

Interactive comment on “Version 2 of the EUMETSAT OSI SAF and ESA CCI Sea Ice Concentration Climate Data Records” by Thomas Lavergne et al.

Anonymous Referee #2

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Review of Version 2 of the EUMETSAT OSI SAF and ESA CCI Sea Ice Concentration Climate Data Records, by Lavergne et al. (2018).

This paper gives a thorough, informative and detailed description of three important new climate data records of sea ice concentration. The science in the paper is comprehensive. I therefore only have suggestions for minor improvements (though there are quite a few) - mostly for clarifications to the text. The paper is clear and easy to read, despite a number of minor grammatical errors which are detailed below.

Minor comments

Page 2 line 1: Is this the observation uncertainty in assimilation for models? Unclear,
C1

need to elaborate line 32: quantify what you mean by “coarse resolution”

Page 3 line 4: quantify what you mean by “medium resolution” line 19/20 & 22 (and throughout): Why only an “initial evaluation”. Reading on shows that you have done more than just a cursory evaluation which is what this wording implies. Suggest reword.

Page 4 line 2: Suggest mentioning data gap in AMSR data earlier, perhaps when introducing Table 1. line 4: Suggest “documented in Table 2” should be “documented in the comments in Table 2”. Would also be useful to have a full list of outages, perhaps a link to this in another document? Line 10 (and Table 2): “width of the polar observation hole” is not given, it’s the bit that’s viewed rather than the hole, also not a width as it’s an angle, suggest rename this column line 23: Not sure that spatial resolution of SMMR is “somewhat similar” to SSM/I and SSMIS, suggest reword line 26: Clarify difference between sampling and resolution line 32: Consider showing eFoV in Table 2.

Page 5 line 4/5: Clarify if L1 data for SMMR, SSMI/S, SSMIS line 5: Add a line on what is an FCDR and what reprocessing has it undergone. Overlaps? Calibration? QC? line 6: add what period AMSR-E data covers line 9: more information needed on “resolution-matched”

Page 6 line 1: what type of grid? EASE? Line 2: what are the necessary steps? Can reference later on in paper if necessary lines 5-8: suggest moving these lines to page 5 line 32, after “flags”. Would flow better. Line 18: clarify these numbers are sea ice fraction line 23: needs citation for BRI more accurate than BPM at high concentrations line 28: Figure 3 illustrates for AMSR-E data, example from Comiso (1986) is for SMMR. Need to clarify that these can be applied to other instruments.

Page 7 lines 4/5: show ice signatures on plot (mentions in text to left and right but not that clear) line 8: text says D-A, use A-D for consistency. Also A,D in figure 3 and D,A in figure 4, make consistent.

Page 8 line 4: What is the magnitude of the ice concentration change between algo-

rithms for this example? Line 10: show $\theta = 90$ on figure

Page 9 line 5: Have you also used a sliding window? Wording implies not, if it is suggest adding “similarly” before sliding. Why was the window changed from ± 15 to ± 7 days? Line 13: Why can this be assumed? Expand. Line 15: and SMMR, SSM/I, SSMIS? Also remove “than”. Line 15/16: suggest moving sentence beginning “Recent investigations...” to line 13, before “It is assumed...”

Page 11 First paragraph: This is confusing as it sounds like different RTMs for each instrument but is it actually different optimisations? Reword. Line 10: quantify what is meant by “rather large” line 27: Is there a citation for the ATBD document itself? From line 20: As not using GR2219v suggest editing this section as don’t need to describe in detail or give previous examples.

Page 12 line 1: Would be helpful to use a different symbol other than T to avoid confusion with temperature line 26: Implies that $<10\%$ will be removed anyway, even if GR3719v $< T$. If so need to clarify this in text. Note also in this section that GR3719v is also used for AMSR despite different channels. Also in this section, it is not really clear how the threshold values for the Gradient Ratios are selected, needs clarification.

Page 13 line 1: If you say it’s visible, need to show on a figure line 12: Would be useful to show in a figure for visualisation line 13: “u” in italics is given as “U” on figure 4, needs to be consistent line 26: Why is there an increase in concentration due to the atmospheric correction (with reduced standard deviation) in figure 5? line 29: Are the contours specifically for 2015? Need to elaborate.

Page 14 line 2: confirm if this is the standard deviation of the differences, or the standard deviation over January for each pixel, then the difference of these (latter is as worded) line 8: Would be useful to see impact of ice curve correction and atmospheric correction separately on figures line 26: clarify footprint mismatch is between different channels

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Page 15 lines 1&3: need to explain “3 dB footprint” or remove lines 2/3: also mention AMSR products line 10 and paragraph: Needs more information on how K was calculated line 21: land spill-over effects are critical for users in that missing data around coasts causes problems and has to be dealt with. Where you have removed data, have you done any filling?

