates, explanations have been tentatively proposed.

4.2 Diatom record

4.2.1. Lake Nyamogusingiri (Fig. 4a).

P.5192 I.5 - An explanation on HOW the discussed zones have been determined (criteria)? Moreover, zones that are indicated on figs 4a and 4b refer to a much more detailed zonation (on which we also have NO information at all). The authors should : 1) - either indicate on fig. 4 only the zones that are discussed in this section 4.2.1. In this case, give a number or name to each of these zones. OR 2) - either discuss here the zones that are drawn on fig.4. Consistency between text and fig.4 to be checked.

P.5192 I.5 - Interval of the zones-periods are given from the older to the more recent (1145-1265); this should be easier to read if the same sorting was used for depth intervals, i.e. 127-102 cm rather than 102-127 cm. This comment is general and usable for the following zones.

P.5192 I.15 - *N.lancettula* . As a general comment that is also applicable in the whole section 4.2 (e.g. P.5194 I.17; p.5194 I.26, ...), the authors should make a decision on how to refer to diatom genera, and follow it all along the text. After having used a genera-species name, 1) - either decide to you continue mentioning it in full; 2) - either decide to mention in the following text the only initial of the genera. Alternative use of one and the other formulation, for the same species (e.g. *Nitzschia palea* or *Nitzschia lancettula* alternatively referred to as such, or as *N.palea* and *N.lancettula*) should be avoided.

P.5192 I.15 - It is unclear in which manner the reference of Stager et al. (2005) could

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support the conclusion that *Nitzschia lancettula* rise would indicate a lake deepening. In another attempt to understand the meaning of this reference, if this mentions also a lake deepening at Lake Victoria, this should be used in the discussion section, and it is also unclear how far the comparison between these two phases is suitable.

P.5192 I.18 - Almost the same comment as above: how can Stager et al. (2005), support the relationship between *N.lancettula* abundance and not only the higher levels, but even, the lake water column stratification ???

P.5192 I.21 - Leland and Porter (2000) refer to the Illinois basin, and moreover to a RIVER ecosystem. A warning on the use of the autecology of the species at a worldwide scale (and used in different ecosystem types) should be made. Authors themselves warn on the assumptions behind the use as a 'universal' tool of the species autecology, as they recommend the use of 'local' transfer function, rather than large geographical scale databases. The authors have implemented a new transfer function, to interpret Ugandan diatom records in terms of water conductivity (Mills & Ryves, 2012), and they indicate that this revealed more suitable than databases compiled at the semi continental scale (Data from Gasse et al., 1995, compiled in the European Diatom Database Initiative). A fortiori, rigorous cautions would therefore be indicated on the use of references such as Leland & Porter (2000). The same comment can also be made for the use of several other references, among which van Dam et al. (1994), Sabater (2000), Charles et al. (2006), all of them referring to temperate Europe or North America, and some also referring to rivers. At least, the authors should mention how far the quoted reference is close (or far) to their context: mentioning the context of the study in such references (geographical area and/or type of ecosystem) could be sufficient, as this information could act as cautions and warnings.

P.5193 I.1 - A zoom-focus of fig. 4a on the last century at lake Nyamogusingiri would help visualizing and understanding the most recent changes.

4.2.2. Lake Kyasanduka (Fig. 4a).

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P.5193 I.20 - The interpretation of lake Kyasanduka record begins at 1100 AD, but the diatom record seems to shows data since ANTE-1170 AD. Is there a reason to discard such data at the lowermost part of the record?

P.5194 I.19-21 - Changes in turbidity also might be a consequence of climatic changes e.g. rainfall intensity and/or inter-annual variability, frequency and intensity of extreme events,...

P.5195 I.2-3 - *Nitzschia palea* is a widespread species, found in a lot of regions, and in different environments. The morphological entity certainly includes several (or a lot of) ecotypes or cryptic species (e.g. Trobajo et al., 2009; 2010), that might not have the same ecological requirements. Its relationship with environment is therefore certainly not univocal.

Trobajo, R., E. Clavero, V. Chepurinov, K. Sabbe, D.G. Mann, S. Ishihara & E.J. Cox, 2009. Morphological, genetic and mating diversity within the widespread bioindicator *Nitzschia palea* (Bacillariophyceae). *Phycologia* 48: 443-459.

