

Line number	Comment QS	Comment by authors
13	location (?)	changed accordingly
14-15	strikethrough "of associated changes"	deleted "of associated changes"
14-15	I understand what you mean, but I'm not sure about the sentence.	changed as suggested in line 15
15	Why not something like this? "Sediments from the Auckland Volcanic Field maar lakes preserve records of such large-scale climatic influences on regional paleoenvironment changes, as well as past volcanic eruptions."	changed accordingly as suggested
17	rapidly deposited	changed accordingly
17	high-resolution	changed accordingly
19	highlighted "combining" and "combined"	replaced the first "combining" with "using"
23-24	results suggest major influences of unaccounted catchment processes, preventing straightforward geomagnetic interpretations,	this section (on Be in the abstract) was now removed following comment (RC1-C1)
25	can you really confirm the presence of the Laschamp based only on 10Be? I'm not sure.	this section (on Be in the abstract) was now removed following comment (RC1-C1)
25-27	highlighted "We have integrated our absolute chronology with tuning of the relative paleointensity record of the Earth's magnetic field to a global reference curve (PISO-1500)."	not changed as it is unclear why this sentence was highlighted
35	strikethrough "events"	deleted "events"
36-37	Convolutd sentence. (...) uncertainties prevent understanding accurately the generation (...)?	changed to "... uncertainties prevent accurate understanding of the generation..."
41	of	changed accordingly
41	available	added "available"
41	spanning	changed accordingly
42-43	Convolutd sentence. Why not something like: "In this context, the laminated sediment sequences from maar lakes of the Auckland Volcanic Field (AVF) provide key paleoclimate records for the LGI and beyond."	changed as suggested
50	How does it change through time?	extended the sentence to "This study focuses on the lacustrine sediment sequence contained in Orakei Basin, deposited following the phreatomagmatic eruption forming the maar crater until the post-glacial sea-level rise breached the crater rim and led to the current connection between Orakei Basin and the sea (Fig. 1; Peti and Augustinus, 2019)."

55-57	In this study, we integrate absolute dating techniques (tephrochronology, radiocarbon, luminescence) and correlative dating (tuning of paleomagnetic field variations established by the relative paleointensity and meteoric ^{10}Be) to develop an original age-depth model of the Orakei maar lake sediments.	changed as suggested
55-57	The following paragraph (or most of it) could be move in the method section.	The segments of the two following paragraphs (with respective edits) have now been moved to the beginning of the respective methods sections.
62-63	strikethrough “since it is a well-established technique for dating organic macrofossil samples younger than ca. 50,000 years (Bronk Ramsey, 2008).”	deleted “since it is a well-established technique for dating organic macrofossil samples younger than ca. 50,000 years (Bronk Ramsey, 2008).”
71-72	Do you mean by wiggle-matching of climatic records?	deleted “environmental” in “synchronous changes” given caveats of circularity when wiggle-matching climatic records
72-75	I don't think this is a good exemple to illustrate previous sentence. Geomagnetic changes are independant of environmental variations (idealy). I'm not sure to understand properly these two highlighted sentences. You could also add another reference dealing with ^{10}Be (the one cited is about RPI)	See above comment. Removed ^{10}Be part of this sentence to solely focus on paleomagnetic data here, and on ^{10}Be in the following sentence.
78	Carcaillet et al do not used ^{10}Be for dating terrestrial sediments. Simon et al. (2020 QGeo, 10.1016/j.quageo.2020.101081) do such a thing, but not by correlating with paleointensity changes (rather using ^{10}Be radioactive decay). To my knowledge your paper and the one submitted by Lisé-Pronovost et al. (in revision in QGeo) are the first ones to try using ^{10}Be as a relative dating tool by comparing with RPI references. Despite poor results, you could mention this here ;)	We moved this part to section 3.5 (Be methods) and removed the caveat in terrestrial settings and reference to Carcaillet et al as the same statement is repeated in this section. We added “Though the radioactive decay of ^{10}Be has been used to date sediment much older than the Orakei sequence (e.g., Frank et al., 2008; Simon et al., 2020a), no study has been published yet applying ^{10}Be variations in sediment cores as a relative dating tool by comparison to RPI reference data beyond the Laschamp Excursion (Nilsson et al., 2011).” to section 3.5.
83	because you most likely do not retrieved a ^{10}Be production signal, I agree with your interpretation.	see more detailed comments in results and discussion sections
83	deposition	changed accordingly
83, 84	highlighted “robust” twice	changed second instance of “A robust independent chronology” to

