Groundwater level estimation in tropical peatland area

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Abstract: This paper proposes a method of the groundwater level estimation in Indonesian tropical peatland (Central Kalimantan region). Peatland has been a major CO_2 emission source because of the increase of peat decomposition and forest fire by human induced activities, including illegal logging and building canals. In Indonesia, peat swamp forests cover considerable portions of Kalimantan, and 37.5% of CO_2 emission source is from peatland. Monitoring peat swamp forests in Indonesia provides key useful information in management of peatland ecosystem. It's important to develop the method to estimate the groundwater level in the wide area for the peatland. Although the groundwater level is needed to measure each survey point by field survey, it spends a lot of time to set put enough survey points and measure each of them operationally because the peatland area is so wide. The method estimates the groundwater level using leaf spectrum information of the peat swamp forest. Many previous researches showed a good relationship between groundwater level and vegetation condition on the peatland soil. In this study, we clarified the relationship of the groundwater level, water potential and the spectrum of the leaf by field survey and spectral analysis.

  The study area was Central Kalimantan province in Indonesia and we setup two test sites around Parankaraya area. These test sites have primary swamp forest. We collected the spectral data, leaf water potential and measured groundwater level at two sites to compare the difference. .

  In this study, two steps were examined to clarify relationship between leaf spectrum and groundwater level. In this first step, we confirmed relationship between leaf spectrum and water potential. In the second step, we verified relationship between the groundwater level and the water potential. In the 1st step, LASSO regression and NDSI were applied to build the prediction model of water potential from leaf spectrum. By using this model, we evaluate the correlation between leaf spectrum and water potential.

In the 2nd step, measured data of groundwater level and water potential was used for correlation evaluation.

The result of 1st step showed that correlation between water potential and leaf spectrum was high with our prediction model, and in the 2nd step, the field data proved high correlation between water potential and leaf spectrum. These two results showed the possibility that correlation between groundwater level and leaf spectrum is high and prediction model of groundwater level with leaf spectrum has high accuracy. In the future study, we will build and evaluate the prediction model of groundwater level with airborne or spaceborne hyperspectral data. Our study may enable to build prediction map of the groundwater level in Indonesian tropical peatland