Dear Editor and Reviewers,

Thank you for all your comments and suggestions on the manuscript. Making the required changes improved the quality of the article by adding additional context to the previously conducted analyses.

The article added an analysis of changes in winter air temperature during the study period, which made it possible to show that rising temperatures are not the main factor responsible for the decrease in ice frequency. In order to demonstrate the mechanism by which dam reservoirs affect river ice cover, the variation in water temperature at a cross-section below the Czorsztyn-Sromowce reservoir complex was presented. During the public discussion period of the article, field studies were also carried out which showed, the significant influence of the dam reservoir on the water temperature below its location.

The results of the field measurements were included in the article. In addition, based on the literature, a broader description of the mechanism by which dam reservoirs affect the occurrence of river ice cover has been added to the introduction. The discussion chapter has been updated with information on the variability of air temperature during the study period, the results of field surveys and water temperature analyses from the C3 cross-section.

A few minor changes picked up by the author while working on the manuscript have also been added to the article.

Below, in the form of a table, I send my response to the comments of the Editor and Reviewers.

Reviewer comments	**Authors reply**
Editor comments (Prof. Dr. Daniel Farinotti)	
Please provide a manuscript version with line numbers, as this will facilitate the work of the reviewers.	Correction has been added to the text.
On page 5, please point the reader at the "Data availability statement" when introducing the "online public database of the Institute of Meteorology and Water Management - National Research Institute (IMGW-PIB)".	Correction has been added to the text.
For Eq. (3) on page 6, please clarify that variable "x1" is eventually defined to be the average air temperature from 14 days before the considered day (at least this is what I understood). Please also add a brief explanation for why "14 days" are considered to be a suitable time period (at the moment, the choice seems arbitrary)	Correction has been added to the text.
On page 6, please spell out the acronym "AUC-ROC"	Correction has been added to the text.
On page 8, Fig. 2, please use the caption to clarify whether the numbers of fays with ice cover are based on observations, or on the logistic regression given by Eq. (3).	Correction has been added to the text.
On page 10, Fig. 4, and page 11, Fig. 5, please use the caption to clarify that the red vertical line shown in panels "a)" marks the time at which the dam was constructed.	Correction has been added to the text.

On page 13, Fig. 6, the caption mentions a panel "c)" showing "daily air temperatures from measuring stations". Since this panel seems to be missing, please either add the panel or remove the information from the caption.	Correction has been added to the text.
On page 14, Fig. 7, something went wrong when calling the individual panels in the caption ("a" is never mentioned while "c" is called twice). Please amend as necessary.	Correction has been added to the text.
On page 18, please correct the erroneous call to Figure 8 in the sentence starting with " In Europe, most of the reservoirs in areas where…" (the call should be for Figure 9).	Correction has been added to the text.
Reviewer comments #1 (Dr. Andrew Newton)	
In the discussion I am not convinced it has explained what the dam has changed in the ice regime itself. Yes, the ice season has reduced, and it does appear that this might be associated with construction of the dams, but that in itself does not do enough in my view, particularly given the scale of impact that you state this paper might have. I think there needs to be a greater investigation into the potential causality of these changes. You outline some theoretical ideas, such as changes in discharge, but provide no evidence from the study site that could help to back this up. I strongly suspect you are correct in your hypothesis about what caused the impact, but it would make the paper significantly stronger if you could demonstrate some of this. Perhaps these data do not exist, but if they do, then I would encourage using these data to help make your point. If you have data such as Figure 9 for other time periods, then this would be a good place to start.	A broader theoretical description regarding the influence of dam reservoirs on the occurrence of river ice cover has been added to the introduction chapter. The results chapter presents the results of field measurements, a long-term measurement series of water temperature and flow volume on the Dunajec River. Unfortunately, no data are available for the second river studied (San). The presented data confirm the role of reservoirs in transforming the ice regime of the rivers (higher water temperature and the rise of states in winter downstream of the dam). However, a detailed analysis of the relationship between air and water temperature, river water levels and the occurrence of ice cover requires further detailed research.
There is clearly a difference in the ice cover trend before and after the dam construction (Figure 2 shows that), but these trends have been derived from just two time periods – before and after. I would like to see you try some moving averages of that trend, perhaps a moving window of ~10-15 years within the before and after time periods. I suspect this would help to demonstrate that it was not a gradual change, but a rather blunt one. This would help to make your point of the dam influence, though it still does not explain the causal mechanism.	Graphs with moving averages have been added to the figures. The addition of these graphs helped to better depict the sharp decline in the frequency of ice cover occurrence after the construction of the reservoirs.
I would also like to see some greater statistical analyses of the climate change signal. This need not be complicated – e.g., some work can clearly be done on investigating the climatological trends in the weather station data and how these trends might relate to your ice regime changes. If there is no, or only a small, climate change signal in your weather stations, then this helps to make your point that it must have been the dam construction that impacted the ice regimes. This would be especially useful if data are not available to address point (1) above.	Climate signal analysis was added to the article. It showed that in the study area climate changes in the winter period were not very significant (statistically significant trends in the period 1982-2015 occurred only in November). In addition, the average values of air temperature in Winter for the 10 years before and after the reservoir's construction and the corresponding average number of days with ice cover during these periods are given (in Figures 8 and 9). The addition of this type of analysis made it possible to show that climate variability is not responsible for the sharp decline in the frequency of ice cover occurrence.