Page 16 line 3: Does this improve things compared to Cavalieri et al. (1999) alone? line 6: Year for Donlon paper should be 2012. Also, not to change in the paper but note that I believe the mask has been updated for the SST CCI v2 processing. Line 15: “New Scotland” should be “Nova Scotia”, no need to translate as still same in English lines 15&16: State whether you have done anything different in processing to get ice over inland regions and fresh water, either here or elsewhere in paper line 29&30: Clarify that you are not filling in missing days, e.g. in the SMMR period etc. Are you filling around coasts?

Page 17 Evaluation of the data: Have you simply looked through the data? Issues where processing has gone wrong, or the data looks strange have previously been an issue for OSI SAF CDRs. It would be very helpful for users not to have to do this QC. Line 7: add what the ERA-Interim data is used for in the processing line 28: colour scale is blue-red, not blue-yellow-red line 29: Is noise just characterised as below 10%? line 33: suggest move “as nominally returned by the SIC algorithm” to line 27 after “raw_ice_conc_values”

Page 18 line 16: what about summer?

Page 19 line 23: SMMR uncorrected is also better than for SSM/I and SSMIS, particularly in the NH. Why? Line 30: in winter? Line 31: need to give seasonal figures

Page 20 line 4: “internally consistent” - do you mean consistent over time? Line 5: Can’t tell from figure 8 that it’s the smallest possible. Suggest reword “and smallest possible retrieval noise” to “and a small retrieval noise” line 14: change “thus after the OWF is applied” to “thus after all the filters including the OWF are applied” for

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clarification line 17&18: as the range changes are they stable with time? Also need to give separate summer and winter values and incorporate line 20 in the discussion. Also separate summer and winter values line 21. line 27: might be worth adding that this is addressed as future work later in the paper line 33: Need to elaborate on how this could cause an increase over time

Page 21 lines 17&18: Why 2 months in summer and 3 months in winter? line 23: Give the T2m threshold (if not mentioned elsewhere?) line 25: “skewed a bit” – could quantify the skewness, or reword to “slight negative skew” or similar, and elsewhere. Line 27,28,29: should refer to Figure 12, not Figure 10. Values given are not the same as on Figure 10, unclear. Line 33: In winter it looks fairly similar though.

Page 22 line 3: reference “(Figure 12)” after “100%” line 4: should be Figure 12, not Figure 11 line 7: Suggest replace “less good” with something like “poorer, but still acceptable”. Suggest cut the last sentence of this paragraph as is a repetition. Line 12: The total uncertainty is described as “standard error” on Figure 12, need to reword this. Paragraph around line 20: Elaborate on why uncertainties for SICCI-50km are smaller than for the other two datasets. Line 25: For high sea-ice concentration range they are slightly underestimated, especially for OSI-450.

Page 23 line 1: Confusing wording. Ground truth locations are not outside expanded maximum ice climatology? Line 17: Reword “it is also designed to remove” as “it also has the effect of removing”, as this is a side-effect of the filter, rather than a planned part of the design. Line 24: replace “these wavelengths” with “the wavelengths of the PMR channels” for clarity.

Page 24 line 3: Unclear what is meant by “at most” in this context line 13: add “AMSR-E and AMSR2” before “channels” for clarity. Line 21: add “variable” after “raw_ice_conc_values” for clarity. Line 29: Expand “ECV” acronym here

Page 25 line 5: change “two components” to “two algorithm components” for clarity line 10: add section number after “Outlook” line 16: add “data” after “AMSR2” line 23: add

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“channel” before “frequencies” for clarity. Lines 26&31: add “closed” before “sea ice”

Page 26 lines 18-19: The level itself is not stable, though always remains below 15% - needs rewording. Also not accurate to say “well below 15% SIC threshold” for SICCI-50km. Lines 23&24: Confusing wording: “maximum 1%” and then “a couple of percent” - needs rewording.

Page 27 line 20: expand SIE acronym line 24: Add some more information on plans to implement improvements for CDRs into operational processing chains (a few lines).

Page 28 line 6: expand EO acronym (and use acronym on line 7) line 23: URL for CMEMS is “marine.copernicus.eu” (there is a typo)

Page 29 lines 2&3: Confusing wording – is it the first satellite or the first satellite with MWI? Reword. Line 14: Add “channel” before frequencies for clarity. Line 15: This implies users should combine the products (which they shouldn’t if they want a consistent product). Clarify that different products are available for different user needs. Lines 25-27: how can this be used? Users will treat uncertainties provided with data as the observation uncertainty.

