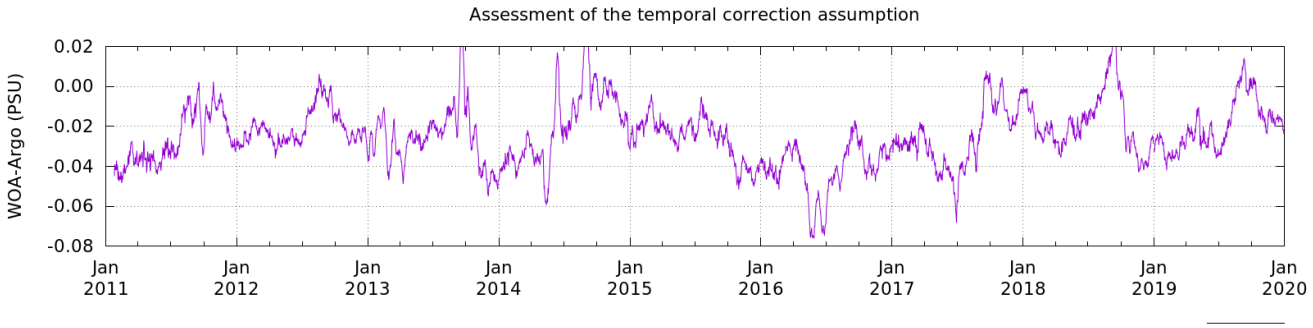
Answers to Reviewer #1:

This paper describes a global sea surface salinity product produced by the Barcelona Center. It discusses the algorithms by which the SSS values are produced from raw brightness temperature. It then goes on to do a number of comparisons to Argo data and other SSS products, compute singularity exponents, display power spectra, etc. The paper is thorough and appears complete. Thus it is very much worth publishing, largely as is. I have made a few comments of an editorial nature below.

Thank you very much for your comments.

My only substantive argument with their methods is noted on line 169. It is not clear how they used the assumption of constant global average SSS, or whether it is even a very good assumption.

We have checked this assumption by comparing the global average of a constant salinity reference (World Ocean Atlas 2013) against collocated Argo salinity measurements.
The following figure shows the difference between WOA 13 and Argo salinity measurements:



As observed in the figure, the assumption is valid up to hundredths of psu.
We have included this Panel in Figure 1 and we have modified the text accordingly.

The authors need to go through all of the references to make sure they are correct and complete, including links. Many of them provide both a DOI link and one directly to the publisher (e.g. Nieves et al). I would recommend deleting the direct links to the publisher, but that is a decision for the editors of ESSD. All references should include a DOI if available, or a URL for technical reports available online. Again, this should be according to the editorial policies of ESSD.

We have reviewed all the references. They, now, only contain their doi (or URL for technical reports) when they are available.

Line 62. The link given here may not lead to the correct place. It gets cut off at the line break. Ditto lines 79-80, 267-269, 772-773, etc. The authors need to check all links in this paper.

We have edited the URL long links provided to make them more legible and make sure they lead to the correct place.

Lines 84-85. Is this the same SST as described above?

The auxiliary SST provided by ECMWF is based on SST OSTIA but it has been collocated in time and space with SMOS measurements.

Lines 82-87. The references given here are not accessible, so I cannot check on the source of the ancillary data to see if it is properly described.
The permissions to distribute this data are restricted to the Expert Support Laboratory teams and the private companies working on the mission. The European Space Agency (and also the European Center for Medium Range Weather Forecasts (ECMWF)) are the entities that manage this.
However this link:
https://smos-diss.eo.esa.int/oads/access/collection/AUX_Dynamic_Open
allows accessing to the data by searching SM_OPER_AUX_ECMWF* in the search box.

Lines 117-118. "...by subtracting each individual s_nˆraw from the corresponding..."?
We have modified the text as follows:
Lines 118-119:
.. by subtracting the corresponding SMOS-based climatology $s^c(\gamma)$ from each individual $s_n^{raw}(\gamma)$….

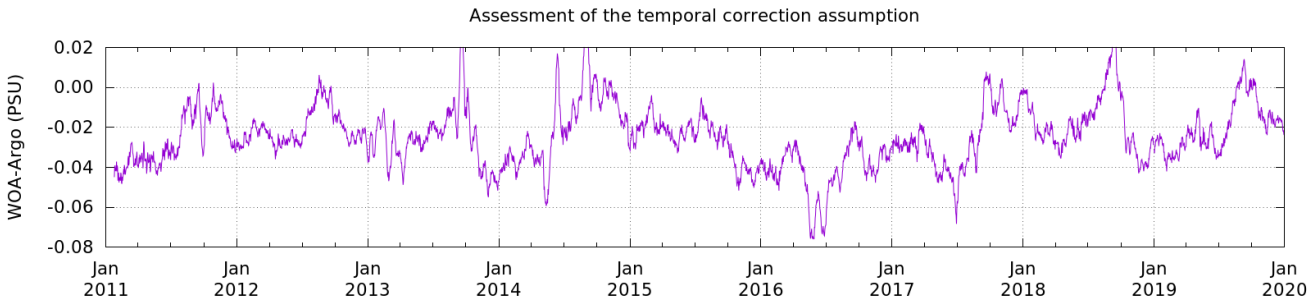
Line 138. Practical salinity is only defined in the range of [2 42]. See Unesco (1981). The Practical Salinity Scale 1978 and the International Equation of State of Seawater 1980. Tech. Pap. Mar. Sci., 36.
The reviewer is right. We have removed psu from that line. Although psu is defined in the range of [2:42], due to the radiometric errors of the instrument, the retrieved salinity from SMOS TBs could reach values that are out of this interval. Here, we extend the interval of "valid" salinity retrievals, because there are still some corrections in the methodology that have to be applied after this step that could lead to valid retrievals.

