

## Response to review on “A critical review and presentation of the complete, historic series of K-indices as determined at Norwegian Magnetic Observatories since 1939”

*Ingeborg Frøystein and Magnar G. Johnsen*

### Response to reviewer 2

**We thank the reviewer for reviewing our manuscript. Below we address their concerns, the comments are in black text and our responses are in red bold text.**

I find this work significant, since it offers not only a deep analysis of extensive time series of K, but also a thorough and detailed description from historical and analytical perspectives. Studies like this are valuable for dealing with series which result from concatenated measurements, something that is now widespread across numerous scientific fields dealing with long-term time series, like space weather and atmospheric and climate sciences, that have data which come from different instruments, analysts, or even changes in the measurement location.

I consider that this work can be accepted for publication in this journal with minor revisions. Below, I list some comments, followed by minor corrections I suggest regarding typographical or other minor issues.

Comments:

What is a "log-normal-esque" distribution? In particular, what does "esque" mean?

**We agree that the “log-normal-esque” is an unfamiliar term, and we have changed it into “log-normal like” in the revised text.**

In section 3.1 (Distributions during the transition from handscaling to automatic methods) I suggest complementing the analysis including a statistical index with % confidence of the comparison made in Figure 4. Maybe the Kolmogorov-Smirnov test, to test the distributions similarities, or any other of your preference.

This will complement what you mention in Line 281. There you say " We have seen that the TGO method provides a good match with the HS and FMI derived K values in the the old and new series for TRO and DOB (Fig. 4)."

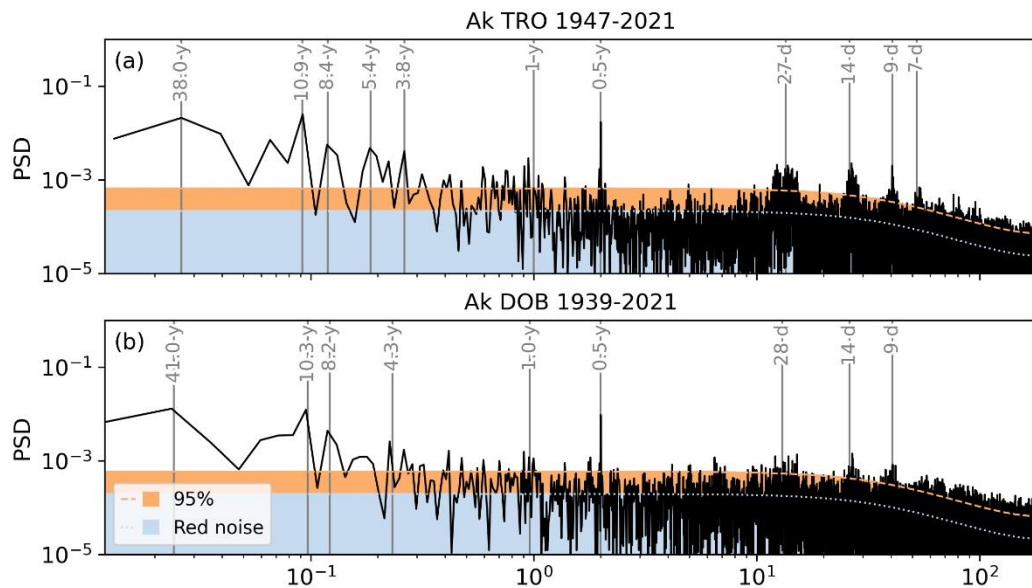
**We have performed a Pearson’s test on our results, since it is robust with large data sets, and find high correlations (TRO 0.978 and DOB 0.893, respectively). We have added this to the revised manuscript.**

In Section 5.1 (Power spectra of Daily Ak), a possibility if the series has data gaps, is to use Lomb-Scargle. This is only a suggestion.

