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Assessment of the gully morphology measurement method based on UAV photogrammetry

Ji Yang[1,2], Yifan Dong[1,2], and Jiangcheng Huang[1,2]
[1]Institute of International Rivers and Eco-Security, Yunnan university, Kunming，China
[2]Yunnan Key Laboratory for International Rivers and Transboundary Eco-Security, Kunming , China

How to use a suitable method to accurately measure gully morphology is very important in the study of gully erosion monitoring and development, and the development of Unmanned Aerial Vehicle (UAV) has made it easy to apply UAV photogrammetry techniques to gully erosion studies. The aim of this study is to evaluate the accuracy of data and the efficiency of data processing by analyzing the errors of different schemes, and to provide suitable plan design ideas for the study of gully by UAV. Gully is the object of study and different flight schemes and Ground Control Point (GCP) placement schemes are used to acquire and process the data, and finally the errors are analyzed by Digital Surface Model (DSM) and orthophoto. Among all the schemes, the one with a flight altitude of 30m, 80%/70% photo overlap and 11 GCPs had the highest accuracy (Mean absolute error of 0.0353m and root mean square error of 0.0525m), but this scheme took more data collection and processing time and was less efficient. The number of GCPs and the placement location also have a significant impact on the accuracy，the position closer to the GCPs has a smaller error，and this study proves that the number of GCPs should not be more than 9 and should be evenly distributed in different parts of the gully.. When the flight altitude is 70m, the overlap is not less than 50%/40%, and the number of control points is 6, both accuracy and measurement efficiency can be taken into account at the same time. In addition, the sources of errors and the distribution locations of checkpoints with high errors were analyzed in four aspects: shadow, slope gradient, slope direction and vegetation. The use of UAVs in gully erosion studies is very convenient to get the later products with centimeter-level accuracy, and based on the results of the study we suggest that the flight altitude and photo overlap can be appropriately reduced when designing the scheme, and the number of GCP can be increased in the areas that need to be focused on and the areas with large elevation changes. At the same time, flight safety, UAV battery power, data collection efficiency and processing efficiency should be considered comprehensively.