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Multi-temporal Soil Erosion Modelling over the Mt Kenya Region with Multi-Sensor Earth Observation Data

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Accelerated soil erosion is the principal cause of soil degradation across the world. In Africa, it is seen as a serious problem creating negative impacts on agricultural production, infrastructure and water quality. Regarding the Mt Kenya region, specifically, soil erosion is a serious threat mainly due to unplanned and unsustainable practices linked to tourism, agriculture and rapid population growth. The soil types roughly correspond with different altitudinal zones and are generally very fertile due to their volcanic origin. Some of them have been created by eroding glaciers while others are due to millions of years of fluvial erosion. The soils on the mountain are easily eroded once exposed: when vegetation is removed, the soil quickly erodes down to bedrock by either animals or humans, as tourists erode paths and local people clear large swaths of forested land for agriculture, mostly illegally. It is imperative, therefore, that a soil erosion monitoring system for the Mt Kenya region is in place in order to understand the magnitude of, and be able to respond to, the increasing number of demands on this renewable resource.

In this paper, we employ a simple regional-scale soil erosion modelling framework based on the Thornes model and suggest an operational methodology for quantifying and monitoring water runoff and soil erosion using multi-sensor and multi-temporal remote sensing data in a GIS framework. We compare the estimates of this study with general data on the severity of soil erosion over Kenya and with measured rates of soil loss at different locations over the area of study. The results show that the measured and estimated rates of erosion are generally similar and within the same order of magnitude. They also show that, over the last years, erosion rates are increasing in large parts of the region at an alarming rate, and that mitigation measures are needed to reverse the negative effects of uncontrolled socio-economic practices.