Page 30 Line 7: Would be useful to provide URLs for the data archives. Line 18: Update this, says “[Indicate subset used]” References in general: Provide URLs if available for Technical Reports etc. Some DOIs have come out as links and others not.

Figures and tables: Some acronyms are in figure and table captions before being introduced in the text. Suggest defining in captions.

Figure 1: Add section number for Outlook.

Figure 2: Add that L2 SIC is also swath, L3 is a single daily averaged file. Define acronyms used in figure in caption.

Figure 3: Title should be “AMSR-E” (currently “AMSR”). Labels in the figure need to

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be closer to the points (or colour coding would help). In figure caption, give section numbers where BFM and OWF are described in the text. “mean water signature” should be “mean open water signature”

Figure 4: Left plot: Label “BRI”, “BPM” and “BFM” on plot. Add theta label on plot. “u” in caption is labelled “U” on plot, make consistent. Axis labels should also match convention in caption, e.g. “37H” rather than “h37”. Right plot: “Freq. Mode” should be “BFM”, “Bristol” should be “BRI”. Add “theta” symbol to “Rotation angle” axis label.

Figure 5: Centre panel: Difficult to see any detail using this scale, needs to be shortened. Doesn’t have to be the same as left panel as showing different variables.

Figure 6: Need to show 0% as white (or similar) for SIC plots so can see detail around ice edge. Would also be helpful to plot ice_conc minus raw_ice_conc_values.

Figure 7: Need to show 0% as white (or similar) so can see detail at low uncertainties.

Figure 8: Figure legend - datasets should be capitalised for consistency

Figure 9: Figure legend - datasets should be capitalised for consistency. If SICCI-25km and OSI-450 lines were thinner (like SICCI-50km) it would be easier to see the lines for both hemispheres.

Figures 10, 11: Specify that the sea ice concentration is uncorrected. Numbers in parentheses are in front of the season, not behind. Unclear - “Numbers below the season denote the mean SIC plus/minus one standard deviation” - there’s only one number so how can this be plus/minus? Also Figure 11: The SH plots are “bumpier” than the NH plots – add comments on this.

Figure 12: Standard error is not mentioned in the text.

Table 1: Give months in the time period. Worth adding that grid is EASE grid. Caption: “entering” should be “entered in”.

Table 2: Start date for DMSP SSM/I has an error (“090”), check table for other errors.

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Technical corrections

General comments: Throughout, need to ensure there is a space between numbers and their units.

Throughout have used “...” or “etc...”, should probably just be “etc.” or sometimes “e.g.” but check journal style guide.

Have referred to e.g. F10, F11 satellites, suggest using full name (include DMSP) at the start of the paper for clarification.

Specific comments: Some of the following are corrections of grammatical errors, and some are rewording suggestions to improve the readability of the paper.

Page 2 line 4: “allow” should be “allows” line 5: “are” should be “is” line 6: “to understand” should be “for understanding” line 11: “are” should be “is”, “have” should be “has” line 28: unclear what you mean by “possibly” in this context, if it’s the possibility that filtering can be applied needs rewording

Page 3 line 17: remove “up-front” here, reads a bit strangely in this context. Also, “entering” should be “entered”

Page 4 line 3: “some” should be “a” line 4: “more” should be “most” line 6: give section number for Outlook. Line 20/21: “Such wavelength” should be “Such a wavelength” line 23: replace “needed for” with “used in” line 25: add “(Table 2)” after “channels” line 31: “diameters” should be “diameter”

Page 5 line 1: I think “One” should be “Two”, also change “swath” to “swaths” line 2: change “orbit” to “orbits”, “extent” to “extents” line 5: expand CM-SAF acronym line 7: “directly accessed directly” should be “accessed directly”, “Japan space agency” should be “Japan Aerospace Exploration Agency” line 15: “contribution” should be “contributions” line 18: “ERA-Interim” should be “ERA-Interim reanalysis” line 20: “ERA-Interim prior” should be “ERA-Interim data prior” (or similar), “early period with” should be “earliest period of” line 24: “from” should be “of”, “for” should be “in” line

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27: “operated to process” should be “for” line 32: “(L3) collects” should be “(L3) chain collects”

Page 6 line 3: “apply” should be “applies”, “format” should be “formats” line 5: “similarly” should be “similar” line 29: define OW (given above in context of algorithm but worth defining here again), same for CI line 30.

