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## Monitoring of a landslide through the use of UAV survey

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The monitoring of landslides using UAVs is particularly convenient as these are dangerous areas that present access difficulties. This study aims to integrate monitoring carried out via traditional techniques (GNSS and total station surveys of benchmarks) with UAV photogrammetric survey, as the latter allows for a precise assessment of the volumes affected by movement. The Masarach landslide, located in Friuli Venezia Giulia (north east Italy), covers an area of approximately 200 ha. Two surveys were carried out two years apart in order to measure displacements of much greater magnitude than instrumental errors. In the first survey, restricted to the most active area, a six rotor UAV was used, with a maximum take-off mass of 4 kg, which carried a 20 Mpixel APS-C camera. 243 high resolution images were captured and 27 GCPs (Ground Control Point) were surveyed with a GNSS RTK receiver. In the second survey a DJI Phantom 4 Pro UAV was used, carrying a 20 Mpixel 1" sensor camera. 978 high resolution images were captured and 40 GCPs (Ground Control Point) were surveyed with a GNSS RTK receiver. Data were analyzed using Agisoft Metashape Professional to produce an orthophoto and a DSM (Digital Surface Model) with a ground resolution of 0.02 m and 0.04 m respectively. The DSMs were compared in ArcGIS to calculate the moving masses and highlight the areas of greatest instability. It emerged that approximately 10,000 cubic meters of landslide material were transported to the Arzino stream below, with verified displacements on the control point ranging from meters to centimeters. This work made it possible to accurately define the most active portion of the landslide.