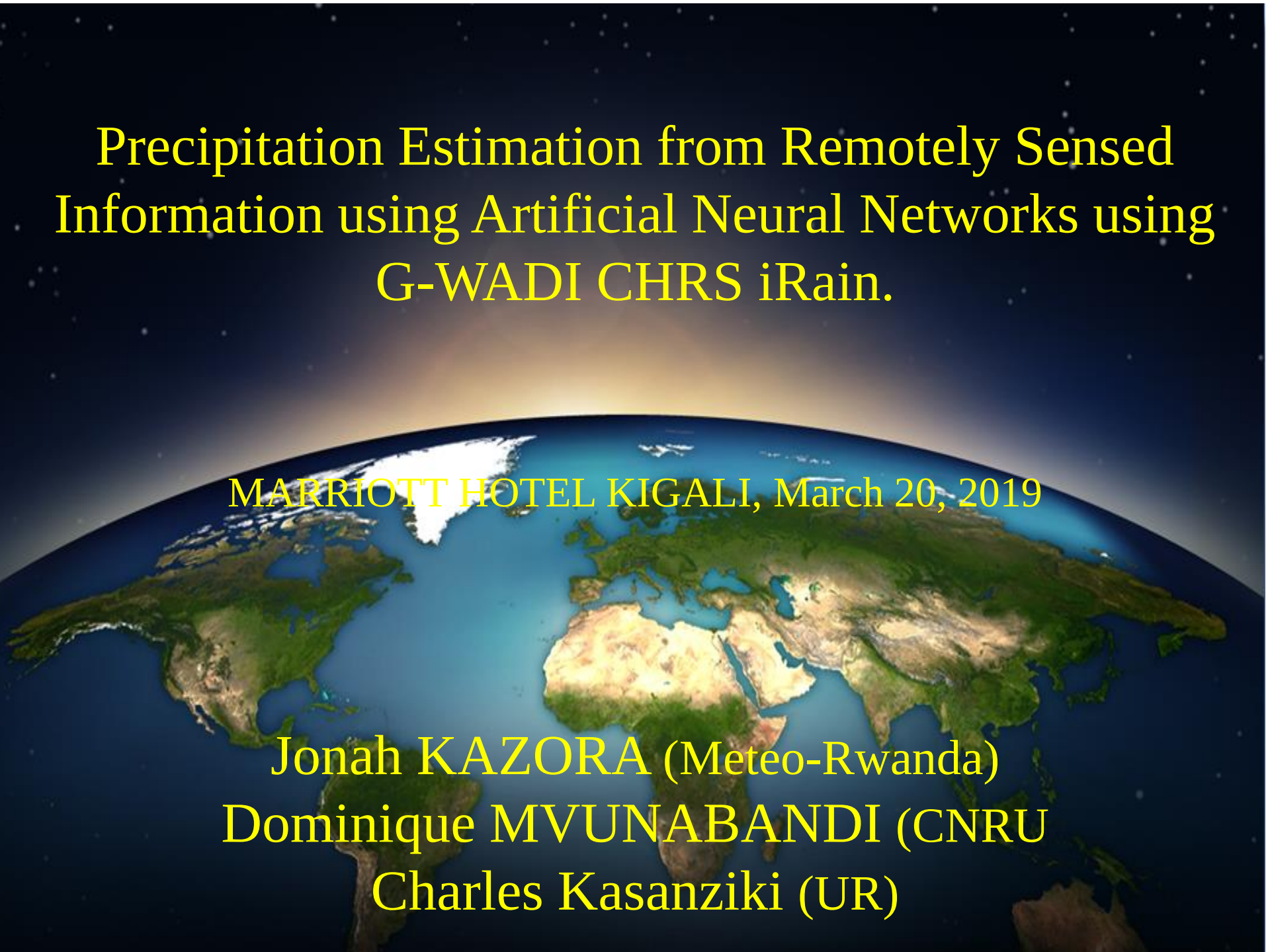
Precipitation Estimation from Remotely Sensed Information using Artificial Neural Networks using G-WADI CHRS iRain.



MARRIOTT HOTEL KIGALI, March 20, 2019

Jonah KAZORA (Meteo-Rwanda)
Dominique MVUNABANDI (CNRU
Charles Kasanziki (UR)

CHRS - UCI

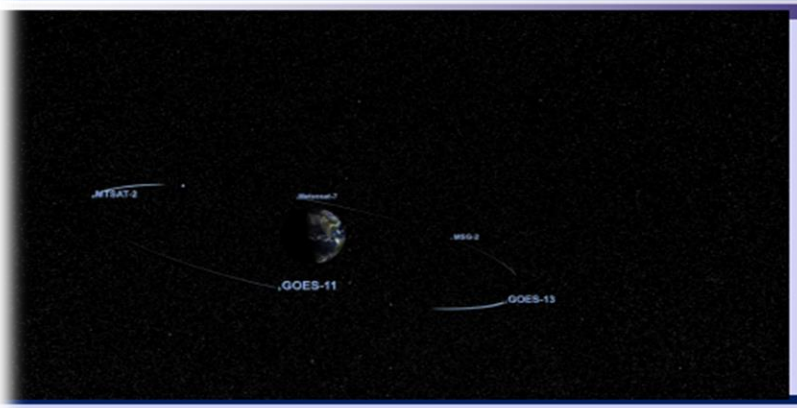
Overall objective: To build capacity through equitable access to relevant information and the development of means to extend the benefits of space and weather agencies' vast technological resources, for a mitigation of Hydrologic Disasters.

Specific objectives:

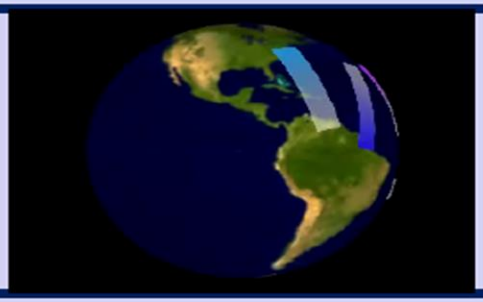
- To improve hydrologic prediction through development and refinement of hydrologic models and use of advanced observations, particularly from remote sensing sources;

- To develop decision support tools for generating and evaluating a variety of hydro-meteorological and hydro-climatologic information required by the water resources management community
- To develop mathematical algorithms capable of estimating precipitation both from space-based and in-situ observations at spatial and temporal resolutions relevant to hydrologic applications, particularly in the semi arid environments;
- To contribute to the education of well-trained hydrologists and water resources engineers responsive to the growing needs of public and private sectors at the state, national and international levels.

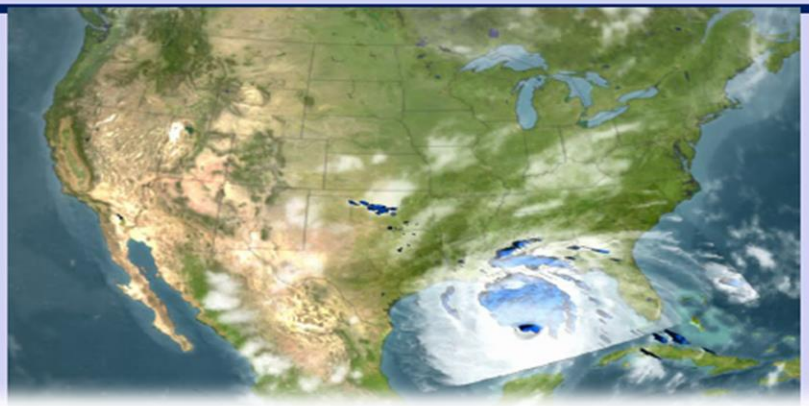
Satellite Data for Precipitation estimation



