Evaluation of Forest Aboveground Biomass Estimation Capacity of X-band and P-band Interferometric SAR Data

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Abstract

Based on X- and P-band interferometric SAR, high-precision forest height and volume scattering intensity were extracted, and on this basis, the forest AGB is accurately estimated by combining forest height and volume scattering intensity characteristics. Then, the estimation ability of forest AGB was evaluated from the single characteristics of forest height and scattering intensity and the combination of the two.

Methods

Flow chart of proposed method
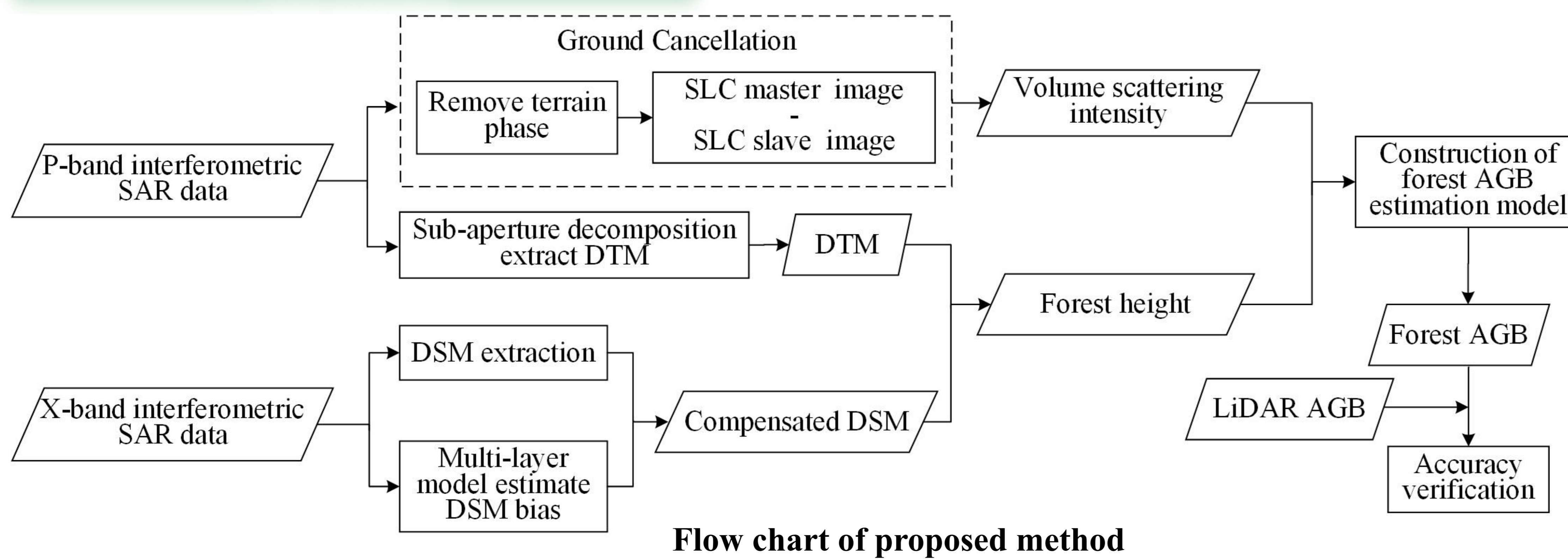
➤ The forest height estimation method of multi-frequency InSAR was enhanced to realize high-precision extraction of forest height.

➤ The P-band SAR volume scattering intensity extracted by the ground cancellation algorithm is combined with the forest height to achieve high-precision estimation of forest AGB.

