

STUDYING GLOBAL LAKES SURFACE TEMPERATURE VARIABILITIES USING SATELLITE AND IN SITU OBSERVATIONS

Christal Jean-Soverall, Olga Privman, Derrick Seegars,
Abdou Rachid Bah, Hamid Norouzi & Reginald Blake
New York City College of Technology

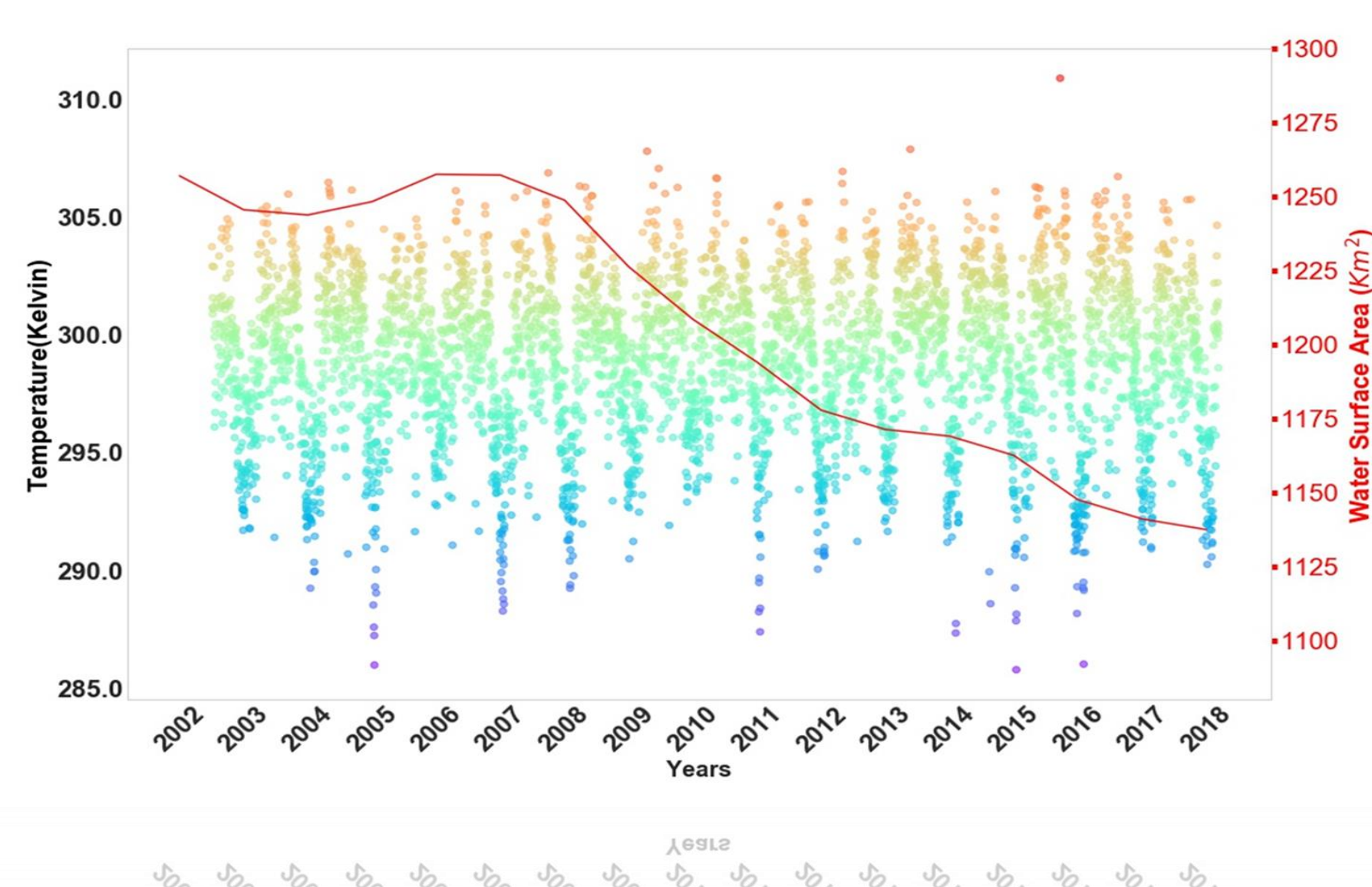
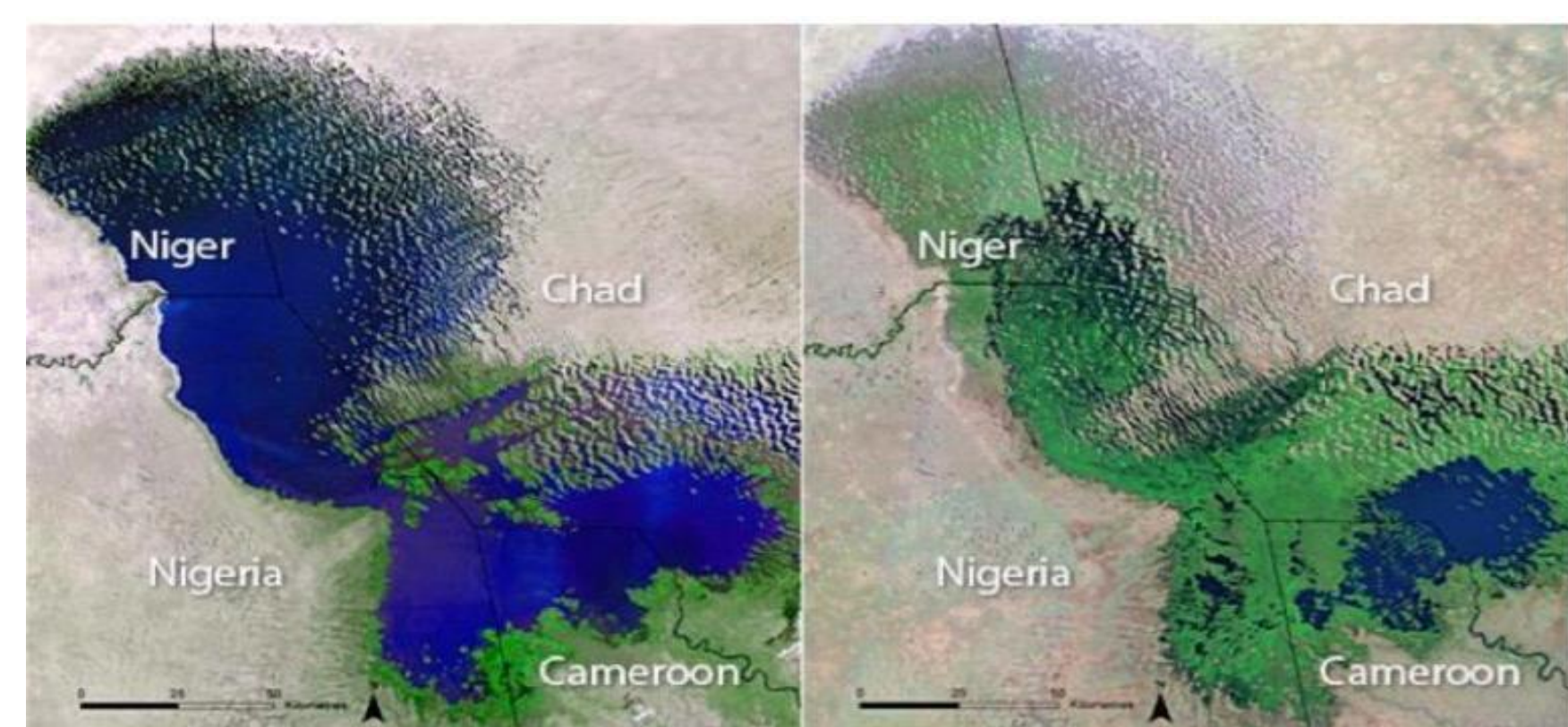
Abstract