Geostationary IR
Cloud top data
15-30 minute temporal resolution

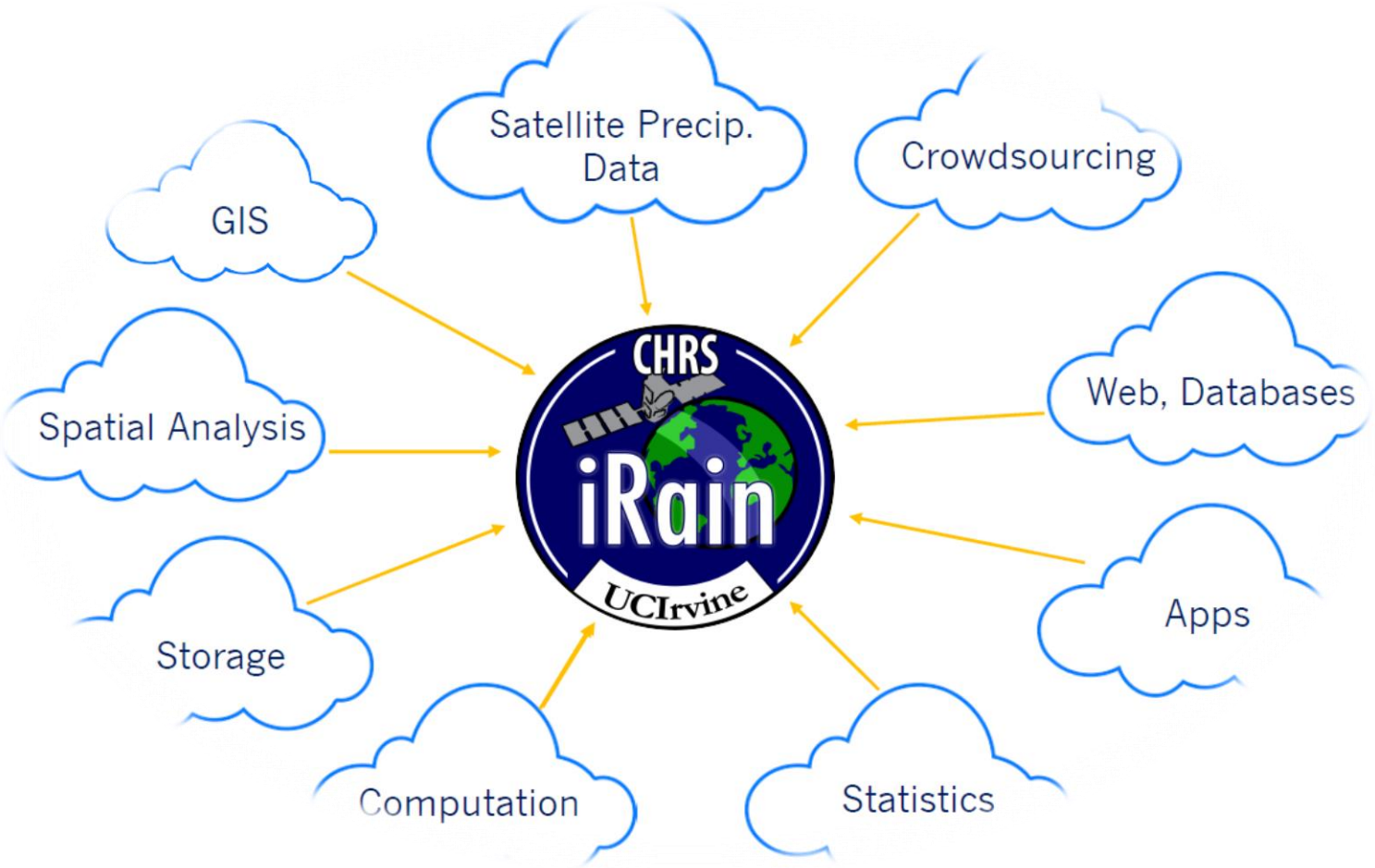


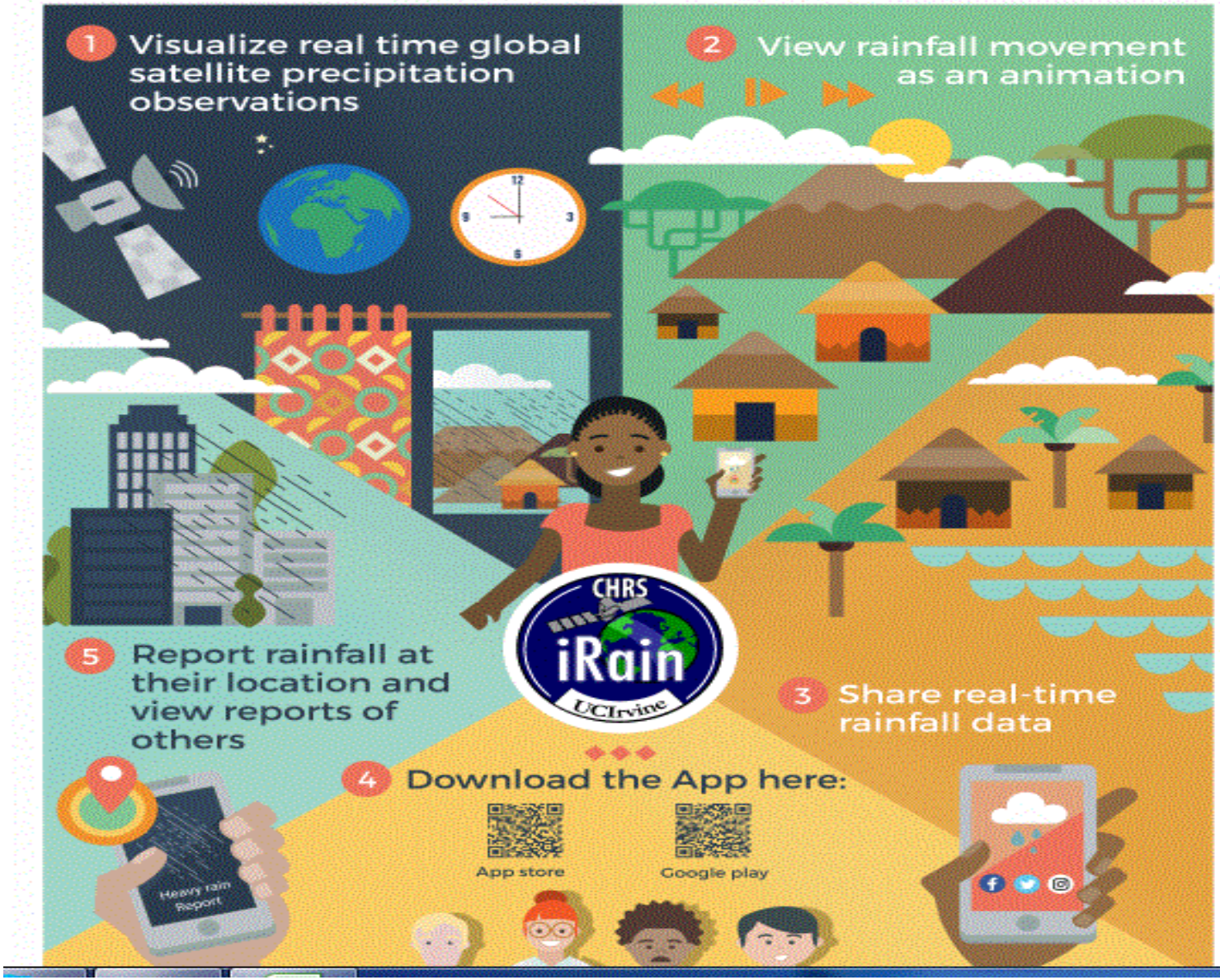
Passive Microwave (SSM/I)
Some characterisation of rainfall
~2 overpasses per day per spacecraft, moving to 3-hour return time (GPM)



