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What is an appropriate size for strike and dip measurements? An evaluation from Lidar, smartphone applications, and geological compass measurements

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Several field measurement technologies exist facilitating the collection of orientation data. However, the accuracy and reliability of mobile applications and high-resolution LiDAR compared to traditional field techniques remains understudied. This paper compares the accuracy and reliability of collecting strike and dip measurements from three different methodologies: LiDAR scans, traditional geological compass (GeoBrunton), and two smartphone applications (Fieldmove Clino and Stereonet Mobile). The study area is a prehistoric cave of Devonian schist called “The Black Cave” located in Randaberg, Norway. Two planes on the outcrop with different orientations, one of foliation (avg. strike and dip 267/18N) and another a joint (avg. strike and dip 123/80SE) were used. Five LiDAR scans were collected from the same position with three frequencies (30 kHz, 150 kHz, and 300 kHz), the 150 kHz and the 300 kHz were gathered with resolutions of 0.1 and 0.05, respectively, while the 30 kHz scan was gathered with three resolutions (0.1, 0.2, and 0.5). On each plane, and using both an iPhone and an Android device, 200 strike and dip measurements were collected. In addition, on each plane, 20 measurements were taken with the geological compass. The geological compass measurements show the maximum spread, in particular on the gentler foliation plane, which is located in an overhang and is rather difficult to measure. The mobile measurements show less spread, with the iPhone measurements being more consistent than the Android measurements, and the Stereonet mobile measurements more consistent than the Fieldmove Clino measurements. The joint plane, which is more irregular, shows larger spread. On this plane, 100 measurements are enough to fully characterize the plane: mean vectors to joint plane poles for 100, 150, and 200 measurements are practically the same and show the same confidence cone. For the foliation plane, 50 measurements are enough to narrow the strike and dip. On the LiDAR clouds, strike and dip measurements on the foliation and joint planes stabilize at sample windows of 0.70 and 0.60 m, respectively. These lengths are larger than the size of a geological compass or mobile device, which shows that sighting measurements are more accurate than device measurements.