Anthropogenic climate change has made a noticeable impact on our worldwide ecosystem, often leading to cascading effects that impact human lives. Although lakes consist of a small percentage of global water bodies, they nevertheless have significant influence on their surrounding environment, impacting the lives around them. For this research, 519 lakes from all over the world were studied using daily observations from the Moderate Resolution Imaging Spectroradiometer (MODIS) from the NASA website. The Lake Surface Water Temperature (LSWT) was found to be an indicator of climate change. In the study, LSWT was compared with Land Surface Temperatures and related factors. Results were analyzed using MATLAB. Approximately 54.24% of the lakes studied were shown to be warming, while 40.03% were shown to be cooling; in addition, 68.44% of the lakes were found to be shrinking; while 24.85% were found to be growing. Continued studies of lake surface temperature trends of global lakes are imperative for communities that depend on them for survival, as well as the entirety of Earth.

Motivation

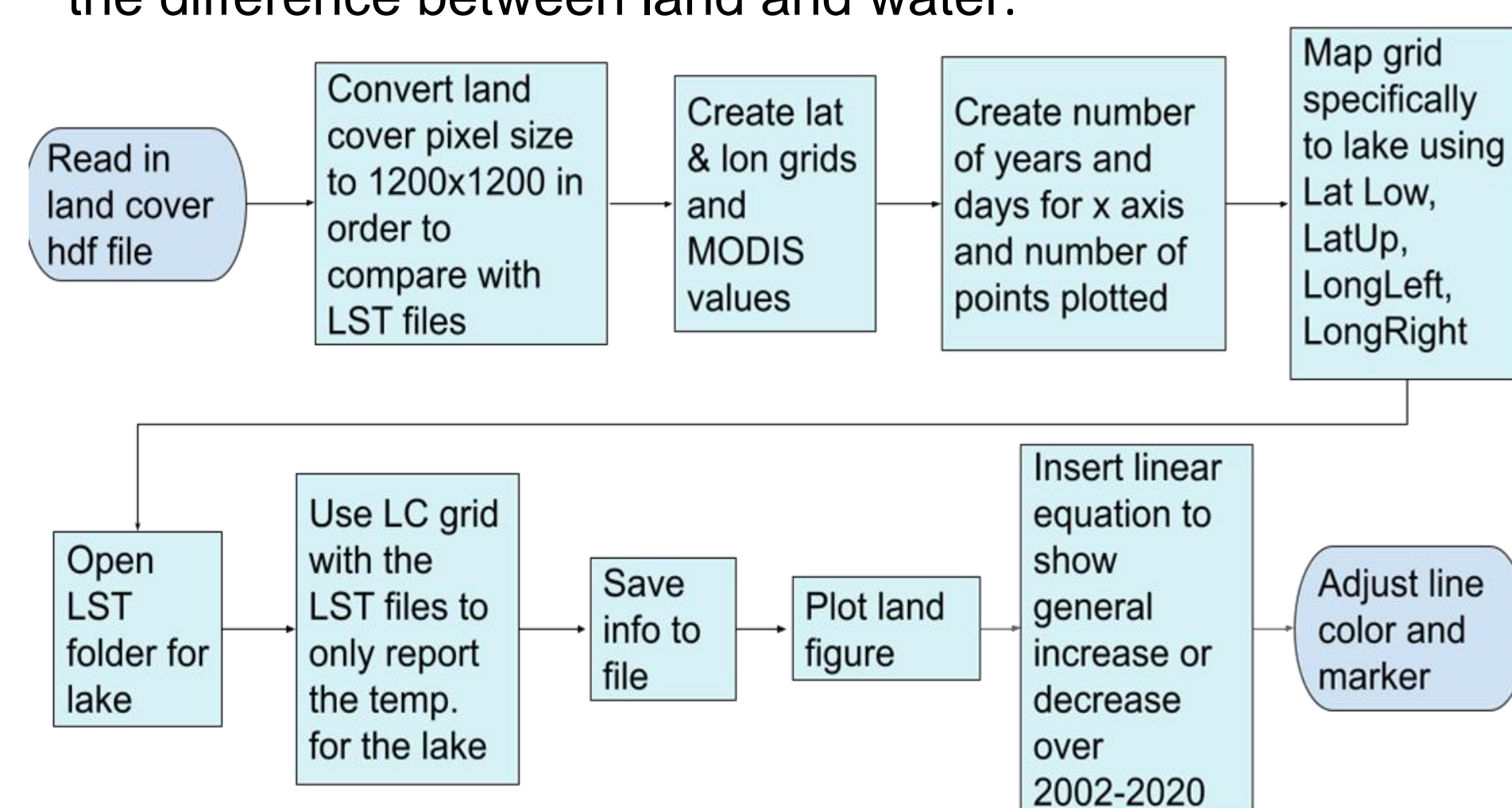
Dying Lakes are an example of climate change phenomena that are a consequence of human pollution and mismanagement.