		"This detailed independent chronology"
85	highlighted "significantly"	deleted "significantly"
118	strikethrough "visible", added "identified"	changed accordingly
132	strikethrough "carefully"	deleted "carefully"
135-13	strikethrough "Marine reservoir age corrections are routinely addressed in the marine realm but more difficult to assess in lake basins due to their different sizes, variable regional lithologies, depths and movement of water masses (Philippsen, 2013)."	deleted entire sentence
138-139	strikethrough "to increase the age resolution"	deleted "to increase the age resolution"
150-151	I understand it is annoying, but could you calibrate using the new SHCal20 curve? At least, look at the difference obtained between the ages after using both references.	The age model has been updated using SHCal20 now.
192	I'm not sure paleomagneticians will like this explanation, but I do understand the following argument ;)	The problem has been observed in nearby Lake Pupuke (Nilsson et al., 2011) so that we assume this to be a real problem...
194-195	strikethrough "This is a problem especially around the age of the Mono Lake Excursion, which correlates with a flare-up of the basaltic volcanoes of the AVF around 30,000 cal yr BP (Molloy et al., 2009)."	Not adjusted, this sentence is needed to explain why no paleomagnetic data is available above ca. 40,000 cal yr BP which would have been great for a comparison of ^{14}C /tephra derived chronology and RPI DTW based chronology (see later part of comment (RC3-C2)).
195	strikethrough "Orakei maar sediment"	deleted "Orakei maar sediment"
209-210	To my opinion, this is very light and you'll need to explain a bit more why you are confident in this RPI proxy if you want to correlate it with references to help building the age model. See for instance the recent paper by Hatfield et al. (2020, Frontiers). What is your magnetic mineralogy? It is very likely that rock mag properties changes through core considering lithological and grain-size changes. It is important to discuss this since you use later RPI to build the age model. Moreover, ARM is also very dependent on grain size at constant magnetic mineralogy.	We added a reference for details to section 4.4 where the more detailed discussion of the NRM/ARM ratio is now placed. See also later comments.
211	6	corrected
213-215	I would rephrase.	Split into two sentences "Meteoric cosmogenic ^{10}Be is produced in the atmosphere via nuclear reactions of cosmic ray particles with nuclei such as nitrogen and oxygen. ^{10}Be readily attaches to aerosols and dust, and

		with a short residence time of ~1 yr, is deposited on the Earth surface mainly via precipitation (Willenbring and von Blanckenburg, 2010).“
217	You could also mention here that you still need to normalized ^{10}Be if you want to obtain records of geomagnetic field strength variations. The two cited references use different approaches, i.e. ^{230}Th xs and flux. Most papers reconstructing past geomagnetic dipole moment from deep marine sediments use the ^9Be normalisation.	adapted to “variability in (normalised) ^{10}Be concentrations” added the “(normalised)” as the specific normalisation with ^9Be is mentioned further below we chose not to expand further on this here
216	strikethrough “to a first order”	deleted “to a first order”
218	These processes essentially complicate the identification of a ^{10}Be production signal (see also recent papers by Czymzik et al.).	adapted to “complicate ^{10}Be provenance, delivery and accumulation and hence the identification of a ^{10}Be production signal (e.g., Czymzik et al., 2015; Nilsson et al., 2011).”
224	es	changed accordingly
224	were	changed accordingly
225	strikethrough “down-core”	deleted “down-core”
225	strikethrough “the”	deleted “the”
226	strikethrough “in the Orakei sediment sequence, which cannot be dated with radiocarbon,”	deleted “in the Orakei sediment sequence, which cannot be dated with radiocarbon,”
231	measure	changed accordingly
232	using	changed accordingly
240	to increase the ^{10}Be resolution	changed accordingly
245-246	strikethrough “Authigenic ^9Be was not analysed for these ten samples and was considered negligible compared to the ^9Be spike mass following measurements at UoA and ANSTO (see above).”	not changed as we consider this statement crucial to justify why $^{10}\text{Be}/^9\text{Be}$ is not presented for the Lund/ETH samples
252	strikethrough “Orakei maar lake”	deleted “Orakei maar lake”
253-256	I agree with this, but you might synthesis this part.	Slightly shortened to “It is crucial to avoid circularity in tuning climate proxies based on assumed synchronicity, when the presence or absence of this possible synchronicity is actually an overarching study objective (Blaauw, 2012).”
256	“relative paleointensity of the Earth magnetic field strength” is strange. Rephrase.	changed to “relative intensity of the Earth magnetic field (RPI)”
257-258	strikethrough “unlike climate signals”	deleted “unlike climate signals”
259	You could add the new study by Hatfield et al. (2020)	reference to Hatfield et al., 2020 added
261-262	strikethrough “uses generalized dynamic programming, in which a complex problem is divided into smaller problems and their solutions are stored for later use. DTW”	deleted “uses generalized dynamic programming, in which a complex problem is divided into smaller

