

## Reviewer Two – Dr. Ashcroft

This paper describes an extension of a recent rainfall dataset for the Island of Ireland, taking the existing 1850–2016 dataset back to 1711 using a recovered summary found at the Irish Meteorological Service Met Eireann. The study is one of those great data rescue stories that shows the value of this work. The data are well described, with limitations and caveats presented appropriately. I particularly liked the use of bootstrapping to get a range of estimates for the annual average rainfall used to construct the full series, and the visualisation of trends. It's a shame that the authors can't find more information about how the recovered summary was developed, but their use of independent and somewhat related sources to verify the extended record is well done. The information about other long-term rainfall data in and around Ireland in this paper will also surely be useful for future researchers. I recommend that the article be published subject to the consideration of the small suggestions below.

We thank Dr. Ashcroft for her supportive comments and thorough and thoughtful review. We share her frustrations about the lack of further information on the original source, but there is nothing more we can do about this, at least given current knowledge of the authors.

It would be good to include a map of Ireland, and perhaps the wider UK region, showing the locations mentioned in the text (including the independent sources) for those unfamiliar with Ireland.

This was also mentioned by Reviewer 1 and we will include a map of the British-Irish Isles with the location of the comparison stations and the locations of all areas mentioned in the paper on the map.

The study talks more about the rainfall variability in summer and winter than that of autumn and spring, despite the fact that the winter record is arguably the least reliable in the first few decades. Is there a reason for this? Are these key seasons for water security in Ireland, or seasons that show particular sensitivity to large-scale features?

Winter and summer are most interesting in term of extremes of flood and drought, while winter in particular is sensitive to large scale features. We also focus on them because they raise interesting questions about the reconstruction – in particular the early winter series and the wet mid-1700s in summer. The autumn and spring series show good reconstructions throughout the record and are less interesting in discussion terms than winter and summer.

Using bootstrapping to estimate the AAR (and uncertainty) seems like a good idea to me. However, a reader might think that the uncertainty shown in Figure 2 represents all of the associated uncertainties with the data, including quality issues of the very early observations. You discuss this towards the end of the paper, but it would be good to add a disclaimer about this in Section 2.1.2 (and in the caption to Figure 2) to clarify.

Good point, we can reword and flag as follows:

In section 2.1.2 we will clarify the sentence relating to the uncertainty bounds as follows:

Second, confidence bounds can be generated for the reconstructed series to convey the uncertainty in estimating the value of AAR.

In the caption of Figure 2 we will describe the bounds as follows:

The grey shading shows the uncertainty in the reconstruction from resampling of the baseline used to estimate AAR only.

Is there any reason why you used Spearman rank correlation over Pearson?

Simply that Spearman's makes no assumption about the distribution of the underlying data. We will clarify.

In section 2.2.1, you mention that the EWR series was used to calibrate the Jenkinson series. Can you elaborate on that? Did you do that, or Jenkinson et al?

This was done by Jenkinson et al (1979) and relates to one of the aspects that we have little information on how the calibration was executed. We will alter the text to ensure clarity that this was done by Jenkinson et al. as follows:

Jenkinson et al. used the EWR data to calibrate their series for Ireland, so there are obvious circularities.

You mention where you obtained the Hoofddorp dataset, but no other comparison series. Are they all from the associated publications? Perhaps specify this.

We thank the reviewer for this valuable insight. We will include the following statement in section 2.2 and update any download links for series used.

Unless otherwise stated all datasets were obtained from authors of the associated papers.

Section 2.3: did you do any quality control/outlier analysis on the data before homogenisation?

The lol series from 1850 -2015 was previously homogenised by Noone et al. (2016). Strictly speaking we do not homogenise the pre-1850 series, we do a basic quality control to check for evidence of breaks in the mean and variance but these are only to identify points of interest rather than correcting the series. Much of our discussion on winter in particular relates to a likely inhomogeneity in the data pre-1790, hence our focus on comparison with other long term records. We also highlight that a key direction for future work is to undertake reconstruction of the early series using regression methods to further examine this component of the record. We are not sure that such a long record, which at a minimum contains changes in recording practice, gauge design and contributing sources, can be called homogenous in a strict sense. We can only establish confidence in parts of the record, which we attempt to do in the paper.