Lake Chad Surface Water Temperature and Surface Area Time Series



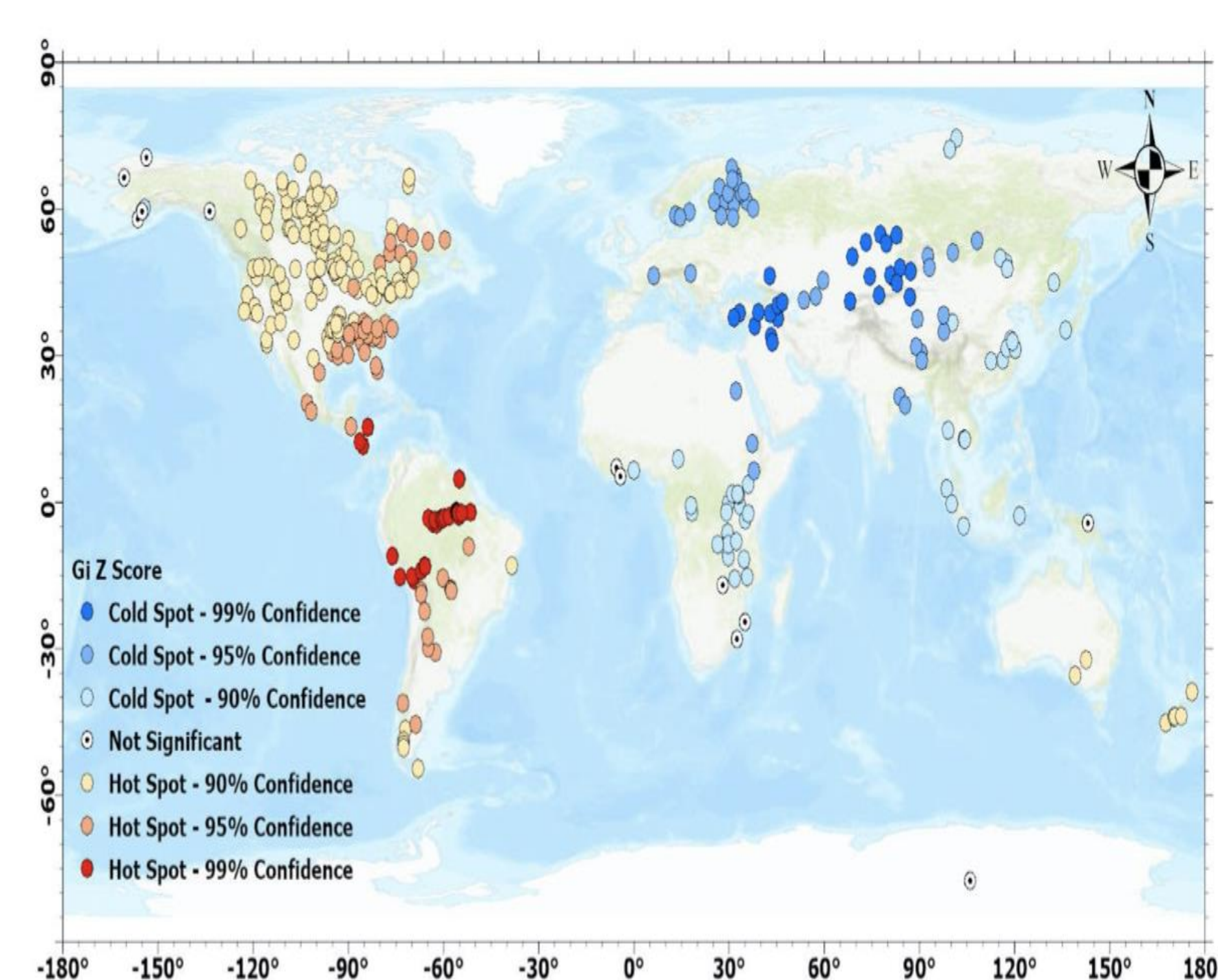
Methodology

- Daily Land Surface temp. from 2002 to 2020 over the lakes
- Obtain from Aqua MODIS "MYD11A1," using NASA Earthdata Search.
- Spatial resolution: 1km
- Acquire, analyze, and visualize by using MATLAB and R
- A linear regression approach was used to calculate the temperature trends in the lake (water), surrounding land, and the difference between land and water.



