Interactive comment on "seNorge_2018, daily precipitation and temperature datasets over Norway" *by* Cristian Lussana et al.

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Received and published: 15 July 2019

Dear Reviewer,

We would like to thank you for the comments that will help us in improving the quality and readability of our manuscript. We are deeply grateful for that.

Point-by-point answers to the comments follow. The reviewer's letter is reported in Italic.

The authors present a new version of Norwegian national daily temperature and precipitation interpolated daily fields from the latter half of the 20thCentury to date. The data product shall, undoubtedly, constitute a valuable national resource for decision makers within Norway and the broader Nordic region. To build confidence in the product peer

review is certainly a necessary condition and thus I see eventual publication as important. In reviewing the discussion paper there are a number of issues thatI believe the authors must address prior to acceptance.

Firstly, the paper structure requires significant work. The introduction mixes methods and discussion. The data section has a significant amount of methods in it and does not clearly denote the various observational / model sources used. Presently there is very limited description / analysis of the derived spatial fields and characterisation which would be important for users. Finally, there is no discussion section. My suggestion would be to substantively restructure the paper for readability into sections that go:

- *introduction,*
- *data,*
- *methods,*
- *product analysis(including showing some example applications),*
- *verification,*
- *discussion and*
- *conclusion.*

Then significant effort is required to shuffle content around to fit that structure, ensuring that relevant text ends up in the appropriate section.Given the need to restructure the paper I shall not point out minor typographical issues in the expectation that they may not persist under any revised structure.A number of other minor points should also, naturally, be resolved by undertaking such a restructure so I do not make these further here.Such a restructuring to my view is essential prior to acceptance.

Reply: we will modify the structure of the paper as suggested.

In terms of the methods there is a significant issue in offsetting Tx/Tn from Tg by 12 hours. If Tg is the mean of 06 to 06 but Tx and Tn are maximum and minimum between 18 and 18 it is physically impossible to robustly assess consistency. This has been shown in e.g. GHCND and can follow from several toy examples you may wish to play with whereby for example a very strong warm front passes through at midnight which would be seen in one day for Tx and Tn but another day for Tg and may lead to an over-propensity of flagging good data as dubious accordingly.This propensity will vary seasonally (higher in winter half year) and geographically (higher further north/ inland) where both diurnal structure decreases and synoptic variability increases.Significant justification would be required for maintaining the use of days offset by 12 hours for the three temperature elements and my strong recommendation would be to align these to the same time which would greatly simplify the analysis and assure better geophysical consistency with fewer false flags.It would also aid usability considerably to align the times for all 4 elements.So, whether you choose 06 to 06, 18 to 18 or some other times I would very strongly urge aligning the times used to define the day here which would enable greater usability and improved cross-checking.

Reply: We will clarify in the text the reasons why we have to use two different definitions of day. As stated at page 4 "TG and RR share the same day-definition so as to better serve hydrological applications, while for historical reasons TX and TN have a different day definition." What we mean by this statement is that the historical measurements back to 1957 have been performed with different offsets. Since our gridded datasets are based on observations, we are forced to use the same day-definition as the observed data. We agree with the reviewer that the ideal situation would be to have the 4 variables aligned on the same day definition. Due to the lack of data, this is not possible. On the one hand, this lack of consistency may constitute a problem for some users. On the other hand, our experience is that TX, TN, RR and TG do provide useful information in numerous applications both for monitoring the ongoing weather and for research. As an example, we may mention two applications that are particularly important for the Norwegian society: (1) hydrological numerical models op-

erated by the national civil protection authorities make profitable use of seNorge_2018 TG and RR; (2) TX and TN can be used to compute e.g., widely used climate indices (http://surfobs.climate.copernicus.eu/userguidance/indicesdictionary.php).

The authors make a throw away remark at the end of page 2 regarding suitability for long-term trend characterisation which seems to rely upon findings of a prior analysis. It is unclear whether the findings would persist into the present dataset in the Norwegian context. It is necessary, in my view, to show this and the suggested change in overall paper structure should facilitate this.

Reply: we will clarify this important point in the revised paper. The users must be aware that variations in the observational network do have an impact on the gridded datasets.

In the methods Xi is used twice, one should be Xj. Then the same overhat nomenclature is used to denote both a point estimate and a spatial scale. This is very confusing to the reader in what is already a very statistically dense paper. Assuming that the average ESSD paper is not a statistician it would be very useful to simplify where possible the discussion of methods and certainly to use unique notations when talking about distinct things so as to not confuse unnecessarily your readers. Overall, a reduction in the number of equations would likely serve the ESSD readership.

Reply: We will revise the description of the method as suggested by the reviewer. It is worth remarking that the mathematical notation adopted is based on Ide et al. (1997), that is widely used in data assimilation (DA) and described in several books (e.g., Kalnay 2003). By adopting those standards, readers that are familiar with DA (not necessarily statisticians) will recognize the equations used and, at the same time, those readers that are not familiar with DA can rely on the vast literature on this topic.

References: Ide, K., Courtier, P., Ghil, M. and Lorenc, A.C., 1997. Unified Notation for Data Assimilation: Operational, Sequential and Variational (Special Issue Data Assimilation in Meteorology and Oceanography: Theory and Practice). Journal of the Meteorological Society of Japan. Ser. II, 75(1B), pp.181-189.

Kalnay, E., 2003. Atmospheric modeling, data assimilation and predictability. Cambridge university press.

The right hand panel of figure 6 uses a non-intuitive colour scale whereby wetter values are red and drier values blue(as I understand this panel at least). If I am correct it would be advisable to flip the colour bar so that the colours intuitively map to wet / dry rather than doing so counter-intuitively. If I am wrong then an improved explanation is required.

Reply: we will modify the figure as suggested.