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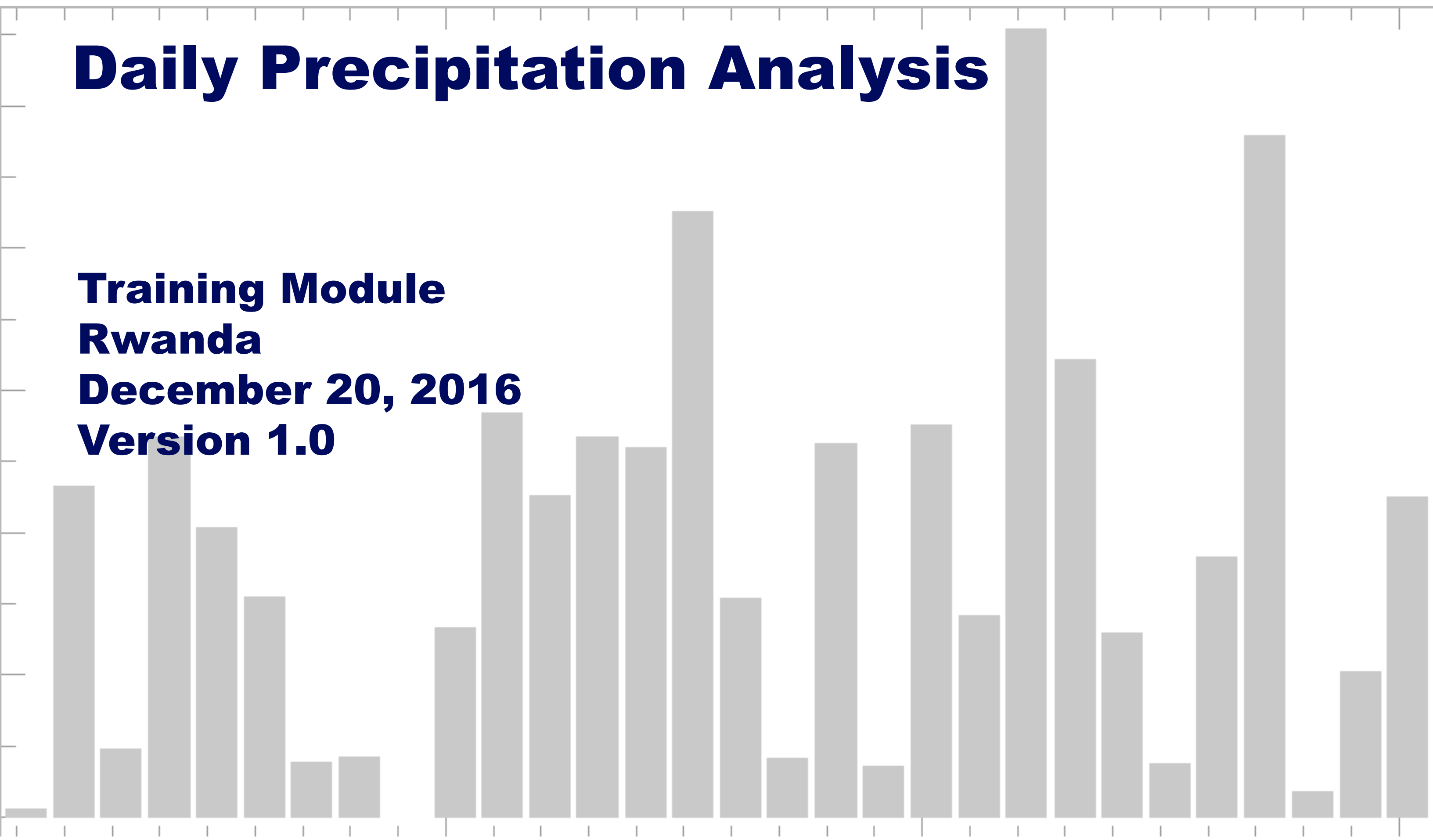

# Daily Precipitation Analysis

**Training Module**
**Rwanda**
**December 20, 2016**
**Version 1.0**

Rwanda Meteorology Agency

International Research Institute for Climate and Society (IRI), (2016). Daily Precipitation Analysis - Rwanda. December 20, Version 1.0. Palisades: IRI.

