

Arctic Lake Classification from NASA ABoVE Digital Color Infrared Airborne Imagery



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Background and Overview

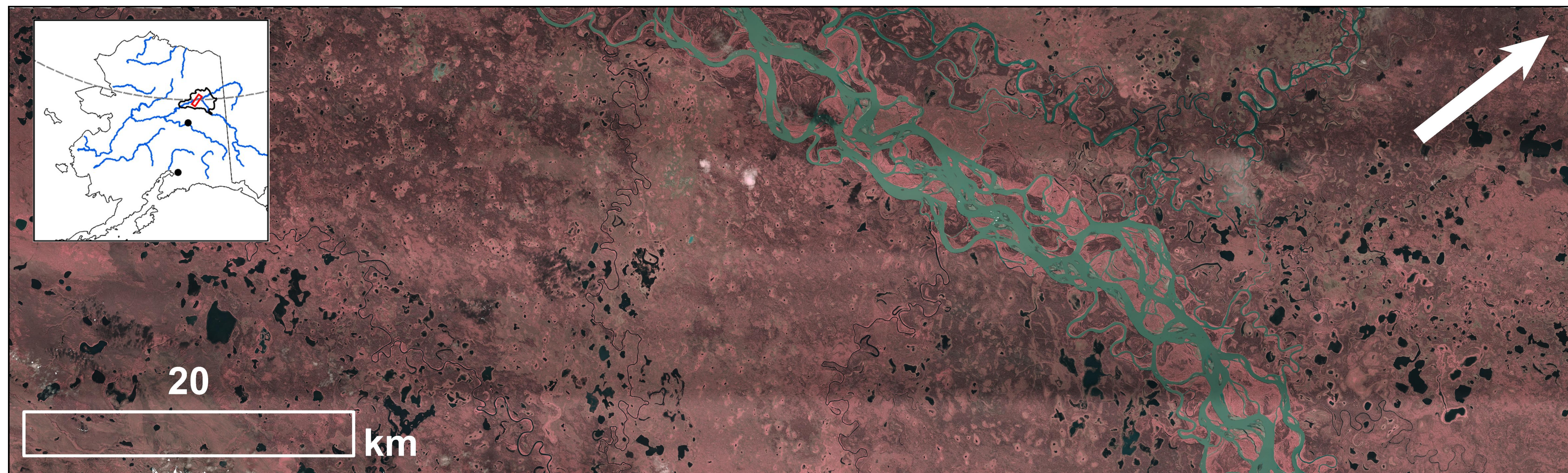
- Arctic regions contain world's highest density of lakes
- 20-40% of Arctic lowland region (Nitze et al. 2017)
- Lakes changing in size due to thawing permafrost
- Imagery is coincident with water surface elevation measurements from novel AirSWOT radar instrument
- Imagery is from June-August 2017 airborne campaign

