

## A method for measuring surface rupture displacement by using UAV - Application to the 2014 Kamishiro fault earthquake

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The surface ruptures associated with the 2014 Kamishiro fault earthquake (Mj 6.7), central Japan was photographed by digital cameras mounted on an unmanned aerial vehicle (UAV) and a high pole. The resulting Digital Surface Model (DSM) generated using the Structure from Motion (SfM) -Multi-View Stereo (MVS) software enabled accurate measurement of the terrain section, as well as variations in directions and amounts of three-dimensional surface displacements. Imaging technology mounted on a UAV is used to obtain widespread surface measurements, while the pole camera is used for the detailed photography of important locations. The accuracy of the DSM will be confirmed by the comparison of our findings with the measurements by other methods, such as auto-level, Total Station, and terrestrial LiDAR.

As a result, we were able to create a DSM of a resolution of a few centimeters. The shaded diagram of the DSM indicates the following: 1) Surface rupture has propagated in an intricately bent and branched manner. 2) Small-scale deformation and deformation along several meters of width have taken place. Subsequently, this DSM was compared with the cross-sectional survey and measurements carried out by the auto-level and LiDAR, and it was confirmed that the DSM is characterized by fine topographic changes. However, an error of about 10 cm could have been present depending on the location.

Keywords: The 2014 Kamishiro fault earthquake, surface rupture, UAV, SfM-MVS, Ultra-high-resolution DSM