

Interactive comment on “A Bayesian spatial assimilation scheme for snow coverage observations in a gridded snow model” by S. Kolberg et al.

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There are no submitted comments from referee #1.

Authors' response to comments from referee #2:

Overall comments: Referee #2 regards the transformation of variables as being our paper's main innovation. This view is somewhat different from to our own, and this was commented in a separate Author's Comment on these pages. In the revised manuscript, we have tried to state more clearly the problem we address and what we consider our main idea for solving it to be, hopefully preventing readers from looking for features they will not find.

We appreciate the general comments regarding the presentation of the methodology, and in the revised paper we have ensured that the terminology is statistically correct. We also try to ensure precision in terms for which both statisticians and hydrologists may have a clear intuition, not necessarily coincident. Apart from terminology, we have rearranged some paragraphs and deleted some text of minor importance, to clarify the major problem, approach, and results. We aim at a hydrologist as the target reader, thus assuming more knowledge of general hydrology and snow modelling, than of statistical methods.

Specific comments; the page and line numbers refer to the original paper, new locations are specified to (sub)section.

1. page 1187, line 25 “General Accuracy” replaced by “standard error”.
2. page 1188, lines 5-12 The actual lines were of minor importance, and are deleted. The term “dynamic” is avoided in the whole text; no part of our analysis satisfies this term in a statistical sense.
3. Page 1189, lines 4-10 No distribution is assumed, “describes” is replaced by “measures”, but we have kept the word “uncertainty” as an intuitive, imprecise word for the spread of a distribution. This paragraph is now placed under subsection 1.2.
4. Page 1189, end of the second section. Reference to Huang and Cressie (1996) added. This paragraph is moved to the Introduction section.
5. Page 1190, line 10 and figure 1. Comment is related to the term “dynamic”, which (as correctly assumed by the referee), was used here to mean “time variant”. We now avoid this term. The sentence on page 1190 and the figure 1 caption are rephrased; and the ‘l’ in the caption corrected to ‘λ’. The actual text is now the first under subsection 1.1.
6. Page 1191, eq. 5-6. Notation changed from y' to y_1 to avoid confusion with differentiation, and y_1 is explained below the equations. These are now Eq. 4 and 5.

7. Page 1193, line 4. The term “dynamic” is replaced by “time varying”, and the paragraph is rewritten. The actual text is now under subsection 2.1.

Page 1193, line 26: The Gaussian Markov Random Field is introduced as a class of spatial models, and since all confusing use of the term dynamic is deleted from the paper, it is not explicitly repeated here that the Markov property relates to space only. The whole presentation of GMRFs is rewritten, and is now placed under subsection 2.2.

8. Page 1194-95. The transformation of ψ ; is formally defined in eq. 8, page 1192 (eq. 7 for m). Reference hereto is added in the revised manuscript, and the repeating of the transformation equations in eq 10 and 12 are deleted. The introduction of the transformations is re-written to clarify their justification based on hydrological modelling practice (see the Author comment). The actual paragraphs are now located under subsection 2.2.

9. Page 1196. The introduction of the likelihood function is rewritten, and now clearly states how the parameters are determined. This is now subsection 3.1

10. Page 1197. The paragraph is rephrased and now clearly state that the storage is related to runoff by a linear tank model, which should be familiar to hydrologists. This is now subsection 3.2.

11. Page 1199-1200 As explained in the Author Comment , we see the use of spatial models as the main feature of the new methodology, and the transformation as a way to increase the value of the spatial models. The same Bayesian approach, using the same SDC, but without the spatial models or transformations, was reported in an earlier paper (Kolberg and Gottschalk, 2005). We cite and compare to this paper in the presentation of the method (originally on page 1191, now under the Introduction section), as well as in our discussion (page 1202, lines 10-11, now section 6). Also our first conclusion compares the main result to “a non-spatial prior model previously reported”.

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