GC33F-08 Changes of paddy rice planting areas in Northeastern Asia from 1986 to 2014 based on Landsat data

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Paddy rice is an important cereal crop and main grain source for more than half of the global human population. However, knowledge about its area and spatial pattern is still limited due to large changes in agriculture in different regions; for example, higher latitude areas underwent increase (e.g., northeastern China) and decrease (e.g., South Korea) of paddy rice planting areas due to climatic warming, urbanization and other drivers. It is necessary to track paddy rice planting area changes in these regions in the past decades. We developed a pixel- and phenology-based image analysis system, Landsat-RICE, to map the paddy rice by using Landsat imagery. The algorithm was based on the unique physical and spectral characteristics of paddy rice fields during the flooding and transplanting phases. First, Landsat images are preprocessed and time series vegetation indices (NDVI, EVI, and LSWI) are generated. Second, MODIS Land Surface Temperature (LST) data were used to define thermal plant growing season (0 ^{o}C, 5 ^{o}C and 10 ^{o}C), which provides a guide for selection of Landsat images within the period of flooding and transplanting. Third, several non-cropland land cover maps (e.g., permanent water bodies, built-up and barren lands, sparsely vegetated lands, and evergreen vegetation) are produced through analysis of Landsat-based vegetation indices within the plant growing season and combined as a mask. Fourthly, vegetation index data within the time window of flooded and rice transplanting were analyzed to identify flood/transplanting signals. Finally, the maps of paddy rice planting areas were generated through overlying the results from Step 3 and 4. Paddy rice planting area changes were investigated in some hotspots of Northeastern Asia from 1986 to 2014 at 30-m spatial resolution and 5-year interval. This study has demonstrated that our newly developed Landsat-Rice system is robust and effective for tracking paddy rice changes in cold temperate and temperate zones.

Authors

Jinwei Dong
University of Oklahoma Norman Campus
Xiangming Xiao
University of Oklahoma
Weili Kou
University of Oklahoma
Yuanwei Qin
University of Oklahoma Norman Campus
Jie Wang
University of Oklahoma
Geli Zhang
University of Oklahoma
Cui Jin
University of Oklahoma
Yuting Zhou
University of Oklahoma Norman Campus
Michael Menarguez
University of Oklahoma Norman Campus

Berrien Moore
University of Oklahoma

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