EGU21-16181
https://doi.org/10.5194/egusphere-egu21-16181
EGU General Assembly 2021

Unified, high resolution water quality retrievals from Earth Observation satellites

James Harding
University of Edinburgh, Institute for Infrastructure and Environment, School of Engineering, Dunfermline, United Kingdom of Great Britain – England, Scotland, Wales (james.harding@ed.ac.uk)

Earth Observation (EO) satellites are drawing considerable attention in areas of water resource management, given their potential to provide unprecedented information on the condition of aquatic ecosystems. Despite ocean colours long history; water quality parameter retrievals from shallow and inland waters remains a complex undertaking. Consistent, cross-mission retrievals of the primary optical parameters using state-of-the-art algorithms are limited by the added optical complexity of these waters. Less work has acknowledged their non- or weakly optical parameter counterparts. These can be more informative than their vivid counterparts, their potential covariance would be regionally specific. Here, we introduce a multi-input, multi-output Mixture Density Network (MDN), that largely outperforms existing algorithms when applied across different bio-optical regimes in shallow and inland water bodies. The model is trained and validated using a sizeable historical database in excess of 1,000,000 samples across 38 optical and non-optical parameters, spanning 20 years across 500 surface waters in Scotland. The single network learns to predict concurrently Chlorophyll-a, Colour, Turbidity, pH, Calcium, Total Phosphorous, Total Organic Carbon, Temperature, Dissolved Oxygen and Suspended Solids from real Landsat 7, Landsat 8, and Sentinel 2 spectra. The MDN is found to fully preserve the covariances of the optical and non-optical parameters, while known one-to-many mappings within the non-optical parameters are retained. Initial performance evaluations suggest significant improvements in Chl-a retrievals from existing state-of-the-art algorithms. MDNs characteristically provide a means of quantifying the noise variance around a prediction for a given input, now pertaining to real data under a wide range of atmospheric conditions. We find this to be informative for example in detecting outlier pixels such as clouds, and may similarly be used to guide or inform future work in academic or industrial contexts.