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Inversion of water quality by remote-sensing monitoring based on machine learning in complex freshwater environments

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ABSTRACT

Small-area urban water areas play an important role in the human ecological environment and as a source of drinking water. Most such urban water bodies are long and narrow, so ordinary remote-sensing data sources are not suitable for monitoring. To address this problem, we use the four water-quality metrics of total nitrogen, total phosphorus, turbidity, and algal density as detected from unmanned aerial vehicle (UAV) remote-sensing images. We apply an improved least squares model to evaluate and invert the water quality in the complex freshwater environments of Longhu Lake, which is a tributary of the Yangtze River. These environments combine the polymorphism characteristics of urban rivers. The results show that (1) the band-ratio model is appropriate to estimate the water-quality parameters, and inversion by band combination is more accurate than inversion with a single band. (2) Comparison of the unary linear function, polynomial function, and exponential function with the least squares model shows that the latter produces the best inversion results and the smallest error. In addition, data from different periods are summed to verify the applicability of the model. The inversion results indicate that the elements responsible for polluting city rivers must be further explored by comparing point source pollution with non-point source pollution. The results show that the UAV multispectral estimation model based on the least squares method is accurate and stable and can provide strong support for water-quality monitoring in small areas. This method has important practical significance for improving intelligent and automated water-monitoring technology.

Keywords: Water-quality inversion; Machine learning; Unmanned aerial vehicle remote sensing

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