Farmer's First Africa: Providing Precipitation Forecasts for the Central African Republic

athenium analytics | FARMERSFIRST AFRICA

To learn more about the FFA organization, visit us at **farmersfirstafrica.org**

Jonathan G. Fairman Jr., Athenium Analytics **jonathan.fairman@athenium.com**
Emmett Soldati, Farmer's First Africa **emmett@farmersfirstafrica.org**

Value of Precipitation Information

Precipitation forecasts are critical to farmers but are often unreliable or unavailable in areas that offer little infrastructure. Farmer's First Africa (FFA) has a two-phase solution to this issue in the Central African Republic:

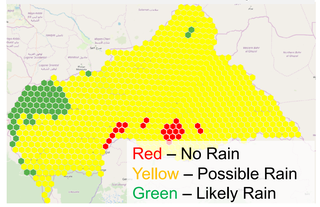
1. Categorical probabilistic precipitation forecasts, determined by offseason analysis at Athenium Analytics, are disseminated across the country using shortwave radio broadcasts.
2. FFA has a network of 39 precipitation gauges, allowing for forecast verification and optimization of our forecast algorithm.

The result is a forecast in which our farmers can have confidence. Famers can directly contribute to the system's improvement by installing a plastic Rain gauge (pictured) and texting observations to our Central African Republic staff.

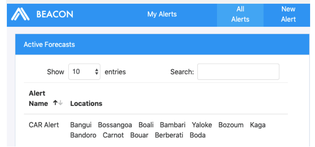
This robust, low-cost system is expandable throughout the region and directly helps local farmers by providing vital precipitation information.

Automated Forecast Process

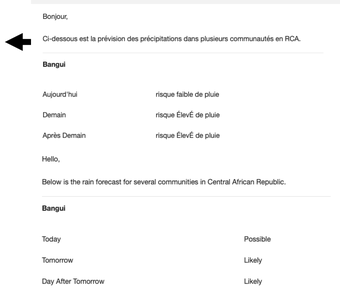
Categorical precipitation forecast determined by precomputed optimized thresholds produced by Athenium Analytics from NOAA Global Ensemble Forecast System



Forecast subset by designated site selected by FFA Central African Republic staff



Automated e-mails sent at 00 UTC in English and French to FFA Central African Republic staff



Bonjour,

Ci-dessous est la prévision des précipitations dans plusieurs communautés en RCA.

Bangui

Aujourd'hui	risque faible de pluie
Demain	risque ÉlevÉ de pluie
Après Demain	risque ÉlevÉ de pluie

Hello,

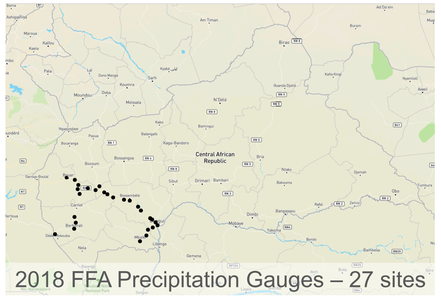
Below is the rain forecast for several communities in Central African Republic.

Bangui

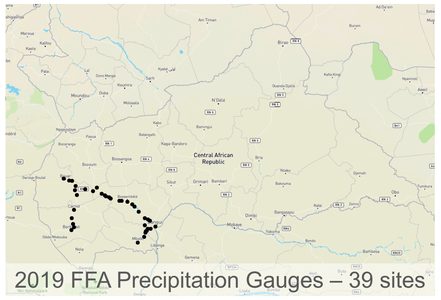
Today	Possible
Tomorrow	Likely
Day After Tomorrow	Likely

Staff broadcast alerts via shortwave radio at 7 a.m. local time

Building Our Precipitation Gauge Network



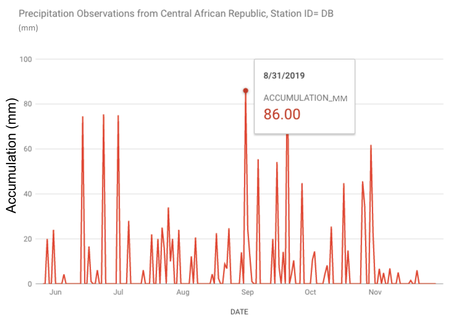
Program Director Emmett Soldati (right) oversees gauge installation.



