



## **Accurate, low-cost 3D-models of gullies**

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Soil erosion is a widespread problem in arid and semi-arid areas. The most severe form is the gully erosion. They often cut into agricultural farmland and can make a certain area completely unproductive. To understand the development and processes inside and around gullies, we calculated detailed 3D-models of gullies in the Souss Valley in South Morocco. Near Taroudant, we had four study areas with five gullies different in size, volume and activity. By using a Canon HF G30 Camcorder, we made varying series of Full HD videos with 25fps. Afterwards, we used the method Structure from Motion (SfM) to create the models. To generate accurate models maintaining feasible runtimes, it is necessary to select around 1500-1700 images from the video, while the overlap of neighboring images should be at least 80%. In addition, it is very important to avoid selecting photos that are blurry or out of focus. Nearby pixels of a blurry image tend to have similar color values. That is why we used a MATLAB script to compare the derivatives of the images. The higher the sum of the derivative, the sharper an image of similar objects. MATLAB subdivides the video into image intervals. From each interval, the image with the highest sum is selected. E.g.: 20min. video at 25fps equals 30.000 single images. The program now inspects the first 20 images, saves the sharpest and moves on to the next 20 images etc. Using this algorithm, we selected 1500 images for our modeling. With VisualSfM, we calculated features and the matches between all images and produced a point cloud. Then, MeshLab has been used to build a surface out of it using the Poisson surface reconstruction approach. Afterwards we are able to calculate the size and the volume of the gullies. It is also possible to determine soil erosion rates, if we compare the data with old recordings. The final step would be the combination of the terrestrial data with the data from our aerial photography. So far, the method works well and we are able to produce accurate and low-cost 3D-models of gullies.