Results

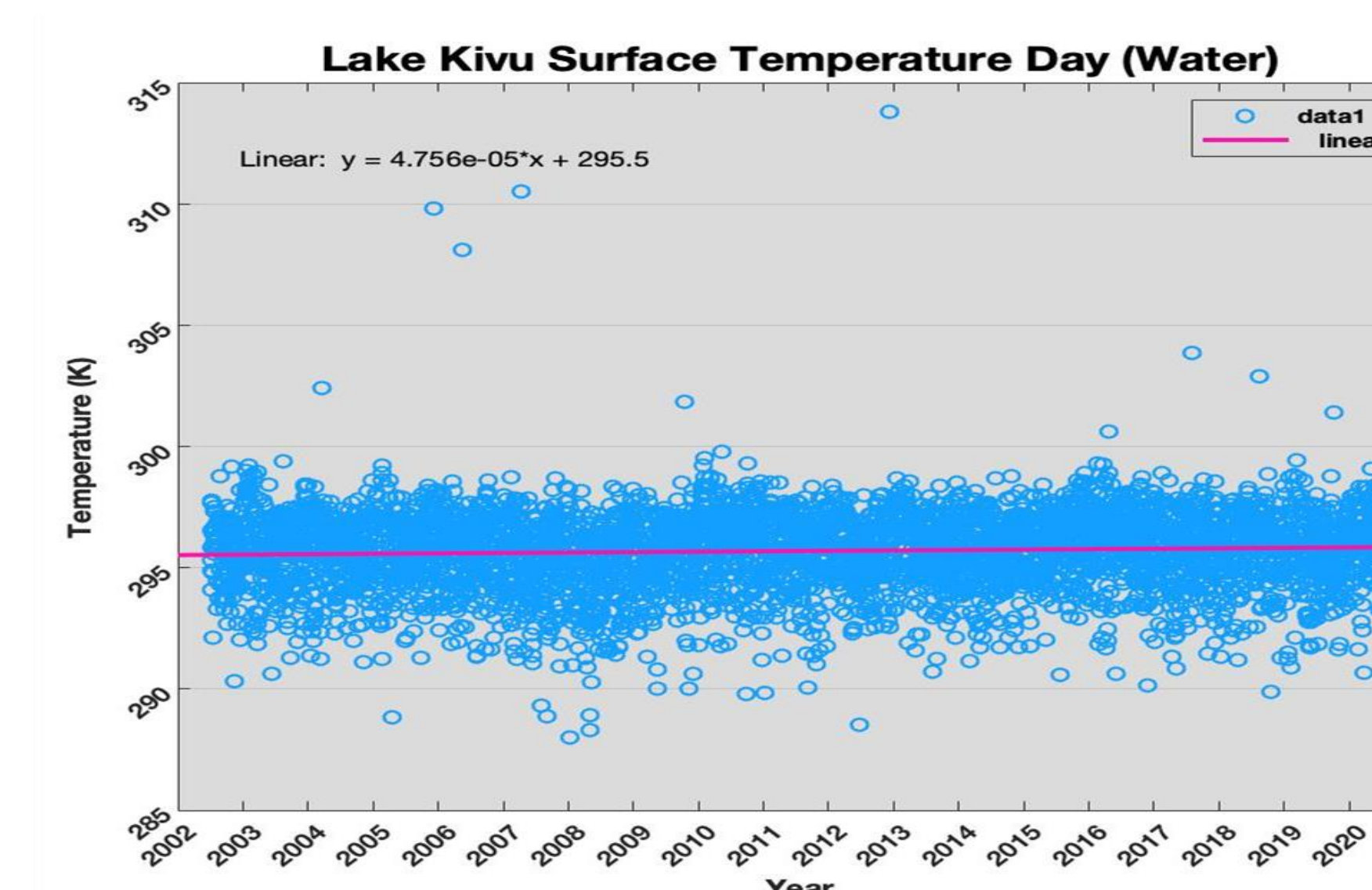
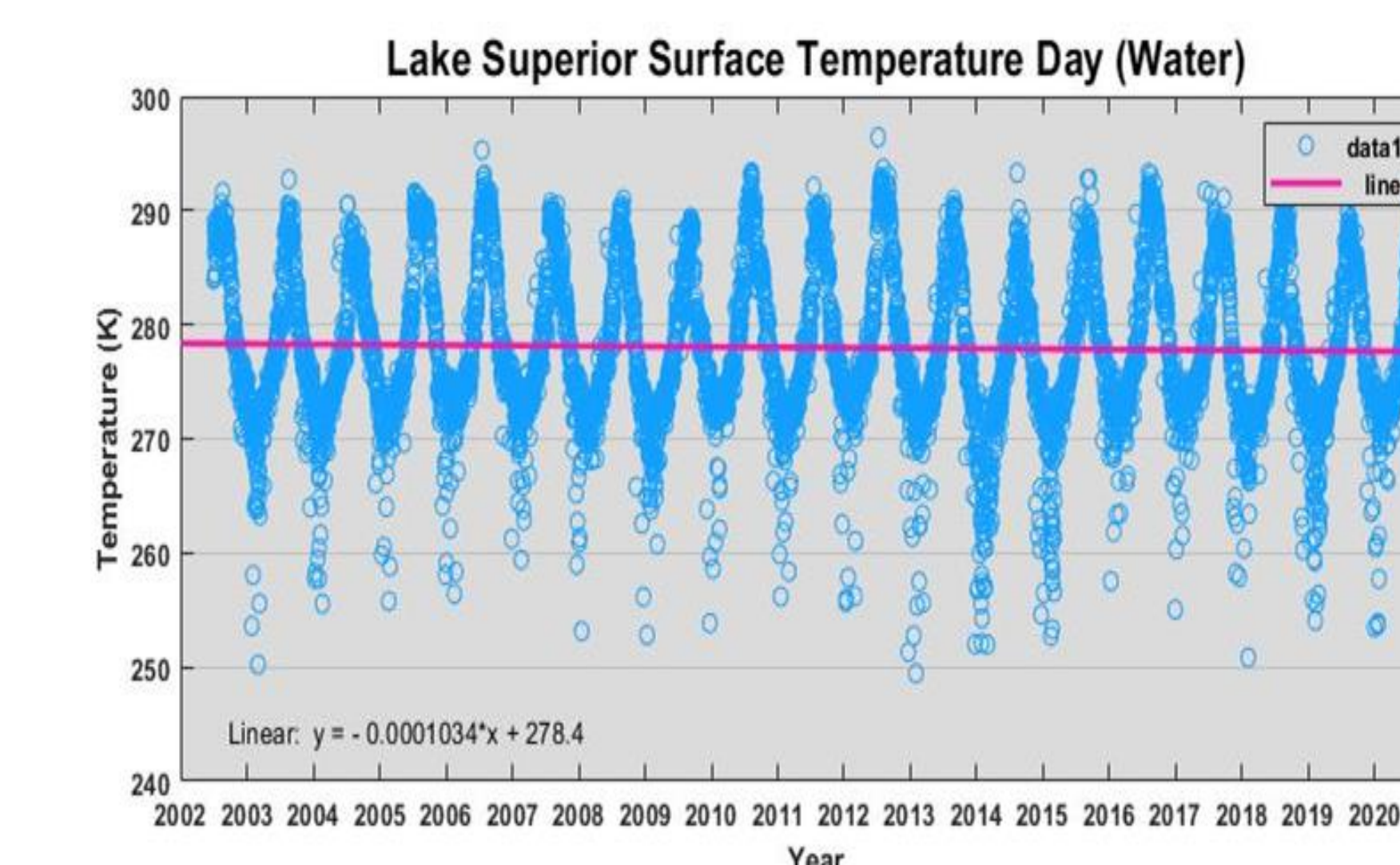