Trobajo, R., D.G. Mann, E. Clavero, K.M. Evans, P. Vanormelingen & R.C. McGregor, 2010. The use of partial *cox1*, *rbcL* and LSU rDNA sequences for phylogenetics and species identification within the *Nitzschia palea* species complex (Bacillariophyceae). *European Journal of Phycology* 45: 413-425.

5 - Discussion

5.1 Lake level...

P.5195 I.8 - The title of this section is not informative enough. Even if the discussion leads to doubt of the validity of the conductivity (C) reconstruction, this is part of this section: the C reconstruction was done, and discussed and it would be useful to state this in the title, as it also appears in fig. 4, and is finally used in some points of the discussion when indicating freshwater phases. I suggest one of the following version: 'lake level and water conductivity reconstructions...' OR 'lake level versus

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water conductivity reconstructions...'

P.5195 I.15 - As a general proxy, the RELATIVE variations of the often used ratio of planktonic vs benthic species abundance is a fairly good indicator of RELATIVE lake level changes, in spite of the presence of facultative planktonic species, that in some cases, might complicate this generally useful tool.

P.5196 I.1 - With the database used from EDDI, quoted as European Diatom Database (2013), it would be fair to quote also the (easy to identify, as there is only one reference feeding EDDI, for Africa) initial re-ference from Gasse et al. (1995). The conductivity optimum in this work is 3.78 ($C \sim 6000 \mu\text{S.cm}^{-1}$).

P.5196 I.1-4 - "...although its distribution [of *Cyclotella meneghiniana*, referee's note] in contemporary western Ugandan crater lakes results in a low optimum in the model applied here (see Mills and Ryves, 2012, for a full discussion) in agreement with observations from other East African lakes ". In EAST AFRICAN LAKES of the EDDI database, *Cyclotella meneghiniana* is a species found not only in freshwater lakes, but also in salted lakes, with high percentages. E.g. in Lake Kindai (Tanzania), the species reaches 54% of the assemblage, associated with a conductivity of about 4800 $\mu\text{S.cm}^{-1}$; in the crater lake Kirongoro (Uganda), the species represents 15% of the assemblage, associated with a conductivity of about 16,300 $\mu\text{S.cm}^{-1}$.

5.2 Drivers of diatom...

P.5197 I.11-12 - 'The periods represented overlaps...discussed'. This is unclear. In the section 'method', it is stated (apparently, to the contrary) that '... they are temporally uneven and overlaps were not used... (P.5190 I.25-26). This APPARENT discrepancy might be due to a misunderstanding, but this deserves explanation, and clarification with a less ambiguous phrasing, formulation, explanation.

P.5198 I.8 - On tables 3 and 4, RDA results shows ORGANIC flux as being significant in lake Nyamogusingiri, and MINERAL flux in lake Ky. = Consistency between text and

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tabs 3 and 4, to be checked.

P.5198 I.11 - Naivasha lake level is not reported on table 4, as being a parameter statistically significant. = Consistency between text and tab.4, to be checked.

P.5198 I.11-13 - 'The more recent period shows a clear shift. . . diatom records'. This is not a completely rigorous conclusion, as for the period 1980-2000, lake Nyamogusingiri record shows significant similarity with the lake level of Kasenda (table 3). This should be discussed, as it suggests either i) a multivariate cause of changes for this period, i.e. both local perturbation and a more regional (climatic?) driving cause impacting both Kasenda and Nyamogusingiri, and not only a catchment perturbation driver or ii) a catchment perturbation at each of the two lakes both Kasenda and Nyamogusingiri, coincident in time. It could be noted also that, at lake Nyamogusingiri, in this attempt to identify drivers of changes, this more recent period share similar characteristics with the older period (1144-1242 AD).

5.3 Coherence between records . . .

P.5199 I.2 - ' . . . it might be expected that where paired lakes show a synchronous response, these are a direct result of a regional-scale forcing mechanism; other non-synchronous changes are likely to be much more in local'. An accurate understanding of the mechanisms of changes should enable to show that non-synchronous changes might, in some cases, be a response to regional or continental-scale forcing mechanisms (e.g. delays, thresholds, . . .). This is moreover implicitly acknowledged on P.5202 I.1-2 'It is possible that these two periods of lake level changes are a result of the same external driver. . . with Kyasanduka . . . [having, referee's note] an immediate response to a shift in precipitation: evaporation ratio might be expected. . . lake Nyamogusingiri may be less sensitive to changes, thus displaying a delayed response to the same forcing mechanism. . .'

