Timely information for frost impact mitigation from MODIS Aqua and WRF NWP forecasts

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1. Rationale

A lot of interests in frost issues began in 2012 after a devastating frost event that caused damage to vast areas of tea plantations leading to massive financial losses.

- Records show that frost has been a major problem since 1992 leading to a cumulative loss of 1.5 million Kg of green leaf tea.
- Frost losses have raised awareness on the problem and illustrated the devastating effects of climate change on livelihood
- This work fills an information gap on the likelihood of frost events in vulnerable areas, using remotely sensed MODIS data and GIS tools, WRF Numerical Weather Prediction (NWP) surface temperature forecasts, to create of an algorithm for frost detection
- This timely information improves the lead time for mitigation measures.

Figure 1: A Tea plantation affected by Frost bite (Photo credit: James Finlays)

2. Objectives

Create a frost risk information service for tea growing areas through:

- Generation of satellite data-derived frost monitoring maps for East Africa
- Forecasting of frost risk using data from Kenya Meteorological Service WRF NWP output
- Validation of temperature estimates from satellite observations and numerical weather modelling using ground temperature observations and recorded historical frost events

4. Earth Observations and Other Inputs

- MODIS Aqua L2 Land Surface Temperature
- MODIS Aqua Geolocation files for reprojection
- KMS NWP outputs
- WSN sensor data (temperature, humidity, wind direction etc.)

3. Approach/Project Activities

- MODIS data processing: downloading, reprojection (using MRT Swath Tool and a Geolocation file), and mapping of the daily available MODIS LST product from Aqua platform
- Acquisition of WRF NWP data: NWP surface temperature forecast text files are downloaded from KMS, rasterized and mapped to show the distribution of surface temperatures for the next 72 hours at 14 km
- Calibration: WSN point data is used to calibrate both satellite and KMS forecasts to achieve better accuracy

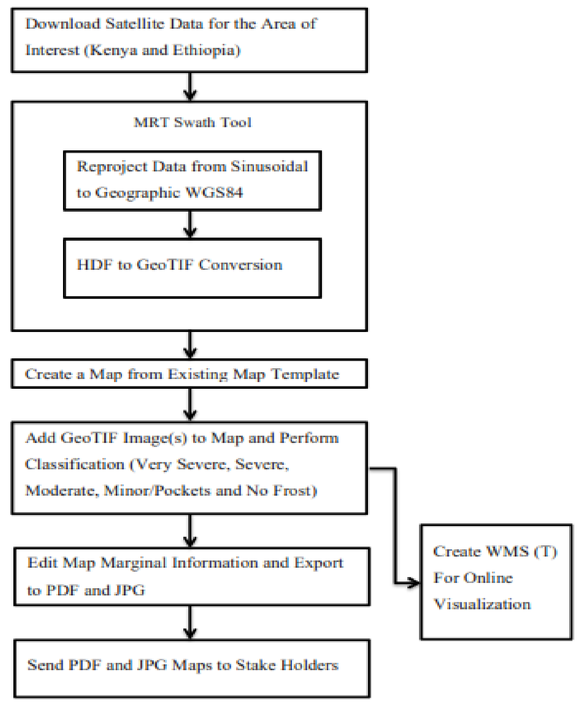

Figure 2: Frost Monitoring and Forecasting approach

5. Results

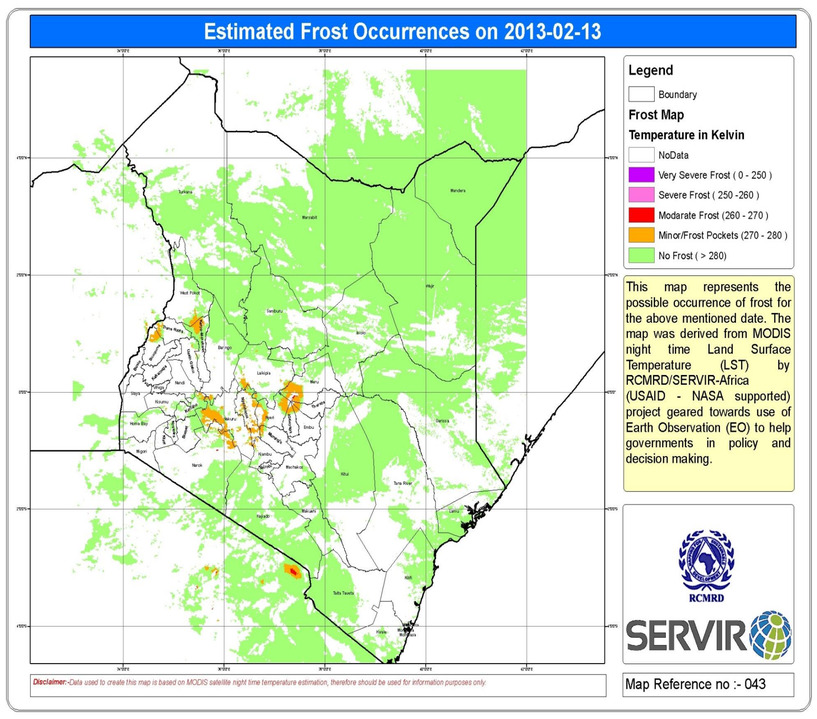

Figure 3: A frost product showing the distribution of the surface temperature from MODIS Aqua LST dataset

Figure 5: A training session during the two day workshop in July 2015

Figure 4: One of the WSN node on a Tea farm in Kericho

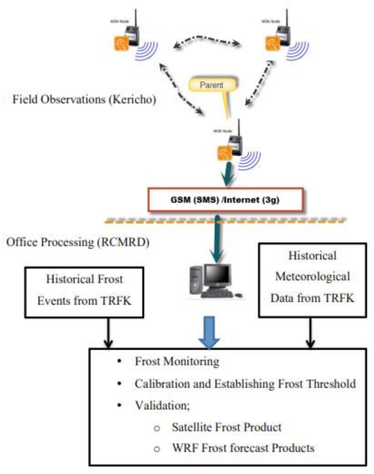

Figure 6: Wireless Sensor Network configuration

Achievements (Summary)	Amount
No of stakeholders (individuals) trained	21
No of climate adaptation tools developed	1
No of stakeholder engagement events	2
No of agencies engaged (Govt and NGOs)	10
No of data layers generated	3

6. Outcomes/Anticipated Impacts

- There is an increased corporation between NGO's, private and government institutions to address frost issues
- Capacity building activities for partners and students who wish to pursue frost research
- There is an increase in awareness of remote sensing options to address issues affecting the society
- Dissemination of the frost product increased the number of its users

7. Project Partners

- Tea Research Foundation (TRFK)
- Kenya Meteorological Service (KMS)

8. Project End Users

- Kenya Meteorological Service
- Ministry of Agriculture (MOA)
- County government of Kericho
- James Finlays
- Kenya Tea Development Authority
- Small-scale Tea growers