I would like to see a table that provides the geographical characteristics of the different water and weather stations, such as elevation. It would also be helpful to provide a comment on which weather stations are used to infer the air temperature at which water gauges – this is not currently as clear as it could be. This will provide a stronger link between the datasets.	A table with the required data was added to the text.
I would like to see greater discussion in the text about how reflective the author feels the weather stations are of the temperature that is likely to have been observed at the water gauges. For example, the lack of geographical information about the different data sites – e.g., elevation – means that I cannot be sure what elevation difference there might be between them, and this will certainly impact how representative those observations are likely to be. Maybe there is little difference in elevation, but this needs to be explained in more detail, and if there are major differences in elevation between the weather stations and the associated water gauges, then I would think that this needs to be taken into account when drawing up the correlations between temperature and ice presence. The strong correlations do suggest this might not be a significant factor, but I still think this needs to be properly accounted for, or at least discussed.	Information on the altitude of hydrological and climatological stations has been added to the text. In addition, a brief commentary has been added to the text regarding the height of the station's location and the representativeness of the data.
The impact of the work needs to be developed further. The start of your concluding point (1) is very important but given the above issues I am not sure you have presented a strong enough case to robustly make this argument. If you can make the above revisions, then you certainly will have. There also needs to be some extra information on what this result would also mean for climate change studies – essentially that the trends of a declining river ice cover are not a de facto proof of climate change, and the wider hydrological setting needs to be taken into account in such settings. If you are able to make the revisions above you will be able to: 1) prove the dam influence is the case, and 2) prove that climate is not the main driver. This is a key selling point of the paper and if that case can be made more strongly, it will provide a good contribution to the literature.	The article adds a description of the variability of air temperature during the study period and shows that the Czorsztyn-Sromowce dam reservoir complex affects the change in water temperature and flow volume. An additional conclusion has been added to the text relating to the relevance of the results obtained in the context of climate change impact studies.
In a large number of places in the text it is not always clear what is being referred to. The reader can often infer it, but it is better to be specific and unambiguous – e.g., instead of saying “their”, “this” etc., state what it is you are referring to.	Corrections have been added to the text in unclear places.
I would encourage rewording of the locations from above/below the dam to upstream/downstream of the dam. This is much clearer language. I highlighted some instances, but not all of them.	Correction has been added to the text.
All minor comments and suggestions sent in pdf form have also been incorporated into the revised version of the manuscript.	
Reviewer comments #2 (Anonymous Referee)	

Some details on the environment of the water gauges and climatological stations would improve the manuscript. Some examples: How far are the water gauges located from the dam? Are the water gauges located above the dam affected by the backwater of the reservoir? (Backwater has the opposite effect on river ice regime.) Has there been any other anthropogenic influence on the river bed conditions in the river section under investigation? At what altitude are the climatological stations are located?	The manuscript was supplemented with the required information. Information was added on the altitude of the stations used, the distance of the hydrological stations from the reservoirs, and other factors potentially affecting the ice cover of the rivers studied were characterized.
Why was the average air temperature of the 14 days prior to ice cover occurrence used for the modelling? Please explain it more detailed. Had other temperature averages or cumulative temperature sums been tested?	A brief explanation of the adoption of this parameter has been added to the text.
How have the climatic conditions developed 1950–2020? What kind of temperature trend has been observed? The results shown in Fig.2, 4–5 suggest that there might have been changes in winter temperature conditions, especially since the 1990s.	Climate signal analysis was added to the article. It showed that in the study area climate changes in the winter period were not very significant (statistically significant trends in the period 1982-2015 occurred only in November). In addition, the average values of air temperature in Winter for the 10 years before and after the reservoir's construction and the corresponding average number of days with ice cover during these periods are given (in Figures 8 and 9). The addition of this type of analysis made it possible to show that climate variability is not responsible for the sharp decline in the frequency of ice cover occurrence.
In case of the San River, the available data set for the pre-dam period is slightly short and incomplete for comparison.	In the case of cross-sections S2, S3, S4, the period of available data on the occurrence of ice cover before the formation of the reservoir is 18 years, which, in the author's opinion, is a sufficient period to generally characterize the ice conditions occurring at these water gauge cross-sections. In the case of cross-section S1, data are only available for 12 years due to gaps. Unfortunately, the data for periods prior to 1950 are characterized by significant deficiencies and high uncertainty, so it is not possible to use them for this type of analysis. Information on the observed and modeled number of days with ice cover for equal 10-year periods before and after the reservoir's construction has been added to Figures 8 and 9. To some extent, this will allow the reader to analyze the observed changes not only for the entire periods studied (1950-2020) periods, but also for equal periods before and after the reservoir's creation. In addition, information on the average winter air temperature for these periods has been added to the text, which illustrates the relationship of air temperature changes to transformations in the occurrence of ice cover.
When comparing the results of the 2 dams, it should be taken into account, that the post-dam reference periods are different (Dunajec River: 1993–2020, San River: 1969–2020). Global trends show that winter warming has accelerated since the 1980-90s. If this is	Added to the text is a discussion of trends in air temperature over the time period studied and a discussion of the role of temperature variability on the question of how dam reservoirs affect river ice cover.

also the case here, it should also be taken into account when interpretating and discussing the results.	
Why was it necessary to use satellite data to study the spatial extent of dam effects on river ice regimes? Please justify this more detailed. This could be analysed on the basis of river ice observations at the water gauges. Has the result of the river ice classification been compared with the observational data for the winter of 2016/17? Satellite data could possibly be used to reduce the data gap in river ice observations after 2015.	The rationale for the use of remote sensing data has been added to the text (it is not possible to determine the section downstream of the reservoir where there is no total ice cover from the water gauge cross-sections).
Fig.6 and Fig.7: Please use a thicker line to represent the rivers. Perhaps the inclusion of water gauges would help the navigation on the figure.	A larger font and lines were used where possible. In other cases, the size of the figures was increased for better visibility. In Figure 7, the location of the water gauge cross sections was added for better presentation of the data. In other cases, please leave the figures unchanged.