Bayesian merging of numerical modeling and remote sensing for saltwater intrusion quantification in the Vietnamese Mekong Delta

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Abstract

Saltwater intrusion has become one of the most concerning issues in the Vietnamese Mekong Delta (VMD) due to its increasing impacts on agriculture and food security of Vietnam. Reliable estimation of salinity plays a crucial role to mitigate the impacts of saltwater intrusion. This study developed a hybrid technique that merges satellite imagery with numerical simulations to improve the estimation of salinity in the VMD. The salinity derived from Landsat images and by numerical simulations was fused using the Bayesian inference technique. The results indicate that our technique significantly reduces the uncertainties and improves the accuracy of salinity estimates. The Nash-Sutcliffe coefficient is 0.73, which is much higher than that of numerical simulation (0.69) and Landsat estimation (0.67). The correlation coefficient between the merged and measured salinity is relatively high (0.75). The variance of the ensemble salinity errors (2.57 ppt^2) is lower than that of Landsat estimation (3.65 ppt^2) and numerical simulations (8.69 ppt^2). The proposed approach in this study shows a great potential to combine multiple data sources of a variable of interest to improve its accuracy and reliability wherever these data are available.

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