Review report of the article

Weekly-gridded Aquarius L-band radiometer/scatterometer observations and salinity retrievals over the polar regions: applications for cryospheric studies

By Brucker et al.

This is an interesting article presenting a new database reconstructed from the Aquarius L-band radiometer/scatterometer observations, and made available on the web. This database will certainly be useful for scientific applications for the polar region analysis, since in the case of the Aquarius research mission, the data are not converted as much into geophysical products as for other operational satellite missions. As example, the Aquarius data are not gridded (swath track), some are contaminated by Radio Frequency Interferences. The proposed processing, specifically designed for Polar regions, fully justifies this database to make easier and efficient the analysis of these data for the scientific community, in particular for the cryospheric applications.

This article is divided into two parts: 1) the description of the database; 2) and some observations of each extracted parameter variations and behaviors over the Greenland and the Antarctic ice sheets, as well as over polar oceans (sea ice cover and salinity).

This makes this article relatively long. Maybe, to split it into two articles could render its reading easier? This is a suggestion only. If the authors keep the presentation as it, please clearly separate the two parts, in order to allow the reader only interested by the second part, to skip the first part (i.e. by including a short summary at the database at the beginning of the second part, with a recall of the abbreviations, in Table 3 for example).

In general, some more basic physical explanations would be useful to better follow the observed signal variations.

In selected figures, to add the standard deviation of the signal will illustrate the observed variability recorded in the database.

The publication of this paper is thus well justified with minor changes.

Below some specific comments (P=page; L=line)

The Phased Array type L-band Synthetic Aperture Radar (PALSAR) sensor on the Japan's Advanced Land Observing Satellite (ALOS) should be mentioned in the introduction.

P5923 L25 : penetration depth: several hundreds of meters, yes certainly in dry snow conditions, but thousands of meters ??

P5924 L9 … "three L-band radiometers…" : we understand later that there are 3 beams at respectively 3 incidence angles. Is there 3 different antennas? Better introduce this aspect here (later in the text, homogenize the terms: radiometer vs beam?).

P5924 L12 The scatterometer frequency is at 1.26 GHz: why not 1.4 GHz? (give a reference here)

P5925 L3 …" temporal scale … appropriate for studying the Earth's polar regions." The choice of averaging the data over 7 days is more a technical than a scientific choice. Indeed, as described later in the second part, the authors outline several times that some events that modify the signal (the brightness temperature TB and/or the Radar cross section NRCS) occur at a lower temporal scale than at a weekly scale: - melt/refreeze event at Summit , Greenland; - surface roughness variation (due to daily wind-induced variation); - sea ice cover evolution… The weekly scale is certainly very interesting for a lot of studies (in particular for long term inter-annual variations), but this could be a limitation for some particular cases. Thus to introduce this aspect more clearly as a technical constrain rather than as a scientific choice (the later not yet clearly demonstrated), and recall this limitation in the conclusion.

P5926 L 7 beam vs radiometer?

P5926 L13 " The higher Aquarius incidence angle…" not lower?

P5927 L12 what means "stability" here?

P5927 L13 : RFI : give a reference here. How is defined the RFI flag?

P5928 L15 What about the atmospheric emission and transmissivity? And the radiation from celestial (galactic) sources? (which can be strong and spatially variable at L-band, LeVine D. M. and S. Abraham (2004), "Galactic noise and passive microwave remote sensing from space at L-Band," *IEEE Trans Antennas and Propagation,* vol. 42, pp. 119-129). It is not clear if the average weekly TBs are corrected for these atmospheric contributions?

P5929 L1 It appears that the incidence angle and the orbit are also 2 other important characteristics of the product?

P5931 Table 3 : I suggest to recall the meanings of the abbreviations in this Table 3 (NFP, ICEF, NRCF); to define the beams; SSS is a combined orbit product? Give the source of the SSS data. Even well described in the text, this will help the reader to synthetize clearly all the parameters of the proposed database in this Table.

P5932 L11 Why differences in orbits are seen? (basic explanation here)

P5932 L14 The effect of snow layering effect (variation of density layer, i.e. refractive index) is also very important in the Tb signal. See below.

P5932 L20 "first time" ? : SMOS is now also providing L-Band data over GIS and AIS ?

P5933 Add (GIS) and later (AIS) in the title section

P5933 L20 The lowest Tb : H or V? When?

P5935 Section AIS : Do not discuss the mixed contaminated pixels (continent and ocean), not really interesting for a general overview of the signal variation. Stay focus on the ocean in one part, and on the continental zone in the other part. For the continental zone, the melting zones at low elevation have a very different behavior compared to the central dry zone. In the wet zone, the signal is dominated by the emissivity variations caused by the surface melting and then by surface ice layers. In dry zone, it is now known that the density profile plays an important role (in particular at H pol) and could explain the very low TB measured. Also variations in density between layers could explain the observed differences between H and V polarizations depending of the incidence angle.
I suggest to add TB values at different angles in the Figure 7 (TB at Dome C). This will also promote the interesting adding values of the datasets at different incidence angles provided in the proposed Aquarius database.

P5937 Section Sea Ice. Include here some basic statements : sea ice increase leads to increase emissivity (decrease dielectric constant) and thus increase TB …

P5937 L28 “noise” is maybe not the appropriate term here: “variability”?

P5939 Ice sheet NRCS signal: better precise the direction of the variation : NRCS increase or decrease ?

P5939 L27 Add “not shown” for the correlation discussed here.

P5940 Sea ice effect on NRCS variation? Dielectric variation of the brine?...

P5940 TB variation with frozen soil ? Significant decrease of dielectric constant of the frozen soil leading to increase emissivity and thus to increase TB…add the recent Mironov et al analysis on frozen soil. Also Mironov clearly shows strong differences between the TB variations as a function of incidence angle.
Mironov V.L., K. V. Muzalevskiy, and I. V. Savin (2013), Retrieving Temperature Gradient in Frozen Active Layer of Arctic Tundra Soils From Radiothermal Observations in L-Band—Theoretical Modeling, *IEEE J. of Topics in Applied Observations and Remote Sensing*, 6(3), 1781-1785.

P5941 SSS analysis. It is not clear why the SSS data are not flagged to avoid pixels with high ICEF values?