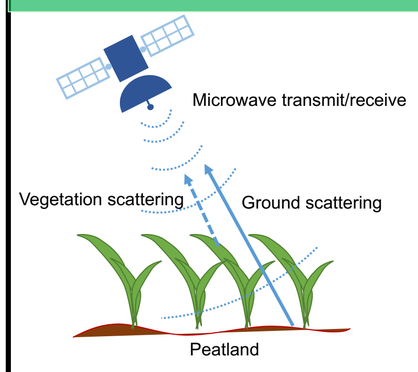
Development of Groundwater Table Depth Estimation Method for Tropical Peatland

Yuta Izumi
The University of Tokyo, Japan

Abstract

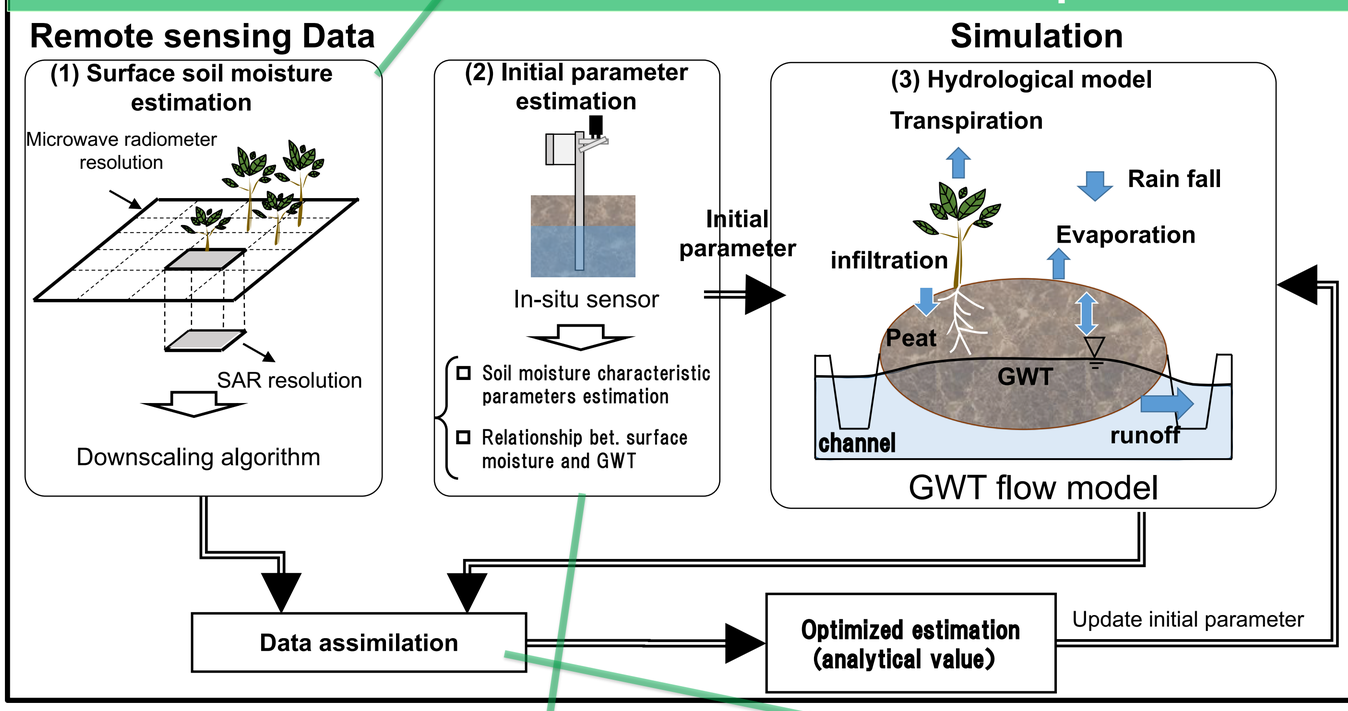
Tropical peatlands, being important carbon sinks and stores, play a critical role in carbon cycling between the earth surface and the atmosphere [1]. In Indonesia, especially in Kalimantan and Sumatra, a substantial amount of tropical peatlands has been deforested. Such a land transformation has resulted in a decrease of groundwater table depth over the tropical peatland, increasing a peat fire risk and accelerating a carbon loss due to the microbial decomposition. Therefore, spatio–temporal information of the groundwater table depth is of importance in managing and evaluating the tropical peatland as well as predicting the potential risk. In this background, this study aims to develop the groundwater table depth estimating method for tropical peatland in Indonesia. Because this study is now ongoing, the research plan and expected outcomes are described in this poster.

Soil moisture estimation



Microwave remote sensing has a potential to offer the surface soil moisture information over wide area. This study utilizes synthetic aperture radar (SAR) and microwave radiometer data to estimate the soil moisture with medium resolution and accuracy (via downscaling algorithm). Furthermore, this study aims to develop the soil moisture estimation method incorporating vegetation cover usually presented over the tropical peatland.

Groundwater Table Depth Estimation Framework



The proposed groundwater table depth estimation framework is based on the integration system of satellite remote sensing products and the numerical simulation (hydrological model). The hydrological behavior is modeled by the employed groundwater flow model, describing the relationship between surface soil moisture and groundwater. The groundwater table depth is then estimated through the model optimized by data assimilation technique. Several unknown parameters in the hydrological model is derived by in–situ sensors.

In–situ sensors

One of the sensor installed In central Kalimantan, Indonesia (image from [2])

Several in–situ sensors, measuring groundwater table depth, surface soil moisture, and precipitation, are available over tropical peatland in Indonesia. Those information is used to calibrate the hydrological model and validate the result.

Data assimilation

Data assimilation technique assists to modify the numerical simulation results by remote sensing products and produce the optimal groundwater depth estimation value.

Impact of this study

The spatio–temporal information of the groundwater table depth to be estimated in this study can

- estimate the carbon dioxide emissions via the relationship between groundwater table depth and CO_2 efflux [3]
- support to predict the potential risk area of the peat fire
- evaluate the peatland restoration

References

[1] O. Mitsuru et al. 2016. Peatland inIndonesia." In Tropical Peatland Ecosystems, 49-58. Springer.

[2] J. Widodo et al., "Application of SAR Interferometry Using ALOS-2 PALSAR-2 Data as Precise Method to Identify Degraded Peatland Areas Related to Forest Fire." Geosciences, vol. 9, no. 11, 2019.

[3] T. Hirano et al., "Carbon dioxide emissions through oxidative peat decomposition on a burnt tropical peatland." Global Change Biology, vol. 20, 555-565, 2014.

For further details, contact: Yuta Izumi, Ce-506, 6-1, Komaba 4-chome, Meguro, Tokyo 153-8505 JAPAN (URL: http://wtlab.iis.u-tokyo.ac.jp/ E-mail: yizumi@g.ecc.u-tokyo.ac.jp)