The Estimation of Mangrove Biomass Based on UAV-borne Lidar Data

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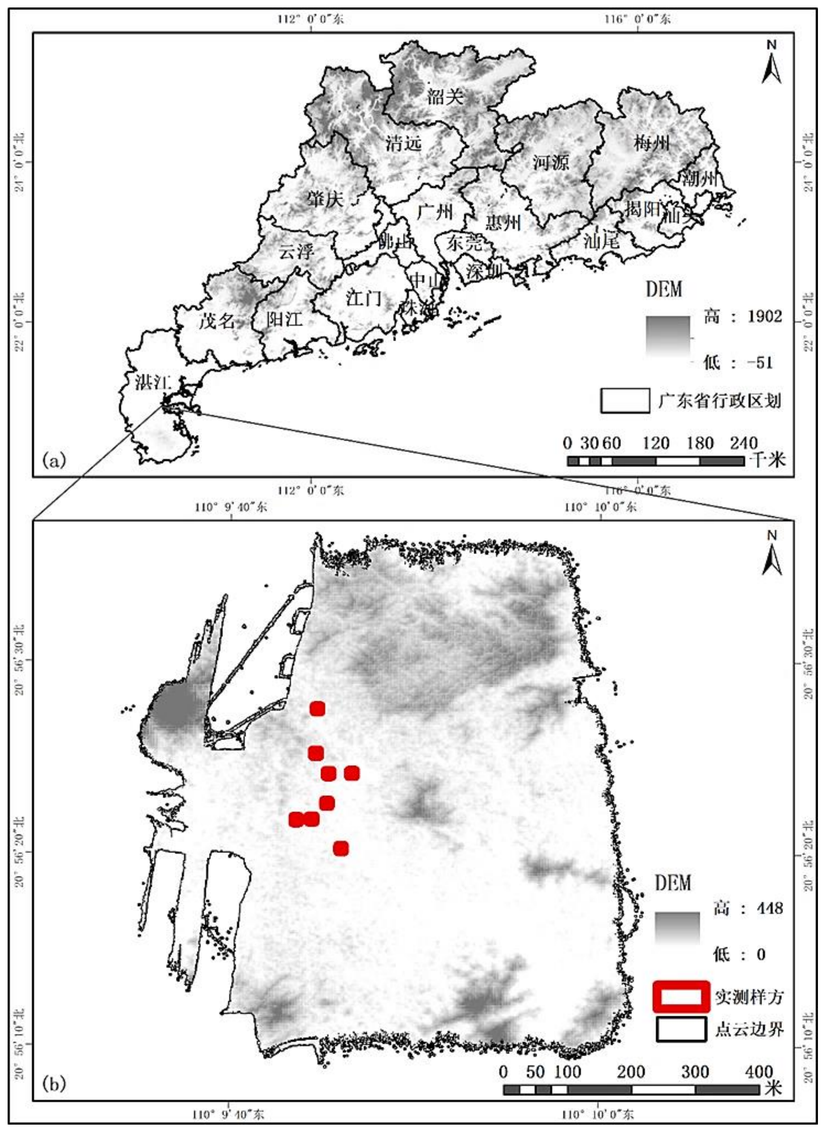
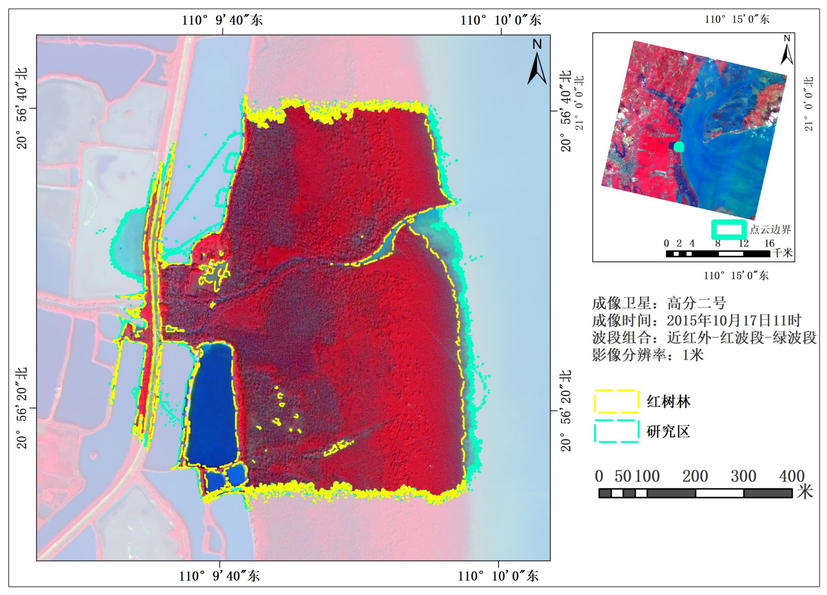
Abstract:

