

Interactive comment on “Liquid-water content and water distribution of wet snow using electrical monitoring” by Pirmin Philipp Ebner et al.

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This paper provides interesting results about the progressive wetting of snow during heating at 0°C. To do so, dielectric properties are measured during microwave heating, and these properties enable to follow the evolution of heating during 3 stages, dry snow heating, wet snow heating, and the early stage of percolation. Thanks to the experimental configuration, these measurements enable to provide a precise analysis of the percolation initiation stage, and the corresponding water content for various initial snow densities. This seems to be the main result of the paper. An observation of the wet snow sample is done by micro computed X-ray diffraction tomography, but the results are only very briefly analysed.

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Since my knowledge regarding wet snow, percolation, and dielectric measurements of water content is very weak, I am not able to estimate the relevance of the results provided, as regard to the concerned community, and to previous work. I hope that the editor or the other reviewer will be able to do so in order to complement my review work.

Regarding the way the results are presented and the organisation of the paper, I am very critical.

- The english is very poor. I am not an english speaker, so I am usually quite undemanding on this aspect, but this paper really need strong rewriting. Therefore I will not give any english correction suggestions since it should be all looked up.

- Some sentences are too short, or do not seem to be at the good places, and the way the paper is designed make it quite hard to follow at some part. Illustrations will be given in the following step by step commenting of the paper.

For those main reason I recommend major revisions, and I count on the editor to verify that the scientific content worth the work to be publish.

Detailed comments:

- Abstract lines 20-21: I don't understand the sentence very well, or it feels like it is not at the good place... Shouldn't you describe your results before mentioning perspectives?? lines 33-34: In what is it pertinent? Maybe give a few clues. Line 35: "narrow range" of which parameter?

- Introduction Line 41: about reference to Löwe et al. 2011. I think that many different authors characterized snow before Löwe et al. 2011, so please find appropriate original references. (or put no reference if the info is very general) Lines 56-57: the sentence is not clear. Maybe use another term that grains that can refer to snow when dealing with a structure of the water content. + "cause" -> because of ? Line 61: The transition point in terms of water content? Temperature? etc? Please be more precise Line 76:

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what does the "right" site mean? Not clear for people who don't know the curve... Line 123-125: Why is this sentence in the middle of the three regime listing?? Furthermore, only very few is said about this micro CT analysis in the paper... so either there is more about it in the paper, or you should maybe even remove it.

- Experimental setup Lines 146-147: this sentence is really unclear (english?) Line 153: what is the "star point"? Line 154: do you mean "preventing circular current to occur in the circuit"? Part 2.1: how do you preserve the liquid content during the 2.7 h of scan at -5°C? what is the sample temperature during the scan and how do you verify that there is no evolution of the sample during those 2.7 h? How did you transfer the sample from the dielectrical measurement devise to the microCT holder? There is a lot missing in this part for the reader to understand the specific methodology followed.

- Method First: please specify "Method" for what? You already presented method for microCT just before for instance.

- Results General: Make it clearer how you highlight the transition in the various signals between no percolation - percolation. It will help to access to the main result of a percolation transition for a typical water volume fraction of 5 to 12. This part 3 should be made clearer about the way the different parameters measured lead to the main result (that appear to me to be the value of the water content at the transition between no percolation and percolation). Line 216- 222: This part does not present results but the sample preparation method, please move it to the "method" part. Line 223-224: I don't understand this sentence. Isn't it what you want to obtain and to measure, in order to follow changes in those properties by measuring electrical properties?? Do you mean "Electrical properties vary with temperature, water content and present different evolution depending on the initial snow density"? The relation between electrical properties, temperature and water content are nevertheless expected by the relations provided in part 3... Line 229-230: what do you mean? The temperature profile shows the temperature increase... but not the process. Maybe "resulting from the heating process" is what you mean? Line 242: "affected", not clear, do you mean "impacted"? Line

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272-273: I think that it is not “the temporal evolution” that increases but the liquid water mass and volume fraction, please rephrase. Paragraph lines 269-279: This part should be given before providing the result about the range of volume fraction corresponding to the beginning of percolation...

- Discussion Line 292: Please remind what those results are. A figure and a table is not a summary of major results, it is just the data used to access to the results... Lines 303-304: it should be the contrary!! The measured values (what values are we talking about?) depend on temperature and snow structure. And since you are heating, wouldn't it be more correct to say : " the heating process up to 0°C shows that the measured values evolve with temperature and snow structure (by the way, how can you verify that the snow structure is evolving?). Unless you mean that it depends on the density. But it is not the same process as the dependance on the temperature since temperature is evolving during the process, while the structure (density let's say) is a initial parameter not measured during the heating... Well, as you can see, I don't understand what you mean and it seems to me that you refer to a parameter (structure) that you are not evaluating. Lines 303-314: This sounds more like your interpretation rather than a demonstrated results. How do you assess these hypotheses related to the structure changes that you don't observe? Are there any previous work that could strengthen your hypotheses? And maybe say that it is an hypothetical explanation... Line 316: which “important material properties” are you talking about? Line 339: “our results”, which results? please be precise. Line 346: Please discuss micro CT observations in the “results” part, in particular to be able to provide some clues on the condition that enable to be confident on what is observed (how to maintain the liquid layer during 2.7 h at -5°C, and also to show if the structure evolves (or not) during the scan, the limits due to the low resolution, etc...). A specific part about the micro CT measurements is strongly missing.

- Summary and conclusions This part is not really a conclusion, but more a repetition of the discussion... Please be clearer about the main "take home message" that you want

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to highlight in your conclusion. Line 375-377: I do not agree, I don't see where you measured the morphological properties of snow during your experiment. Apparently you deduced it from your electrical parameter measurements, but it is not clear. Please be clearer about it. The morphological observation of 1 sample after the test, that is on top of that too weakly presented, can not be used to convincingly talk about morphological evolution. Line 378-379: why don't you give a curve of the percolation starting point as a function of initial density, that would indeed make your main result turn out much clearer!

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