Results

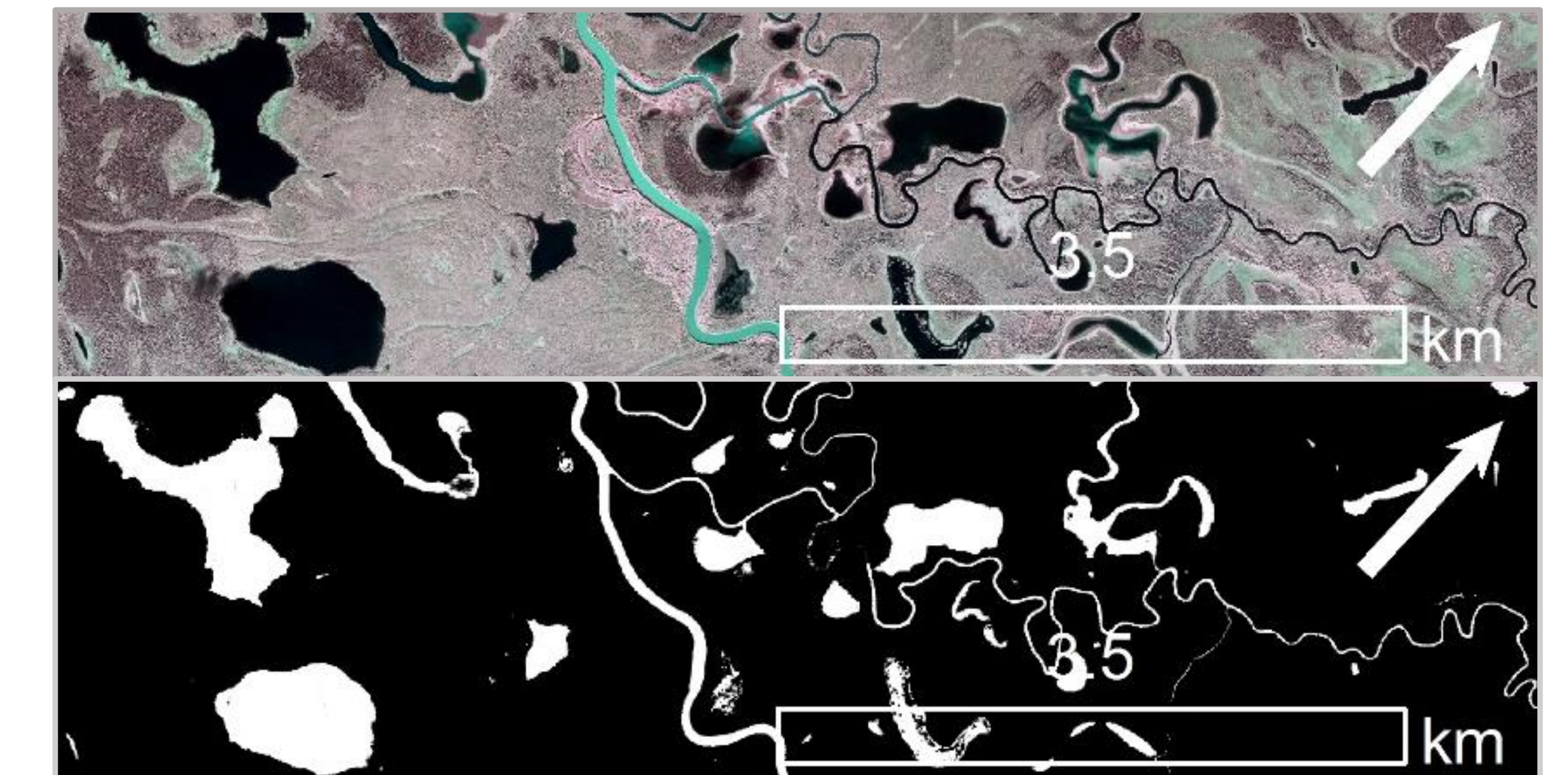
- Overall accuracy (sum of correctly classified pixels divided by total pixels) is **98.3%**
- Algorithm identifies **37** water bodies in validation region, as opposed to **21** manually verified
- Difference between classified and manually verified lake perimeters: **1.24%**
- Robust classification independent of water color
- Emergent vegetation is classified as land
- Sensitivity to vegetation can be adjusted by multiplying NIR values by a constant in the NDWI equation

Discussion and Conclusions

- Sensitivity to vegetation can be adjusted by multiplying NIR values by a constant in the NDWI equation
- Uses for water classification map:
 - Verify water delineations from AirSWOT
 - Hydrological studies on permafrost regions
- Higher resolution water map than existing pan-Arctic datasets
- Further work: different ways to validate dataset

