

Correlation between forest fires in Indonesia and soil water content through the satellite imaging and the direct spectral measurements of soil

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In recent years, the smoke caused by the forest fires in Indonesia has become a serious problem. It affects the arrival and departure of airplanes. Moreover, a health problem has occurred in neighboring countries. Especially, El Niño in 2015, which scaled one of the largest, has reduced the precipitation in Indonesia, consequently increasing the forest fire significantly. Although most of the forest fires are caused artificially, the surface soil water, reflecting the amount of precipitation in the area, would be also related to the fire. Since Indonesia is covered with peat moss, the soil also burns when the fire occurs, and this makes the fire last for a long time. In the previous study, Furumoto et al. estimated the amount of soil water in Indonesia using the typical vegetation index of NDVI (Normalized Difference Vegetation Index). However, there's a time lag of 1-2 months between the change of rainfall and NDVI values, which makes it difficult for us to judge immediately whether the forest fire will occur. The degrees of surface soil water have been detected by infrared satellite images with a poor spatial resolution so far. It is not enough to discuss in detail the correlation between the degrees of surface soil water and the cause of the forest fires.

This study aims to establish a method to discover the correlation between the regions of the forest fires and the surface soil water with a high spatial resolution using remote sensing. Our approach is 1) the direct spectral measurements of soil with a several soil water content and 2) the satellite image analysis.

First, three areas of satellite images were used; Blang Pidie, Riau, and Martapura. Each area locates in Pulau Smatera. We estimated the soil water content using NDWI (Normalized Difference Water Index), NDSI (Normalized Difference Soil Index). The seasonal change of NDWI and NDSI was observed by about 0.3. This result indicates that we can distinguish between the wet and dry season. We found that the forest fires occur a lot in each area from September to October (the end of dry season). This suggests that there is a correlation between the forest fires and the soil water content. We also made the two dimensional maps of NDWI and NDSI, to make sure the correlation between the forest fires and the indices. Moreover, considering that the land of Indonesia is covered with peat moss, we measured the spectra from peat moss actually.

Keywords: Forest fire, Indonesia, Soil water, Remote sensing, Reflection spectrum