Test site and data
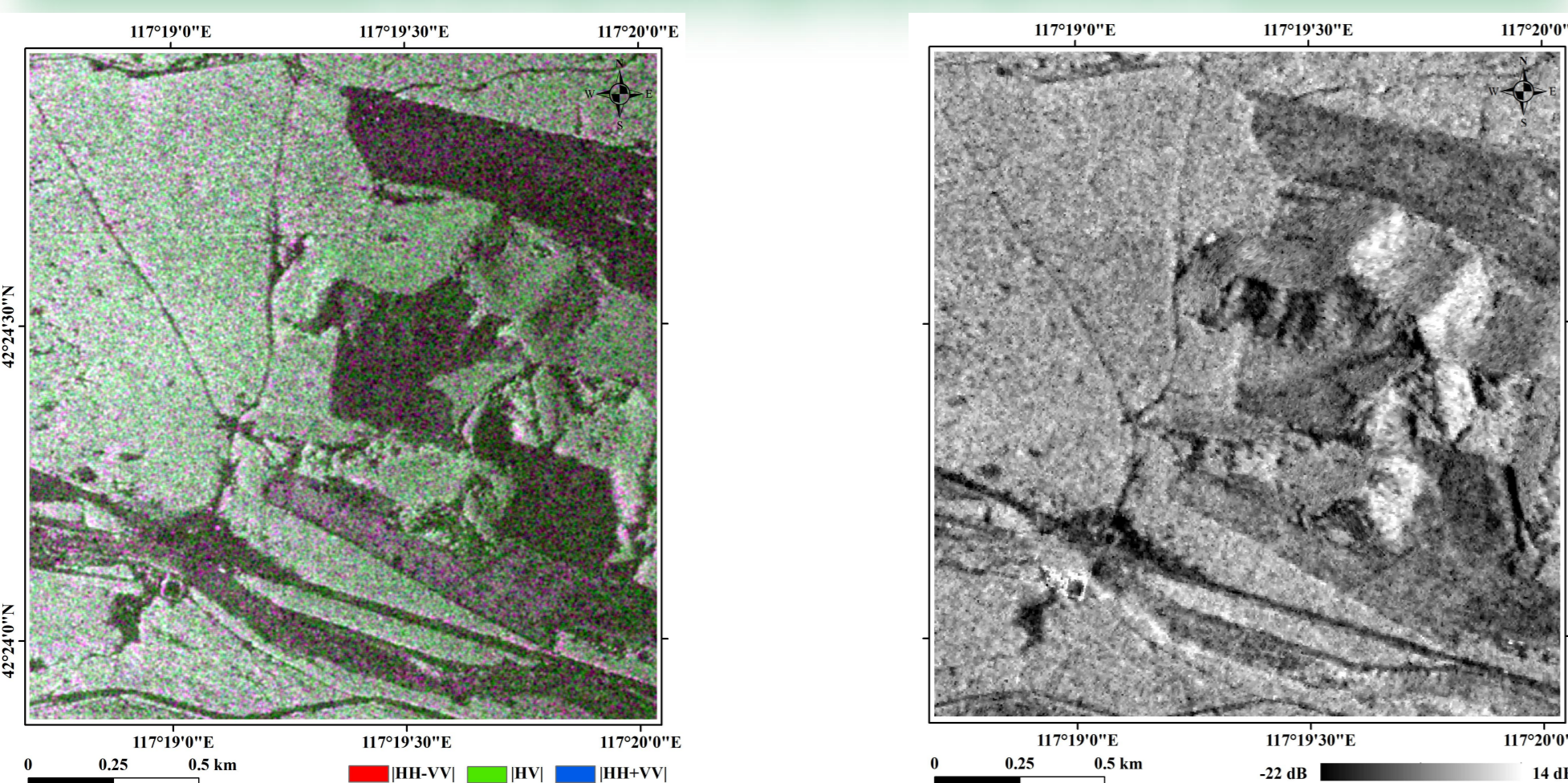
Pauli RGB image of the P-band master image

