



## The potential of satellite soil moisture for agricultural applications in emerging economies

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The implementation of satellite observations in agricultural services can automate numerous field processes, thereby reducing the costs of these services substantially. Consequently, this increases the potential to offer data-driven products to individual farmers. However, over the last couple of decades, limitations related to cloud cover, data coverage and resolution have led to a relatively small commercial exploitation of this potential. Fortunately, with the rapid growth of public and private satellite constellations, a new era has emerged in which satellite derived products are expected to reach the maturity needed to create impact on a local scale.

Projects such as the Copernicus Climate Change Service (C3S, <https://climate.copernicus.eu/>) and the ESA Climate Change Initiative (ESA CCI, <http://cci.esa.int>) facilitate access to global, long-term satellite-based data products that are not interfered with by clouds. In addition, the issue of low resolution has partially been solved by merging different satellites or using advanced downscaling methods. One climate variable of which major positive impact is expected within the agricultural sector is soil moisture due to its key role for both crop growth and the emergence of diseases.

In order to demonstrate the potential of high resolution soil moisture products to agriculture services, the present work assesses three case studies:

(1) Firstly, in order to reduce the global insurance and loan gaps, financial products based on satellite-derived soil moisture data are being developed for smallholder farmers in Kenya. Within this case study, the potential impact on food security and the livelihoods of these farmers is evaluated.

(2) Secondly, the added value of satellite soil moisture data for improving both water use efficiency and water productivity is assessed for a sugarcane company in Mozambique.

(3) Lastly, in a case study in Indonesia, the main purpose is to improve good agricultural practices for pepper farmers using temperature, vegetation and soil moisture data from satellite observations.

For all case studies, satellite remote sensing information creates new opportunities to improve existing agricultural practices. In particular, the relevance of consistent satellite data records are highlighted, which is one of the key aspects of European satellite programs like ESA CCI and C3S. Nonetheless, the real challenge is twining this advanced technology with the existing information infrastructure and the particular needs of end users. It is therefore of importance that, besides technical studies, future work also focuses on the practicalities and pitfalls behind the implementation of this technology.