

## ***Interactive comment on “Boreal snow cover variations induced by aerosol emissions in the middle of the 21st century” by M. Ménégoz et al.***

### **Anonymous Referee #3**

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Journal: TC Title: Boreal snow cover variations induced by aerosol emissions in the middle of the 21st century Author(s): M.M. Ménégoz et al. MS No.: tc-2012-162 MS Type: Research Article

Referee comment

General comments

The paper presents estimates of the changes in snow season length and snow amounts induced by aerosol emissions and their effect on snow albedo. This is valuable contribution, as it estimates the significance of the aerosol emissions in the present day snow conditions, as well as projections for the future.

So the scientific question at hand is relevant. It was very interesting to read about dis-

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discussion on roles and significances of greenhouse gas induced warming and emissions what comes to changes in the snow cover. Of course a modeling study has its problems – it is very difficult, almost impossible to evaluate how realistic the models are, and e.g. the emission projections that are used as a base information. As a person who is not expert in emission scenarios and coupling of these models, I would appreciate discussion on this. Several simulations were conducted in the study, which is very good.

The quality of the paper is good – it is well structured and written, language is fluent. Methods are clearly described. Symbols, abbreviations, and units are correctly defined and used.

I suggest publication after minor revision. Suggested corrections and comments are listed below.

Detailed comments (line numbering refers to the printable version)

Title is still somewhat misleading. The area considered was Northern hemisphere (in some cases Arctic), not only boreal zone. Also snow cover variation is a vague expression. Authors deal with snow season length and snow amount (SWE). Is it possible to re-formulate the title?

Abstract is thorough but perhaps too long and detailed.

4734-Line 4 (and on several other lines) Is it necessary to use capitalization this way?

4734-Line 13 Sentence here seems to have peculiar word order.

4737-Line 22 “This phase advanced” – what does this mean?

4737-Lines 27 and 28 Snow-cover variation – authors could be more exact. Pan-Arctic area? In title it says boreal.

4738-Line 4 Word order of this sentence should be checked.

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4738-Line14 Aqueous-phase? Is this the correct term?

4739-Line 4 What does snow cover mean here? Please give some more details about the snow model. What quantities of the snow pack are simulated? What processes are included in snow modeling?

Line 13 -> This might be part of discussion?

Line 24 This density value is rather high.

4740-Lines 4-5 Has this possible overestimation been discussed in Discussion? This page includes also explanation of other assumptions. Possible errors due to these should be discussed also later in the paper.

4741-Line 1 “Realized” is a strange word.

Line 7 Nudging. This method is not familiar to me and perhaps not to some other readers. Please explain what you have done, and why nudging only for winds?

4742-Lines 5 and 8 Word order in these sentences should be checked.

Line 12-> “pair of 11-yr simulations” - is this a common procedure? Why in only these scenarios?

Line 28 -> Can you discuss how realistic these projections are?

4743-Line19 “In the following. . .” sentence is not needed.

4744-Line 7 -> Word order of this sentence should be checked.

Line 15 “Regarding. . .” This is a complicated sentence.

4745-Line 15 -> This might be part of discussion? Word order of this sentence should be checked.

Overall comment: also some other parts of Results should be more suitable to Discussion.

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4746-Line 6-> and Line 26 -> Word order of this sentence should be checked.

4747-Line 9 “concomitant” is a strange word.

Line 20 “nowadays” – present day?

Line 20 -> Word order of this sentence should be checked.

Sections 4.2 and 4.3 Majority of these sections are part of results.

4750-Lines 2 and 5 “Diminution” is a strange word.

Conclusions – over all comments Results, Discussion and Conclusions should be all arranged, so that all results are presented in the right place, and Conclusions does not have too much repetition.

4752-Line 1 “snow to rain” – snow precipitation and rain?

4753-Line 19-> These last sentences are a bit disconnected from the rest of the text. I would rather appreciate a more thorough discussion if these aerosol effects are enough considered in the climate/snow scenarios at the moment, and how this work will contribute to the climate change impact studies. Should I understand that at the moment the climate scenarios are too optimistic what comes to future snow conditions?

Reference list is comprehensive and as far as I can tell, correct.

Figures are OK (even though there are many – is e.g. figure 5 needed?).

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Interactive comment on The Cryosphere Discuss., 6, 4733, 2012.

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