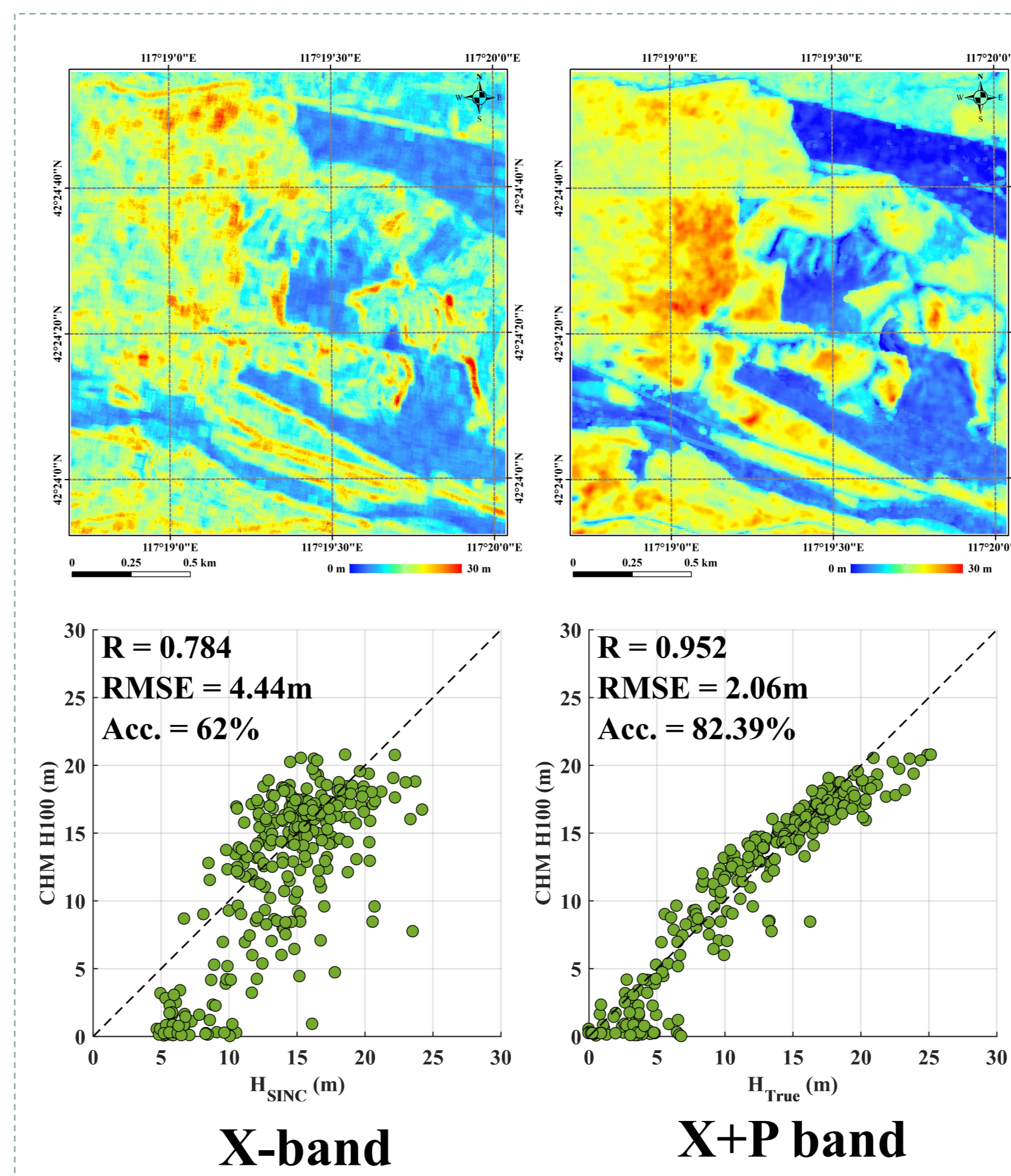**X-band master image backscatter intensity image**

