

The Cryosphere Discuss., referee comment RC1
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Comment on tc-2022-89

Carlo Marin (Referee)

Referee comment on "Snowmelt Characterization from Optical and Synthetic Aperture Radar Observations in the Lajoie Basin, British Columbia" by Sara E. Darychuk et al., The Cryosphere Discuss., <https://doi.org/10.5194/tc-2022-89-RC1>, 2022

The paper presents a method to estimate the snowmelt duration exploiting Sentinel-1, Sentinel-2 and Landsat-8 images. The method was applied in the Lajoie basin in British Columbia considering four melting seasons. The method exploits the multitemporal information provided by Sentinel-1 to identify the run-off onset, whereas sentinel-2 was used to identify the end of the melting season. In particular, this was possible by exploiting the relationship between the melting phases and multitemporal SAR backscattering originally described in Marin et al. 2020 and the capability of the multispectral optical data acquired in the visible and short wave infrared bands to identify the snow cover. Differently from the paper of Marin et al. 2020, the Sentinel-1 data has been studied outside the European Alps, with different land cover types, included forested areas, and considering, for some of the analyzed years, lower temporal frequency of acquisition i.e., 12 days or more. The evaluation of the results suggests the possibility to perform a detailed analysis of the melting season. The paper is well written but there are some points that can be further improved increasing in this way the general interest for the work.

Specific comments

Pag 7 line 173. It would be interesting to know how much the percentage of infilled areas is. Moreover, it is not clear, at least to me in the present form, if the signature always developed also in the cases where the dates were outside of two and a half standard deviation.

Pag 8 line 198. The identification of the end of the season using sparsely acquired high resolution data is a very challenging task. Some methods have been presented in the literature that try to address this problem using HR multi-source (optical-optical and optical-SAR) data and it is worth mentioning them.

Table 2. It is not clear, at least to me in the present form, what the image frequency is. For example 1-7 days refer to the day in which there is an acquisition?

Table 3. It would be interesting to know the percentage of image for which the cloud cover is less than a given low threshold e.g., 30%.

Figure 2. It is not clear why the shaded blue representing the melt period is not stopping at $SWE = 0$ for some years. I think this is the rule to be applied once the onset is identified.

Interestingly the onset for the runoff is derived in simplified snow model by considering the average temperature (and the radiation) i.e., degree day model. If air temperatures are available for the Lajoie basin, it would be interesting to discuss the difference between Sentinel-1 in identifying the runoff onset (temperature can be spatialized at high resolution and thresholded accordingly).

The sampling time provided by Sentinel-1 seems to be not adequate, in Shannon sense, to properly sampling the melting which has probably a temporal resolution less than one day. That means that the error could be potentially of several days. How is this uncertainty propagating in the case of snow melt duration analysis when different years are compared? What is the ideal revisit time needed for this kind of analysis?

I'm looking forward to seeing the snow melt duration for all the southern cost mountains of British Columbia at least for one year. Do you think this is possible? In case I would comment the main challenges of this operation in the manuscript.