		problems and their solutions are stored for later use. DTW"
278-279	Identified by which proxy in your sediments? PMAG intensity or direction? 10Be? You should say that you applied the age from Lascu to the identified Laschamp interval in your sediments.	sentence extended to "the U/Th-age of the Laschamp Excursion as identified by paleomagnetic direction and intensity using the age of 41,100 ± 350 (1 σ) years BP from Lascu et al. (2016)"
280	RPI	changed accordingly
281	reference curve	deleted "reference curve"
281	with	deleted "with"
281	stack	added "stack"
281	of radiocarbon ages using	added "of radiocarbon ages using"
282	of radiocarbon ages	deleted "of radiocarbon ages"
282	conducted by	deleted "conducted by"
282	done by	added "done by"
298-299	highlighted "and substantial thickness (>30 cm) suggest that this layer is the Rotoehu tephra."	Not clear why this was highlighted?
338	These outliers were not incorporated in the age-model.	Not added, sentence from next comment moved here instead (slightly adapted to "Since the model recognises these outliers there was no need to remove them manually."). We like to make the difference clear between removing sample ages by the operator ("manually") vs. adding them to the Bacon input and the age model not passing through them at all and thus the model recognising them as outliers.
345-346	The Bacon age model recognises all 13 outliers and hence there was no need to remove them manually."	see comment above
356	The remaining six samples provided ages, and these results"	deleted "The remaining six samples provided ages, and these results"
356	of the remaining six samples	added "of the remaining six samples"
356	They are	changed to "They conform"
374-375	of magnetic field inclination and reduced intensity of the Earth magnetic field."	deleted "of magnetic field inclination and reduced intensity of the Earth magnetic field."
374	geomagnetic	added "geomagnetic"
382	Some of the Figure in Appendix C should appear in the main text and be discussed more thoroughly here. This is very important to allow the use of RPI record. An easy way is to discuss if your data respect the Tauxe's criteria. Also, did you removed part of your record due to identified problematic layers?	Problematic layers were removed as part of the construction of the event corrected depth scale removing most problematic paleomagnetic data as well as samples with MAD > 15 as stated in section 3.4.