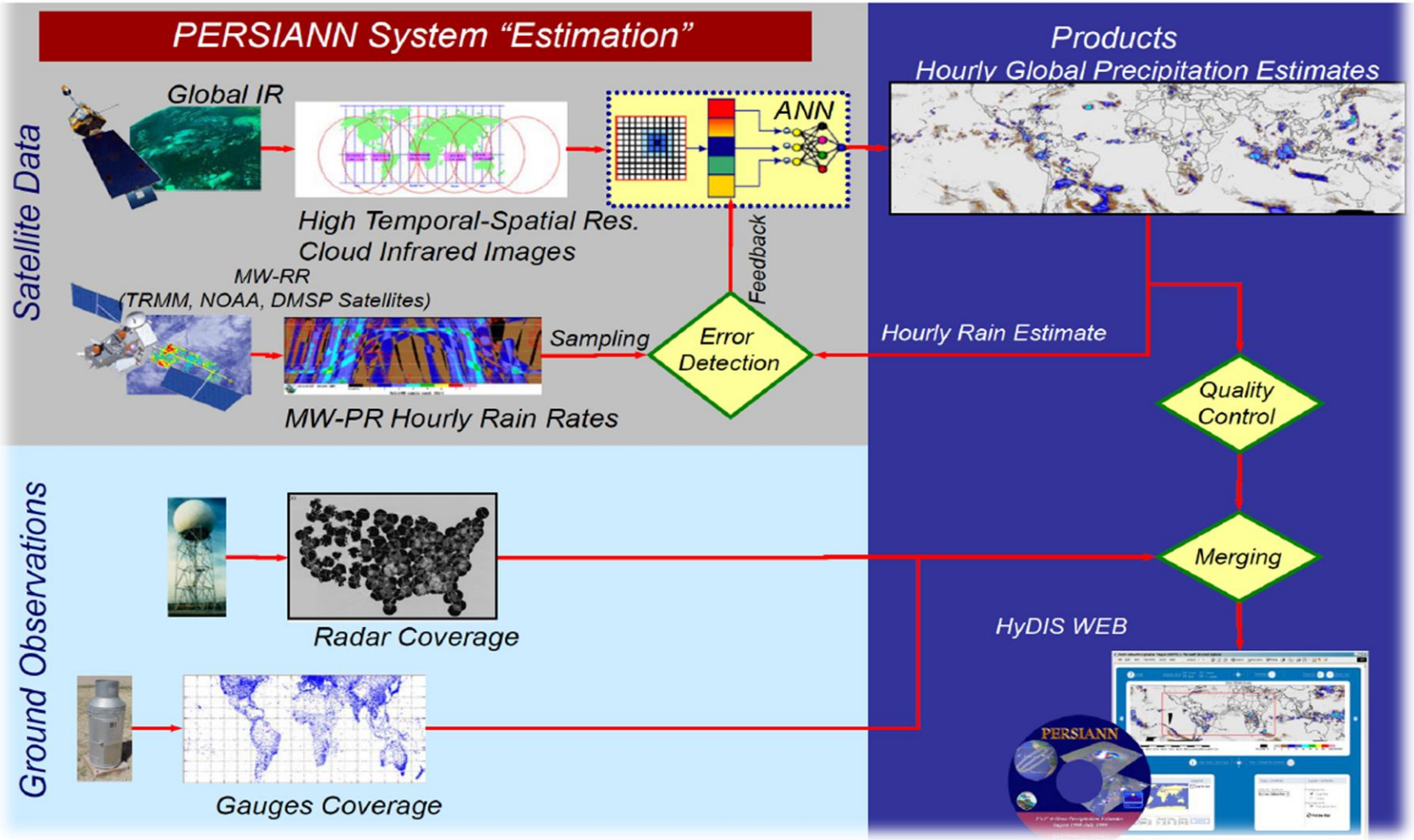
TRMM precipitation RADAR
3D imaging of rainfall
1-2 days between overpasses
(S-35°N-35 °)

CHRS iRain

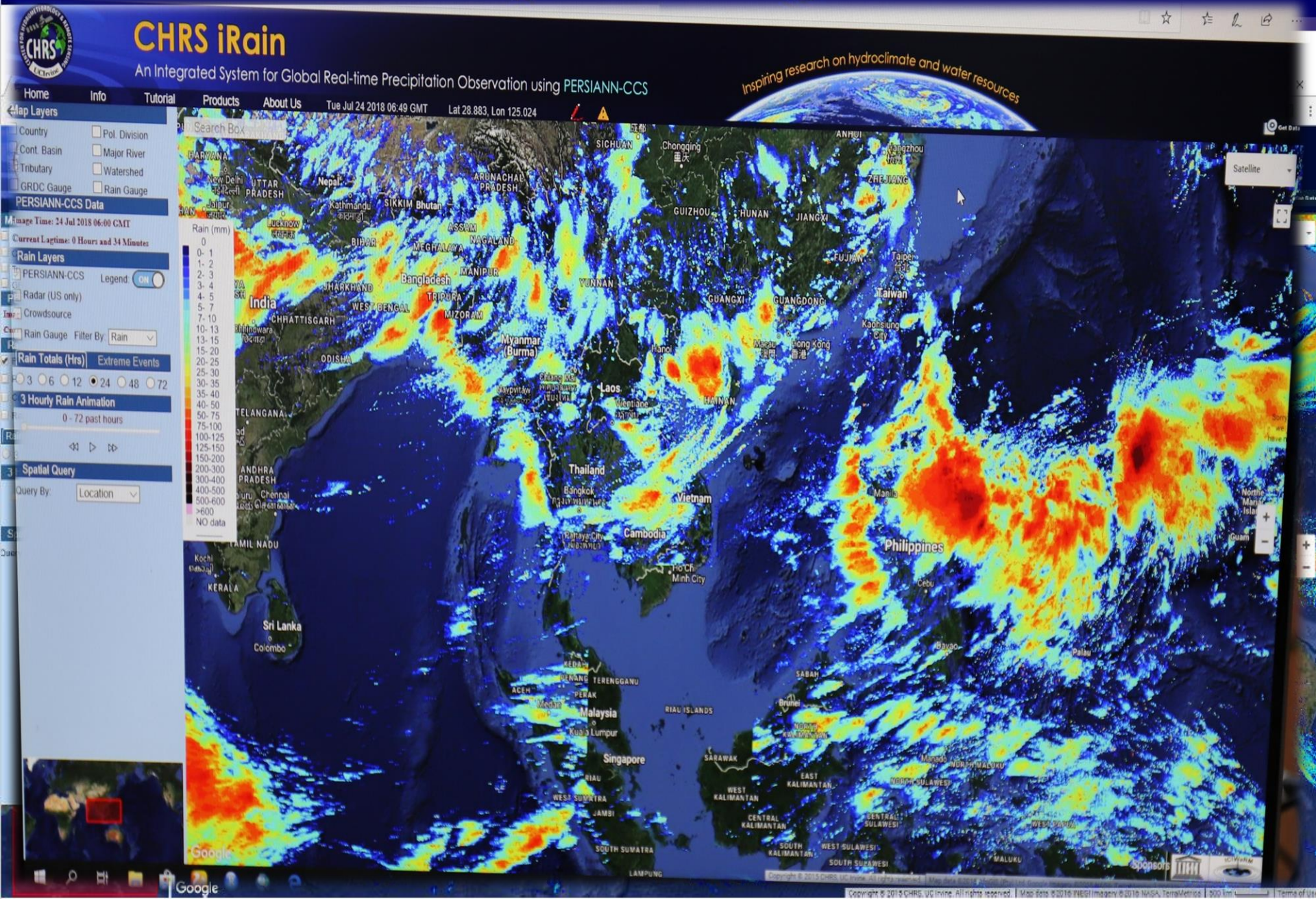

Satellite Precip. Data
Crowdsourcing
GIS
Spatial Analysis
CHRS
iRain
UCIrvine
Web, Databases
Storage
Apps
Computation
Statistics


