

Simultaneous detection of burned areas of multiple fires in the tropics using multisensor remote sensing data

Abstract

Fires associated with recurrent El Niño events have caused severe damage to tropical peat swamp forests. Accurate quantitative information about the frequency and distribution of the burned areas is imperative to fire management but is lacking in the tropics. This article examines a novel method based on principal component analysis (PCA) of the normalized difference water index (NDWI) from multisensor data for simultaneously detecting areas burned due to multiple El Niño-related fires. The principal components of multitemporal NDWI (NDWI-PCs) were able to capture the areas burned in the 1998 and 2003 El Niño fires in NDWI-PC3 and 2, respectively. The proposed method facilitates the reduction of dimensionality in detecting the burned areas. From 22 image bands, the proposed method was able to accurately detect the burned areas of multiple fires with only three NDWI-PCs. The proposed method also shows superior performance to unsupervised classifications of the principal components of combined image bands, multitemporal NDWI, NDWI differencing and post-classification comparison methods. The results show that the 1998 El Niño fire was devastating especially to intact peat swamp forest. For degraded peat swamp forest, there was an increase in the burned area from 1998 to 2003. The proposed method offers the retrieval of accurate and reliable quantitative information on the frequency and spatial distribution of burned areas of multiple fires in the tropics. This method is also applicable to the detection of changes in general as well as the detection of vegetation changes.