Page 7 line 1: “TB in point” should be “TB at point”, similarly “lines in point” should be “lines at point” line 2: “and geometric” should be “and a geometric” line 6: remove “originally”, “describes” should be “describe” line 20: “onto” should be “on” line 25: “cope for” should be “cope with”

Page 8 line 1: would read better as “Figure 4 (right panel) also shows that the optimum...” line 16: “space” should be “spaces” lines 19/20: replace arrows with “ “ line 26: “section so” should be “section has so” line 32: “by Eq. 1” should be “using Eq. 1”

Page 9 line 20: “was” should be “has been”, comma before “which” line 21: “varies” should be “vary”, “follows” should be “follow” line 25: “yield highest” should be “yield the highest” line 26: “yield departure” should be “yield a departure” line 27 and 28: “departure” should be “departures”

Page 10 line 3: add commas both before and after “the uncorrected SIC value” line 7: “re-analysis” should be “re-analyses” line 20: Add “For Tb_nwp” at the start of the line line 22: Add “For Tb_ref” at start of sentence before “Theta_instru” line 26: remove “for F10” (already mentioned in this sentence) line 29: “for being” should be “to be”

Page 11 line 3: “allows” should be “allowed” line 9: “ones” would read better as “datasets”. Also, having introduced the acronym WFs should use on this line instead of “Weather filters” (also on line 20). Line 14: no hyphen in unaffected line 18: suggest changing “so far did not adopt” to “have so far not adopted”, also “from” should be “in” line 19: change “by using adhoc status flags” to “on an adhoc basis by using status flags” (as the flags themselves are not adhoc) line 22: “re-used” should be “reuse” (or

C9

“have reused”) line 23: Suggest add “For example,” before Spreen et al. Line 25: “to” should be “with” line 26: “with” should be “for”, “for which” should be “where”, suggest changing “threshold is 0.053” to “threshold is set to 0.053”

Page 12 line 2: “intersect” should be “intersects” line 6: missing close bracket after (A-D), also “illustration how” should be “illustration of how” line 7: “into” should be “in” line 11: add “and” before “the varying effects” line 12: suggest replace “not remove” with “avoid removing” line 13: “show” should be “shown” lines 16,17: “T” should be in italics line 20: “naming” should be “name” line 22: change “is set to” to “will” as this is an unintended consequence line 23: suggest changing “we rather refer to such filters as ‘Open Water Filter’” to “we refer to such a filter as an ‘Open Water Filter’”, also suggest “add” changed to “include” line 24: “are” should be “is” line 27: “Noticeably” should be “Notably” line 28: “attached a” should be “attached to a”, also change “as to if the OWF detected it” to “corresponding to OWF detection”

Page 13 lines 1&2: “high concentration range” should be either “a high concentration range” or “high concentration ranges line 5: remove “likewise” line 10: change “best appear” to “are best shown” line 11: “T” in B_CI(T) should be bold lines 14&15: “constantly” should be “consistently” line 28: “Laptev and Kara Sea” should be “the Laptev and Kara Seas” line 29: would read better to remove “old” after “2 years”, also “on right panel” should be “on the right panel”

Page 14 line 6: “north for Canadian” should be “north of Canadian” line 8: remove “that what” line 9: change “and” to “which” after “section 3.4.1,” line 19: “data is assimilated” should be “data are assimilated” line 21: “those” should be “that” line 28: “algorithm to retrieve” should be “algorithm for retrieving”

Page 15 line 1: suggest change “relevant to discuss” to “relevant for discussion of” line 4: “Earth surface” should be “the Earth’s surface” line 7: remove “that is” line 9: “cells” should be “cell” line 20: remove “shortly” line 21: suggest change “presenting less” to “have undergone little” line 28: “details” should be “detail” line 30: suggest

C10

change “among others” to “including” line 31: remove “is computed” line 32: change “the antenna pattern functions are approximated” to “the approximation of antenna pattern functions” line 33: “from central” should be “from the central”

Page 16 line 1: “for contribution” should be “for the contribution” line 4: “were” should be “have been” line 5: “where” should be “were” line 7: “as input” should be “as the input” line 13: “were” should be “was”, suggest change “base” to “basis”, “pixel” should be “pixels” line 18: “in SH” should be “in the SH” line 19&20: change “where to select the Open Water training samples” to “where the Open Water training samples were selected” line 26: “conversely” should be “converse”, suggest “CDR of” should be “CDR method of”

