Photon-counting LiDAR and Cloud Computing for Bathymetric and Water Dynamic Modelling of Ramsar-listed Lakes

Xiaoye Liu[1], Zhenyu Zhang[1]*

[1] *School of Surveying and Built Environment, University of Southern Queensland, Toowoomba, Qld 4350, Australia*

Spatiotemporal dynamic information on surface water area and level is a prerequisite for effective wetland conservation and management. However, such information is either unavailable or difficult to obtain, particularly in remote areas with limited data. This study developed ways to leverage Landsat imagery and photon-counting LiDAR data to develop bathymetric models and time series of water dynamics over the last 35 years (1987–2021) using machine learning method on a cloud computing platform for lakes identified as international importance in the Western District Lakes (WDL) Ramsar site in Victoria, and Currawinya Lakes Ramsar site, Queensland, Australia. Our results revealed distinct seasonal (dry and wet) water variation patterns and long-term changes in WDL Ramsar lakes in response to seasonal rainfall variations and regional climate changes for the periods of before, during and after the Millennium Drought when southeast Australia experienced unprecedented dry conditions. It is found that many permanent Ramsar-listed lakes in the region have become to ephemeral lakes due to climate change. In this study, for the first time, detailed bathymetric models and water dynamic information of Lake Wyara and Lake Numalla in semi-arid Queensland were also developed. The outcome of this study provides a baseline to help understand the historical and ongoing status of the Ramsar-listed lakes in a warming and drying climate in support of the development of strategic plan to implement international obligations for wetlands protection under the Ramsar Convention.

Keywords: Photon-counting LiDAR, Ramsar Convention, Bathymetry, Water dynamics, Cloud computing