4CS21-2021-000017

Abstract for an Invited Paper
for the 4CS21 Meeting of
the American Physical Society

A Machine Learning Approach Using Gravity and Cosmic Ray Muon Data for Shallow Subsurface Density Prediction at the Showa-Shinzan Lava Dome, Usu, Japan

KATHERINE COSBURN, University of New Mexico

Imaging shallow subsurface anomalies at volcanic structures is important for understanding magma transport and hazard monitoring. In recent years, the use of machine learning has gained increasing attention for solving complex inversion problems, particularly within the field of seismology. Here we present a physics-based, machine learning method for imaging static density variations at the Showa-Shinzan lava dome in Japan. We generate synthetic cosmic-ray muon and gravity datasets using theoretical knowledge of the forward kernels, which we use to train a machine learning (ML) algorithm to interpret subsurface density anomalies. The accuracy of our trained ML algorithm is determined by comparing against the known forward calculation and we validate our model on previously published gravity and muography data from the Showa Shinzan lava dome, which we then compare methodologies with a more traditional inversion. Our work thus far has focused on static imaging, however, we explore the feasibility of the ML algorithm for generating a time series of images if given time-varying geophysical observations. Another advantage of using a (supervised) physics-based approach is its applicability to a range of observables, such as seismic travel times and electrical conductivity.