Comment on essd-2025-660:

The paper presents a new sea ice concentration dataset derived from reprocessed data from the Nimbus-5 ESMR radiometer. The new processing addresses two main issues that characterized the previous version of the dataset (Kolbe et al., 2024). First, the authors incorporate locally and seasonally defined dynamical tie points to account for differences in the signatures of ice types, including improved estimation of multi-year ice. Second, they develop new quality control filters that allow to discard fewer observation points compared to the previous methodology. This represents a real advancement over the previous study and the dataset provides added value by closing significant gaps compared to the earlier processing. This enabled a more complete dataset at early times (late 1972 to 1977).

The dataset is straightforward to use both in QGIS and using python scripts for the Northern and the Southern hemisphere. The manuscript is generally clearly structured and well written. I think that a few minor revisions could further clarify the achievement and validation of the new dataset.

General comments:

- While the algorithm tuning and dataset description for the Arctic regions are clear and well-elaborated, I believe the description of the dataset and the application of the algorithm to Antarctica is somewhat rushed. I understand the RTM model accounts for initial radiative differences between the two regions, but the manuscript would benefit from more explicit acknowledgment of these hemispheric distinctions throughout. This suggestion primarily concerns rephrasing and making explicit statements where regional differences exist. For instance, when it comes to one of the paper's primary novelties (local dynamical tie points) it would be important to clarify the differences in the tuning and the validation processes more explicitly throughout the manuscript. To summarise, I believe a more thorough discussion of the hemispheric differences in the quality of the dataset would strengthen the paper. I will elaborate on this concern in the following points:

    - The absence of an equivalent for Fig. 3 for Antarctica suggests that a clearer statement about the choice of the areas selected as references and the subsequent tuning for the Arctic and their transferability for Antarctica would be necessary.
    - Lines 53-54 state that the objective is to evaluate uncertainties and estimates for both polar regions; therefore, a consistent comparison of dataset quality throughout the paper is necessary for both hemispheres.
    - Equation (6) is presented only for FYI-MYI, but the same equation applies to ice types A and B. This should be explicitly specified in the text. Additionally, while FYI-MYI and ice types A and B are distinguished in terms of ice and snow electromagnetic properties , after their introduction, ice types A and B are not mentioned again until the conclusion.

- Line 211 presents the validation with ice charts (Arctic region) and then the use of the word ‘global’ for the SIE estimates.
- Section 4.3 contains minimal discussion of Antarctica. Similarly, the Antarctic subplots in Figure 9 appear to lack corresponding commentary in the text. (The same applies to the few comments on Fig. 8 for the Southern hemisphere). Perhaps adding a dedicated discussion paragraph on the differences in results and uncertainties in the dataset between the polar regions would enhance clarity.

- Section 4.5 appears somewhat disconnected from the preceding results discussion. I recommend either strengthening the connection to the dataset presented in this study or incorporating this content into another section where the link to the data would be clearer.

Technical comments:

- Line 8: ‘in some places’ , could it be rephrased in a more accurate way?
- line 67: I understand it is mentioned in the Introduction and cited with Kolbe et al. 2024 but I would specify again the name of the radiative transfer model (RTM).
- Line 85: remove ‘and’ .
- Line 88: make ‘this’ more explicit.
- Line 92: grammatically correct but ‘that each’ makes the sentence difficult to read, I would rephrase and avoid using the semicolon before the list .
- Line 163 to 166, I would add at least one reference for this statement.
- Lines 206 to 208: the different standard deviation behavior for FYI and MYI, along with the subsequent interpretation, could be better addressed in the Results and Discussion section rather than in the tuning description, given that this represents an interpretation and comparison with the previous algorithm rather than a methodological detail.
- Figure 3: I suggest to label the area selected given that you are referring to them later (for instance, Baffin Bay).
- Figure 7: it is good to see how the LDTP tie points follow TB more closely for the sea ice, however it is not straightforward to understand the dip of the ice tie points when the ocean tie point should be assumed. This is just a suggestion on the visualization choice.
- Figure 8: The use of the same color scale for different TB ranges across the subplots may reduce clarity. Please consider whether individual color scales for each subplot would more effectively highlight the results shown in the figure.
- Line 239-240: as mentioned, I think ice types A and B should not be used interchangeably with FYI and MYI, as the signatures are not necessarily the same. Tie points update: it is great to see the method has improved compared to previous work in the Arctic, where tie points are mostly sensitive to ice age. Is it straightforward to attribute the fewer tie point updates in Antarctica to MYI-FYI differentiation in this region?
- Line 265: specify ‘coverage’.
- Line 278: @ → at
- Figure 10 caption: correct Arctic to Antarctic.
- Line 304: change to full stop if you write with capital A after 1)

- Line 307: the sentence describing ice-type ambiguity resolution could be rephrased for improved clarity.
- Line 307-310 : while this independent validation provides valuable support for the analysis quality, the authors should clarify what strengthens confidence in the Arctic product (evaluation from Kern (2025) and ice charts) and what validates the Antarctic product as well (Kern et al. 2022).
- Reference to subplots throughout the manuscript would be easier for the reader with the addition of panel letters to multi-panel figures.