**We have made some rudimentary attempts on this, and found that no extra information can be extracted by this approach. We therefore prefer to avoid this extra effort. Also, for the sake of comparison with other studies like the one by Nevanlinna et al (2011), it is preferable to use the same technique. The data gaps in the time series'' are typically short and few (see <https://flux.phys.uit.no/coverage/> if interested).**

In Figure 15, of the power spectrum, I would add the line showing the 95% confidence limit, or the red- or white-noise spectrum.

**We agree that a confidence line or noise limit could be useful. We add a line showing the red noise level and 95 percent confidence line to the spectra. In addition, we redo the spectra on log-log scale (instead of log-linear as in the originally submitted manuscript) to improve the readability of the spectra. We have uncertain, however, if it adds much new information to the manuscript. Apart from showing that the labeled periods are real signals. We are interested in the reviewer's opinion on this.**



**Figure R1: New power spectra including a red noise distribution and a 95 percent confidence line.**

Minor comments:

Line 4: In "In t his paper," there seems to be a space in the worth "this". Please, check.

**Yes, that is correct. This is fixed in the revised manuscript.**

Lines 8-9: In " It becomes clear that each method "both have strengths and weaknesses." I am not sure if it should be "It becomes clear that each method have both strengths and weaknesses." Please check.

**We agree and have rewritten the sentence as "It becomes clear that each method has both strengths and weaknesses".**

Line 58: " Halddetoppen, marked in white." Isn't it in green?

**This has been fixed in the revised text.**

Line 79-80: " (e.g. (Nevanlinna, 2004; Nevanlinna et al., 2011)))" I think it should be "(e.g. Nevanlinna, 2004; 80 Nevanlinna et al., 2011)". Please check.

**This is now corrected.**

Line 116: " (e.g. Sergeyeva et al. (2021); Nevanlinna and Häkkinen (2010))." I think it should be " (e.g. Sergeyeva et al., 2021; Nevanlinna and Häkkinen, 2010)." Please check.

**This is now corrected.**

Line 151: " The QDVs are are the monthly averages ..." delete one "are". It should be " The QDVs are the monthly averages ..."

**This is now fixed.**

Figure 4 captions: "TRO (19080, 1988-1991)" should be "TRO (1980, 1988-1991)"

**This is now fixed.**

Line 227: "Even though the there are shifts in the distributions, ..." It should be "Even though there are shifts in the distributions, ...". That is, delete "the".

**Correct, this is fixed in the revised text.**

Figure 6 caption: Check this figure caption. a) corresponds to TRO and b) to DOB.

**The caption is now corrected.**

Line 434: "For these dates the fitted QDC are clearly erroneous (not shown), with amplitudes up to 10000 nT.". Is 10000 nT the correct value? It seems too large. Please check.

**Yes, it is correct that the value was 10000 nT. This is why it was clearly erroneous. However, it has become clear that these QDCs are caused by a bug in the FMI fortran implementation. Following reviewer#1's suggestion, we have recalculated the FMI K-indices with the c language implementation instead. The results of our analysis are unchanged, but the cases where the QDC reaches values of 10000 nT and the FMI derived K-indices are too large are removed. Therefore, the discussion of these amplitudes is removed from the revised text.**

And "erronous" should be "erroneous".

**Yes, this is now corrected.**

Line 443: " where KFMI = 9}." Shouldn't it be " where KFMI = {9}." Please check.

**Correct, this is now fixed.**

Line 488: "AK" shoulfn't it be "Ak"?

**Yes, this is now corrected.**

Line 534-535: " (e.g. Mayaud (1980))." I think it should be "(e.g. Mayaud, 1980)." Please, check the instructions for authors.

**This is now corrected.**

Line 554: " (e.g. Menvielle et al. (2011))" I think it should be " (e.g. Menvielle et al., 2011)"

**This is now fixed.**

Line 559: "frequncy" should be "frequency"

**This is corrected.**

Line 561: "provided in (Table 4)." I think it should be "provided in Table 4."

**This is now corrected.**

Line 615: "have a strength" I think it should be "has a strength"

**Correct, this is now fixed.**