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0.0.1 Derivation of digital terrain models in a very high spatial resolution with a remote controlled ultra light air vehicle

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The topography is a very important parameter for hydrological / geomorphological processes. But derivation of digital terrain models in a very high spatial resolution is either very time consuming when it has to be done by ground measurements, or very expensive if aerial photos have to be taken. So there is a demand of methods to derive digital terrain models in a very high spatial resolution for comparatively low costs in a reasonable time.

Therefore the ability to derive digital derivation models from aerial photos taken with an easy to transport, lightweight and low cost ultra light air vehicle was tested in a small catchment in the north of Benin, Africa. The UAV consists of a special light weight steel frame with a 5.5 hps strong 2-stroke engine and special type of parachute which serves as a wing. This allows a slow and stable flight and guarantees as well high safety in case of a failure of the motor. The desired sensor can be attached on a gimbal mounting. The overall weight of the UVA is between 8 kg and 12 kg. Up to six kilogram payload can be carried. The maximum flight speed is up to 30 km/h. Flight time is more than 60 minutes, and the of the remote control is between 1.5 km and 8 km dependent on the legal regulations of the country. The UAV can be operated up to 6 m/s wind speed and needs a runway of about 25 m length. The big advantage is that it is very easy to fly and to land so that everyone can learn to operate it within

1-2 days. A big advantage is that the demounted UAV can be carried as normal flight carriage in an air plane, so it can be used everywhere in the world (according to the legal situation).

The aerial photos for the DTM derivation had been taken with a standard digital consumer camera (10 mega pixel) which was calibrated in the department of photogrammetry to compensate the distortion of the lenses. It was possible to gain images with the necessary overlap for derivation of digital terrain models using the UAV. For derivation and accuracy of the DTM 200 ground control points were measured with a differential GPS in a precision of less than 1 cm.

The precision of the derived digital terrain models in was 7 cm in height. Sp the height of single yams heaps could be measured. As well the proper alignment of small dikes to prevent soil erosion could be checked. That offers fascinating possibilities for detailed process understanding and gaining input parameter for hydrological / geomorphological modelling. As well for the assessment of roughness parameters or characterisation of river beds that method can be used.

Ongoing work is now to investigate different block bundle adjustment programs and to get information how much precision is lost if the amount of ground control points is reduced.