# Acknowledgements

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CHAPTER

ONE

# DAILY PRECIPITATION ANALYSIS TRAINING - RWANDA

## 1.1 Daily Precipitation

Understanding patterns of daily rainfall is tremendously useful for a range of climate and society applications; particularly in agriculture, water management and public health. Understanding the daily distribution of rainfall can help farmers and and government planners understand production risks and adjust farming practices to improve crop performance or reduce losses, can help water managers make time sensitive decisions about reservoir levels and can help public health experts understand the evolution of disease epidemics in fine temporal detail. To this end, the IRI has created daily precipitation analysis maprooms for specific data sets with partner institutions.

## 1.2 Overview

*Why was it developed?*

- The Daily Precipitation Analysis Maproom was created to explore historical daily precipitation by calculating simple seasonal statistics. The initial design of this maproom was a response to demand, by agricultural researchers and decision-makers in South Asia, for information about climate-related risks to local agricultural production.

*What can the Daily Precipitation Analysis Maproom be used for?*

- To analyze the variability of rainfall statistics for a chosen time of year: cumulative rainfall, frequency of rain days, frequency of dry or wet spells.
- To map the mean, standard deviation or probability of exceeding a chosen threshold, over years.
- To produce yearly time series of a chosen statistic derived from daily precipitation data. Clicking on the map will produce a local yearly time series of the chosen statistic.

*What can the Daily Precipitation Analysis Maproom NOT be used for?*

- Predicting precipitation

## 1.3 Definition

The daily precipitation is derived from reconstructed rainfall on a 0.0375° x 0.0375° lat/lon grid (about 4km) from Meteo Rwanda. The time series (1981 to 2014) were created by combining quality-controlled station observations in Meteo Rwanda's archive with satellite rainfall estimates.

## 1.4 Interpretation

The control bars (Fig 1.1), have some buttons that can be clarifies as follows:

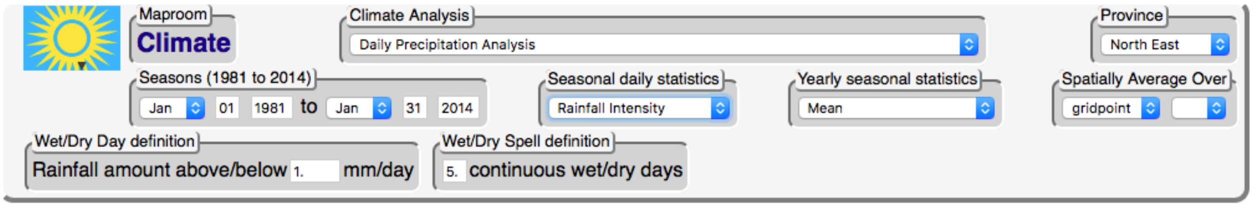


Fig. 1.1: Current Control Bar for Daily Precipitation Analysis Maproom for Rwanda

*Years and Season* : Specify the range of years over which to perform the analysis and choose the start and end dates of the season , over which the diagnostics are to be performed. Wet/Dry Day/Spell Definitions: These define the amount in millimeters (non inclusive) above which a day is considered to be a wet day (as opposed to dry), and the minimum number (inclusive) of consecutive wet (dry) days to define a wet (dry) spell.

*Seasonal daily statistics* : Choose the seasonal diagnostic quantity (i.e the statistic of the daily data) to be computed for each season, from the following choices. Total Rainfall: total cumulative precipitation (in mm) falling over the season. Number of Wet Days: the number of wet days (as defined above) during the season. Rainfall Intensity: the average daily precipitation over the season considering only wet days.

