## **Response to comments**

**Paper #:** essd-2022-289

**Title:** Lake Surface Temperature Dataset in the North Slave Region Retrieved from Landsat Satellite Series – 1984 to 2021

Journal: Earth System Science Data

## **Reply to Reviewer #1**

The paper of Attiah et al. "Lake Surface Temperature Dataset in the North Slave Region Retrieved from Landsat Satellite Series - 1984 to 2021" brings an interesting overview of long-term dataset in the high latitude regions where the historic (but also recent) in situ observations are scarce. It analyses more than 500 lakes which also allow to analyse spatial variability of the temperature across the whole region.

I appreciate the detailed description of the methodology including data quality control. As not being a remote sensing expert I can't judge on every detail of the process. Therefore, I stress that this issue is hopefully reviewed by other reviewers.

We are thankful to the reviewer and appreciate their suggestions and valuable and positive comments for improving the manuscript. We have addressed or responded to all comments to improve the quality of this manuscript. Below, we provide the answers to the comments and questions raised by the reviewer. For convenience, comments from this Reviewer are provided in <u>black text</u>. Responses to each comment are provided in <u>blue text</u>.

I would suggest including more details on the validation of the dataset against the in situ observations. This is to me essential for the reader/user as this basically can tell us something about how reliable the Landsat-derived results are. As I understand, the observations are made manually, but some of them with use of automatic loggers. You demonstrated that the individual datapoints are well represented, but are the statistical parameters derived from in situ and remotely sensed datasets comparable in terms of open water season average LST for example?

Thanks for the comment. As suggested, LST values for a few statistical parameters have been calculated to further compare LST from in situ measurements with Landsat-derived values. The average yearly LST, total LST average and variance for available data are reported in Table 1 (see below). This analysis is added to the revised version of the manuscript.

Statistical Parameters	Data	Period	North Slave LST (°C)	In-Situ LST (°C)
Average LST for	ECCC	1999	12.2	11.9
open water season		2000	11.8	10.8
(June –		2001	14.2	13.7
September)		2002	11.2	11.1
		2003	12.5	12.2
	DataStream	2014	14.2	13.7
		2015	14.5	15.1
		2016	16.4	16.1
		2017	15.5	15
		2019	13.3	14.2
<b>Total LST</b>	ECCC	1999-2003	12.6	12.3
Average for open	DataStrean	2014-2019	14.8	14.9
water season				
Variance	ECCC	1999-2003	14.9	15.5
	DataStrean	2014-2019	4.1	3.8

Table 1: Statistical Parameters between North Slave LST and In-Situ LST.

I think it is essential to distinguish between water LST and temperature of a frozen/snow covered lake. I think it would be worth including this information in the dataset. This would also allow the user to estimate changes in lake ice cover duration, date of freezing and melting.

Thanks for the comment. As suggested by the reviewer, a few new parameters have been included in the dataset. First, the total number of LST pixels for ice/snow and for open water, respectively, for each lake, has been extracted for each given day. Furthermore, the percentage of ice pixels was estimated for each available day of all lakes in the dataset. With this, we believe users can determine their thresholds in deriving lake ice phenology from the data, including lake ice cover duration, date of freezing and melting. This is added to the revised version of the manuscript.

You stated that the aim of your work is to distribute the data among the public/authorities. I don't think that any of these people would be able to process or use the data in its present form. I think that it would be great if you can also provide the reader/user with processed dataset of LST average values (for example) – in a table form. My suggestion would be to generate annual average LST for open water season, length of the open water, melt date, freezing date.

Thanks for the great suggestion. Processed tabular LST data has been generated for each lake studied and included in our dataset. Each lake name will be followed with longitude and latitude to allow for easy query based on location (e.g., AcastaLake\_-115.564 \_ 65.3783). This data includes the mean LST, median LST, maximum LST, minimum LST, total ice-covered pixels, total open-water pixels, percentage of ice pixels, area of Lake, lake area captured, Landsat sensor data and tile from which it was extracted. Additionally, another tabular LST data with monthly LST means for all lakes studied has also been included in the dataset.

The description of this dataset is included in the modified manuscript (See Table 2). Table 2 below shows the column structure and information contained in the table associated with the two new types of tabular data generated for all lakes.

Column	Description	
Lake_Name	Name of the Lake from which the lake surface temperature was retrieved. The name of lakes was predominantly derived from the Water file-Lakes and Rivers polygons data from Statistics Canada. Lakes' unknown names were prefixed "NoNameLake" and a number	
Date	The date which the lake surface temperature(LST) represents	
Year	The year of the LST in the format "YYYY."	
Month	The month of LST in the format "MM."	
Day	Day of LST in the format "YY."	
Maximum_Temperature	The maximum LST recorded on the lake at a given time in degrees Celcius (°C)	
Minimum_Temperature	The maximum LST recorded on the lake at a given time in degrees Celcius (°C)	
Median_Temperature	The median LST from all available pixels in degrees Celcius (°C)	
Mean_Temperature	The mean LST from all available pixels degrees Celcius (°C)	
Total_Pixels	Kels         Total number of Pixel representing the lake	
LST_Pixels	Number of pixels with LST values retrieved from the lake	
Percentage_LST_Pixels	Total percentage of pixels with LST values captured from the lake. Values are rounded to the nearest 1	
Count_Water_Pixels	Number of LST pixel values greater than 0 retrieved from the lake at a given time	
Count_Ice_Pixels	Number of LST pixels values less than 0 retrieved from the lake at a given time	
Percentage_Ice_Pixels	Total percentage of ice pixels captured from the lake at a given time. Values are rounded to the nearest 1.	
Landsat_Row_Path	Tile name, Row and path of the Landsat from which LST was retrieved	
Lake_Area	Surface Area of the Lake in square kilometres (km <sup>2</sup> )	
HyLak_ID	The ID is derived from the HydroLAKES dataset. Lakes with no ID are indicated with 0.	
HyLak_Depth	The average depth of the lake derived from the HydroLAKES dataset in meters (m)	
HyLak_Volume	The volume of the lake derived from the HydroLAKES dataset is million cubic meters $(1 \text{ mcm} = 0.001 \text{ km}^3)$	

 Table 2: Columns names of the tabular dataset and the description.

HyLak_Elevation	Elevation of the lake surface derived from HydroLAKES	
	dataset in meters above sea level	
Long(m)	Longitude point on the lake in meters	
Lat(m)	Latitude point on the lake in meters	
Long(DD)	Longitude point on the lake in decimal degrees	
Lat(DD)	Latitude point on the lake in decimal degrees	
Monthly_Mean_Temperature	The mean LST on the lake for a given month	