

## ***Interactive comment on “Use of Sentinel-1 radar observations to evaluate snowmelt dynamics in alpine regions” by Carlo Marin et al.***

### **Anonymous Referee #1**

Received and published: 8 October 2019

#### General comments:

This paper tries to link the backscattered signal of C-Band SAR Sentinel-1 data to the main 3 melt periods in alpine regions: moistening, ripening and runoff. This work is also supported by physical snow modeling using SNOWPACK and in-situ dataset from 5 different monitoring stations in the Alps.

I really appreciate the physics based explanation of  $\sigma^0$  variations. That being said with the information in this manuscript, it is really not clear to me how the authors generated the "theoretical" curves of figure 5. More explanation and details on how the authors generated those curves is needed. What input data was used?

Another important factor which might be linked to the previous comment is that it seems

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the authors used the behaviors observed at the five sites to describe the theoretical curves generated and used to create their approach to detect the 3 main melt phases. The authors then use those same sites to validate the approach which I find redundant. The authors would need independent data to validate the approach. This would not be needed if the approach was based on theory of  $\sigma^0$  behaviors and those behaviors are observed in the S-1 data. Again, I feel like the curves generated in figure 5 need better explanation.

Nonetheless, the authors seem to understand the different radiative transfer interaction of the microwave signal with the different snowpack properties. It would have been nice to see some radiative transfer modeling from SMRT or a similar RT model to simulate the  $\sigma^0$  behavior.

Specific comments:

L.5. Remove "be" in "to be obtained".

L.51. Change "The establishing"

L.76. change "has demonstrated" to "was shown"

L.94-95. This nominal resolution is only true for the high res IW mode. It can be removed in this section of the text since it is better described in the data section.

L.98. Remove "the" in "the monitoring"

L.106. change "polarimetric" to "polarization"

L.144. correct "properties"

L.171. remove "round the grains", metamorphism does not always round the grains, more complex shapes can be created. Simply remove this part.

L.187. change to "October 1, 2016"

L.280. correct "removal"

L.411-412. not clear to me what you mean by depolarization here. To me depolarized signal implies that the V transmit is switched to H thus increasing VH and decreasing VV. An ice layer alone would not depolarize your signal, it would affect the scattering by adding a reflective layer in your snowpack.

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Interactive comment on The Cryosphere Discuss., <https://doi.org/10.5194/tc-2019-175>, 2019.

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