Lines 144-145. These skewness and kurtosis criteria are not discussed. What is their purpose? Why the values given (1 and 2)?
This is discussed in more detail in Olmedo et al 2017. The idea is that this approach is less accurate under non-Gaussian conditions. Skewness with absolute values larger than 1 are very skewed distributions. In this case, the definition of a

central estimator of the distribution, which is required for mitigating systematic biases, is less accurate. The same happens with the kurtosis. Kurtosis lower than 2 correspond to very flat distributions, where the definition of a central estimator is less accurate. We have added the following discussion in the text:
Lines 147-153:
These filtering criteria are the same as the ones introduced in (Olmedo et al., 2017). The only difference is that now the criterion corresponding to the kurtosis is more relaxed: In (Olmedo et al., 2017) the set $\{s_n^{raw}(\gamma)\}$ was considered not valid and thus discarded out when the kurtosis of the distribution were larger than 4. Now we filter only platykurtotic distributions but not leptokurtotic ones. Regarding the impact of the filtering criterion corresponding to the skewness, this is the same as the one proposed in Olmedo et al. (2017). This criterion aims at discarding ocean regions affected by RFI contamination. Although some geophysical events tend to be not symmetric and fresh, as continental discharge and ice melting, and this leads to negative skewed salinity distributions, the typical skewness in these cases is around -0.5. The skewness values lower than -1 correspond typically to distributions that are affected by non geophysical phenomenon. However, we continue revisiting this criterion and probably in the next version of the product we will analyze the impact of not including this criterion of the skewness.

Line 148. Where does the 25 come from?
We have clarified this in the text:
Lines 157-160:
We discard specific salinity retrievals $s_n^{raw}(\gamma)$ when the corresponding SMOS debiased salinity anomaly ($s_n'(\gamma)$) is larger than σ_{γ}. Since we want to keep the geophysical variability, we include a threshold defined by $5\sigma_{\varphi,\lambda}$ being $\sigma^2_{\varphi,\lambda}$ the expected geophysical variance of the salinity at the gridpoint (φ,λ). This is new with respect to the criterion proposed in (Olmedo et al., 2017). We discard the salinity retrievals that satisfy:

Line 169. This is problematic. it is an assumption the authors are making, but it is not clear it is true. Can they please provide a reference or some other justification.
We have included the following plot in Figure 1:



The plot represents the mean difference between a constant salinity field, the annual climatology WOA13 and the salinity provided by Argo floats. As observed in the figure, the hypothesis is confirmed up to hundredths of psu.
We have included this in the text:
Lines 188-191:
We use the constant annual reference WOA13 to assess this assumption. The top plot in Figure A1 shows the temporal evolution of the mean difference between the salinity field provided by WOA13 and the collocated uppermost salinity measurements provided by Argo floats. The results show that this hypothesis is true up to hundreds of psu.

Figure A1. It's interesting that the difference decreases over time. Can the authors interpret this?
SMOS mission is actually an old mission. Some drifts have been detected at the level of brightness temperature measurements. There is no reference to this. This is actually a current topic in the internal meetings of the SMOS Payload Calibration Meetings.

Line 232. "spatial radio"?
We have changed:
"spatial radio" by "smoothing windows of radius"

Lines 291-292. Repeats from lines 205-210.

We have removed this sentence

Line 329. Missing ")"
Corrected

Line 358. "power-law" behaviour?
Corrected

Line 434. Repeats from line 415. Delete.
Deleted

Lines 456-459. "Figure A8..." This information is in the caption and does not need

to be repeated.
Deleted.

Line 497. Not remembering the earlier section where this is described... H_0 is the black curve in Fig. A12 and H-bar is the white one? Put this in the caption.
Yes. The reviewer is right. Thanks for notice! We have corrected the text and added the notation in the caption of the figure.

Line 690. This reference is undecipherable. Provide a URL. Ditto the Sabater and de Rosnay reference.
Corrected.

Section 5. It was not obvious how to access the data from the emodnet or cmems sites. Visualizations were available, but not the data themselves.
True. Both links correspond to visualization of the data. The access to the data is throughout the BEC SFTP service. Section 5 has been modified accordingly to make it clearer.