

Interactive comment on “Monitoring ice break-up on the Mackenzie River using MODIS data” by P. Muhammad et al.

Anonymous Referee #2

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General comments: This manuscript addresses relevant scientific questions within the scope of this journal. It presents a relatively new tool to monitor the river ice: MODIS data. A few river ice studies have been done with this sensor because it is limited to large river like the Mackenzie. The methodology is not clear and all the images processing done by the authors should be explained to allow their reproduction by interested scientists. In my specific comments, I suggest addition of Tables to clarify the methodology and the comparison of the results with other studies. In my opinion, Figure 5 and Figure 7 are not essential to the comprehension of the paper but a diagram of the images processing steps is needed. Results are interesting and show the interest of using satellite products. The discussion section could be shorter, more direct on the main arguments. Many references listed are not cited in the manuscript. They should be retired from the list since they are not pertinent.

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Specific Comments: - Section 2.2 MODIS Data should be divided in two sections. 2.21 MODIS Data and 2.22 MODIS processing or a new section MODIS processing could be added.

- Page 2788, a Table should be prepared to describe the parameters of MODIS L3 and L1 product (resolution, wavelength of each band, DN, SDS. . . ,). As Cryosphere is not a remote sensing journal, the spectral color of each band should be added too (red, green, infrared,...).

- Page 2789, a second Table is needed which gives the number of L3 images available (downloaded) from Aqua and Terra each year (from DOY 100-160) as well as the number of images really used (absence or limited cloud cover) each year from Aqua and Terra. It will be also pertinent to add two columns for the L1B products used from Aqua and Terra.

- The processing of the MODIS data needs to be explained in more details so the reader could do the same approach with other MODIS data sets if needed. I recommend that a schema be added showing all the analysis steps for the L3 and for the L1B products that the authors have done after extracting the data from the NASA data base and up to interpretation of the classified image. The processing chain seems different for the two products and they are not use for the same purpose either. It is not clear what is done automatically?

- The scientific data set values (SDS) should be explained. . .what processed have been done to this data set? How they are different then the DN values?

- What do you means by matching SDS values to derive the threshold values for L1B product? This should be explained and the schema of the processing chain could help to clarify the approach. Could you explain how the thresholds on Table 2 were established?

- Section 2.3 The approach to estimate the ice velocity is not clear either. The para-

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graph on the WSC data availability in section 3.1 should be move in this methodology section (Ice velocity)

- Section 3.1 The first paragraph of this section should be moved to the section 2.11 MODIS Data.

- Section 4.1 This section should be in the RESULTS Section as section 3.3 (Ice break-up and snowmelt relation) because new results are presented (Fig. 10, 11 and 12). However, the last paragraph of this section (line 13-22, page 2796) could stay in the Discussion; the authors could see where this paragraph fit better.

- Section 4.0 could start with the discussion about the Spatial and temporal ice break-up patterns (section 4.1). However a Table is needed to summarize all the information presented in the 1st paragraph on page 2796 and 2787. This Table could give the localization (name and kilometer) , the range of dates for each study (reference), and the tool used (MODIS, others) including this study. This Table would then replace the paragraph.

- The last paragraph of section 4.3 mentioned that certain preconditions are required to use MODIS? Are-you referring to the ice velocities measurements? Probably, but this paragraph needs to be rewritten. You could directly specify the minimum width of a river to be able to estimate the ice velocities and the others conditions.

- Page 2800 - One of the conclusion is that channels bars, river meandering and channel constriction are important factors controlling ice runs and ice break-up. The sentence should be rewritten differently because those morphological controls are known for a while. The MODIS image may help to identify those.

- The reference to the Canaan River event is not pertinent.

Technical corrections: - P. 2791 Fig. 6 should be Fig. 5 (order of discussion). - P. 2792 Fig.6 should be Fig. 5 and inversely Fig.5 should be Fig.6 - Figure 2. For visibility, it would be better to select 3 years only, like 2002, 2007 and 2011. - References should

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