G-WADI
1 Visualize real time global satellite precipitation observations
2 View rainfall movement as an animation
CHRS
iRain
UCIrvine
5 Report rainfall at their location and view reports of others
3 Share real-time rainfall data
4 Download the App here:
App store
Google play
Heavy rain
Report

Precipitation Estimation from Remotely Sensed Information using Artificial Neural Networks



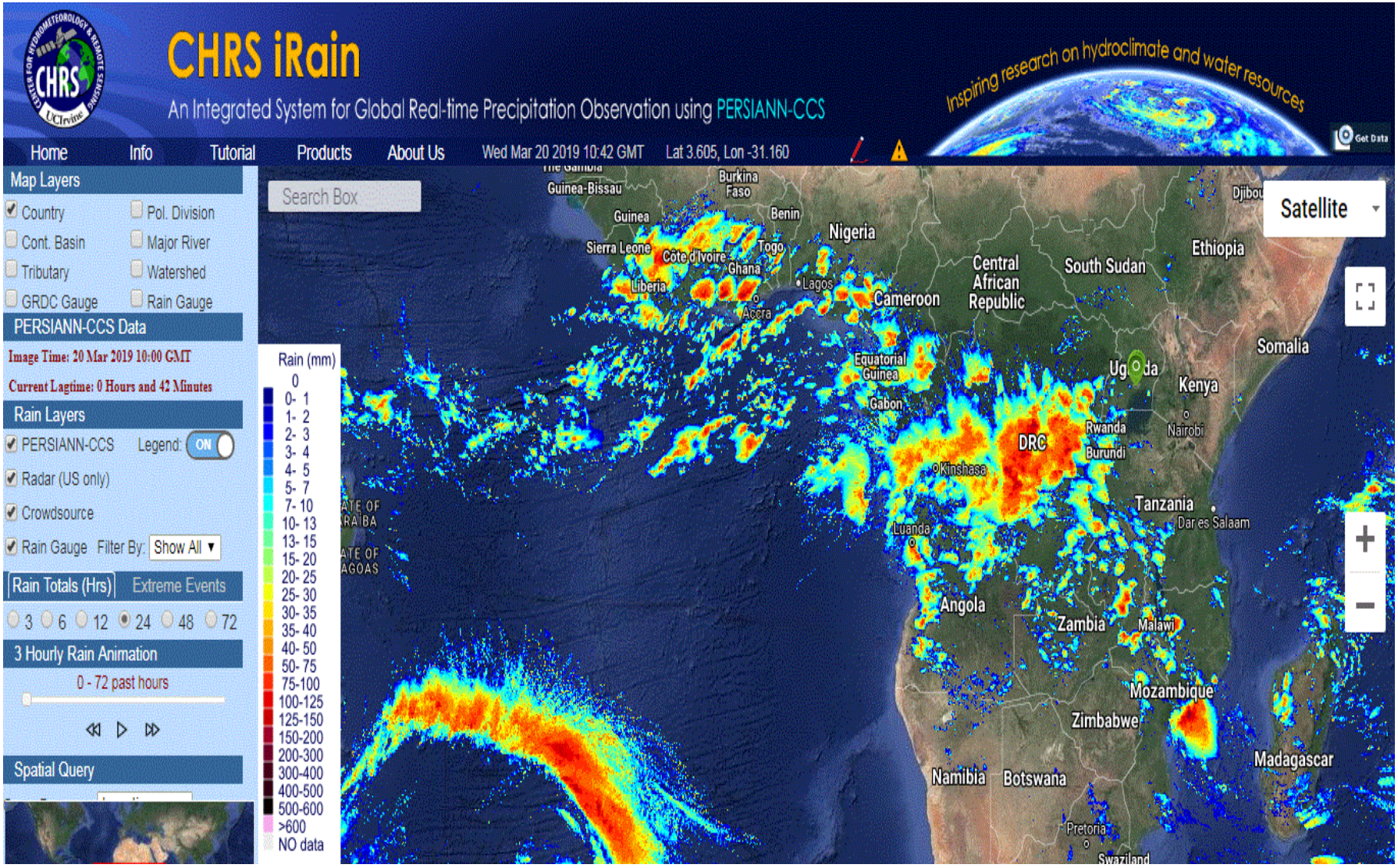
iRain: http://irain.eng.uci.edu/



PERSIANN Websites and Apps

- CHRS iRain
- CHRS RainSphere
- CHRS Data Portal

CHRS iRain


CHRS iRain
An Integrated System for Global Real-time Precipitation Observation using PERSIANN-CCS
Inspiring research on hydroclimate and water resources
Home
Info
Tutorial
Products
About Us
Wed Mar 20 2019 10:42 GMT
Lat 3.605, Lon -31.160
Get Data
Map Layers
Country
Pol. Division
Cont. Basin
Major River
Tributary
Watershed
GRDC Gauge
Rain Gauge
PERSIANN-CCS Data
Image Time: 20 Mar 2019 10:00 GMT
Current Lagtime: 0 Hours and 42 Minutes
Rain Layers
PERSIANN-CCS
Legend:
ON
Radar (US only)
Crowdsource
Rain Gauge
Filter By:
Show All
Rain Totals (Hrs)
Extreme Events
3 6 12 24 48 72
3 Hourly Rain Animation
0 - 72 past hours
Spatial Query
Search Box
Satellite
Rain (mm)
0
0- 1
1- 2
2- 3
3- 4
4- 5
5- 7
7- 10
10- 13
13- 15
15- 20
20- 25
25- 30
30- 35
35- 40
40- 50
50- 75
75-100
100-125
125-150
150-200
200-300
300-400
400-500
500-600
>600
NO data
Guinea-Bissau
Burkina Faso
Guinea
Benin
Nigeria
Sierra Leone
Côte d'Ivoire
Togo
Ghana
Liberia
Lagos
Accra
Cameroon
Central African Republic
South Sudan
Ethiopia
Somalia
Equatorial Guinea
Gabon
Kenya
Nairobi
Rwanda
Burundi
DRC
Kinshasa
Tanzania
Dar es Salaam
Luanda
Angola
Zambia
Malawi
Mozambique
Zimbabwe
Namibia
Botswana
Madagascar
Pretoria
Swaziland