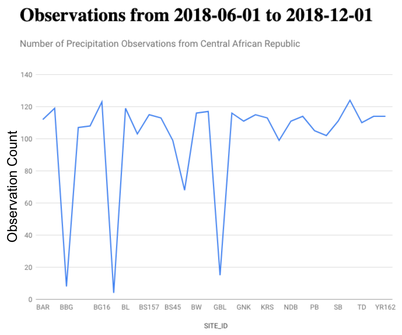
Precipitation Observation Inventory and Validation

Observations are texted to FFA staff by farmers and tracked in Google Docs, with web portals for live tracking. This allows dynamic checks on station fidelity and observations from each site. Individual observations may be tracked to determine outliers.

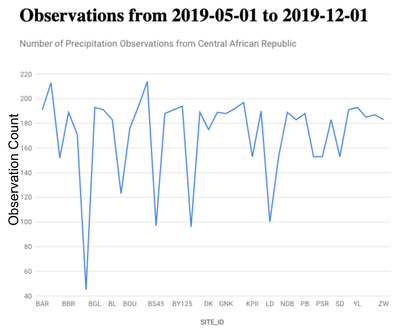
Post-season comparisons with Athenium Analytics precipitation products link recorded site observations with our blended satellite precipitation analysis and forecast verification. On average, daily RMSE values between satellite-derived precipitation and the FFA precipitation network are **8 mm/day**, similar to the RMSE between the satellite and Global Historical Climate Network stations in the Central African Republic.



2019 observations from Dabere, Central African Republic.



2018 precipitation inventory from Farmer's First Africa gauges.



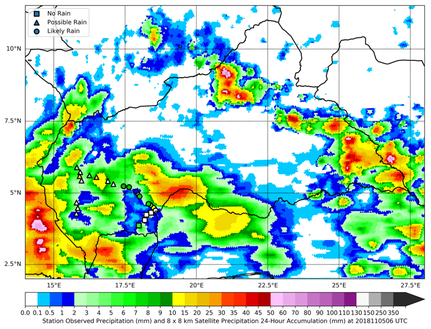
2019 precipitation inventory from Farmer's First Africa gauges.

Forecast Verification and Optimization

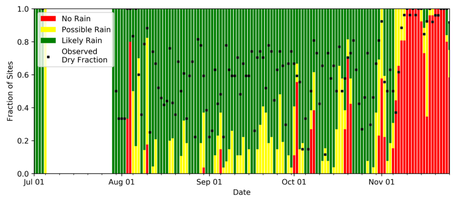
FFA's 2018 precipitation observations indicate more *Likely Rain* forecasts and fewer *Possible Rain* forecasts. New thresholds for the probabilistic categories were implemented for the 2019 season.

The threshold changes would have resulted in a **2018 skill increase** from **50.5%** to **62.4%** versus observed station precipitation and **67.5%** to **68.4%** versus IMERG satellite precipitation.

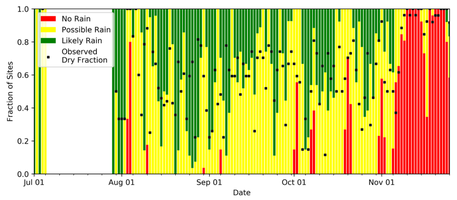
For **2019**, the new forecast thresholds showed similar skills scores of **59.2%** versus observed station precipitation and **71.3%** versus IMERG satellite precipitation.



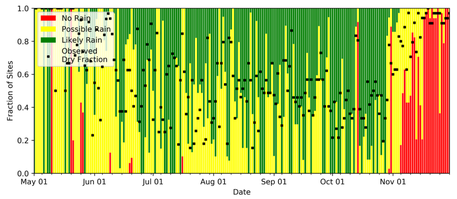
This example shows the Athenium Analytics precipitation forecast at specific sites versus satellite precipitation. Shapes indicate forecast category; colors indicate the amount of observed precipitation.



Original July-December 2018 precipitation forecast. Black dots indicate the percentage of observation sites in which precipitation was not observed (dry fraction). In 2018, the forecast had a 50.5% forecast skill.



Optimized July-December 2018 precipitation forecast. Forecast skill improves to 62.4% in identifying precipitation days in Day One forecasts.



Athenium Analytics precipitation forecast data for May-December 2019. Forecast skill versus station precipitation is 59.2%.

The Future

FFA's explorations into forecast improvements include operational Weather Research and Forecasting (WRF) model deployment, additional precipitation sites and partnerships with local mobile phone companies for more efficient forecast dissemination. Other variables such as temperature from deterministic Global Forecast System data may be added to alerts for our Central African Republic staff.

The generation of the probabilistic forecasts will improve based on 2019 information, with algorithmic tweaks occurring in the offseason.

FFA precipitation forecasts provide a much-needed service to the Central African Republic, using a probabilistic Rain forecast algorithm specifically tuned to gauges in the region. Expansion to other nearby countries is possible, given funding and resources.