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### Analysis of Surface Temperature Trends of Global Lakes Using Satellite Remote Sensing and in Situ Observations

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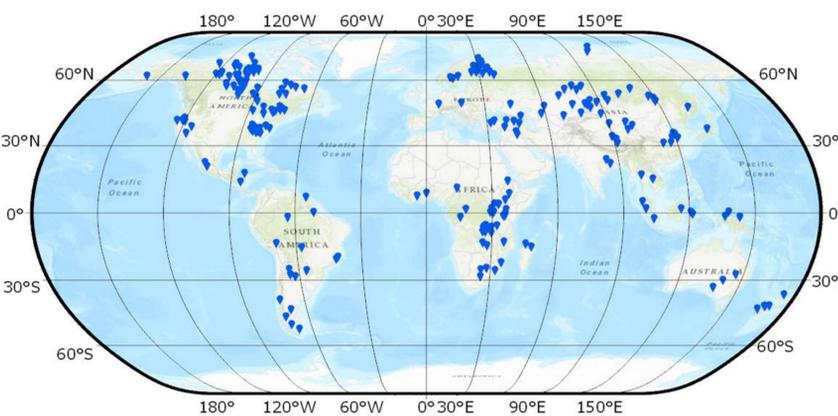
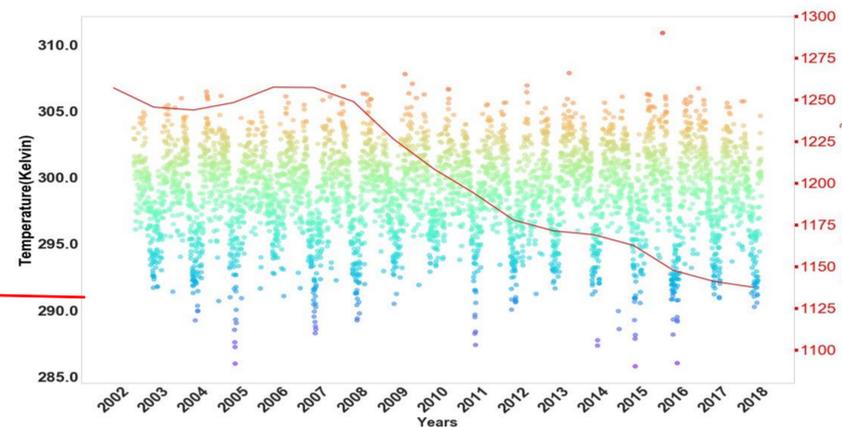
**ABSTRACT:** Even though lakes make up a small percentage of the water bodies on the global land surface, lakes provide critically important ecosystem services. Unfortunately, however, several lake surface areas around the globe have been changing with many of them drastically decreasing due to climate variability and local mismanagement at the basin-scale level. Lake Surface Water Temperature (LSWT) is recognized as a critical indicator of climate change in lakes. The changes in water and the surrounding land temperatures may be an indicator of climate variability if there is consistency between changes in both temperatures. This project focuses on the application of remote sensing to investigate the changes in lake surface water temperatures and their relationship with their surrounding land cover type in a bid to identify the main driving factors of these changes. In this study, 507 global major lakes have been investigated. An analysis of temperature variation over these lakes has been conducted using daily observations from the Moderate Resolution Imaging Spectroradiometer (MODIS) from year 2002 to 2018 over the lakes and their surrounding land areas. The rates of change of temperature for both the lakes' water surface and their basins as well as the changes in the lakes' surface areas were calculated. The relationship between the rates of LSWT change and other lake characteristics such as lake depth, salinity level, geographical location, and size were also investigated. Moreover, changes in the occurrence in the timing of the annual formation and disappearance of lake ice in the United States were examined. Preliminary results show that many of the lakes' water temperatures are warming faster than their surrounding land temperatures. In addition, approximately 43.15% of the studied lakes are warming, and about 51.00% of them are cooling. Furthermore, 62.53% of the lakes are shrinking while 28.35% of them are growing. Moreover, as latitude increases, the difference between the water temperature and the air temperature increases and vice versa. More importantly, on average, there is 0.13 days per year of earlier ice out over the period of study. This study, therefore, provides insights about LSWT variability on a global scale.