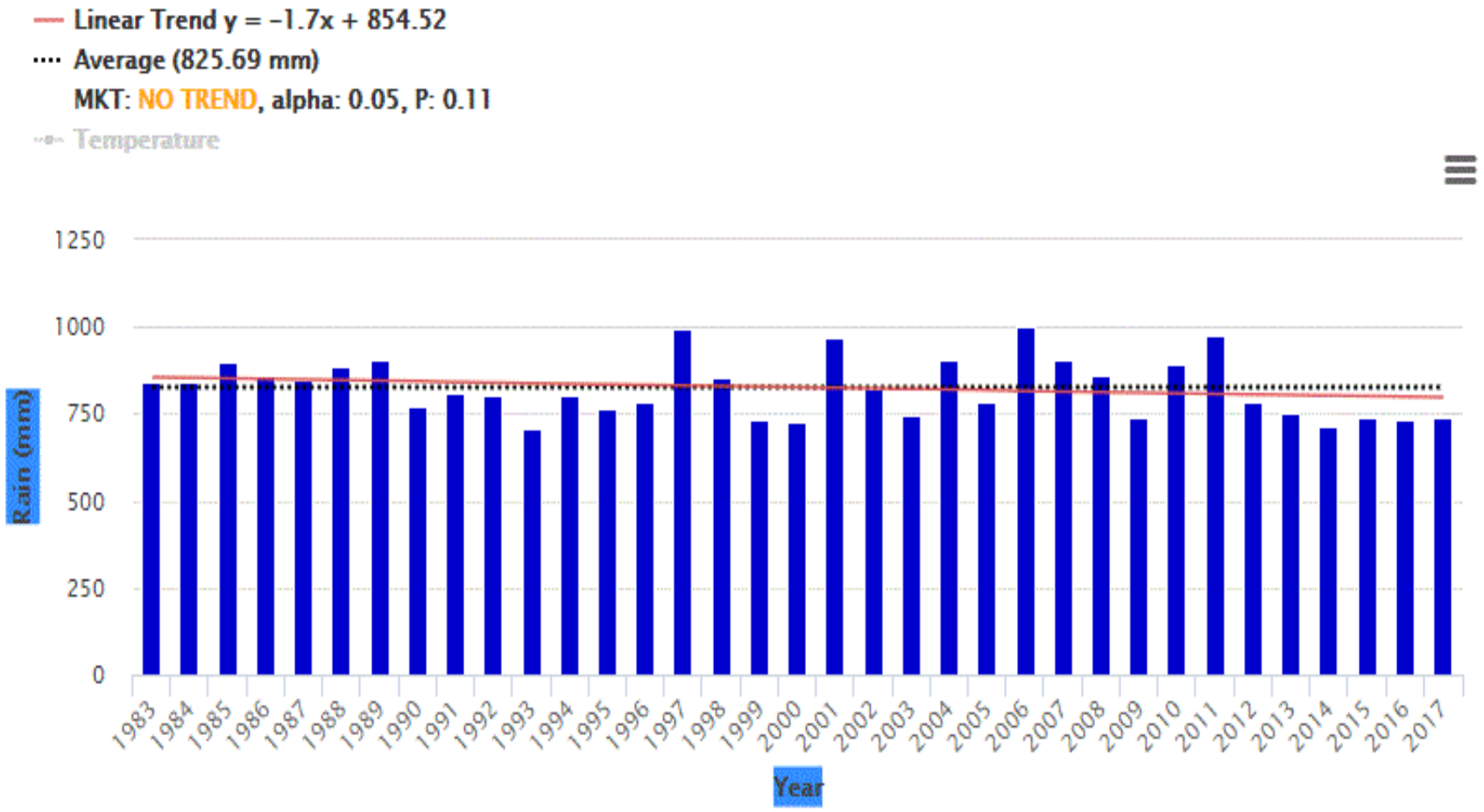
CHRS RainSphere

An Integrated System for Global Satellite Precipitation Data and Information

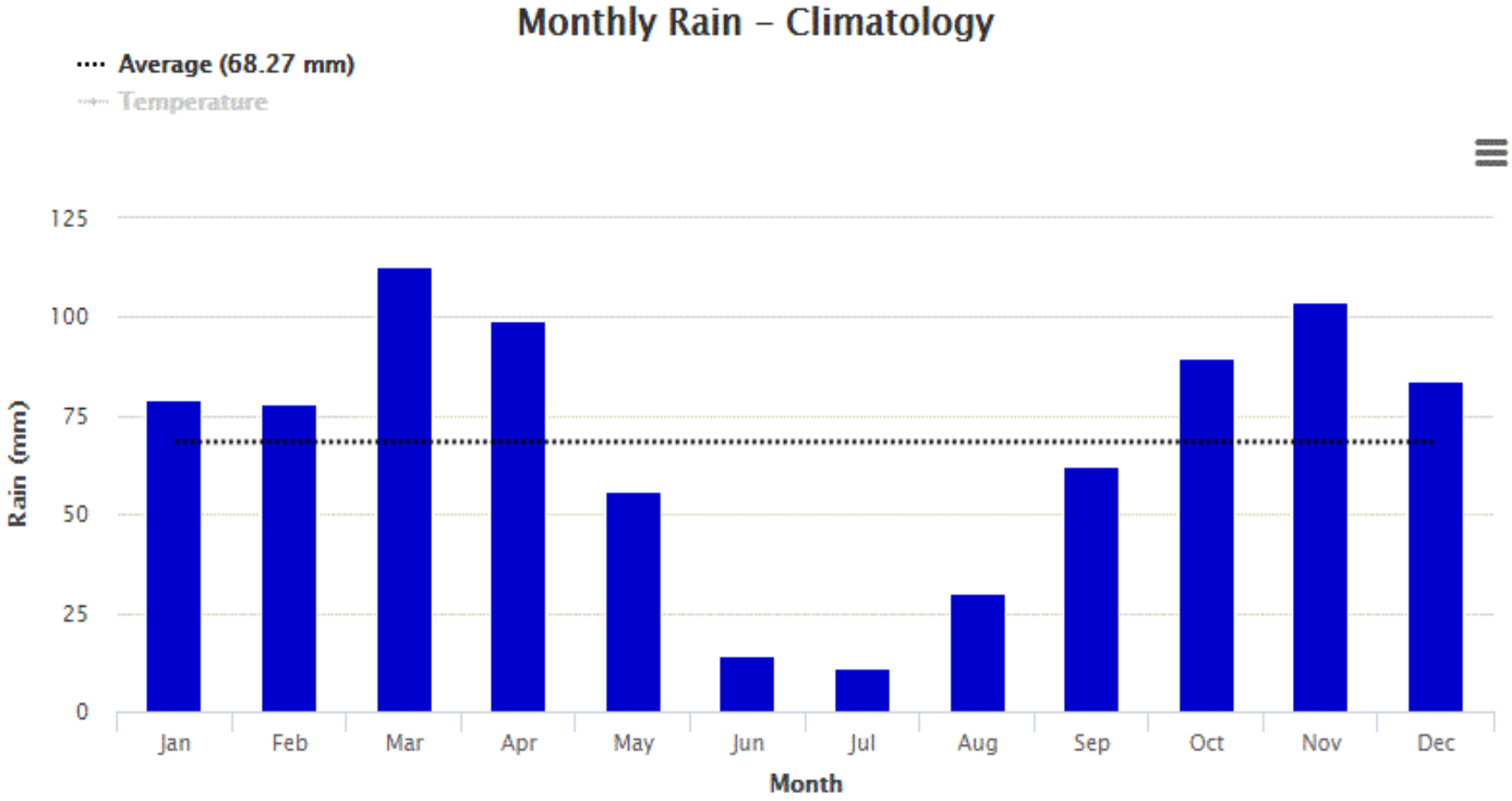
http://rainsphere.eng.uci.edu

inspiring research on hydroclimate and water resources

Yearly Rain

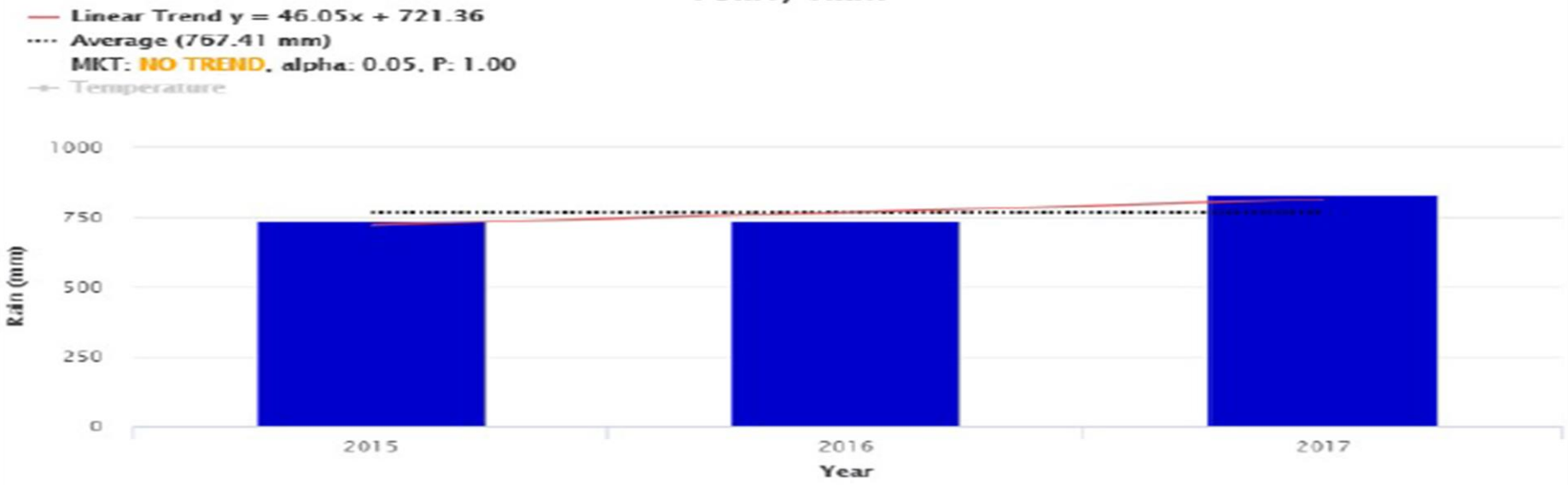


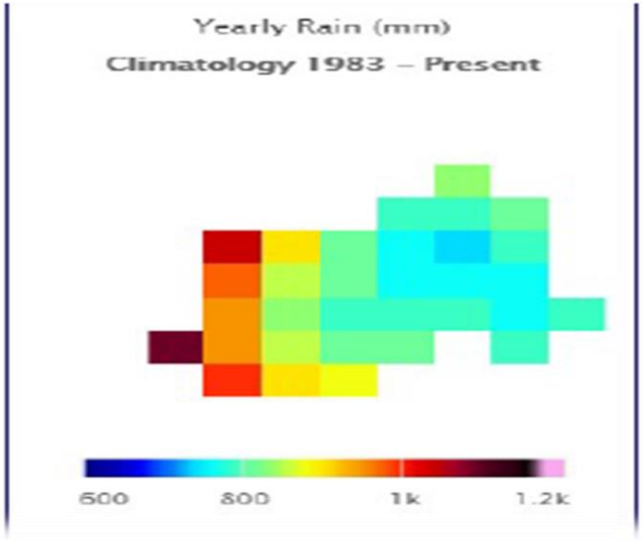
CHRS RainSphere
