A comparative study of cross-product NDVI dynamics in the Kilimanjaro region - a matter of sensor, degradation calibration, and significance

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While satellite-based monitoring of vegetation activity at the earth's surface is of vital importance for many eco-climatological applications, the degree of agreement among certain sensors and products providing estimates of the Normalized Difference Vegetation Index (NDVI) has been found to vary considerably. In order to assess the extent of such differences in highly heterogeneous terrain, we analyze and compare seasonal fluctuations and long-term monotonic trends (2003-2012) in the Kilimanjaro region, Tanzania. The considered NDVI datasets include the Moderate Resolution Imaging Spectroradiometer (MODIS) products from Terra and Aqua, Collections 5 and 6, and the 3rd Generation Global Inventory Modeling and Mapping Studies (GIMMS) product. The degree of agreement in seasonal fluctuations is assessed by calculating a pairwise Index of Association (IOAs), whereas long-term trends are derived from the trend-free pre-whitened Mann-Kendall test. On the seasonal scale, the two Terra-MODIS products (and, accordingly, the two Aqua-MODIS products) are best associated with each other, indicating that the seasonal signal remained largely unaffected by the new Collection 6 calibration approach. As regards long-term trends, we find that the negative impacts of band ageing on Terra-MODIS NDVI have been accounted for in Collection 6, which now distinctly outweighs Aqua-MODIS in terms of greening trends. GIMMS NDVI, by contrast, fails to capture small-scale seasonal and trend patterns that are characteristic for the highly fragmented landscape which is likely owing to the coarse spatial resolution. As a short digression, we also demonstrate that the amount of false discoveries in the determined trend fraction is distinctly higher for $p < 0.05$ (52.6%) than for $p < 0.001$ (2.2%) which should point the way for any future studies focussing on the reliable deduction of long-term monotonic trends.