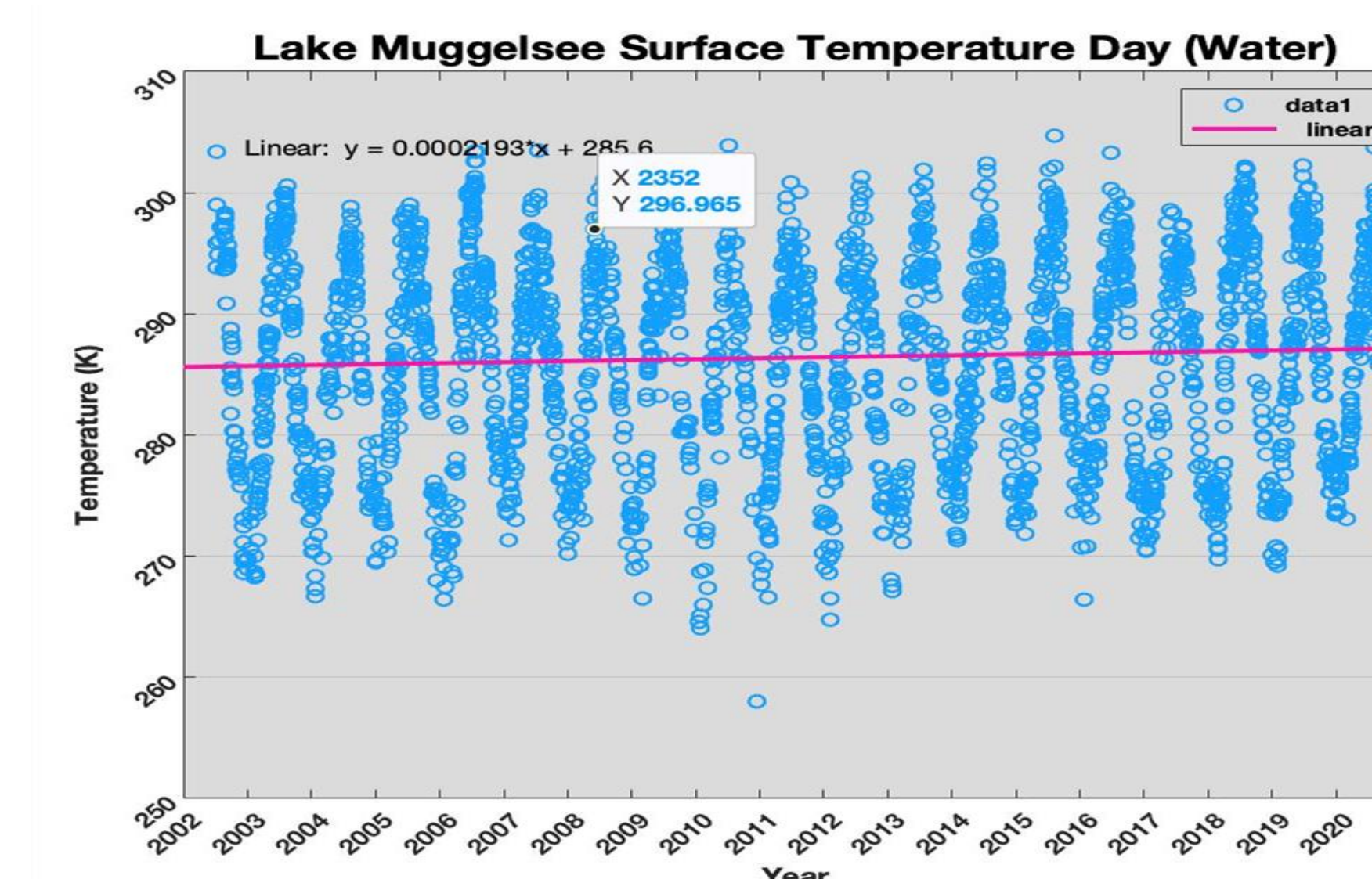