		<p>We have now moved Figure C5 (and parts of its caption) to the main text (section 4.4) and extend the text by the following discussion regarding Tauxe's criteria:</p> <p>"The magnetic data partially fulfils the loosely defined criteria to assess the reliability of paleointensity data from sediments (Tauxe, 1993). It appears that magnetic concentration variations exceed one order of magnitude at times and the magnetic grain size is likely not confined to a very narrow range, but all other criteria are generally fulfilled.</p>
389	You should probably add other references presenting the Laschamp excursion from sediments or lava flows.	<p>changed to "Laschamp Excursion (e.g., Cassata et al., 2008; Ingham et al., 2017; Laj et al., 2014; Laj and Channell, 2015; Mochizuki et al., 2006; Roperch et al., 1988) dated to $41,400 \pm 350$ yr by Lascau et al. (2016)."</p>
393-394	could...	<p>changed to "could correspond to"</p>
394	Similarly to previous comment, they are numerous (although less numerous than for the Laschamp) papers dealing with the Blake from sediments, cite some of them. Why only referencing results from speleothems?	<p>extended to "Blake Excursion (Smith and Foster, 1969; Thouveny et al., 2004; Tric et al., 1991; Zhu et al., 1994) dated to $116,500 \pm 700$ to $112,000 \pm 1,900$ years by Osete et al. (2012)."</p>
404	Use the slope to calculate RPI. The slope method should give high correlation coefficients if demagnetisation steps look alike, this is good to reinforce trust on your RPI record.	<p>We choose not to apply the slope method as we already provide the information of different demagnetisation steps which all give very similar data. Following Valet and Meynadier (1998) it is mostly not significant which approach is used.</p>
406	e.g.	<p>added "e.g.,"</p>
408	add also references from lava flows. Some measurements exist from nearby lava flows. See introduction in my recent paper for exemples and a discussion of such low intensity during the Laschamp (10.1016/j.epsl.2020.116547).	<p>adapted to "the Laschamp Excursion as measured in sediments (e.g., Channell et al., 2009) as well as in lava flows from France (e.g., Laj et al., 2014; Roperch et al., 1988) and New Zealand (Cassata et al., 2008; Ingham et al., 2017; Mochizuki et al., 2006)"</p>
410	not removed by normalization procedure then...	<p>added ", which was not fully removed by the NRM/ARM normalisation procedure"</p>

412-413	Is any rock mag or environmental proxy correlate with the RPI? If yes, say it and discuss. If no, say it since it strengthen your interpretation.	sentence above extended to “NRM recording in a higher energy depositional environment (compare Fig. 2) and observed in a minor anti-correlation between dry bulk density (not shown) and RPI.”
416	Norwegian Greenland Sea Excursion? The RPI low corresponds to a slight shift in inclination. Is it reliable? If yes, say it and discuss. It would be the first NGS-Exc. identified in this area.	The following paragraph has been added: “The short-duration RPI trough around 52 m aligns with a very shallow inclination of +0.4° at 51.2 m (Fig. 6). The combination of inclination, low RPI and its depth (inferring an age of ca. 61,000 yr) suggests that this may be the Norwegian-Greenland Sea Excursion (Bleil and Gard, 1989; Løvlie, 1989). This probable reversal of the geomagnetic field was considered to be restricted to high latitudes accompanied by a global low in geomagnetic field intensity and has been confirmed in various northern high-latitude sites (Channell et al., 1997; Nowaczyk et al., 1994, 2003; Nowaczyk and Baumann, 1992; Nowaczyk and Frederichs, 1999; Simon et al., 2012; Xuan et al., 2012). However, low field strength and potentially excursions directions have also been interpreted as the Norwegian-Greenland Sea Excursion in Black Sea sediments (Liu et al., 2020; Nowaczyk et al., 2013) and the Western Equatorial Pacific (Lund et al., 2017). The occurrence of the Norwegian-Greenland Sea Excursion in the Orakei maar lake record would thus constitute its first observation this far south although additional samples are needed to confirm its occurrence in the Orakei record.”
422	+ ref	changed to “inverse record to the relative paleointensity time-series (Elsasser et al., 1956; Ménabréaz et al., 2011).”
423	strikethrough “may have”	deleted “may have”
423	contains	added “contains”
425	strikethrough “geochemistry”	deleted “geochemistry”