The study area is located in the Saihanba Forest Farm in northern Hebei Province, China. P-band InSAR data were acquired by repeated orbital interferometry observations by the airborne SAR system on October 29, 2019. X-band was acquired by the TanDEM-X system and imaged on December 29, 2018.
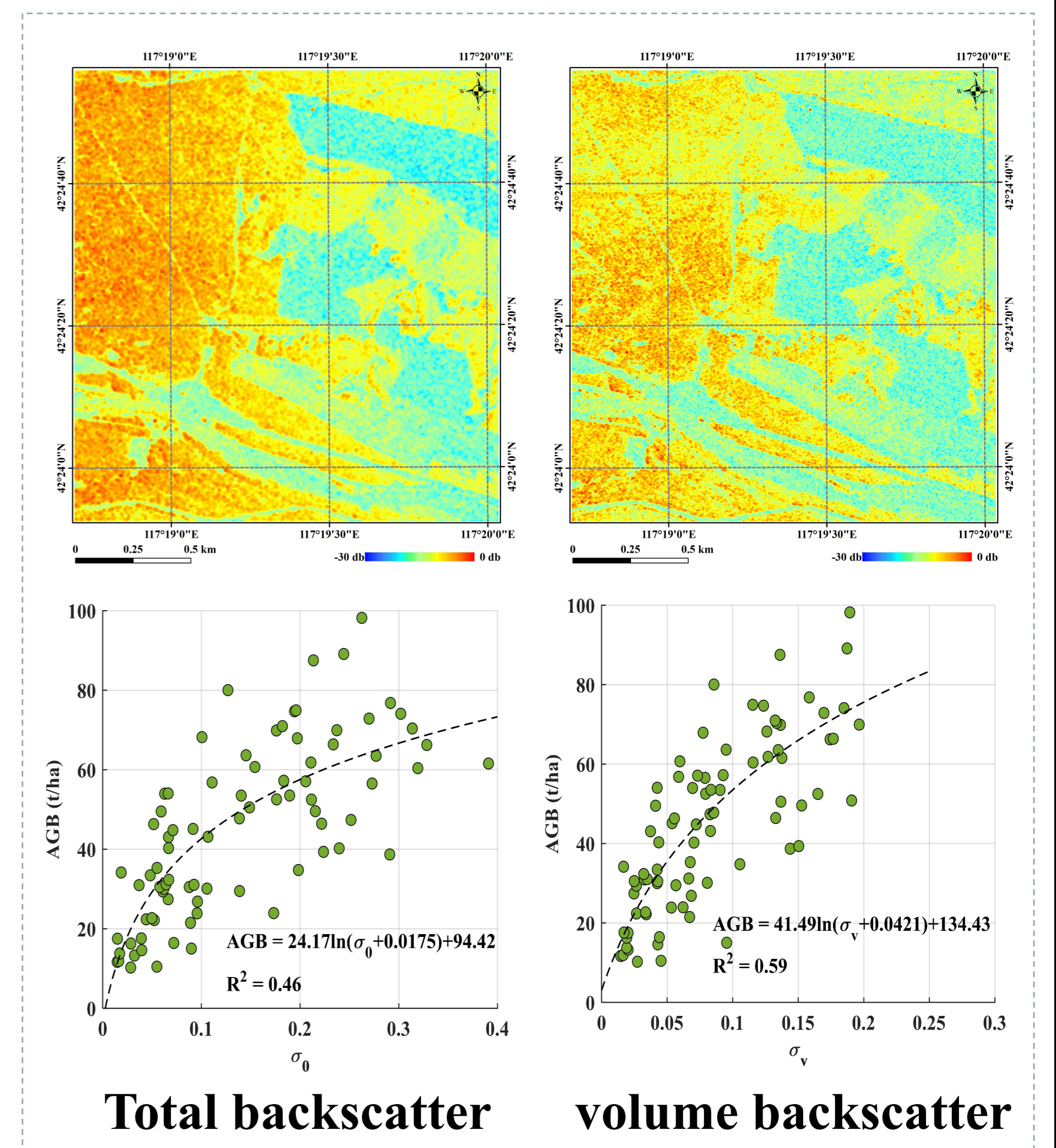
Conclusion

Compared with the volume scattering intensity extracted from P-band and the forest height extracted by P+X data, the combination of the two can achieve better forest AGB estimation effect. When it comes to estimating forest AGB using a single characteristic, the forest height extracted from P+X bands performs better than the volume scattering intensity of the P band .

Results

Forest height extraction results

R = 0.784
RMSE = 4.44m
Acc. = 62%

X-band

R = 0.952
RMSE = 2.06m
Acc. = 82.39%

X+P band

Backscatter intensity & AGB

$AGB = 24.17\ln(\sigma_0 + 0.0175) + 94.42$
$R^2 = 0.46$

Total backscatter

$AGB = 41.49\ln(\sigma_v + 0.0421) + 134.43$
$R^2 = 0.59$

volume backscatter

AGB Estimate the results

P-band volume backscatter

Acc. = 72.60%

P+X band forest height

Acc. = 80.12%

P+X band forest height and volume backscatter

Acc. = 83.73%

LiDAR AGB

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