Geophysical Research Abstracts
Vol. 19, EGU2017-3415, 2017
EGU General Assembly 2017

Inversion of vegetation optical depth and water content in the source region of the Yellow River using FY-3B microwave data

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Abstract. In this study, we use dual polarization brightness temperature observational data at the K frequency band collected by the MicroWave Radiation Imager (MWRI) on board the Fengyun-3B satellite (FY-3B) to improve the τ-ω model by considering the contribution of water bodies in the pixels to radiation in the wetland area of the Yellow River source region. We define a dual polarization slope parameter and express the surface emissivity in the τ-ω model as the sum of the soil and water body emissivity to retrieve the vegetation optical depth (VOD); however, in regions without water body coverage, we still use the τ-ω model to solve for the VOD. By using the field observation data on the vegetation water content (VWC) in the source region of the Yellow River during the summer of 2012, we establish the regression relationship between the VOD and VWC and retrieve the spatial distribution of the VWC. The results indicate that in the entire source region of the Yellow River in 2012, the VOD was in the range of 0.20-1.20 and the VWC was in the range of 0.20 to 1.40, thereby exhibiting a trend of low values in the west and high values in the east. The area with the largest regional variation is along the Yellow River. We compare the results from remote-sensing estimated and ground-measured vegetation water content, and the root-mean-square error is 0.12. The analysis results indicated that by considering the coverage of seasonal wetlands in the source region of the Yellow River, the microwave remote sensing data collected by the FY-3B MWRI can be used to retrieve the vegetation water content in the source region of the Yellow River.