Page 17 line 14: “of SICCI-25km” should be “of the SICCI-25km” line 22: “file” should be “files” line 27: “Bottom” should be “The bottom” line 29: “corresponds” should be “correspond” line 32: “by OWF” should be “by the OWF”

Page 18 line 6: “indicate” should be “indicates” line 14: replace “are covered by” with “cover” line 18: Suggest replace “several” with “three”, “One” with “The first” line 19: “its” should be “their” line 25: no hyphen in intermediate

Page 19 line 9: “albeit” should be “despite” line 12: “from” should be “for” line 15: “from” should be “for” line 16: “improve much” should be “much improve” line 18: “parametrization” should be “parametrizations” line 21: “from with” should be “for”, also “were” should be “where” line 25: “sensibly” - do you mean “ostensibly”?

Page 20 line 9: remove “at best” and add “ideally” before “preserving” line 19: reword “very little few jumps are” to “very little change is” (or similar) line 23: could remove “lowest” and “highest” as it’s already clear this is the range

Page 21 line 10: remove comma after “but” line 14: “details” should be “detail” line 21: “East Antarctic” should be “the East Antarctic” (or “East Antarctica”) line 23: remove “being”, suggest replace “by too” with “with” lines 29&30: suggest move “than for the

C11

other two CDRs” after “more” on line 29 line 30: “e.g.” should be “i.e.” line 31: add “for all three CDRs” after “2%”. lines 32&33: suggest change “less good than that” to “poorer than”

Page 22 lines 5&6: change “Arctic” to “the Arctic”

Page 23 line 3: Suggest reword “can be picked” to “may be selected” line 4: Suggest reword “and to the least at the location of the ground-truth estimates used in the section” to “where the ground-truth estimates used in the section are located” line 5: Change “More developed” to “A more developed”, “as wetter” to “as a wetter” line 6: Change “We finally” to “Finally, we” line 12: “in large extent” needs to be reworded, perhaps replace with “generally” or “to a large extent” line 13: Capitalisation of “Passive Microwave” varies, be consistent line 15: “on combination” should be “on a combination”, also need to define acronym “PMR” line 19: “take” should be “pay” line 20: “in field” should be “in the field”, also use “OWF” acronym for consistency line 21: “are pertaining” should be “pertain” line 25: Remove “distinguishing between” and add “to be distinguished” to end of sentence.

Page 24 line 1: “aims” should be “aim”, also “from interested” should be “from the interested” line 6: replace “was” with “were” twice line 17: “is ‘spilling’ ” should be “ ‘spills’ ”, also “appear” would be better than “look” line 19: “foot-print” sometimes has a hyphen, sometimes not, needs to be consistent line 20: “instrument” should be “instruments” line 29: “improvement” should be “improvements”

Page 25: line 7: “on March 1985” should be “in March 1985” line 8: add “dataset” before “only”, also add “on” before “09 July” lines 9&10: change “achieving” to “to achieve” line 11: suggest reword “algorithms allowed e.g. to consistently process SIC” to “algorithms also allowed consistent processing of SIC” line 14: change “15 years record” to “15-year record” line 18: change “will” to “would” line 20: change “had met” to “would meet” line 33: add “the” before “coarsest”

Page 26 lines 3&4: Confusingly worded: “seasonal cycle of sea-ice and snow proper-

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ties during summer". Should this be sea ice extent? (Also be consistent throughout about whether to use a hyphen in sea ice or not) line 15: "than" should be "as" line 17: Suggest remove "For all practical purposes" line 29: Remove "namely" line 33: remove "that"

Page 27 line 1: "impact of melting" should be "impact that melting" line 3: Suggest change "more efforts" to "further effort" line 4: Remove "same" and "that was" line 10: "if to selecting" should be "if selecting" line 12: "dimension" should be "dimensions" line 17: "the sea ice cover, sea ice area" should be "of sea ice cover, and sea ice area" line 27: "exploring" should be "exploration" line 28: "channels" should be "channel", "that" should be "than" line 30: Suggest change "could not be better embedded by SIC" to "could be better embedded in SIC" line 32: "Filter" should be "Filters"

Page 28: line 2: Suggest adding "still" after "can" line 24: Change "at best" to "to achieve" line 33: "passed" should be "past"

Page 29 line 5: Add "However," before "Because" (as shouldn't start a sentence with because) line 17: "product contains" should be "products contain" as there is more than one product. Line 19: Replace "on the hand a" with "ease of", "product" should be "products" line 20: remove "of all products", "is" should be "are", "has" should be "have" line 25: "this provides" should be "this paper provides" (or similar)

Page 30 line 6: "making" should be "make".

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