

DISCONTINUITY MAPPING IN NATURAL CAVES: A COMPARATIVE STUDY OF MANUAL DATA COLLECTION, STRUCTURE FROM MOTION, AND IPHONE 13 PRO MAX

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The stability of many shallow caves relies heavily on understanding rock discontinuities, such as stratification, faults, and joints. Analyzing these discontinuities and determining their orientations and dispersion are crucial for assessing the overall stability of caves. Traditionally, this has been done using manual methods, such as a compass with a clinometer, which is effective but limited by accessibility and time constraints. In recent years, remote sensing techniques like Structure from Motion (SfM) and newer technologies, such as the iPhone 13 Pro Max's 3D scanning capabilities, have gained popularity in geomechanical analysis due to their ability to provide high-resolution 3D models of cave interiors.

This study presents a comparative analysis of manual measurements, SfM, and the iPhone 13 Pro Max for discontinuity mapping in Badajo Cave (Segovia, Spain). Each method's accuracy, efficiency, and practicality were evaluated. While the iPhone 13 Pro Max offers a convenient, rapid alternative with some limitations in range and detail, SfM provides superior precision for more complex geometries, though at the cost of more equipment and processing time. The findings show strong correlations between the geomechanical parameters captured by all three methods, highlighting the advantages and drawbacks of each technique. This study emphasizes the importance of integrating modern technologies for geological assessments, offering insights that can benefit both researchers and practitioners in geotechnical and geological fields.