Thawing and freezing process of permafrost at post-wildfire areas burned in 2014, 2018 and 2019 near Batagay, Sakha Republic, Eastern Siberia

*Kazuki Yanagiya[1], Masato Furuya[2], Go Iwahana[3,4], Petr Danilov[5], Alexander Fedorov[6]

1. Graduate School of Science Hokkiado University, 2. Department of Earth and Planetary Sciences Hokkaido University, 3. International Arctic Research Center, University of Alaska Fairbanks, 4. Arctic Research Center Hokkaido University, 5. Institute of Northern Applied Ecology North-Eastern Federal University in Yakutsk, 6. Yakutsk Permafrost Institute

Associated with global warming, the frequency and intensity of wildfires were increasing in the arctic region. Wildfire removes surficial vegetation layer that is acted as insulators preventing permafrost from thermal thawing and reduces surface albedo. Yoshikawa et al (2002) suggested that permafrost thawing was accelerated in post-fire area, and the degradation would continue for several years to decades after severe burning. In our previous studies, we observed post-wildfire ground deformation caused by permafrost thawing using Interferometric Synthetic Aperture Radar (InSAR) technique. Focusing on the post-wildfire area burned in 2014 near the Batagay town, East Siberia, we detected not only subsidence signal during the thawing season, but also uplift signal during the early freezing season without loss of coherence. However, we could not observe the deformation immediately after the fire because any SAR satellites did not take the data at the site in 2014.
In this study, we reported ground deformation at post-wildfire areas burned in 2018 and 2019 near Batagay town. Generating InSAR images from two independent SAR data obtained from Sentinel-1 and ALOS2, we detected seasonal deformation signal immediately after the fire. We could not detect subsidence signal during summer season due to coherence loss with the fire. On the other hand, we could detect uplift signal from October to December in 2019. Furthermore, we conducted our first field observation in September 2019 and observed thawing depth, ground temperature, moisture and conducted leveling at each post-wildfire area. Thawing depth was variable depending on inside or outside of the post-wildfire area. It was also depending on the number of years after the fire. We discussed a relevance between the magnitude of ground deformation signals from InSAR images and in situ data. Additionally, we are going to perform second observation at the areas in this coming September. The combination of field observation and InSAR technique can help to understand permafrost degradation on the scale of several tens km². It can also contribute to the understanding of post-wildfire permafrost degradation that occurred throughout Eastern Siberia.

Keywords: InSAR, ALOS2, Sentinel-1, Wildfire, Thermokarst

