z-score normalized cumulative rain-use efficiency differences over the Kilimanjaro region

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The herein presented data is heavily based on the study by Landmann and Dubovyk [1] who investigated land degradation over East Africa on the basis of z-score normalized cumulative rain-use efficiency differences (CRD). In order to assess area-wide CRD, the authors used monthly rain-use efficiencies (RUE; [2]) calculated from

$$RUE = \frac{P_n}{P_r} \tag{1}$$

where P_n and P_r are monthly estimates of net primary productivity (NPP) and precipitation, respectively. z-score normalized CRD was then calculated from

$$CRD = \sum_{i=1}^{n} RUE_{y_{i+1}} - RUE_{y_i} \tag{2}$$

where RUE_{y_i} means the value of RUE in year y_i as derived from Equation 1, and n is the number of years under investigation. Accordingly, the processing chain used to derive area-wide CRD over the Kilimanjaro region, Tanzania, includes the following work steps:

- Monthly maximum value composites (MVC) of the Normalized Difference Vegetation Index [NDVI; 3] are created from the 16-day products originating from the Moderate Resolution Imaging Spectroradiometers (MODIS) aboard NASA's Terra and Aqua satellites. These are 'deseasoned', i.e. intra-annual seasonal fluctuations originating from the bimodal annual rainfall distribution [4] are removed by subtracting the long-term monthly means from the respective raw values [5], and subsequently used to calculate 'conclusive' [$p < 0.001$; 6] long-term trends (Figure 1).
- Monthly P_n is derived from fitting pixel-based linear models to annual MODIS estimates of NDVI and NPP. The models are subsequently used to predict monthly NPP on the basis of monthly raw NDVI.
- Monthly P_r is derived from the 5-km Climate Hazards Group InfraRed Precipitation with Station data (CHIRPS; [7]).

- Monthly values of RUE and, finally, area-wide estimates of the CRD (shown in Figure 2 for all 'conclusive' Aqua-MODIS-based linear trends as depicted in Figure 1b) are calculated from the thus derived estimates of P_n and P_r.

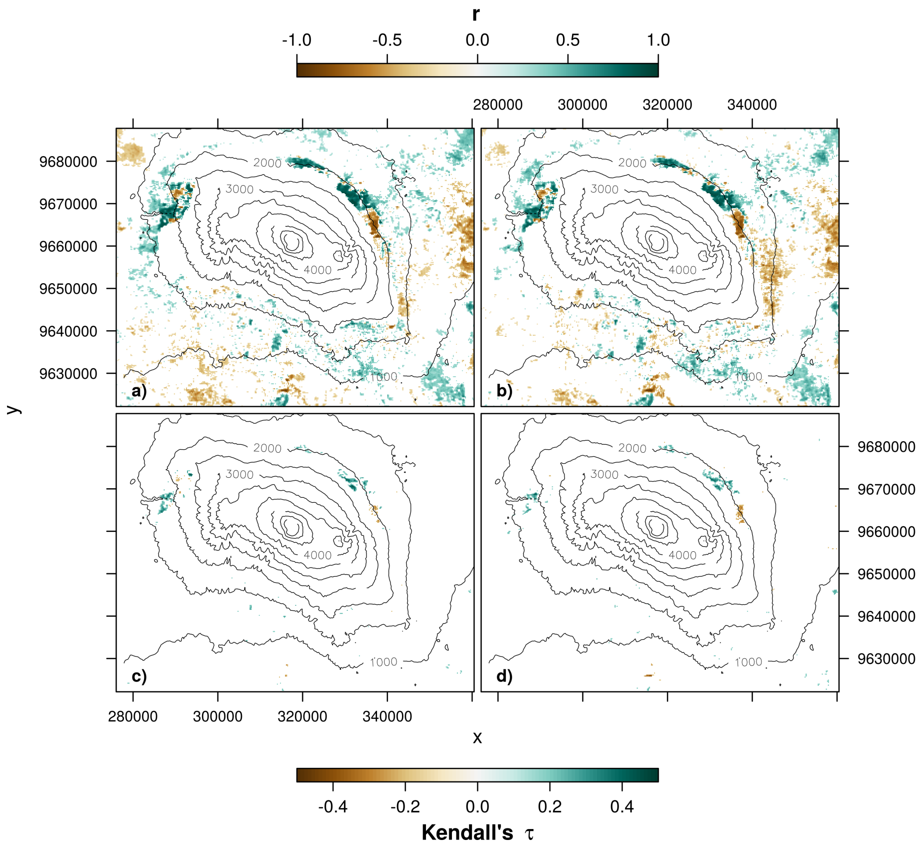

Figure 1. Long-term NDVI trends (2003-2014) from Terra-MODIS (left) and Aqua-MODIS (right).

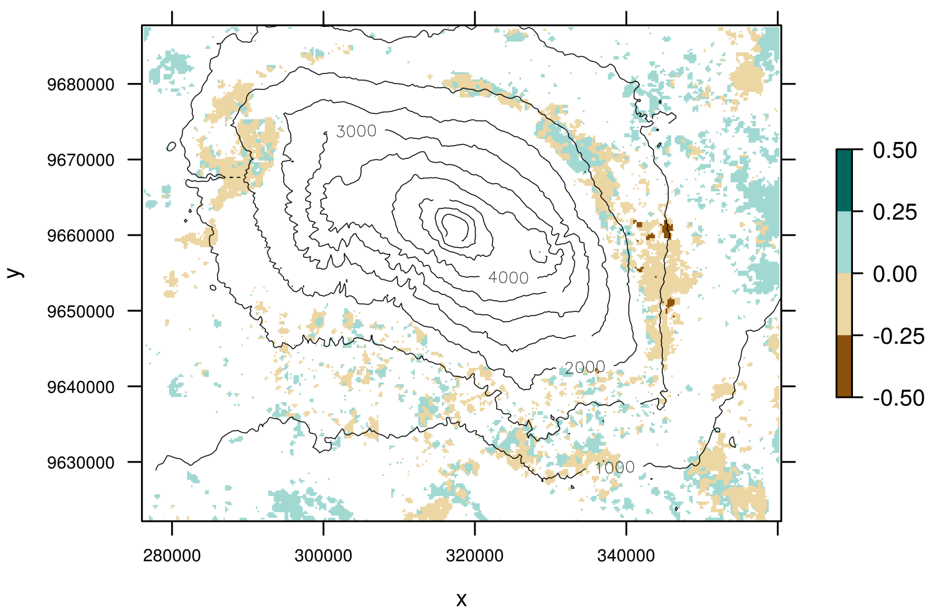

Figure 2. z-score normalized cumulative rain-use efficiency differences (2003-2014).

References

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