

Evaluating satellite-derived salinity indices for surface water salinity estimation using *in-situ* electrical conductivity measurements in Kalu Ganga

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Water salinity is a crucial environmental parameter that influences ecosystem health, water quality, agriculture, and irrigation, with saline water reducing crop productivity and threatening food security. Measurement of water electrical conductivity (EC), either from samples or *in situ*, is the most widely accepted method for estimating salinity. However, measuring electrical conductivity using samples or *in situ* over a large field is a tedious and expensive process. Several studies have been conducted to relate satellite-derived indices with ground truth values to overcome these challenges. A submersible proximity sensor with data logging capability was deployed to EC along a 15.5 km stretch of Kalu Ganga over a period of six months. Four different salinity indices NDWI1, NDWI2, NDWI3, and NDVI derived from Landsat 8 satellite imagery were used to develop a linear regression model relating satellite-derived indices and ground-measured EC. Cross-validation confirmed that the linear model performed best compared to the 2nd order, or the 3rd order polynomial models. The NDWI3 spectral index showed the highest positive correlation (0.811) with EC. The regression model yielded an acceptable performance with an RMSE of 0.0819, R² of 0.6584, and an MAE of 0.0679 with $p < 0.001$. Adopting non-linear regression models is expected to further improve the performance of the model.

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