## MOTIVATION

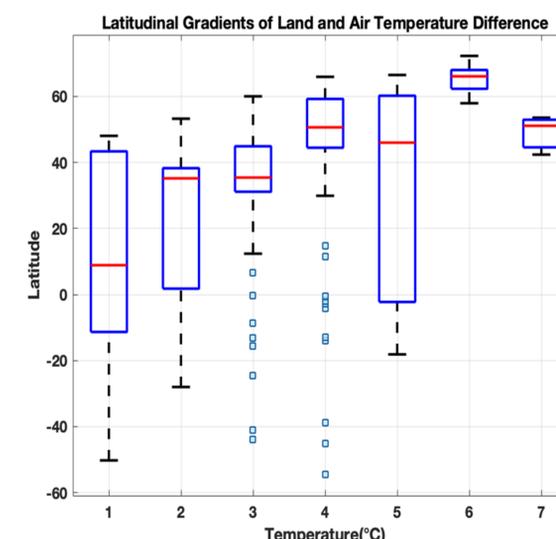
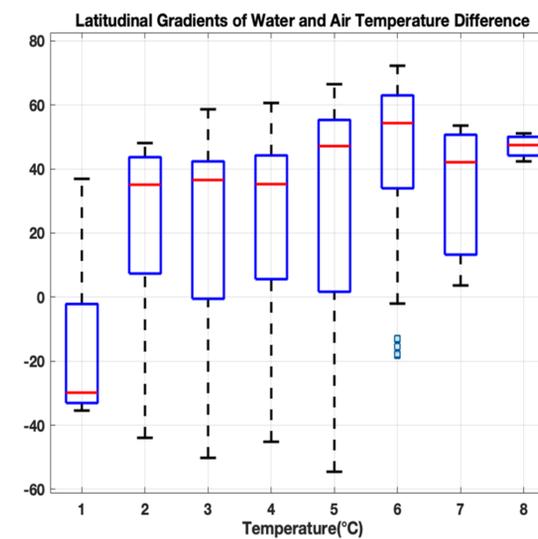
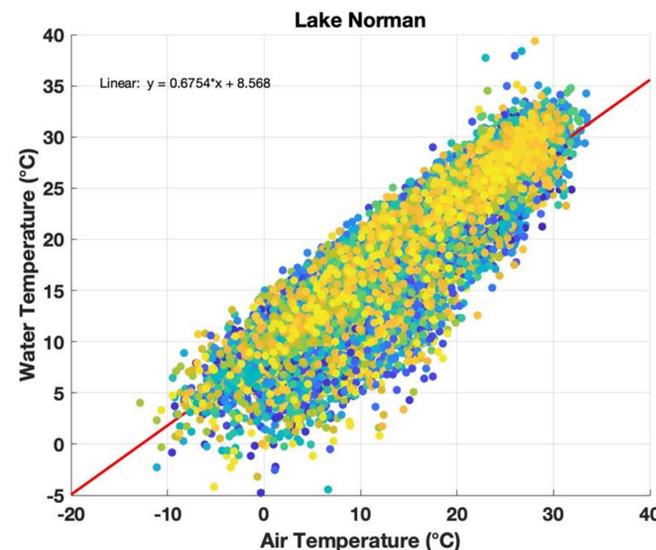
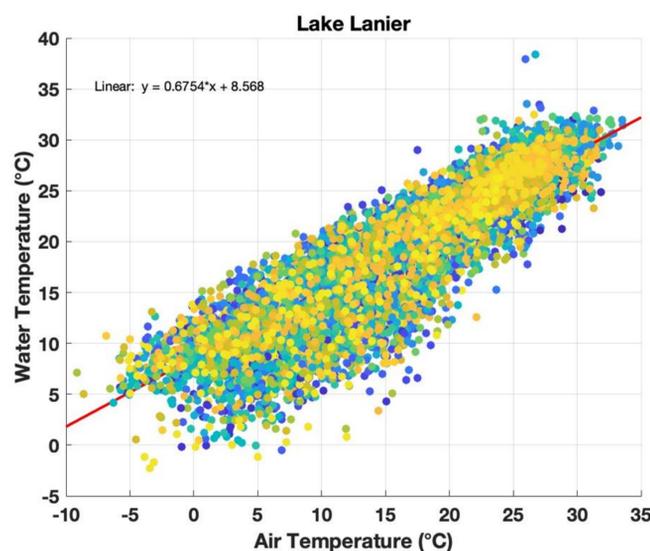
### Lake Chad 1972 / 2007



Lake Chad has decreased by more than 90 % in area over the last 40 years (Gao et al., 2011).



## RESULTS



Linear Regression Models showing the Correlation between Water Temperature & Air Temperature

Box Plots showing the Correlation Between Latitude & Temperature Difference

## CONCLUSION

- There is strong correlation between air temperature and lake surface water temperature (LSWT).
- The temperature changes are proportional to the latitudinal gradients.
- Approximately 43.15% of the studied lakes are warming, and about 51.00% of them are cooling. Furthermore, 62.53% of the lakes are shrinking while 28.35% of them are growing.

## ACKNOWLEDGEMENT

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