*Number of Wet (Dry) Spells* : the number of wet (dry) spells during the season according to the definitions in the Options section. For example, if a wet spell is defined as 5 contiguous wet days, 10 contiguous wet days are counted as 1 wet spell. Note that a spell, according to the definitions above, that is overlapping the start or end of the season will be counted only if the part of the spell that falls within the season reaches the minimal length of consecutive days.

*Yearly seasonal statistics* : a choice of yearly statistics over the chosen season of the selected range of years to produce the map among: the mean, the standard deviation and the probability of exceeding a user specified threshold.

*Spatial Resolution* : The analysis can performed and map at each 0.1° resolution grid point. Additionally it is possible to average the results of the analysis over the 0.1° grid points falling within administrative boundaries for the time series graph.

Figure 1. is an example of the historical probability of seasonal average monthly rainfall product conditioned on El Niño during the July-August-September season, and falling within the upper (wet) one-third ("tercile") of the 1983-2010 historical distribution in rainfall for Rwanda. Please note that this is not a forecast.

## 1.5 Access

The Daily Precipitation Analysis Maproom can be accessed via the Climate Forecast Maproom. http://maproom.meteorwanda.gov.rw/maproom/Climatology/Climate_Analysis/daily_precip.html

## 1.6 Case Study - Rwanda

In Rwanda, bananas are on of the most popular crops that are grown on 17.3% of the total harvested land area (FAOSTAT 2014). In particular bananas are on over a third of the country's cultivated land and account for at least two-thirds of a small farmer's earnings (NISR 2015b).

For this case study we will be observing on how land allocation should look like in the different rainy seasons (A: September-February & B: March-July) for bananas in the southern province of Rwanda (M Nyasimi, M Radeny, J