An Integrated System for Global Satellite Precipitation Data and Information
http://rainsphere.eng.uci.edu
Inspiring research on hydroclimate and water resources

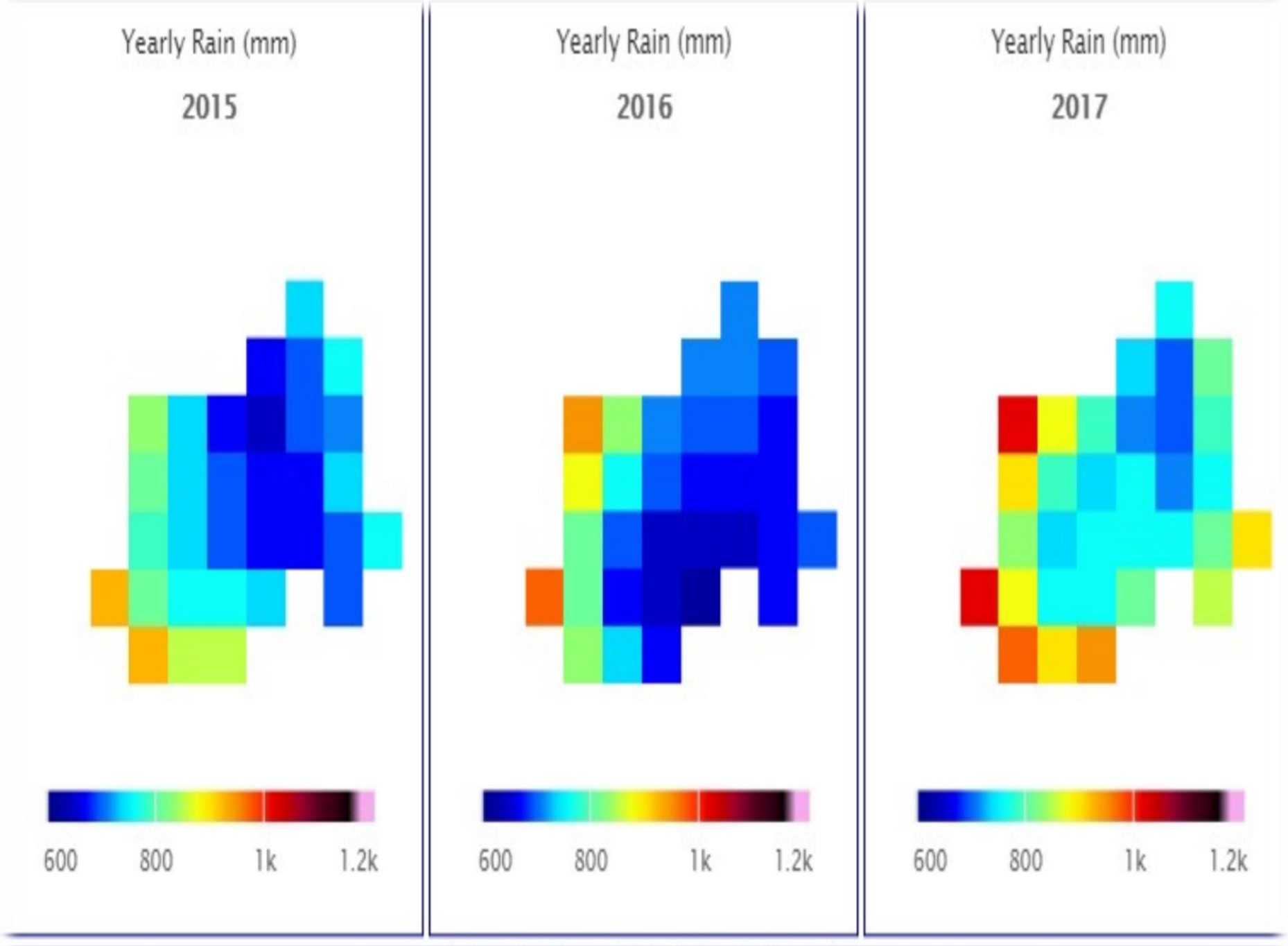

Monthly Rain – Climatology
Average (68.27 mm)
Temperature
125
100
75
50
25
0
Rain (mm)
Jan
Feb
Mar
Apr
May
Jun
Jul
Aug
Sep
Oct
Nov
Dec
Month

RainSphere Country Query
Country/Territory: Rwanda
Area: 25,634 km²
Population: 12,100,049