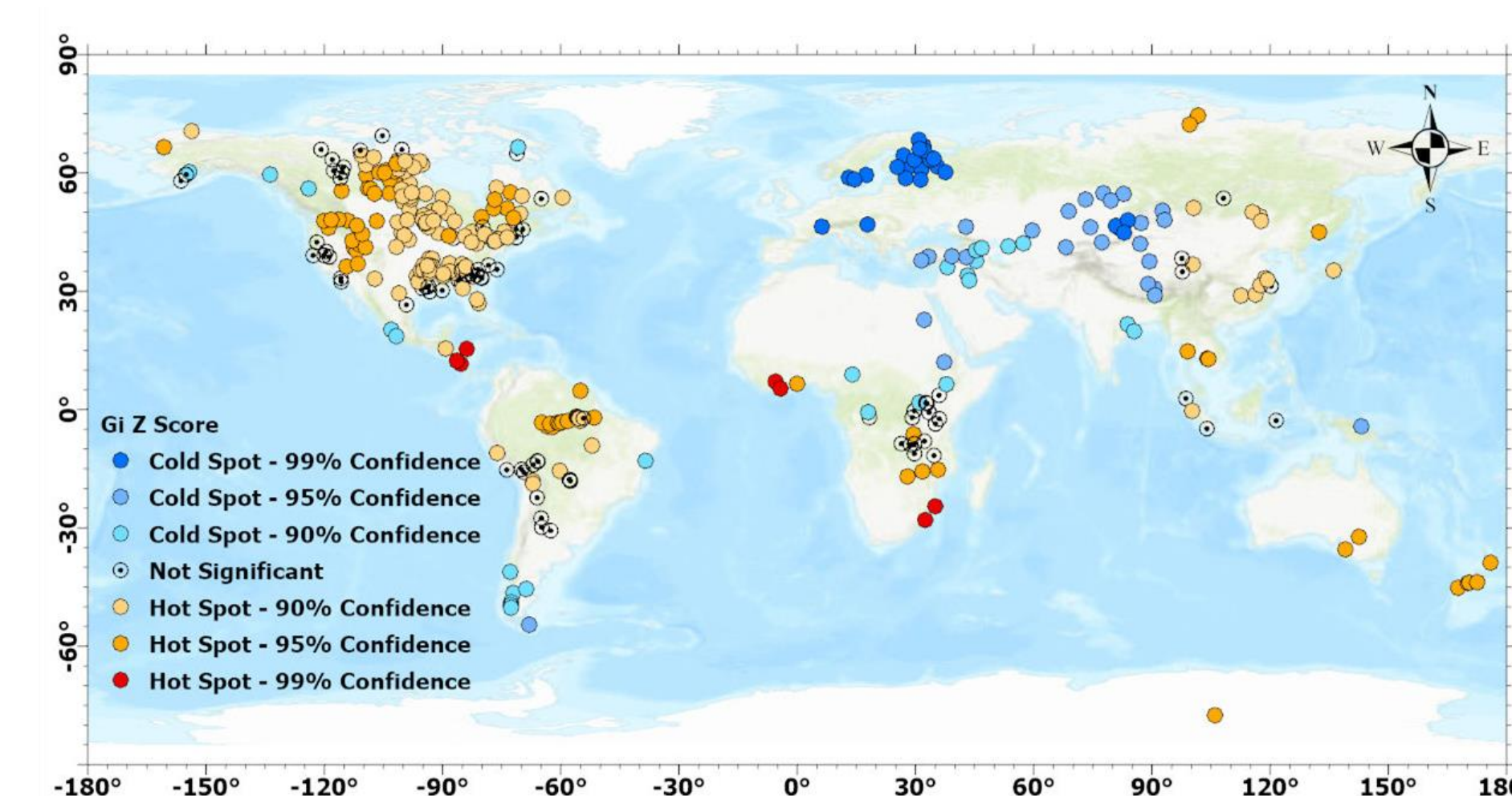
Getis-Ord Gi* Analysis: Water Temperature