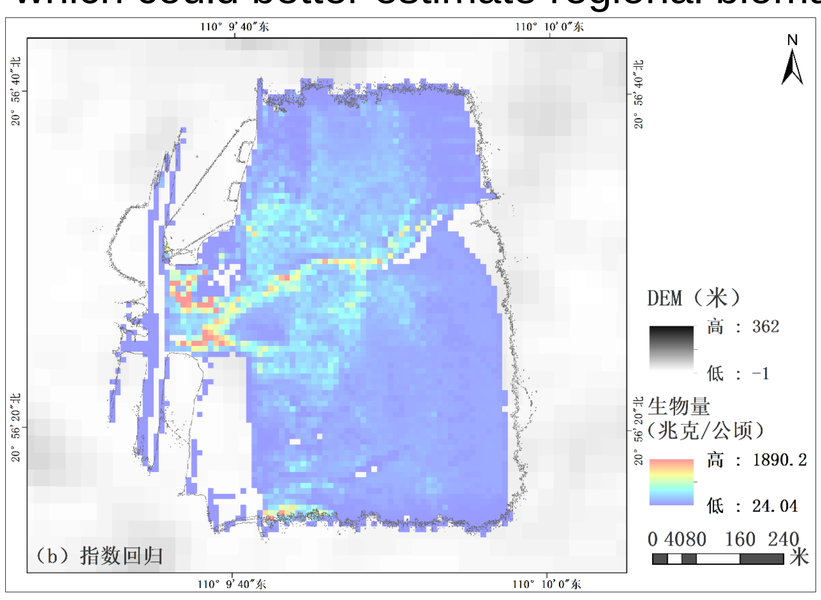
Mangrove, located in intertidal areas between tropical and sub-tropical zones coast, is a community of woody plants periodically immersed by sea water and characterized by mangrove plants. Mangrove ecosystem is one of the most productive ecosystems in the world. Mangrove plants rhizosphere carbon cycle takes a long period and the low decomposition speed of soil organic carbon makes mangrove become an important carbon sink containing a large amount of carbon. Biomass is a significant indicator for mangrove carbon storage estimation as well the evaluation of carbon sequestration capacity. As a consequence, estimating mangrove biomass accurately plays an important role in research on carbon sequestration capacity and other related. Traditional biomass estimation methods are laborious, destructive, long-period which limit it in applying to big-scale area. In addition, mangrove grows on complicated and lush area where is difficult for researchers to carry out a field survey. The rapid development of contemporary remote sensing method provides a more economical and speedy approach to high-precision as well as big-scale area forest biomass estimation. Applying remote sensing technology into regional biomass estimation has been focused by more and more scholars and then used in their practical researches. Many of them obtained good results. Nevertheless, traditional optical remote sensing as well as radar remote sensing are easy to saturate and have poor sensitivity. By comparison, lidar remote sensing performs better. Consequently, in this paper, we hope that by using canopy height model retrieved from UAV-borne lidar data and based on three different models (Linear Regression; Exponential Regression; BP Neural Network) we can develop biomass estimation models which could better estimate regional biomass.