Yearly Rain

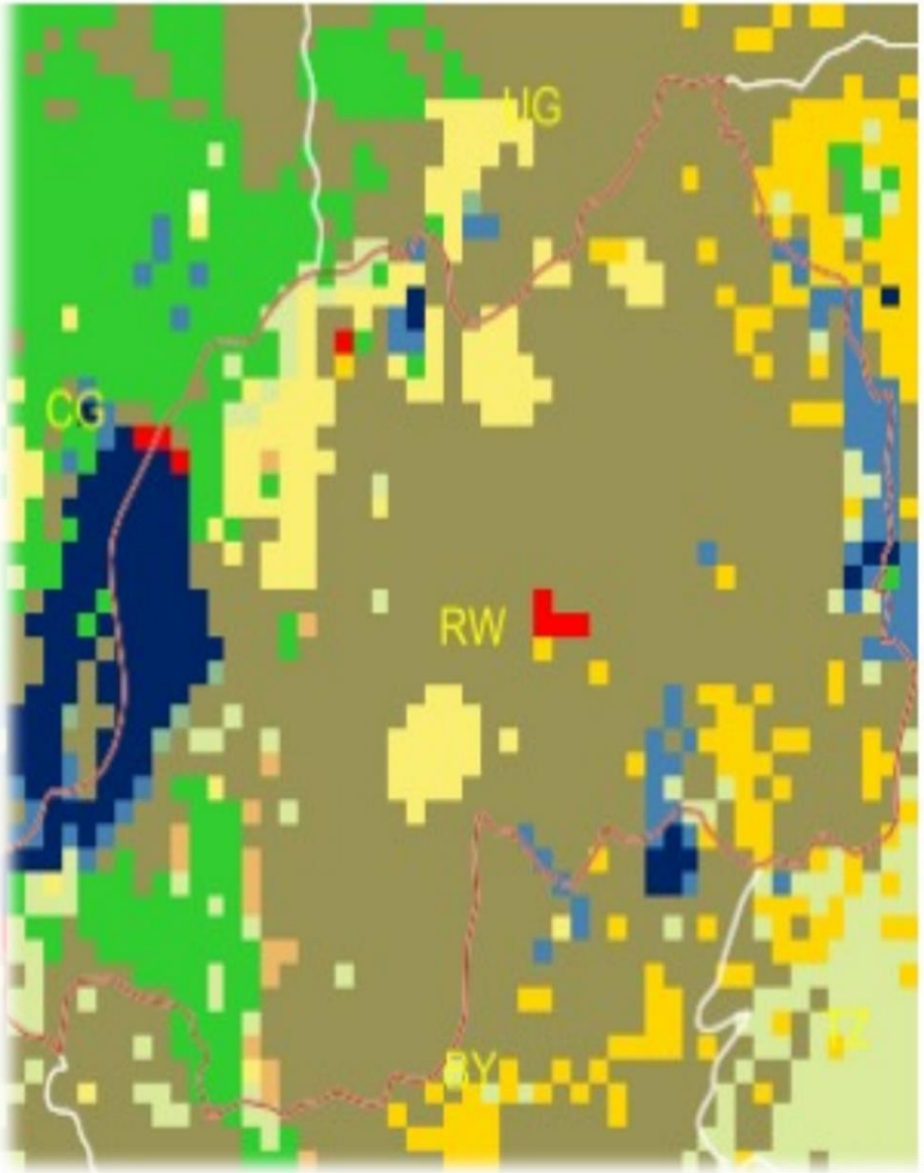






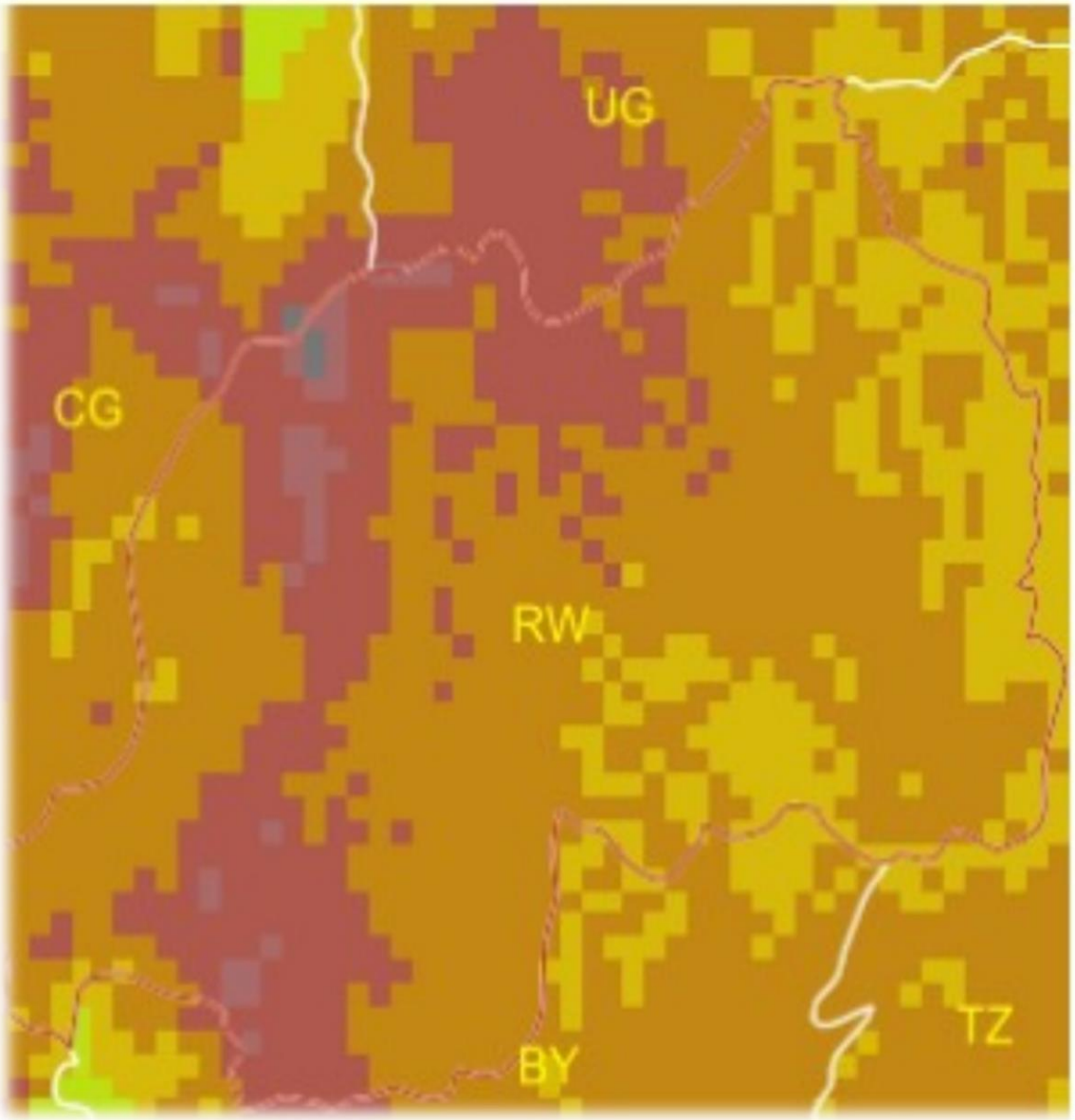
Distribution of Aridity in Rwanda

Land Cover in Rwanda



Countries
IGBP Land Cover Classification
Croplands-Natural Vegetation Mosaic
Open Shrublands
Snow and Ice
Woody Savannas
Barren or Sparcly Vegetated
Savannas
Water
No Data
Evergreen Needleleaf Forest
Missing Data
Evergreen Broadleaf Forest
Grasslands
Deciduous Needleleaf Forest
Permanent Wetlands
Deciduous Broadleaf Forest
Croplands
Mixed Forests
Urban and Built-up
Closed Shrublands