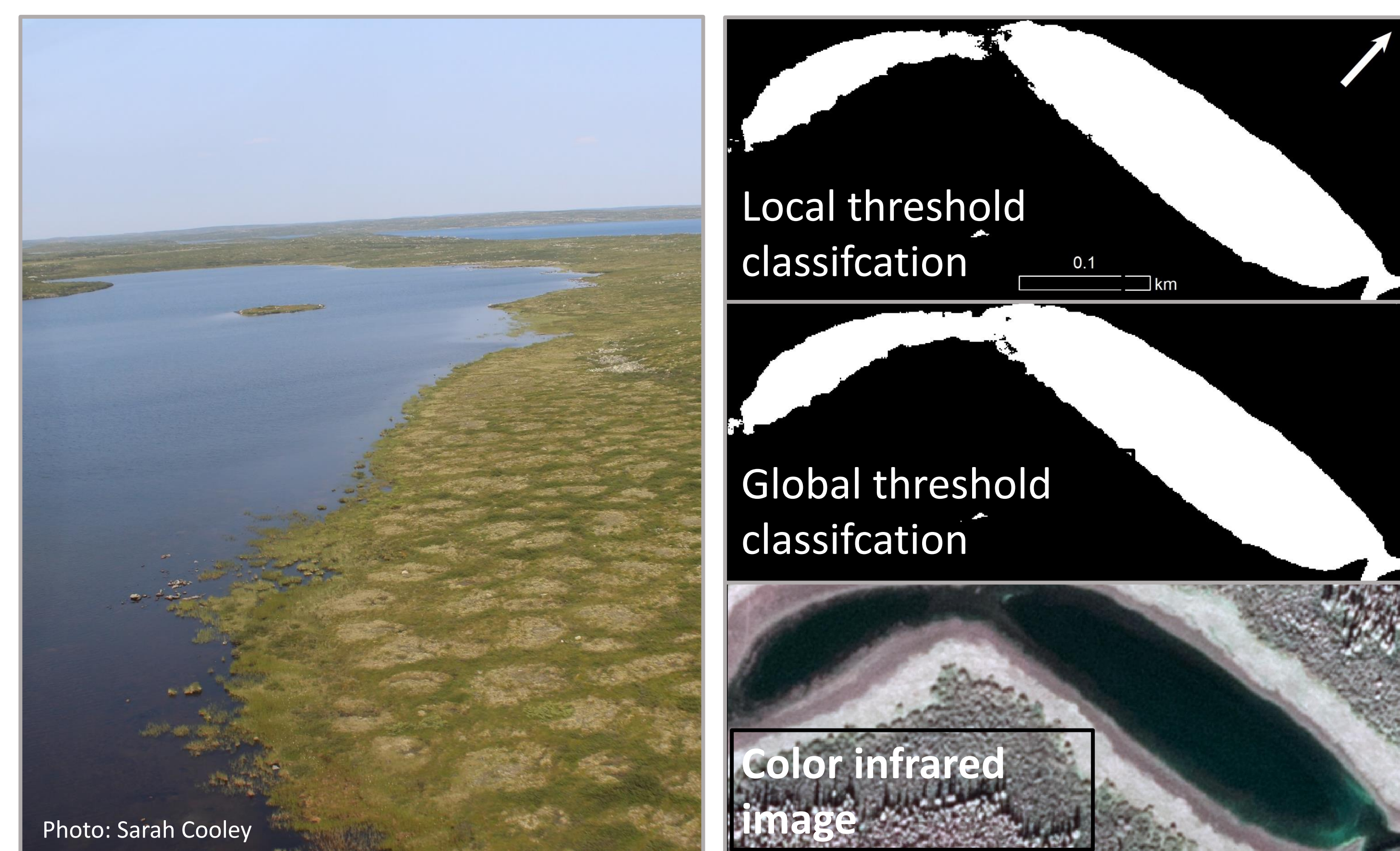


Class	User's accuracy (%)	Producer's accuracy (%)
Water	99.9	98.3
Not water	76.6	97.6



Methods

- NDWI-based water classification
- $$NDWI = \frac{G - NIR}{G + NIR}$$
- NDWI=normalized difference water index; G=green light band, NIR= near infrared band
 - Initial water body guess, followed by buffering and histogram segmentation
 - Local threshold automatically set for each lake and 5km river section
 - Validation by manual delineation from high-resolution imagery of all lakes in a 1.5 km² region
 - Classification algorithm from Li and Sheng, 2012



References

- Li, Junli, and Yongwei Sheng. 2012. "An Automated Scheme for Glacial Lake Dynamics Mapping Using Landsat Imagery and Digital Elevation Models: A Case Study in the Himalayas." *International Journal of Remote Sensing* 33 (16): 5194–5213.
- Nitze, Ingmar, Guido Grosse, Benjamin M. Jones, Christopher D. Arp, Mathias Ulrich, Alexander Fedorov, and Alexandra Veremeeva. 2017. "Landsat-Based Trend Analysis of Lake Dynamics across Northern Permafrost Regions." *Remote Sensing* 9 (7): 1–28.

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