Urban Impervious Surfaces Estimation from RADARSAT-2 Polarimetric Data using SVM Method

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The urban impervious surface is a key environmental indicator in assessing urbanization impacts on the urban environmental and ecological conditions, and it has therefore attracted more interest recently in the remote sensing community. The main objective of this investigation is to explore potential to extract impervious surface in the dense urban areas from RADARSAT-2 fully PolSAR data. To compare the results, the SPOT-5 multispectral imagery is also used. A case study in the dense urban (Beijing, China) is conducted for this purpose by applying the support vector machine (SVM) algorithm to SPOT-5 imagery and RADARSAT-2 full PolSAR data. An accuracy assessment is performed using the high-resolution WorldView images with a spatial resolution of 0.5 m. The root mean square error (RMSE), the mean absolute error (MAE), and the coefficient of determination (R2) are calculated to validate the accuracy of impervious surfaces derived from the SPOT-5 image and RADARSAT-2 PolSAR data. For the SPOT-5 imagery, the RMSE, MAE, and R2 are 16.41%, 12.43%, and 0.8386, respectively. The RADARSAT-2 full PolSAR data yields results with an RMSE of 13.27%, an MAE of 9.98%, and an R2 of 0.8421. The results indicate that the result derived from RADARSAT-2 data is superior to that of SPOT-5 in impervious surface estimation. The results also demonstrate that the bore soil or water can be easily separated from the buildings or asphalt roads using RADARSAT-2 data, which is a difficult task for estimating impervious surface with optical remote sensing data. In addition, compared with optical image, the impervious surfaces covered by tree crowns can be easily extracted from the RADARSAT-2 PolSAR data in sparse trees area. Overall, our results demonstrate that PolSAR image can provide more efficient and useful polarmetric information and has enormous potential for extracting the impervious surfaces.