Diagnosis of spatial and temporal patterns of dry and wet spells due to land-atmosphere water exchange in the tropical savanna of East Africa

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Abstract
Dry and wet spells result from disruption of seasonal climatic patterns and are small-scale moisture anomalies. Fluxes of moisture and thermal radiation regulate precipitation and seasonal average temperatures. These short lived and small-scale moisture anomalies, their patterns and influences are not well understood. These anomalies result in crop failures in East Africa. In the savanna environment, where water is limited, these small-scale moisture patterns need to be investigated as they regulate natural biophysical and agricultural productivity. To mitigate the impact of these dry and wet spells, the pattern of moisture availability needs to be understood. This research develops an index for examining surface moisture variation. It develops a tool for discovering short-lived anomalous moisture condition patterns. By investigating the neighborhood interrelationships between the NDVI and surface temperature using the spatial continuity measure, the Surface Moisture Evapotranspiration---(SMET) index is developed. This index is related to surface moisture availability and absence, surface moisture removal through evapotranspiration, and the ground sensible and latent thermal fluxes. The SMET index can diagnose surface moisture for both bare and fully vegetated lands. Periods of severe moisture deficits and the typical moisture conditions in East African regions are identified by this index. The patterns of dry and wet spells in the humid and the savanna environments are revealed. Clouds are identified by this index. Moisture is investigated at local and regional scales without interpolation. Moisture variation on regional scales could be investigated on a daily bases using the SMET index. The index can be used for climatic impact and change studies. It will facilitate decision-making as an early warning tool for crop production. The index has utility also in terrestrial environmental changes and soil quality monitoring.