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The Cryosphere Discussions

Interactive comment on "The EUMETSAT sea ice climate record" *by* R. T. Tonboe et al.

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The manuscript presents a harmonized Arctic and Antarctic sea ice concentration data set based on passive microwave SMMR, SSM/I and SSMIS satellite observations from 1978 to 2014, spanning observations from 11 different instruments. The new things of this data set are the atmospheric correction and uncertainties given for each pixel individually, based on a careful error estimation. The various error components are considered separately and an overall error model is forwarded in Fig.Âă3.

General comments:

It is an elegant approach to use dynamic tie points to compensate for sensor drift and inter-sensor calibration. Were time series of the tie points also investigated? Could a seasonal cycle, drift or jumps with sensor change be observed? P(age)4L(ine)4 SSMIS data: While the SSM/I data from RSS comprise corrections for geo-location,

sensor calibration and inter-sensor calibration, this is not the case for the SSMIS data. Were similar corrections applied to the SSMIS data? Is the dynamic tie points method considered to compensate automatically these errors?

The large number of 14 subsections of Section 2 could be more structured for easy understanding. I would consider Secs. 2.6 to 2.10 as subsections of 2.5 Uncertainties. According to the short Sec. 2.5 and Eq. (1) I would expect two subsections, one on the tie point uncertainty and one on the representativeness error, with perhaps more subsections. From the sentence in Sec 2.5 'The tie point uncertainty ε_tie-point , including residual atmospheric noise, sensor noise and ice surface emissivity variability, is derived from measurements as the first component of uncertainty' I would expect the section on the first component to treat exactly these errors in exactly this order. However, the heading of 2.6 is 'First component: instrument noise, algorithm and tie point uncertainties', which is different. If the error components are not treated in the mentioned order, then the relation between the different error contributions should be made clear. I do not find algorithm noise treated in Sec. 2.6 which is promised in the heading. Rather, is seems to be treated in Sec. 2.10. Moreover, Secs. 2.12 to 2.14 deal with the correction of known errors which could be a common heading for these three.

Sec. 1.5 Ice charts:

It is very good to use ice chart as independent source. The data source should be indicated. Are those data freely available? Reference? Are they provided in the same polar stereographic grid as the SSM/I data? Is there any conversion required, e.g. from region shapes to pixel data? Some of the ice chart errors can be quantified: If the charts give ice concentrations in 10% steps, this corresponds to adding quantization noise equally distributed in the IC interval [0,10]. It has a standard deviation of 10*sqrt(1/12) = 2.9% IC. Moreover, weekly ice charts will contain as error the development of the ice within one week. This can be estimated considering ice chart differences of successive weeks.

Sec. 2.7 Geo-location error: A reference to Hollinger et al. (1990) is not suitable for SSMIS geolocation which was not launched at the time of publication. More suitable would e.g. be Poe et al., Geolocation Error Analysis of the Special Sensor Microwave Imager/Sounder, IEEE TGRS, VOL. 46, NO. 4, APRIL 2008. They find a geolocation error 'in excess of 20–30 km' which cannot be considered small compared to the footprint size. Was the SSMIS L2B NRT data version you are using (P4L4) ever corrected for such errors?

It would be helpful for comparison with other publications (e.g. with Spreen et al. 2008: . J. Geophys. Res 113, C02S03, doi:10.1029/2005JC003384) to give, in addition to the time series of bias and stddev in Figs. 4-7, the average values for these quantities.

It could be interesting to show in Figs. 8 and 9 also the open water bias for the overlap period. Data Levels 3 and 4 at the beginning of Sec. 2.11 should be briefly explained.

As TCD does no more any typesetting, it would be nice if the manuscript would obey simple rules of typesetting: numbered quantities are denoted with capital words like Figure 1, Table 3, etc., and numbers up to ten are written as words.

Minor points:

Use for the same quantity always the same symbol. Wind is sometime u*, sometimes U* . Ice concentration sometime ic, sometimes IC. Does the * symbol in Eq. (1) at u* have a meaning?

P3L14 'There is SMMR data only every second day': No, each day. Only, because of the narrow swath, full coverage requires data accumulation over two days. Similar P15 L11.

P6L13 ' The representation of atmospheric liquid water column in the NWP data is not suitable to use for brightness temperature correction.': Give reason: because of the spatial and temporal variability of cloud, which is higher than the model grid cell size and model time step size.

P7L1 '. The fluctuations due to atmospheric and surface emission are systematic.': Meaning unclear.

P8 L7: explain OSI SAF

P9L23 'spatial ice concentration standard deviation': meaning of 'spatial' unclear. Omit?

P11L14: meaning of 'logically' unclear. Omit?

P11L30 to P12L3: Necesscity of Eq.(6), Boxcar and Heaviside function unclear. For the subsequent text, it is sufficient to define the truncated ice concentration alpha by P12L4-6.

P13 L15 weighting function Eq. (12): In principle, the function should reflect the antenna pattern. Then it would have to be a Gaussian. Linear weights taken here as simple approximation.

P14L22 and P15L2: equation 6 -> Eq. (13)

P15L18 Latter -> later

P19L22 '(Q3)' not needed, never used.

P20L1-5: There is an extended literature on detecting onset and end of melt season with sophisticated methods. It is ok to use a simple method here, but it should be mentioned that more exist, e.g. by citing the recent article by Close et al.: Regional dependence in the timing of onset of rapid decline in Arctic sea ice DOI: 10.1002/2015JC011187. See also literature cited there.

P21L5: trend in number of open water days shown in figure 13 → Figure 12.

P21 L13 . As for the Arctic the open water days is calculated.. → As for the Arctic, the open water days are calculated.

P21 L 29 the pole → Antarctica or the South Pole

P23 L16 ‘The next update’: insert ‘of the ESICR data set’

P23 L9 ‘minor differences’: why should there be any differences between the two algorithms? Specify.

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