426	+ ref. Please be more specific!	extended by “as ^9Be is commonly released by weathering (Wittmann et al., 2015).”
432	Please look at fig. 3 from Simon et al., 2017 (10.1016/j.epsl.2016.11.052). In that paper, we identified two huge ^9Be peaks within tephra layers. More interestingly, an other tephra layer does not bear similar large ^9Be signature. Likely influenced by the nature of the eruption. In your study, there is only one ^9Be peak while you have other tephra layers, why? Any idea.	Interesting. Contrary to your study we find the large peak below the position of the Rotoehu tephra layer (quite sharp base of the tephra but some cracks extend material below its base). Note that no samples were taken in the tephra layer and the actual layer itself has been excluded from the event corrected depth scale too. In this record, the Rotoehu tephra layer is clearly the thickest and from a very large eruption which may explain why the same or similar ^9Be peaks have not been observed at other tephra layers.
437	Why so? Induced by very heterogenic lithologies and a sampling artefact? Normalising by ^9Be would have likely reduce these deviations (if of lithological origins).	Added the sentence “The reason for this discrepancy is unclear but may be due to very heterogenic lithologies or represent a sampling/analytical artefact.”
447	Bourlès et al., 1989	reference changed to Bourlès et al., 1989
460	The reason why the Be ratio likely does not work is because it does not respect the homogeneous mixing of both isotopes prior to scavenging.	added “as the ratio does not respect the homogeneous mixing of both isotopes prior to scavenging.”
462-464	Please consider rewriting this sentence. What is enhanced? “galactic cosmic-ray production of ^{10}Be ” looks weird.	Changed to “Elevated ^{10}Be deposition...”
473	Don't look further, this is explaining data deviation in some intervals.	see below
475-476	It seems very unlikely that you sediments could bear a 11 year solar modulation signal and not a large-scale event associated with the Laschamp.	We agree, we corrected this to “Again, we have no clear explanation of this discrepancy but it likely is due to heterogenic lithologies and/or represents a sampling/analytical artefact.”
479	Does it compare favorably with records from the Pupuke Lake by Nilsson et al. (2011)?	added “, as also observed at nearby Lake Pupuke (Nilsson et al., 2011),”
481	Most importantly I think is: does your record show coherent features with available ^{10}Be (Be ratio) records? Compare with records presented in Figs. 5 & 6 of Simon et al. (2016; 10.1002/2016JB013335).	we added “– a pattern not observed in the previous ^{10}Be records (Simon et al., 2016).”
483	What did you expected? directional deviation or RPI low? I guess the second which presents a long duration... say it.	added “as an RPI low, hence a peak in ^{10}Be ”

484	Is it significant? It looks to me the Be ratio show the same pattern.	revised to "Two small peaks in 10Be at 73.6 m and 74.6 m may correspond to the inferred level of the Blake Excursion". As we cannot be sure whether it is significant or not, we do not use the Blake Excursion age in the age model.
490	and marine sediments (e.g. Simon et al., 2020, EPSL).	added accordingly
497	strikethrough "s"	deleted "s"
497	These similarities	"This correlation" changed to "these similarities"
501	Why not the opposite? It looks more correct to me since you don't gain anything to sample PISO at 200 year and, at the opposite, you might smooth unreliable RPI feature doing the opposite (Orakei RPI sample to 1 ka). Considering DRM it looks more correct to me.	Thank you for this observation, this indeed also improves the fit. We have updated the DTW application with the Orakei RPI smoothed to match the 1000 yr resolution of PISO and hence updated the age model as well as all related text.
502	strikethrough "between the equivalent ages"	deleted "between the equivalent ages"
512	What is the age uncertainty of PISO?	No age uncertainty is given in Channell et al., 2009. We use ± 1000 years given the temporal resolution of PISO-1500.
514	Carcaillet is dealing with marine sediments, not lacustrine catchment problem.	reference deleted
528	You mentioned just above that the chronology for the lower part of the Orakei sequence is mainly guided by the "AVFAA" tephra... I hope your age model agrees with this age then. It seems very circular to me.	we clarified the above statement to "the "AVFaa" tephra provides an age for the chronology development close to the position of the possible Blake Excursion."
538	I don't get it.	This sentence refers to fig 9. The following description follows the mean line and ignores the related uncertainties presented in the figure. We conclude that this is too confusing to state and potentially self-exploratory.
551	strikethrough "VADM"	deleted "VADM"
575-577	PISO has a resolution of 1 ka because it's a global stack, not because of measurements resolution. The huge advantage is that PISO mainly extracts a dipole variations proxy, useful for global correlation. Orakei RPI can averages a theoretical average resolution of 168 years, but this is likely smoothed by magnetisation acquisition in the sediments.	changed to "Orakei RPI record has a theoretical average resolution one measurement per 168 years although it is likely smoothed by magnetisation acquisition in the sediments"