P.5199 I.11 - It is quite unclear which criteria were used to establish the chronozones that are mentioned as 'common to both cores'. Visual agreement of lake level curves?

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Diatom detailed record? Authors refer to fig. 5j and 5k = lake level, but also to statistical zoning (on diatom records) i.e. results not shown here. From the lake level curves only, some of the chronozones mentioned here as 'common to both lakes' show divergent pattern in the lake level curves (e.g. c. 1990 AD, Nyamogusingiri lake level re-increase, which is not the case in lake Kyasanduka), while some other periods with a similar pattern in both lake are not quoted here.

P.5200 I.3 - Fig. 5 shows a high lake level earlier than the 1210 AD indicated in the text = at about 1170 AD at Nyamogusingiri, almost in phase at Kyasanduka, c. 1180 AD. The lake level curve shows that the lake already had lowered again at 1210 AD. = Consistency between text and Fig.5, to be checked.

P.5200 I.7 - On a fresher event at Nyamogusingiri at c. 1140 AD. . . At the lowermost part of the sequence, in lake Nyamogusingiri, the lake level is very low, and the conductivity is higher than in most part of the sequence (the last century is the only one exception). How could be supported a fresher phase in this lake at 1140 AD? Moreover, the age of the older part of the sequence is described as being 1145 AD (Cf P.5192 I.5). = Consistency between text and Fig.4 (reconstructed conductivity), and fig.5 (lake level curve) to be checked.

P.5200 I.20-21 - Again, the data shown on fig. 5 cannot support the text. In lake Nyamogusingiri, the period 1380-1400 AD is not an arid phase, the lake level curve is at one of its maximum, decreasing slightly after the time interval mentioned, but not reaching a low level before 1440 AD. The period 1510-1600 can hardly be considered as an arid oscillation, as the lake has more or less the same level from 1450 to 1650 AD (Fig.5). In lake Kyasanduka, why (and on which basis?) is the time interval 1610-1680 considered as an arid phase or oscillation? This interval is coincident -on over almost all the period-, with a high lake level, including the highest lake level at about 1650 AD (Fig.5). If analyzing without a priori the records of lake level. . . Lake Nyamogusingiri shows a relatively low level, and even one of the lowermost level periods, (if excepting the likely disturbed 20th century) between 1450 and 1650 AD. So is the case at lake

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Kasenda between AD 1450 to c. 1640 AD, and at lake Kibengo between c. 1450 and c. 1580 AD. The similarity of the onset of this arid phase in the three lakes could be acknowledged, and discussed. = Consistency between text and fig.5 (lake level at Nyamogusingiri and Kyasanduka) to be checked.

P.5200 I.23 - For lake Chad, the reference to Verschuren, 2004 is a review. It should be fair to quote at least one of the original references of Maley (1981, 2004, 2010), OR at least to indicate that the reference Verschuren (2004) is a review of previously published works, including this on lake Chad.

Maley J., 1981 - Etudes palynologiques dans le bassin du Tchad et paléoclimatologie de l'Afrique nord-tropicale de 30 000 ans à l'époque actuelle. Travaux & Documents de l'ORSTOM, n° 129, 586 p.

Maley J., 2004 - Le bassin du Tchad au Quaternaire récent: formations sédimentaires, paléoenvironnements et Préhistoire. La question des Paléotchads. In: L'évolution de la Végétation depuis deux millions d'années. J.Renault-Miskovsky & A.M. Semah eds., Artcom - Errance, Paris : 179-217.

Maley J., 2010 - Climate and Palaeoenvironment evolution in north tropical Africa from the end of the Tertiary to the Upper Quaternary. *Palaeoecology of Africa*, 30: 227-278.

