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Remotely sensed, agriculturally relevant, surface temperature validation in sub-Saharan Africa: preliminary results

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Satellite derived land surface temperature (LST) products are an essential tool for many fields across the physical and earth sciences. For satellite derived LST products and their derivatives to be robust and comparable between sensors they must be validated against ground-based observations. Furthermore, the ground observations themselves need to be well understood and controlled. This requires sensor calibration, atmospheric correction and knowledge of surface thermal emissivity properties in both the field of view (FoV) of the satellite and ground-based radiometers. To date, the observations necessary to enable these activities are primarily confined to North America and Europe with a small number of additional stations in West Africa that are primarily located in desert environments. This is an issue given the known problems that LST products have with regions that experience a wet-dry season cycle with associated changes in vegetation cover and the significant differences between typical agricultural landcover canopy structure and the normal validation targets.

We here outline the recently completed installation of a radiometer based, long-term, LST validation station in Kenya and the initial results stemming from the site. This work is part of the UK Space Agency funded PRISE project and the validation site efforts are carried out in collaboration with the International Livestock Research Institute (ILIR). Additional instrumentation has been provided by the UK National Centre of Earth Observation (NCEO) and the Jet Propulsion Laboratory (JPL-NASA). The site is located at the ILRI research ranch on the Kapiti planes, south-east of Nairobi, Kenya. The vegetation in the area is subject to controlled grazing and consists of savannah scrub with some limited arboreal coverage. The region experiences a short-rains (October/November) and long-rains (March/April to May/June) precipitation pattern that causes the semi-arid savannah to rapidly green-up before senescing as water availability reduces in the post-rain period. The validation site is designed to capture the rapid changes in vegetation state in terms of both optical RGB/VNIR observations and thermal emissivity field surveys.

As well as the highly instrumented Kapiti site, we have access to >120 air temperature loggers that are spread throughout maize and tomato crops at various heights in the canopy. The loggers are located at farms in Ghana, Kenya and Zambia and between them represent a lower quality (than Kapiti) but much deeper record of agriculturally relevant temperatures. Preliminary results of a comparison between Kapiti, field logger, SEVIRI, GFS and ERA derived surface and 2 m air temperatures indicate that all model and satellite temperatures have a bias compared to the field temperatures. Furthermore, the 'best' remotely sensed or modelled temperature is highly dependent on the downstream agricultural application.