

Remote Sensing Team: Airborne Data Can be Used to Map Groundwater Levels

Mir Mustafizur Rahman, PhD

University of Calgary, Department of Geography
mmrahm@ucalgary.ca

Research Team:

Greg McDermid¹, Kirandeep Basran¹, Marko Djanovic², Julie Lovitt¹
and Maria Strack³

¹University of Calgary, Department of Geography

²Ludwig-Maximilian University, Munich, Germany

³University of Waterloo, Department of Geography and Env. Managem.



Project Summary

Information on the position of local groundwater levels can assist with our understanding of ecosystem functioning and provide valuable information for operations managers and restoration specialists. Installing water wells to locate groundwater is labour intensive and produces information that is spatially constrained. We developed a new technique for mapping groundwater levels in wetlands using remote sensing. Our approach is based on the premise that surface water is tightly linked to groundwater in natural wetlands. By mapping and measuring the elevation of surface-water features, local groundwater tables can be inferred. We tested our approach in the diverse “Kirby” BERA study area near Conklin, Alberta, and obtained good results (RMSE \pm 19 cm). Accuracies are primarily influenced by the abundance of surface water, input data quality, and terrain complexity. As a result, our method works well in wetlands and/or low-lying areas where there is abundant open water and the terrain is gently sloping. We have less confidence in uplands where open water is scarce, and the terrain is more complex.

Management Implications and Lessons Learned

We have developed an effective method for mapping local groundwater levels with remote sensing. Our approach requires high-resolution optical data (from drone or manned aircraft) and a LiDAR-based digital terrain model. With good data, it produces estimates with ~decimeter-level accuracies, and works best in wetland environments with gently sloping terrain and abundant pockets of surface water. These conditions are widespread in the boreal.

Publication(s)

Basran, K. K. (2019). Mapping Depth to Water (DTW) in Alberta’s Boreal Region Using Remote Sensing Techniques (MGIS project, University of Calgary).

Dejanovic, M. (2019). Creating a Confidence Index for Observing Depth-to-Water Measurement Difference from Field Data to Photogrammetry. BSc thesis, Ludwig-Maximilian-Universität Munich.

Rahman, M.M., G.J. McDermid, M. Strack, J. Lovitt (2017). A new method to map groundwater table in peatlands using unmanned aerial vehicles *Remote Sensing* 9 (10), 1057