P.5200 I.27 - Again, text on P.5200 I. 27-29 states that lake Nyamogusingiri experienced a high lake level centered on 1450 and 1750 AD, while they occur at 1360 and 1800 respectively on fig. 5. Freshwater phases occur at Kyasanduka not centered on 1740 AD, but much earlier at 1600-1700 AD. = Consistency between text and fig.5j and k to be checked. GENERAL COMMENT: Because of repeated inconsistencies between the text and the fig. (fig.5 in particular), I wonder if there might have been a problem with the timescale? But IF SO, (i) because of the repeated phase of arid and wetter phases, (ii) because of the chronological uncertainties, (iii) because of other sources of uncertainties, and finally (iv) because of the difficulties in reading carefully fig.4, it is highly speculative to check such a suspected error on the timescale. It would be very

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difficult, and too speculative, to guess how and of how many years the timescale could have been translated (as an error on the timescale), and for which curves and lakes?

P.5201 I.15-17 - It is unclear if the sum minimum of Dalton is coincident with an arid phase in lake Nyamogusingiri, as it seems to be in phase with the highest lake level period (Fig. 5k). = Consistency between text and Fig.5j and k to be checked. See also general comments above.

P.5201 I.18 - '... levels are high at Nyamogusingiri and Kyasanduka c. 1690-1800 AD...'. From fig. 5k, levels are high at Nyamogusingiri during the interval 1690-1800 AD, but level is lowering and is intermediate at lake Kyasanduka during most of this time period. = Consistency between text and fig.5j and k to be checked.

P.5202 I.1 - 'Nyamogusingiri documents a decline in lake level several years after Kyasanduka (c. 1840 AD)...'. It could be considered that the Nyamogusingiri lake level declines even later, at c. 1860 AD, as an increase is observed again post-c. 1840, and a maximum high level is reached at c. 1850 AD.

P.5202 I.13-14 - 'These low levels [at c.1890s AD, referee's note] are also observed in lakes Nyamogusingiri and Kyasanduka ...'. Lake Nyamogusingiri still shows a decreasing but still HIGH level at 1890 AD.

P.5202 I.16-17 - 'Lakes Nyamogusingiri and Kyasanduka show a general decline in lake level from c. 1850 AD onwards'. Lake Kyasanduka has already almost reached its lowermost lake level at c. 1850. For this lake, the decline is observed 40 years earlier, and even the general trend to decline in lake level starts as early as c. 1730 on data from fig. 5j. = Consistency between text and fig.5j to be checked.

Regional drivers

P.5203 I.14-15 - [At lakes Victoria, Edward and Nyamogusingiri, referee's note], "...a decrease in lake levels c. 1150 AD, with levels dropping from a short-live high-stand just prior to 1150 A..." In lake Nyamogusingiri, how can be evidenced a high stand

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prior to 1150 AD, since the records of lake Nyamogusingiri includes data from only 1145 AD, which begins with the lowermost stand of the period (fig.5k) ? = Consistency between text and fig. 5k to be checked.

P.5203 I.25 - Concerning the two gradients of spatial variations. The anti-phase that exists for some periods between Lakes Nyamogusingiri and Kyasanduka is not discussed in this manuscript. In particular for the LIA period, Kyasanduka shows an overall high stand, even if interrupted by lower lake phases; to the contrary, the overall stand of lake Nyamogusingiri is low during the same period. How this observation could be integrated in the discussion on the two gradients (North-South and East-West) that are considered in the two paragraphs of P.5203?

6. Conclusions

P.5205 I.20 - "...climate effects when they exist (...) are still filtered through the catchment and modified by the lake itself...". One of the conclusion and recommendation could be the absolute need for a good knowledge of the present-day system. How can be approached, in the present-day system, the relationship between diatom communities, climate forcing or human disturbance, and diatom assemblages in sediments? This usually provides, at least for the modern configuration, a model or a clue, for the understanding of the diatom record in the sediments of a lake system. It usually helps to investigate to some extent how the "filters" of sedimentation process and archives can act on the diatom response.

FIGURES AND TABLES (both specific and technical comments)

Fig. 1 Fig. 1 would gain at showing the total catchment area of lake Nyamogusingiri, which would be more logic. Cross in the lakes should appear in the legend = locations of the coring sites? They also should be more legible (great red dot ?).

Fig.2 and Fig. 3 - Explicit in the legend the meaning of the black line on fig.2b. Total 210 Pb? Dashed line is indicated in the legend; add the same legend for the black line.

