

Preliminary detection of thermokarst landforms and vegetation succession using multitemporal satellite and UAV images

*Hitoshi SAITO¹, Yoshihiro Iijima², Takashi Kirimura³, Alexander N. Fedorov⁴

1. Kanto Gakuin Univ., 2. Mie Univ., 3. Kogakkan Univ., 4. Melnikov Permafrost Inst.

Eastern Siberia is characterized by widespread permafrost thawing and subsequent thermokarst development in open natural and anthropogenic landscapes. The thermokarst development affects the hydrological processes, ecosystems, and human society accompanied by vegetation succession and degradation. Presently we lack quantitative knowledge on the progression of thermokarst distribution in eastern Siberia. This study preliminarily detects the early-stage thermokarst landforms and vegetation succession using multitemporal satellite images of Planet and Landsat and UAV-based high-definition images. Especially, we focus on the changes in normalized difference vegetation index (NDVI) of grasslands around the Churapcha area in eastern Siberia. The results showed that the NDVI of grasslands with early-stage thermokarst landforms was higher than that of grasslands without thermokarst development. The differences in NDVI was large during the growing season from June to August. Analysis of the time series NDVI over the past 20 years showed an increasing tendency in NDVI in early-stage thermokarst grasslands with a history of anthropogenic land use. These results indicate that increases in soil moisture and soil temperature may affect rapid vegetation growth and succession at the early-stage thermokarst landforms. Further study is necessary to verify the results using field observation over a wide area of eastern Siberia.

Keywords: Thermokarst, Permafrost, UAVs, Satellite constellation