Why did you use SNHT and the Pettitt tests for homogeneity assessment? Presumably it's because they don't need neighbouring stations, but it would be worth adding a sentence explaining your choice of these methods over more recent approaches such as RHtestV4.

Yes, these are single series tests and hence their appeal in this case given the lack of possibilities for relative homogenisation. We will add some justification for our choice of these methods over others.

It's great that the original data source is provided with the paper, but will the final digitised dataset also be made available?

Yes, if the paper is accepted we will provide a link to the data for download, this will be held on Met Eireann's website. The link to the data will be provided in the Data Availability note with the paper.

A hopeful question: have you looked into whether Jenkinson or their colleagues are still alive?

We have. The obituary of Prof. Arthur Jenkinson, which outlines his considerable achievements, was published in Weather in December 2006. <http://onlinelibrary.wiley.com/doi/10.1256/wea.171.04/pdf>

As an aside: this work, while suitable for Climate of the Past, would also have been suitable for data-focussed publications such as Geoscience Data Journal or Earth System Science Data. This would have enabled you to attach a DOI to the Jenkinson record (and your dataset) and make it more prominent, rather than including it as an attachment.

Both journals were considered as a possible outlet for publication. We see the merits of attaching a DOI but concluded that the paper and hence the dataset would reach a wider audience and influence discussion more here.

In section 3.3.1 you mention that the post 1950 period is the wettest for winter, but in the discussion talk about the impact that increasing availability of observations has on the trend. Do you think that this post-1950 wet signal might also be an indicator of increasing data coverage?

In short, no – the number of contributing stations is static from 1850 to present.

Table 4: Two decimal places in the correlations is probably enough

We will revise.

Table 5 and 6: One caption mentions that these descriptions are 'derived from', while the other says 'taken from' Rutty's diary. Were they compiled in different ways?

No, both were taken directly from the Rutty diary. We will fix the wording to be consistent in both captions.

Figures 4 to 9: You might want to try some different colour schemes for these spaghetti type plots that are colour-blind appropriate (try <http://colorbrewer2.org/>).

We will do our best here, but this is going to be a challenge with so many comparison series. We are in full agreement that figures should be produced with such considerations in mind. One of the challenges is that we maintain a consistent colour for each series across all plots and will need to investigate possibilities. Adding different line styles (dashed/dotted) will obscure the purpose of the plots which is to show how the lol series (the thick black line in the named figures) compares with other series.

The lol curve should ideally be on top of the other too, I think that would improve readability.

This was our intention. We will reproduce all plots accordingly.

Finally, it would be great if you could spell out the acronyms used in the legend, at least in the first caption.

Thanks for highlighting this issue, the acronyms are already provided in Table 3 however we can include them in the first caption or make reference to the table.

*Technical corrections*

Abstract, line 10: I'd add the word 'boreal' before 'spring, summer and autumn', for southern hemisphere readers.

We will include in revisions

Abstract, line 14: add the word 'volcanic' before eruption

We will include in revisions

Page 3, line 8: do you have a reference about the lost diaries of William and Sam Molyneux?

Yes, it is already included and the reference will be made clearer in our revision.

Page 4, line 11: I'd add the word 'precipitation' before 'record'.

We will include in revisions

Page 4, line 21: I'd add 'community standard' or something similar ahead of the mention of HOMER, to signify its standing in the homogenisation field

We will include in revisions

Page 11, line 17: I feel like a word is missing at the start of this sentence. Maybe 'To derive the lol\_1711 series MEAN'?

We will include in revisions

Page 11, line 23: you talk about the median and mean of the series in the same sentence, is that accurate?

Yes, we used the median series from resampling to examine for changes in the mean.

Page 12, line 28: I'd remove the 'For' at the start of this sentence

We will include in revisions

Page 17, line 35: Maybe add 'around that time' to the end of this sentence, and include a reference to George J Symons' network if you have one

We will include in revisions

Page 19, line 2: remove 'multiple' or 'different'

We will include in revisions

Page 19, line 5: add 'previously' before 'available'

We will include in revisions

Page 19, line 26: 'remain', rather than 'remains'

We will include in revisions