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Legend and/or axis units should explicit that the 210Pb activity scale is in a log scale. Explicit in the legend the meaning of the different colors (green, blue, red). (Fig. 3 only) Add in the legend and/or on the graphic, the signification of the grey band at ~120 cm depth.

Fig.4 - The paper presented here is based on diatom data. A large number of samples have been obtained, and a great amount of work has been achieved. . . As far as I know, and as far as the authors present it, these data are not yet published (the only reference quoted is Mills (2009) that indeed refers to a PhD-thesis). However, the data are very briefly presented and there is a very little highlight on the data that would deserve to be much better valued. In such a way, they would have chance to become reference data in this region, to be available for further comparisons, including regional syntheses,... They could also enable diatomist to investigate the dynamics of the variations in the representation of the assemblages, or variations of a particular species. However, in their present format, the data -that make a major contribution- are almost NOT readable.

I therefore recommend to dispatch the content of fig.4 into not less than 4 detailed figures: 1- For lake Nyamogusingiri : a) - a first figure representing diatom data sensu stricto for lake Nyamogusingiri (% of species, and diatom concentration); b) - a second figure representing synthetised curves (F index, DCA axes, conductivity, diagram of diatom habitat) and other non-diatom proxies. 2 - Idem for lake Kyasanduka in two separate figures.

Fig.4 (continued) - Unit of the diatom concentration should be indicated, even if presented in log. scale. (e.g. it should be noted: Log diatom concentration (valves per g. of dry sediment) OR Diatom concentration (valves per g. of dry sediment, log).

- F index meaning should be explicitated in the text (at least in the section 'method'), and the results of this curve should be commented in the text (even a minima).

- Errors for parameters such as reconstructed conductivity should be indicated.

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- The zones to the right of the graphics are never explained; moreover, they do not correspond to the different zones discussed in the text. Consistency between graphs and text is required.

- 'Inorganic flux' is elsewhere (text) referred to as 'mineral' or 'minerogenic' flux. Homogeneity ?

- In the legend, (b) . . . by weighted-averaging [Add 'OPTIMUM' here] (ascending)'.

Fig. 5 - Almost the same comment as fig.4 - Fig. very difficult to read: the timescale should be much larger.

The timescale should cover the period 1000-2000 AD. Data seem available since ante-1070 AD for lake Kyasanduka.

Explicit in the legend: 1- the red curve (smoothed curve: which method for the smoothing?, how many points?, . . .); 2 - the marks on the top of the lake level curves for lakes Nyamogusingiri and Kyasanduka? 3- the meaning of the grey bands.

Is there a logic of the sorting of the different curves and lakes? If not, lake Nyamogusingiri should be placed above lake Kyasanduka. This order would be more convenient for the reader, as it is the one that has been used in all figs and text, except this last fig.5.

Check units of sunspot numbers.

References should be added on the graph either near the proxy name (e.g. Victoria, SWD, Stager et al., 2005) OR in the legend. Table S1 refers to most of the records, but i) not all of them (e.g. lake Edward) and ii) the link between fig.5 and table S1 might be laborious to made.

The curve of the sunspot numbers seems to have been translated in time or scale: for example, the Maunder minimum is NOT at the expected place on the timescale. But it remains unclear why, in this case, the modern time, refers to 2000 AD, as expected.

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Tab.3 - Complete the period 1421-124X

TECHNICAL CORRECTIONS

P.5184 I.18-24 Could the sentence be cut into several ones?

P.5187 I.14 - Melack, 1978) Nyamogusingiri => [=> means 'Replace by', also in the following corrections] Melack, 1978). Nyamogusingiri

P.5192 I.8 - Aulacoseira ambigua and an increase in... => Aulacoseira ambigua, an increase in...

P.5192 I.26 - Stager and Johnson, 2000 => Would the authors rather intent to quote here "Stager and Johnson, 2007" ?

P.5193 I.1 - A zoom-focus of fig.4 on the last century at lake Nyamogusingiri would help visualizing and understanding the most recent changes.

P.5203 I.7 - (Fig. 5X) => Fig. 5b

P.5194 I.27 tolerant of organic => tolerant TO organic ?

