The Cryosphere Discuss.,
doi:10.5194/tc-2016-287-RC2, 2017

The Cryosphere Discussions
Open Access
EGU

Interactive comment on "A multiphysical ensemble system of numerical snow modelling" *by* Matthieu Lafaysse et al.

Anonymous Referee #2

Received and published: 11 February 2017

Comments on "A multiphysical ensemble system of numerical snow modelling," by Lafaysse et al.

1. This study constructs an ensemble of plausible multilayer snowpack models for applications in snow and avalanche forecasting. The paper employs a sampling approach across different model configurations in detailed comparison with a large set of observations at a long-term well instrumented midlatitude snow site. The paper examines tradeoffs between accuracy with respect to observations and dispersion of the ensemble, and places the results in the context of measurement and forcing uncertainty.

2. While I am not an expert in this area the study made a plausible case that it is a significant advance on previous work. The manuscript was very clear and instructive in its description of the design and method, and in articulating the limitations of the

Printer-friendly version

Discussion paper

approach. The study takes advantages of recent advances from previous authors and extends that work in ways that are well articulated on p.3 (end of Section 1).

3. I have only minor comments on this study but had a couple of questions that the authors could consider on the broader context of this work.

4.How do the authors see this approach being used operationally? Is the basic suggestion that around 30-50 ensemble members could be used to sample the range of independent configurations possible within the model, and that these realizations could be propagated along with initial condition uncertainty in the setting of probabilistic ensemble forecasting?

5. A second question concerns the impact of covariance of errors across evaluation variables shown in Fig. 7. Perhaps the paper addressed the issue and I missed it, but it is not clear if the realizations that lie within the purple boxes are generally independent or if models that have low errors in some variables show low errors in others. Would there be some way of effectively combining the metrics shown in Figure 7 to gain multivariate information?

6. I thought it was insightful for the authors to present information on the surface energy budget that was independent of the tuning/evaluation variables, and would have liked to see more discussion of this. Could this provide other ways of evaluating the independence of realizations?

7. I think it should be made clear in the introduction that this paper clears up several typos of previous papers (p.14).

8. Why is variable availability coming into the definition of equations (21)-(22) but not in (19)-(20)? Are you accounting for variable availability being distinctive in individual model realizations versus in observations? If snow is not on the ground in some realizations but it is in observations, what is done?

9. Could the authors present an explicit expression for the RMSE of the ensemble

Printer-friendly version

Discussion paper

mean? My assumption is that RMSE(bar-E) is estimated by (20) but this should be stated.

10. Section 4.3 Could you make this text as accessible as the previous material? If I understand, the key points of this subsection are

* You are selecting a subensemble n' for further evaluation.

* n' is chosen to limit the computational burden in operational applications (although it is not clear why the tuning here will need to be repeated frequently, or what the ultimate applications will be in practice).

* The n' members should be suitably independent by some measure. P.19 l.29, "most appropriate" is vague.

* The n' members should have similar skill and thus have similar likelihood of being correct.

It's hard to understand what the four ensemble are, but it became clearer after re-reading a couple of times. It is not clear why only a lower bound on skill needs to be defined, don't you want the n' to fall within a range of skill levels bounded above and below? Also,

* Not clear why E4 is based on SS and not CRPS.

* Not clear if the whole procedure would be very sensitive to the choice of reference system for CRPS.

Typos/minor technical comments:

p.1 L. 9: observation uncertainties -> observational uncertainty

l.24: since -> from the

l.26: for the different -> for different

p.2: l.3: relatively to ... -> relative to empirical considerations based on stratigraphy,

surface property measurements, and the outputs . . .

l.4: met by the other other organizations operating -> found by other organizations' operational

l.8: "from the errors of their initial states, which are usually based on analyses or forecasts of NWP models."

l.9: initial conditions -> initial condition

l.10: Then -> In addition

l.11: systems, much coarser -> systems, which are much coarser variability involved -> variability, for example, those involved

l.15: assimilation data -> data assimilation (here and elsewhere)

l.18: also the basis for the confidence -> also increase confidence

l.29: ensemble of snow simulations based on 1701 different combinations of [to avoid implying that others have since built ensembles of 1701 snow simulations]

p.7

l. 5: more affected by -> which is more affected by

p.8 l.4: Crocus default -> The Crocus default

l.8: called S14 -> called S14, [insert comma]

p.13 l.9: IO2 -> The IO2

l.13: role on -> role in

l.21 [and p.15 l.7]: pores -> pore [adjective] or pores -> pores' [possessive]

p.16: l.21: parameter -> parameters

p.18: l.3: to propose -> proposing

l.29: large scales -> large scale

p.21 l.14: fisrt -> first l.28: too -> too many

p.28, l.23 and after:

radiations -> radiation

informations -> information

“including” -> “ , which included”

unsufficient -> insufficient

loosing -> losing

Larger scales applications -> Applications on increasingly large scales

associated to -> associated with

require to select -> require selecting

“optimization and as” -> “optimization. Because “

This would require to also define -> This would also require defining

progresses -> progress [twice]

usefullness -> usefulness

equifinality -> equivalence[?]

usual evaluations -> standard evaluation methods

future works -> future work

Interactive comment on The Cryosphere Discuss., doi:10.5194/tc-2016-287, 2017.