

Earth Syst. Sci. Data Discuss., referee comment RC1
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Comment on essd-2021-334

Anonymous Referee #1

Referee comment on "Improved BEC SMOS Arctic Sea Surface Salinity product v3.1" by
Justino Martínez et al., Earth Syst. Sci. Data Discuss.,
<https://doi.org/10.5194/essd-2021-334-RC1>, 2021

This manuscript describes the procedures used to create and validate V3.1 of the BEC Arctic surface salinity product: Arctic+ SMOS SSS v3.1. The description is reasonably complete and well written. The following comments are offered in the spirit of improving the description:

- Lines 28-29: "L-band frequency is the region of the electromagnetic spectrum offering the most sensitivity to salinity variations". It is optimum from a remote sensing perspective (protected spectrum and reasonable sensitivity), but the maximum sensitivity occurs at lower frequency (500-900 MHz depending on temperature, incidence angle and polarization).
- Line 51: "available [with] prior registration" ?
- Line 53: "L1B product contains TB Fourier components": It is not clear in the text whether the starting point is "visibilities" or an image. If starting from the Fourier components, details of the inversion to an image of TB need to be included.

- Line 67: A better reference (better than 2018) for corrections to the Meissner-Wentz model for the dielectric constant of sea water is: T. Meissner and F. J. Wentz, "The emissivity of the ocean surface between 6 and 90 GHz over a large range of wind speeds and Earth incidence angles," IEEE Trans. Geosci. Remote Sens., vol. 50, no. 8, pp. 3004–3026, Aug. 2012.
- Line 117: Why this choice? For example, how does this compare with the model of Yin et al: "Roughness and foam signature on SMOS-MIRAS brightness temperatures: A semitheoretical approach," Remote Sens. Environ., vol. 180, pp. 221–233, Jul. 2016.
- Line 121: "first Stokes parameter ($I = TBx + TBy$), parameter used to perform the TB inversion". Details needed. For example, how is the roughness correction (which depends on polarization) made?
- Line 152: Typo: "starting from"
- Line 183: See comment 4 above.

- Line 184: "conductivity equation Debye (1970)" The expression attributed to Debye is for the resonance of the water molecule, not conductivity.
- Lines 184-185: "Therefore, we have used the MW model to derive the high latitudes SSS." This certainly is reasonable, but perhaps it should be noted that the MW model has been shown to result in an SST-dependent bias in the retrieved SSS.
- Line 227: Typo: measured TB
- Line 242-243: "Assuming ... high radiometric error ..." There might be other sources of error in addition to noise in the radiometer.
- Line 301-302: "It should be noticed the greater coverage and detail of the gradients of Arctic+ v3.1 product to that obtained from the previous BEC Arctic v2.0 product (fig. 5 a-c and 6)." Wording could be improved.
- Line 318-319: "However, a comparison with punctual measurements can not evaluate the improved data coverage neither spatial resolution." Something is missing.

- Line 365: Typo: extra series: should be "to have a long enough series of ..."
- Line 378: "applied the CTC". Are there limits on the amount of correlation permitted and how it affects the conclusion? This could be important since V2 and V3 are so closely related.
- Line 443-445: "As the method extracts the expected natural variability from the common information between the compared products, it means that the fraction of information in the Arctic+ v3.1 product is the largest of the three products." Has this statement about "information" been demonstrated? Perhaps a reference is needed here.
- Line 449: "at smaller scales than SMAP and BEC v2.0". With the exception of Fig 13a, this does not appear to be true for SMAP.