Catchment properties in the Kruger National Park
derived from the TanDEM-X Intermediate Digital Elevation Model (IDEM)

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1 Introduction and Aims

In 2014, the first Intermediate DEM (IDEM) was released for scientific users providing a subset of the new global Digital Surface Model (DSM) with up to 12 m geometric resolution and 2 m relative height accuracy. This dataset is based on TanDEM-X acquisitions during the first year only (Moreira et al. 2004).

Here we report on the application of this fascinating new data in the framework of hydrological and geomorphological investigations in Kruger National Park (KNP).

2 Material and Methods

Due to time and computer resources restrictions, catchment delineation was based on the 1 arc sec (~30 m) IDEM10 and compared to results derived from the existing NGI 20 m Digital Terrain Model (DTM). Detailed analysis is based on the 0.4 arc sec (~12 m) IDEM04 and RTK-GNSS based terrain point clouds. The Silolweni catchment located in the Tshokwane section of KNP is used as a case study to highlight detailed results (Fig. 1).

3 Results

Figure 1 provides evidence for the unprecedented geometric resolution of the satellite-based IDEM04 digital elevation data set. The undulating character of the terrain is well visible. However, vegetation structure is represented as well in this DSM. For the delineation of channels and catchments this is a disadvantage, especially when channels are lined by riparian forests. Work to separate the canopy surface from the terrain in the high-resolution IDEM04 is under way.

3.1 IDEM10-based catchment delineation

Drainage network and catchment delineation for the southern part of KNP (Fig. 2) was conducted based on the lower resolution IDEM10 after attempts to use the high resolution IDEM04 in one go for the whole area failed due to computer resources limitations. Compared to the previously used 20 m DTM, the IDEM10 clearly picks up more details of the undulating landscape (max. relief ~100m) in Silolweni catchment (Fig. 1). However, the difference in catchment size between the two approaches is less than 1 % for Silolweni and less than 5 % in any other study site.

3.2 IDEM04 and terrain point cloud comparison

Figure 3 shows the comparison of IDEM04 raster height values (m HA) with the RTK-GNSS derived terrain point cloud measurements (N = 1087) in the vicinity of Silolweni reservoir. The mean height error of IDEM04 and point cloud data is 0.40±0.08 m and 0.04±0.01 m, respectively. Please note: Silolweni reservoir was breached in 2010 and dry at the time of TanDEM-X acquisition © DLR 2014, NGI 2009.

4 Conclusions

The application of the new satellite-based global digital elevation model (IDEM) for hydrological and geomorphological studies provides evidence for the great potential of the data set. However, there are as well some limitations: the high resolution requires adequate computing resources, and the fact that the data represents the canopy might not be beneficial to all applications. Further work is needed to disentangle canopy and terrain heights in the framework of catchment property characterization.

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