

Interactive comment on “A model for the spatial distribution of snow water equivalent parameterised from the spatial variability of precipitation” by T. Skaugen and I. H. Weltzien

Anonymous Referee #1

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General comments

The manuscript evaluates an approach which combines a statistical model for the spatial distribution of SWE with a simple rainfall-runoff model (DDD model). The approach is evaluated in terms of runoff model efficiency and MODIS snow cover area in 71 basins in Norway. The results are also compared with results of existing model used for operational forecasting. The results show that the runoff model efficiency of the new model decreases only slightly, but the snow simulations are significantly improved.

The paper builds on results developed by authors in the past. The main novel contribution is the combination of existing rainfall runoff model and a model which estimates the spatial probability density function (PDF) of snow water equivalent (SWE) as a dynamic

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gamma distribution. The context of the research, however, is not clearly formulated in the introduction. The basic assumptions and previous literature on the use of PDF of SWE is not clearly presented, nor the difference to SWE modelling based on simple degree-day or more sophisticated physically based snow modelling. I think this is crucial, because introduction is in many parts very technical (e.g. includes also some equations), but for readers (not familiar with such approach) it is very difficult to understand the meaning and main points of the approach and terminology. I would suggest to clearly outline the approach and also present literature which combines such statistical models with rainfall runoff modeling in the past. In the methodology some basic outline would be also useful (e.g. some schematics how the snow accumulation and melt is modelled by the approach). Moreover the results might be elaborated in more thorough way (including figures). I agree that using a large sample of basins is important, but the results do not show much of the value of such large dataset. It will be interesting, for example, to stratify the basins in the figures according mean elevation, size, or some other characteristics to show some more information than just the efficiency. It is not very clear, why the improved snow simulations do not result in better runoff simulations. Some more evaluations will be interesting here.

Specific comments

- 1) Abstract: The applied methodology and model concept is not clearly presented (the abbreviations SD_G, LN are not very intuitive). The period used for analyses is missing.
- 2) Introduction: This part does not have a clear story. It mixes different topics, but does not clearly outline the research problematic and does not clearly show what the results of previous studies are. The meaning and basics behind the PDF modelling needs to be introduced on lower technical level.
- 3) Modeling: It is not clear whether the results show the calibration or validation period.
- 4) Snow cover area results. It will be interesting also to see the model performance in terms of snow cover duration.

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5) Please check references. They are not always complete and consistent.

6) Table2: Which period?

7) Fig.2: A schematic would be important to understand the method, however, here it is not clear. From the Figure and caption, the meaning of a,s, F_s, etc is not clear.

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