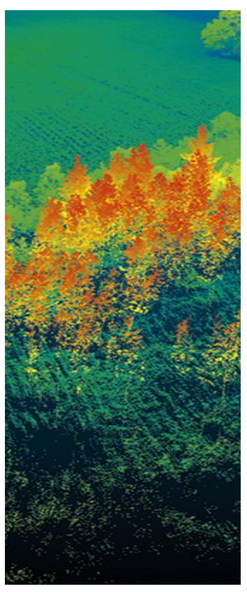
Study area map

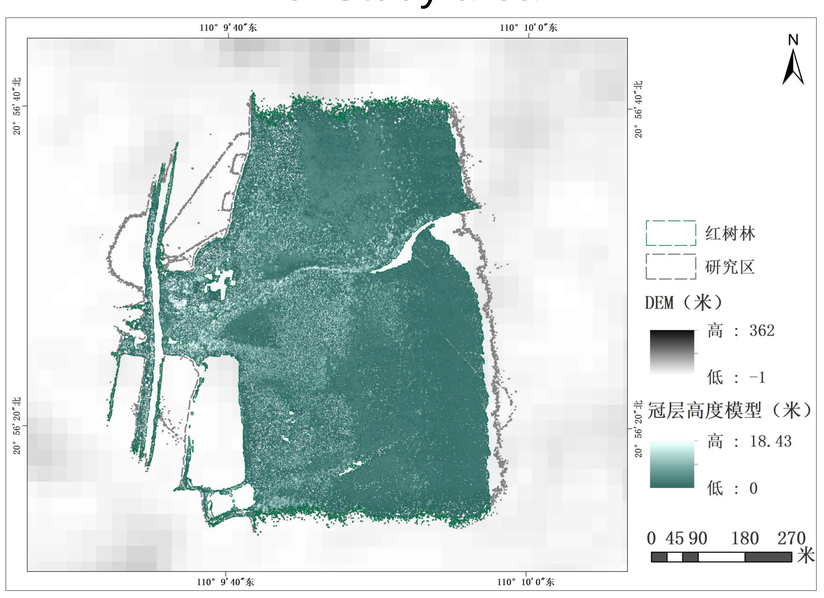


The mangrove distribution map of Study area

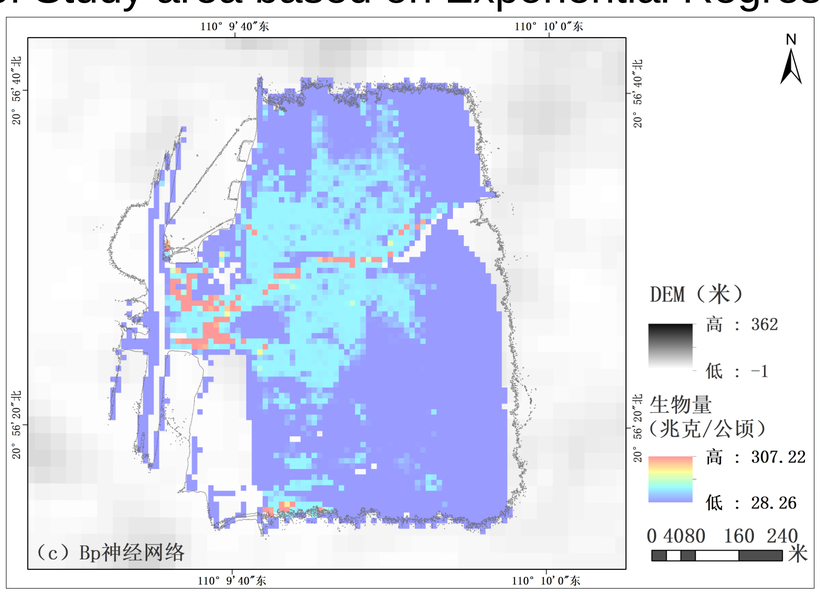


The predicted mangrove biomass map of Study area based on Exponential Regression

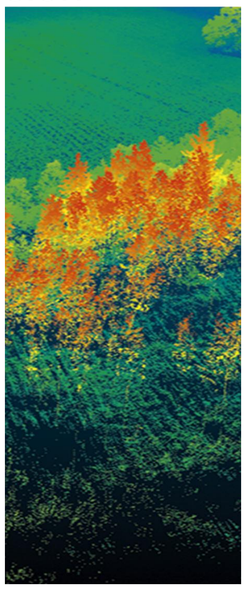


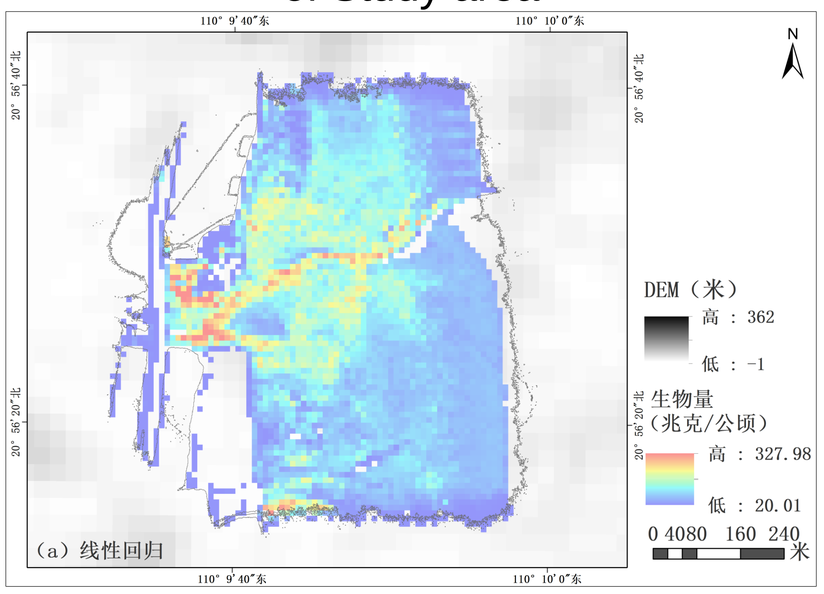


The canopy height model map of Study area



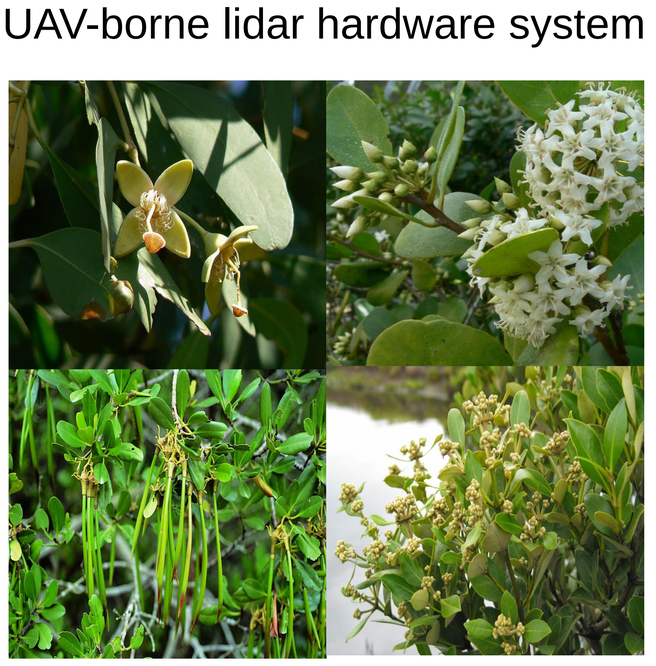
The predicted mangrove biomass map of Study area based on Bp Neural Network





The predicted mangrove biomass map of Study area based on Linear Regression

UAV-borne lidar hardware system



Mangrove Pictures

Conclusions:

The research results show that: ①UAV-borne Lidar can be used to extract the mangrove structural information accurately and improve the retrieval effect of mangrove biomass to some extent. UAV-borne Lidar provides a new and reliable data choice for research on mangrove biomass. ②The model based on exponential regression has the most stable performance (Average R^2 = 0.864; Average RMSE = 21.331). But it is more appropriate for estimation in area where the mangrove trees height has little difference. BP Neural Network strongly depends on the input samples. If the samples are in good quality then the model will gain very good result with an extremely high R^2 as 0.91. When the input samples are poor-quality the model will perform terribly. Linear regression model is less effective than exponential regression model.