

# ***Interactive comment on “A long-term Northern Hemisphere snow cover extent data record for climate studies and monitoring” by T. W. Estilow et al.***

**T. W. Estilow et al.**

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The authors wish to thank three anonymous referees for their helpful comments and time spent reviewing the manuscript. Detailed responses to comments from Anonymous Referee #2 follow:

[Comment] Presentation of the material needs some streamlining to improve readability and provide a clearer picture of the historical evolution of the product.

[Response] Sections have been reworked in the revised manuscript to provide clarity and improve readability.

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[Comment] There also needs to be a more up-front discussion about the caveats to using the data e.g. recommended mainly for continental-scale analysis; has higher uncertainty in summer months over high latitudes; documented difficulties charting snow over dense forest; issues with treatment of patchy snow; conservative mapping of snow in mountainous terrain; evidence of improved mapping of snow cover onset over time. These points are raised in online documentation for the NOAA CDR (e.g. <https://climatedataguide.ucar.edu/climate-data/snow-cover-extent-northern-hemisphere-climate-data-record-rutgers>) and should also be covered in the official dataset publication. The homogeneity of the product also deserves to be highlighted given its flagship role in long-term monitoring of NH SCE.

[Response] All good suggestions. These points are expanded in the revised manuscript.

[Comment] You could probably cut much of the discussion about the differing grids as this seem irrelevant to users of the netCDF version of the dataset.

[Response] In the revised manuscript, the definition of the CDR grid section (3.3) has been reduced and rewritten.

#### Detailed Comments

[Comment] 1. Introduction: This section should be revised to focus on the importance of monitoring SCE and the need to provide a well-documented CDR for NH SCE from the satellite record. As it stands the section is over-generalized, includes dated and somewhat irrelevant references, and makes it seem like the CDR process was somehow responsible for driving the NOAA SCE dataset. Note that the “cryosphere” includes frozen ground, permafrost, land ice and freshwater ice in the opening statement.

[Response] We have revised the introduction accordingly, while keeping the section brief and focused on snow extent.

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[Comment] 2. Historical description of the data product: This section is incomplete and difficult to follow e.g. There is no mention of NOAA being a binary product based on 50% coverage (this is mentioned later in Section 3.2), nor the issue of what day in the week the information represents. There seems to be some overlap between Sections 2 and 3 that needs resolving as this creates some confusion e.g. your comment about 42% of IMS cells doesn't make a lot of sense without putting this in the context of the binary product and the 50% snow cover fraction threshold.

[Response] Sections reworked to provide a clearer description.

[Comment] We also don't get any sense in Section 2 how the resolution and number of satellite passes changed over time. Can this information be added to an expanded Table 1? Hüsler et al (2014) provided this information for the European Alps from 1985–2011 (their Fig. 2) and went the step further of testing the impact of the temporally-varying coverage on the homogeneity of the SCE record.

[Response] This is a good suggestion. While the authors feel this level of detail is beyond the scope of this publication, a similar analysis would fit well in a forthcoming publication that will explore more in-depth analysis of the CDR.

[Comment] 3. Dataset set description: Some of this material belongs in Section 2 to provide a chronologically complete description of the dataset evolution. The citing of Robinson et al. (1999) as evidence that there is no step change introduced from the 1998 transition to daily mapping seems premature in hindsight.

[Response] Pertinent sections have been edited to provide better clarity.

Also, we have performed a change point analysis to verify the results of the Robinson studies. Snow years from 1967 (starting September 1966) to 2014 (ending August 2014) were analyzed. Missing months (August–September 1966, July 1968, June–October 1969, July–September 1971) were replaced with period of record means.

Results of the analysis indicate a significant change occurred between 1975 and 1986,

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with a confidence level of 95%. Mean snow extent for the Northern Hemisphere changed from 25.9 to 24.8 million sq. km. No other significant change was detected by this analysis.

[Comment] Is the section on the definition of the CDR grid really necessary?

[Response] In the revised manuscript, the definition of the CDR grid section (3.3) has been reduced and rewritten.

[Comment] 4.2. Long-term trends: Brown and Derksen (2013) do more than “suggest” that the NOAA dataset has an artificial trend to map earlier snow cover onset; they clearly demonstrate this by comparing NOAA to three other independent data sources.

[Response] We have rewritten and expanded the long-term trends section (4.2) to address this comment, and provide an assessment of uncertainties.

[Comment] 5. Conclusions: It will take a little bit of work but it would make a nice conclusion to compile the number of publications using the NOAA dataset and show how this has increased over time. You could also classify these by research topic (e.g. climate model evaluation, climate dynamics etc) if you were really keen!

[Response] We have included a similar list of publications classified by topic in the technical documentation published at NCDC. Although we agree an updated summary would be useful, it is beyond the scope of this publication. We plan to revisit the idea in a forthcoming publication that will explore more in-depth analysis of the CDR.

[Comment] Figures: Way too many – only include figures that convey key messages. Candidates for cutting are Figs 2, 4, 5, 6, 7, 8.

[Response] Cut several figures per the reviewer’s suggestion.

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Interactive comment on Earth Syst. Sci. Data Discuss., 7, 669, 2014.

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