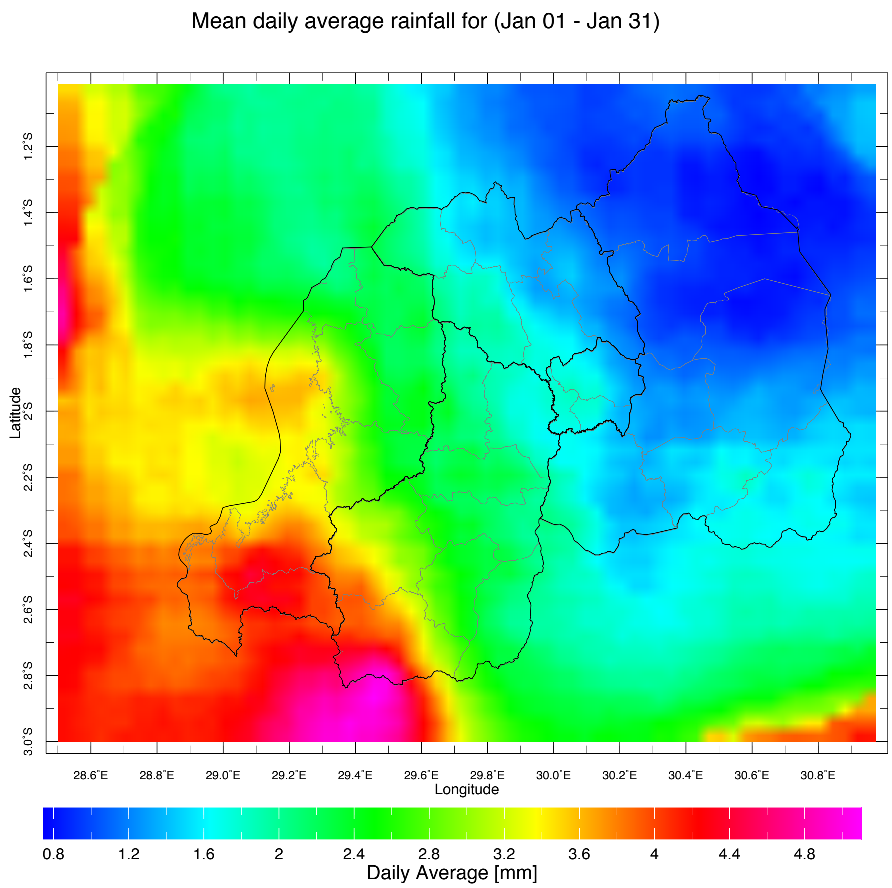


Fig. 1.2: Rwanda Daily Precipitation Analysis Maproom

Hansen - 2016 - cgspace.cgiar.org). So the control bars should be set as Figure 1.3 & 1.4. Where Figure 1.3 will observe the month of September of Season A and Figure 1.4 will look at the month of March of Season B

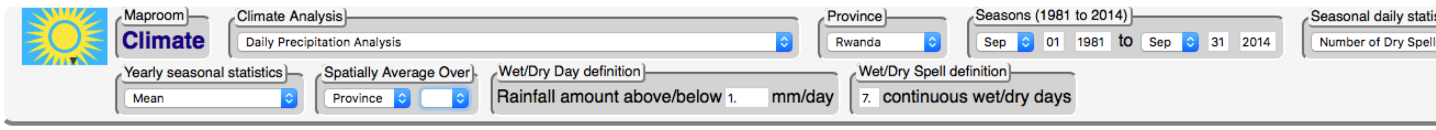


Fig. 1.3: Control bar settings for Season A

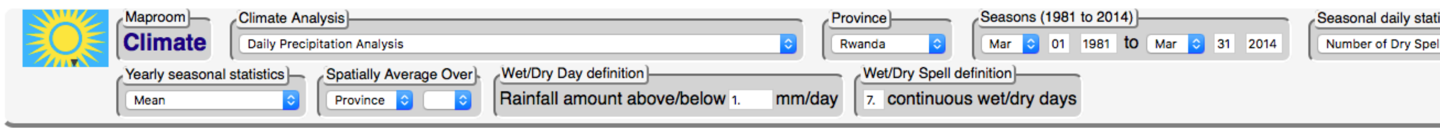


Fig. 1.4: Control bar settings for Season B

Figure 1.5 displays the historical count of number of dry spells for the month of September whereas Figure 1.6 is for the month of March, both referring to the Southern Province and looking at a dry spell definition of 7 continous dry days of each Sept/Mar month of the year.

### 1.6.1 Case Study Summary

As seen when comparing figure 1.5 and 1.6, we can see that the month of September has the highest number of dry spell counts as compared to the month of March for the Southern Province. Hence it would make sense that the percentage of land allocated to bananas would be lower in the month of September rather than the month of March. As a matter of fact the land allocation for bananas in Rwanda is 18% for Season A and 27% for Season B (MINAGRI 2014)

From this climate analysis tool, decision-makers in various sector and especially the agricultural sector can make informed decisions on different crops as look at the trends for each month by tailoring their definition of we/dry spells.

## 1.7 Exercise - Rwanda

Rwanda, located in the tropical belt (latitude: 1°3’S - 2°51’S and Longitude 28°52’E - 30°55’E), sits astride two key climatic regions, East Africa and Central Africa, each with contrasting controls and drivers on climate. Despite being located in the tropical belt, Rwanda experiences a temperate climate as a result of its high elevation.

Rwanda experiences a bimodal pattern of rainfall, which is driven primarily by the progression of the Inter-Tropical Convergence Zone (ITCZ). The ITCZ follows the annual progression of the sun as it goes to the Northern Summer solstice about June 23, and the Southern Summer solstice about December 23 each year. The ‘long rains’ occur over March, April and May (MAM) and the ‘short rains’ occur in October, November and December (OND).

*Please perform the following exercises:*

E1. Proceed to the Daily Precipitation Mapage within Rwanda’s Climate Analysis Maproom, and set the analysis tool bar to the categories in Figure 1.8. (1) Province: Rwanda; (2) Spatially Average Over: Province; (3) Seasons (1981 to 2014): Mar 01 1981 to Mar 31 2014; (4) Seasonal daily statistics: Number of Dry Spells; (5) Yearly seasonal statistics: Mean; (6) Wet/Dry Day definition: Rainfall amount above/below 1mm/day and (7) Wet/Dry Spell definition: 7 continuous wet/dry days.

