

## Removal of residual reflected skylight for accurate measurement of water-leaving reflectance

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Water-leaving reflectance ( $R_{rs}$ ) is crucial for remote estimation of water quality parameters. However,  $R_{rs}$  measured using the above-water approach usually suffers from residual reflected skylight, and thus its applicability is limited. In this study, we proposed a simple method, which only required the in situ  $R_{rs}$  spectrum itself as input, to further remove this effect in the in situ  $R_{rs}$  spectrum. The performance of the proposed method was evaluated using both simulation data and in situ  $R_{rs}$  spectra measured using a radiance sensor with a black tube. The results showed that the proposed method outperformed other existing methods and can be applied to various types of waters. From a comparison analysis using skylight-free in situ  $R_{rs}$  data, the proposed method showed the best performance with the smallest MAPE of 45% (MAPE ranged from 52% to 260% for other existing methods). In addition, the proposed method can improve the quality of  $R_{rs}$  spectra collected under various sky conditions (clear, scattered clouds and overcast), with an increased proportion of higher quality assurance scores. Two showcases indicate that the skylight corrections should be carried out for all above water approach-measured  $R_{rs}$  spectra before they are applied to develop water quality estimation algorithms or to evaluate the performances of atmospheric correction algorithms.

Keywords: remote sensing, inland lakes, above-water method, water-leaving reflectance