P.5195 I.16 - lake level records Lakes Nyamogusingiri => lake level records of OR at OR from Lakes Nyamogusingiri

P.5197 I.13 - Ref. Bradshaw, 2005 certainly rather refers to Bradshaw et al., 2005 ?

P.5198 I.10 - Kitigata => is rather Kitagata. This should be corrected also in the text at each occurrence, and in the figs (fig.5) and tables (tables 3 and 4) and in the supplement materials.

P.5201 I.20 - Lake Kasenda... => Lakes Kasenda...

P.5205 I.1 - palaeolimnological work => palaeolimnological workS ? [except if, for syntax reasons -that I would ignore- 'work' cannot be used in a plural form ?]

P.5205 I.9 - over-ride is written 'override' on P.5196 I.19. Homogenize notation ?

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BIBLIO. REFERENCES

P.5206 I.20 - Florian T. => Thevenon, F.

P.5206 I.21 - Palaeogeogr. Palaeocl. => Palaeogeogr. Palaeoclimatol. Palaeoecol. This should be corrected in several occurrences, each time as it was quoted (refs. Bessems et al, 2008 ; Chalié & Gasse, 2002; Ryves et al., 2001).

P.5208 I.24 - Chalie => Chalié

P. 5210 I.4 - Leiju => Leiju

P.5210 I.21 - benthic algae I the upper Illinois => benthic algae in the upper Illinois

P.5212 I.15 - and El Nino => and El Niño

SUPPLEMENTARY INFORMATION

In this supplementary material, it would be clearer to refer to all the figures as fig.S1, and NOT fig.1, this latter being often used with this format in the supplementary text (e.g. P.2 I.26, P.3 I.5, and any other occurrences). To avoid any misunderstanding, all figs from supplementary material should be labeled and REFERRED TO as Sx.

Homogenize names of the cores. R1C2 is called KR1C2 in some other places. Homogenize between figures, text and legend. I would recommend the use everywhere of the notation KR1C1 rather than R1C1, as the latter might be ambiguous and might induce confusion between the two lakes' cores.

P.1. I.2 - The first paragraph is 1.Results, but there is no paragraph 2. Adjust, as this might be a relict of past versions of the manuscript.

P.1 I.15-17 - The *Thalassiosira rudolfi* curves for correlation of the cores are not presented in the supplementary figures, as they were transferred to the main text and fig. 4 on request of the editor. The correlation is however not presented on fig.4, and the information that is discussed in this text has therefore completely from the manuscript.

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Check and adjust the text and/or the figures, accordingly.

P.2 I.6-7 - Calibrated ages would be 'in series' even if radiocarbon ages are not. See table 1 of the manuscript. See comment below, for P.5 I. 32 + P.6 I. 1

P.2 I.17 - Clarify versus which reference (0cm) are the core depths calculated. If comparing to fig. S2, the lengths of the cores in the text is unclear, and the information does not seem compatible between the text and fig.S2. Check consistency between text and fig.S2.

P.4 I.14 - Supplementary Table 2 => certainly became Table 1 of the article ?

P.5 I.21 - From fig. S2, laminations seem very restricted to only few-cm sediment bands (one or two only), and they do not appear 'throughout the sequence' as stated in the text.

P.5 I. 25-27 - during the day AND show ... Add a dot at the end of the sentence.

P.5 I.32 + P.6 I.1 - Rather Table 1 than table 2 from supplementary material P.5 I.32 + P.6 I.1 - HERE, should be discussed the rejection of the two dates from the lower part of the sequence from Nyamogusingiri, that would give calendar ages in series.

Fig. S1 - Radiocarbon dates on the stratigraphic column are not legible. So is the case for fig.S2 also. Smaller labels on the curves would make the individual data easier to read, at least when several curves are overlapping. This is particularly the case also for fig. S2.

Fig. S2 - Magnetic suscetibility => susceptibility in the title of the axis.

Fig. S3 - The red boundaries that are announced in the legend are not red.

Bibliographic references IF references from the supplementary text must be given in full here, even if already quoted in the text of the article, then reference of Stuiver & Reimer (1993) should be added. IF NOT, then check the list, as some of the references already quoted in the main text, also appear here.

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P6. I.28 El Nino => El Niño.

Interactive comment on Clim. Past Discuss., 9, 5183, 2013.

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