

Water, Weather and Climate Services for Africa, the cases of Ghana and Kenya



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May 2020



Introduction to the TWIGA project

The **objective** of the project is to provide currently unavailable geo-information on weather, water and climate for sub-Sahara Africa by enhancing satellite-based geo-data with innovative in situ sensors and developing related information services that answer needs of African stakeholders and the **GEOSS**community.







Sensors in TWIGA Countries







Mapped Services







TWIGA Services in Ghana & Kenya

Implemented

Pipeline

SN	Service	Description of Service	TWIGA Innovations/Data requirement	
1	How humid is my environment	Provide estimates of how wet the soil is in five classes: very dry, dry, moist, very moist, and saturated. "Very dry" corresponds with wilting point and "very moist" with field capacity.	Thermal imagery from UAVs, Sentinel-1, DTS, Evaporometers, Low-cost soil moisture sensors and TAHMO stations	 Route planning for agribusiness Meteorological information for livestock – EWS Meteorological information for plagues prediction Vulnerability Indexes for Insurance
2	Crop insurance based on soil index	The crop insurance product uses soil moisture conditions for pay-outs instead of only rainfall (this include yield and germination insurance). The soil moisture is determined using satellites and soil moisture probes and DTS in 2 pilot locations (Districts) - one each in Northern and Southern Ghana.	Farmerline's Mergdata Platform, Sentinel-1 derived soil moisture products, Disdrometers, TAHMO Stations, HydroNet Platform, Soil moisture sensors including Teros-12	 Wind forecast for wind energy Water quality monitoring tool Water availability Post-disaster vector-borne diseases forecast Downscaling seasonal forecast Heatwave forecast/heat index Fire danger index
3	Short-term prediction for solar energy	By extrapolating cloud movements and daily cloud formation patterns, it is possible to develop a short-term prediction for the amount of solar radiation reaching the surface. This information will be useful for energy managers that include large solar farms. TAHMO data is used to train the model and assess the results.	TAHMO stations, Satellite Data and Models	 Seasonal forecast (onset of rain, temp) Forecast for fisheries (heavy rains over lakes/coasta areas) Fog prediction Thresholds for specific extremes Map4ER: Mapping for Emergency Response Flood Impact: Early warning flood forecasting
4	EWS for clogging of drains	Urban drainage networks in Africa tend to clog at bottlenecks with discarded plastic. A camera is used to take regular pictures and transform the image into a simple measure of accumulation. This information will be sent to the web. Warnings can be issued to municipalities and/or plastic collectors. Mapping open water floods and vegetated flooded areas, combining satellite remote sensing with UAV. Products: River cross- sections and DEM + flood map + training	GNSS network for early warning system, Disdrometers (intervalometers), Flood Mapping App, TAHMO stations Sentinel-1 data, UAVs, Soil Moisture Sensors, Flood Mapping App, DEM, HydroNet platform	 18. Erosion and landslide Risk 19. Basin Water Control Room 20. Energy flux maps 21. Drought monitoring forecasting 22. Drought/Flood vulnerability maps 23. Yield prediction 24. Pre-harvest crop status 25. Post-harvest crop status
5	EWS for heavy rains			
6	Crop detection and condition monitoring (crop doctor)	Crop detection, crop stress monitoring	UAVs (NIR, NDVI), VegMon App	

Acceleration of TWIGA Innovations

Innovation	TRL before the Project	Status of Innovation	Current TRL
100 Euro neutron counter	1	Experimental stage at the Lab at the TU Delft and Oregon State University	3
Laser micro scintillometer	2	No TRL acceleration yet	2
Doppler radar rain sensor	3	No TRL acceleration yet	3
Evaporometer	4	Installed in an operational environment in Kenya (Narok test bed)	7
Accelerometer tree weighing	4	No TRL acceleration yet	4
Intervalometer rain gauge	5	System complete and qualified and in continuous monitoring mode at selected sites in Kenya (Narok), and Ghana (Tamale)	8
Lightning tracking	6	These are operational in TAHMO stations (commercially available)	9
GNSS water vapour	6	System complete and qualified and in continuous monitoring mode at selected sites in Uganda	8
Flood mapper	7	Mobile phone app to map extent of flooding - System complete and qualified and in continuous monitoring mode at Aboabo, Kumasi in Ghana	8
Humidity Tracker	1	Operational within Farmerline Mergdata App - System complete and qualified and in continuous monitoring mode in Ghana	8
VegMon	1	Mobile phone app to monitor vegetation parameters - System complete and qualified and in continuous monitoring mode in Ghana (Tamale, Navrongo and Kumasi) and in Kenya (Narok)	8
Crop doctor	7	It is operation in Mozambique and Kenya	8





In situ sensors - Atmospheric moisture Precipitable Water Vapor



remote sensing

MDPI

Article

High Quality Zenith Tropospheric Delay Estimation Using a Low-Cost Dual-Frequency Receiver and Relative Antenna Calibration

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GNSS Early results





Getting Rainfall Right Services: Agriculture, insurance, flood



Get handle on variability





In situ Sensors- Rainfall variability



Narok - Kenya: Disdros and Intervalometers





In situ Sensors- Rainfall variability





Nyankpala - Ghana: Disdros and Citizens





In situ Sensors- Soil moisture



Time series of soil moisture and precipitation at station TA00616 (Tamale). Soil moisture profiles show response rainfall: steep rise followed by a gradual decrease in soil moisture content over a period of up to ~25 days.

Teros-12 Nyankpala (Ghana)







In situ Sensors - Soil moisture



Distributed Temperature Sensing





In situ Sensors-Soil moisture





Nyankpala – Tamale, Ghana

Distributed Temperature Sensing





TWIGA Sensors: Soil moisture



SAR Soil Moisture (Sentinel-1)





TWIGASensors: Flood



Kumasi (Ghana)water level





TWIGA Sensors: Flood



Kumasi (Ghana)- Does it drain?





TWIGA Sensors: Flood





Kumasi (Ghana)Hackathon Plastic Spectrometer

Plastic Mapping App





TWIGA Sensors: Crop monitoring



VegMon ODK App – Jan Friesen





TWIGAPlatform





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TWIGA Partners





