

# AHEAD 2020 workshop on the synergies between astrophysics and geoscience



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## Geophysical research via cosmic-ray muon tracking

*Tuesday, March 5, 2024 12:05 PM (20 minutes)*

We highlight recent results from geophysical researches and applications conducted via measuring cosmic muons by HUN-REN Wigner RCP and University of Tokyo. Our main infrastructure is the Sakurajima Muography Observatory in Kyushu, Japan. It is a modular system that is operating with muon trackers based on gaseous detectors and scintillators. The SMO is monitoring the mass density changes through the upper plumbing system of the volcanic edifice and in the atmosphere by means of muography [1,2]. Mass changes has been observed on the surface regions of the volcanic edifice due to deposition and erosion of volcanic ejecta and by post-eruptive lahars. The evolution of magmatic plug has been observed beneath the active craters that helped to explain the link between eruption frequency and ground deformation. An inverse correlation has been observed between the mass density changes beneath two adjacent craters that suggests a branched conduit structure. Besides volcanic phenomena, the SMO captured atmospheric pressure drops caused by tropical cyclones and monitored the passages of different cyclones near Kagoshima. Besides geophysical research, we will present various applications from cosmic background measurements in underground laboratories to muographic surveying of infrastructures (dams, pillars, tunnels). Future prospects of muography in geophysical research will also be discussed.

[1] Oláh, L., Tanaka, H.K.M., Varga, D. Muography: Exploring Earth Subsurface with Elementary Particles Geophys. Mon. Ser. 270 (2022). <https://doi.org/10.1002/9781119722748>

[2] Tanaka, H.K.M., Oláh, L., Varga, D. et al. Muography. Nat Rev Methods Primers 3, 88 (2023). <https://doi.org/10.1038/s43586-023-00270-7>

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