E2. Now, generate the time series, bar graph for the following Provinces: (1) Western Province, (2) Northern Province, (3) Town of Kigali, (4) Eastern Province, (5) Southern Province

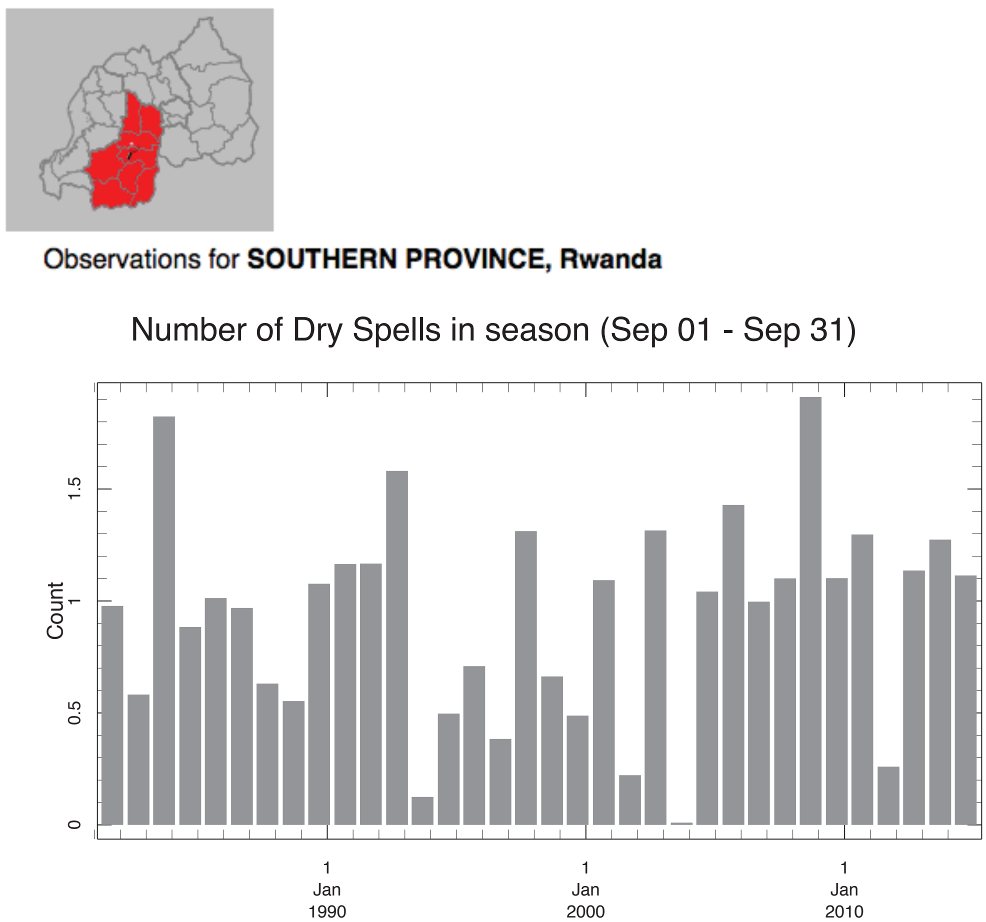


Fig. 1.5: Number of historical dry spells in Sep 01 - Sep 31

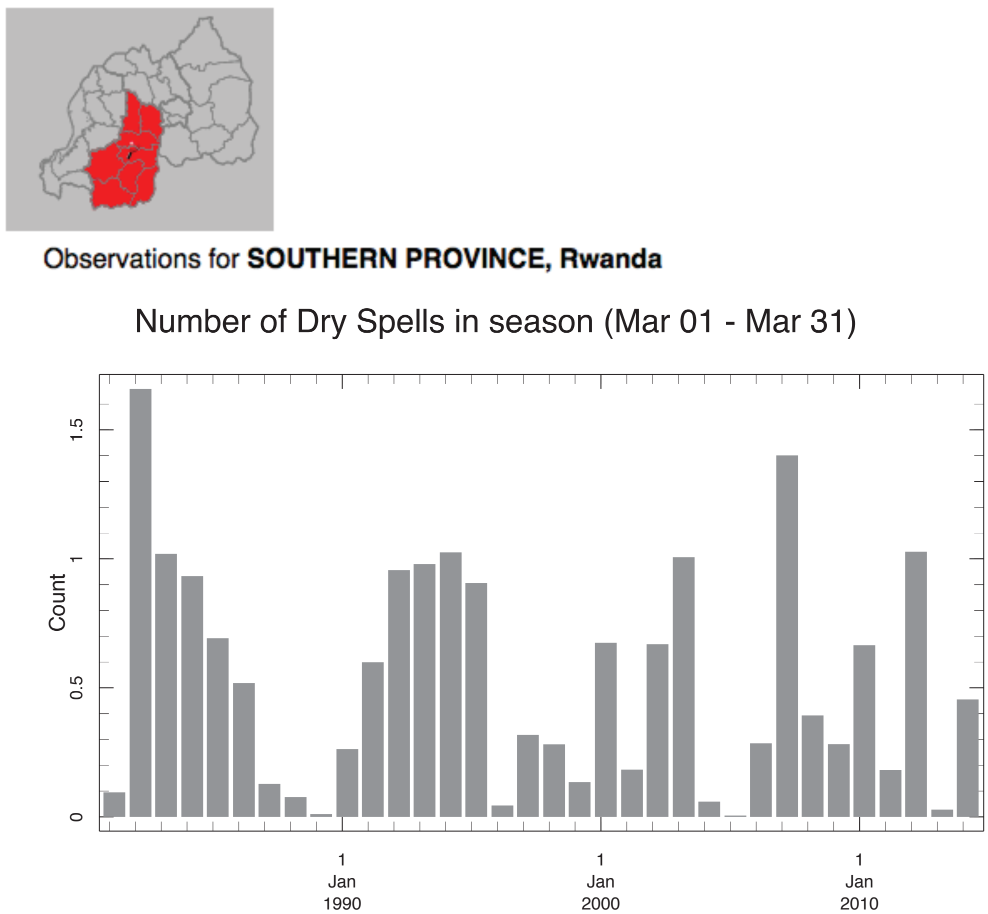


Fig. 1.6: Number of historical dry spells in Mar 01 - Mar 31

E3. By comparing the Provinces rank them in an ascending manner for their suitability for banana cultivation for the season of March.

## 1.8 Quiz

*Please answer the following questions using the Daily Precipitation Analysis Maproom, and figures and tables generated in the previous exercise*

Q1. Which Province is the most suitable for banana cultivation in the season of March?

Q2. Which province had the highest count of dry spells in the year 2000 in the season of March?

Q3. How does the count of dry spells in the month of October in 2000, in the Eastern Province compare to the dry spell count in that same year but of in the Season of March? (a) Lower (b) Same (c) Higher

Q4. According to the results from question 3, what king of conclusion would you make for the year of 2000 for the cultivation of bananas for, the Eastern Province?

### 1.8.1 Quiz - Answers

A1. The Western Province.

A2. The Eastern Province.

A3. (a) Lower

A4. From the previous answers, we now know that the year 2000 had a higher number of dry spells in March that in October hence for this year it would make sense that in that year, the cultivation would be in the season of October than the season of March. Form more investigation we can look at he OND (Oct-Dec) season and the MAM (Mar-May) season to compare the season with the highest and lowest number of dry spell counts.

## 1.9 Summary

In conclusion the Daily Precipitation Analysis Mappage allows users to access data by defining wet/dry spell days as well as the season.

## 1.10 Reference(s)


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