- Lake clustered spatially based on the rate of warming with respect to the global mean
- Lakes in the Laurentian Great Lakes area and in South America are warming faster than the global mean.

Results (Cont.)

Getis-Ord Gi* Analysis: Land Temperature



Conclusion

- The results show that there is a direct relationship between changes in lake area, trends in the lake temperature, and surrounding land temperature.
- 68.44% of lakes are shrinking and 24.85% are growing. Meanwhile, 54.24% of lakes are warming and 40.03% of those lakes are cooling.
- Lakes' water temperature is warming faster than the LST of lakeshore.
- Lakes in the Laurentian Great Lakes area and in South America are warming faster than the global mean.

Acknowledgements

The authors are grateful for the support from The National Oceanic and Atmospheric Administration Educational Partnership Program with Minority-Serving Institutions, known as the NOAA EPP/MSI Program Office, under the Cooperative Agreement Grant #: NA16SEC4810008. The project would also like to thank Christopher Navarrete the Honors Scholars Program Coordinator and Dr. Renata Lansiquot, the Program Director for their support. The authors are solely responsible for the content of this article, and it does not necessarily represent the views of the funding agency, the U.S. government, NSF, or of NOAA-CREST.

References

- Sharma, S., Gray, D., Read, J. et al. A global database of lake surface temperatures collected by in situ and satellite methods from 1985–2009. Sci Data 2, 150008 (2015). <https://doi.org/10.1038/sdata.2015.8>
- Woolway, R.I., Kraemer, B.M., Lenters, J.D. et al. Global lake responses to climate change. Nat Rev Earth Environ 1, 388–403 (2020). <https://doi.org/10.1038/s43017-020-0067-5>
- Wan, Z., Hook, S., Hulley, G. (2015). MYD11A1 MODIS/Aqua Land Surface Temperature/Emissivity Daily L3 Global 1km SIN Grid V006 [Data set]. NASA EOSDIS Land Processes DAAC. Accessed 2021-04-23 from <https://doi.org/10.5067/MODIS/MYD11A1.006>