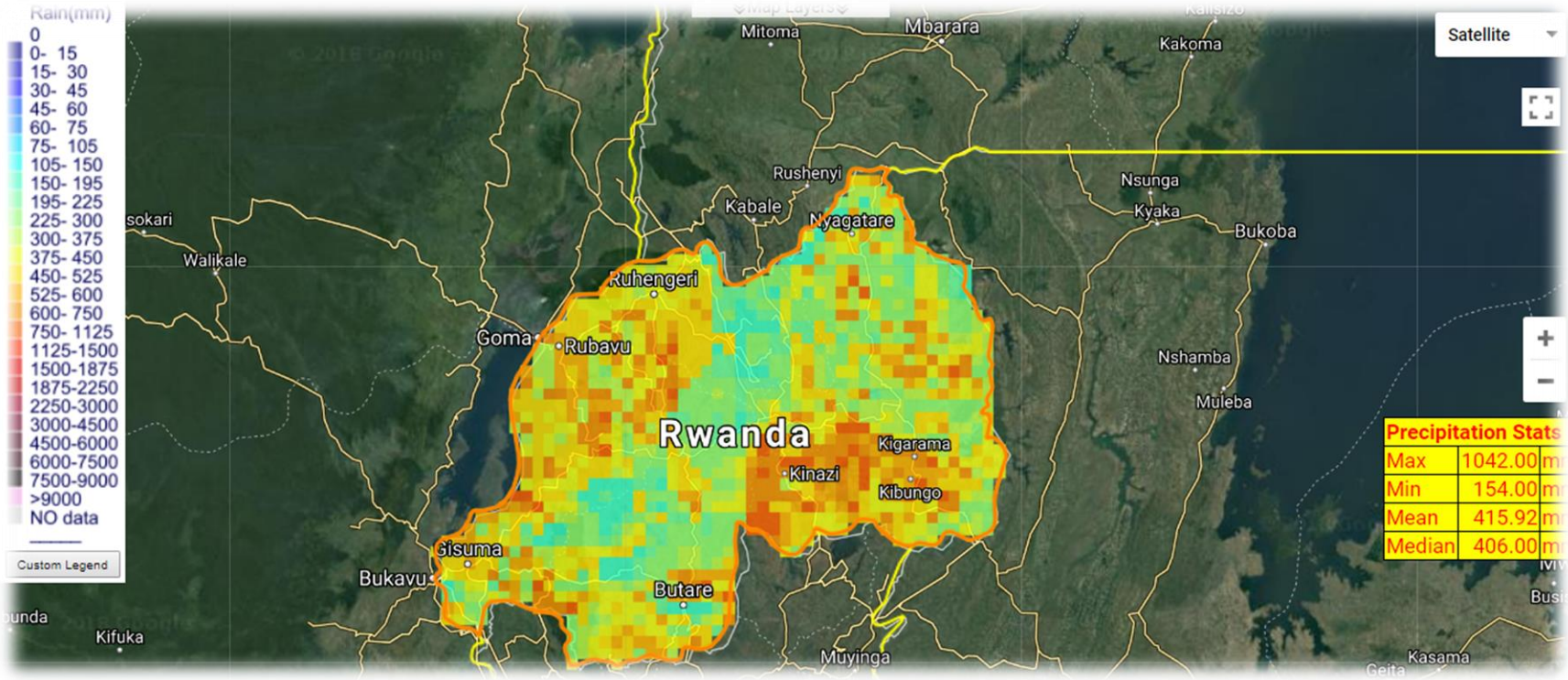
Elevation in Rwanda



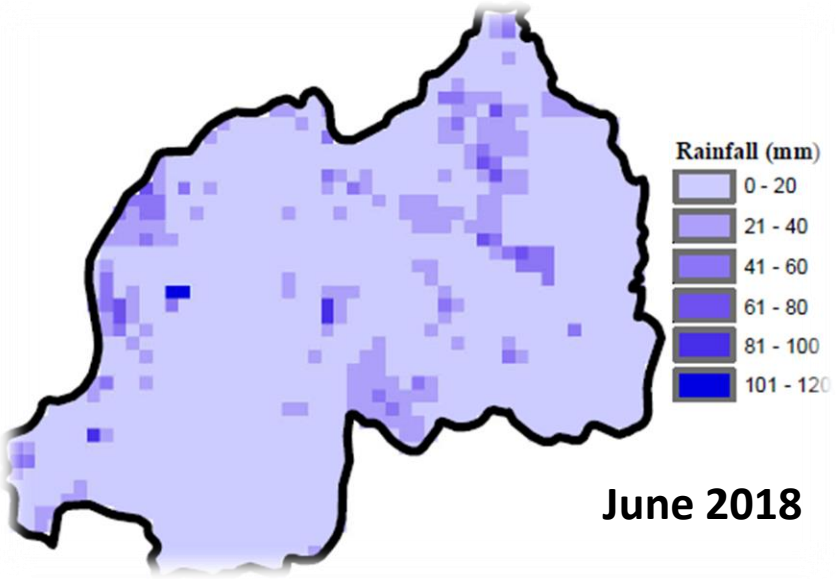
Countries Elevation (m)

- < 0
- 0 - 200
- 200 - 430
- 430 - 710
- 710 - 1030
- 1030- 1395
- 1395 - 1870
- 1870 - 2530
- 2530 - 3450
- 3450 - 4475
- 4475 - 8000
- > 8000
- NO data

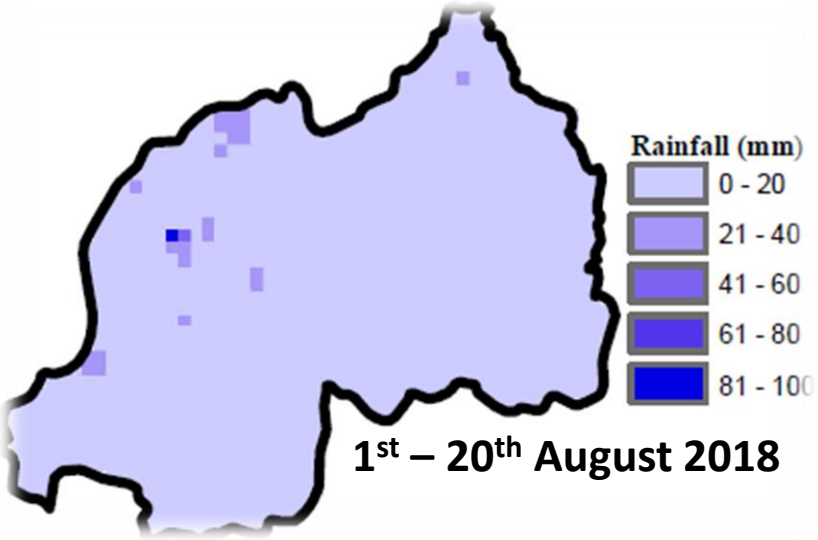
Data portal


Rain(mm)
0
0- 15
15- 30
30- 45
45- 60
60- 75
75- 105
105- 150
150- 195
195- 225
225- 300
300- 375
375- 450
450- 525
525- 600
600- 750
750- 1125
1125-1500
1500-1875
1875-2250
2250-3000
3000-4500
4500-6000
6000-7500
7500-9000
>9000
NO data
Custom Legend
Satellite
Mitoma
Mbarara
Kakoma
Rushenyi
Kabale
Nyagatare
Nsunga
Kyaka
Bukoba
Walikale
Ruhengeri
Goma
Rubavu
Rwanda
Kigarama
Kinazi
Kibungo
Nshamba
Muleba
Gisuma
Bukavu
Butare
Kifuka
Muyinga
Kasama
Precipitation Stats
Max 1042.00
Min 154.00
Mean 415.92
Median 406.00

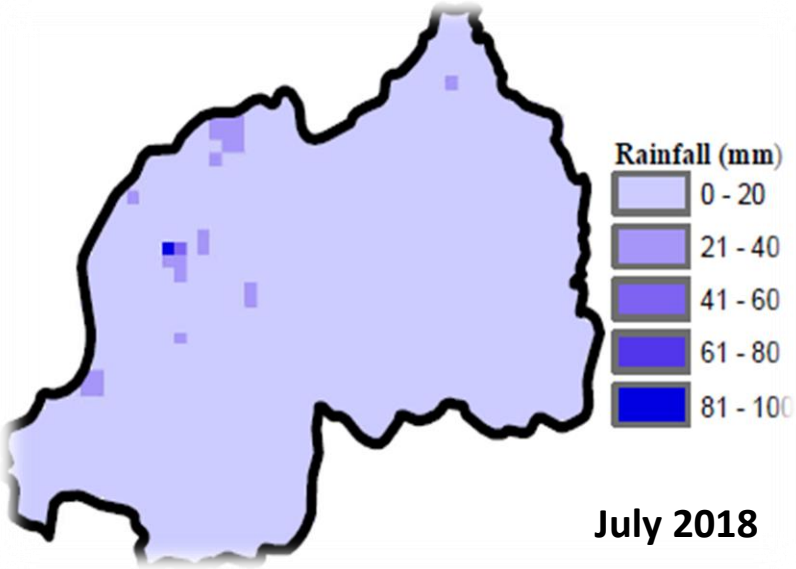
Rainfall



June 2018

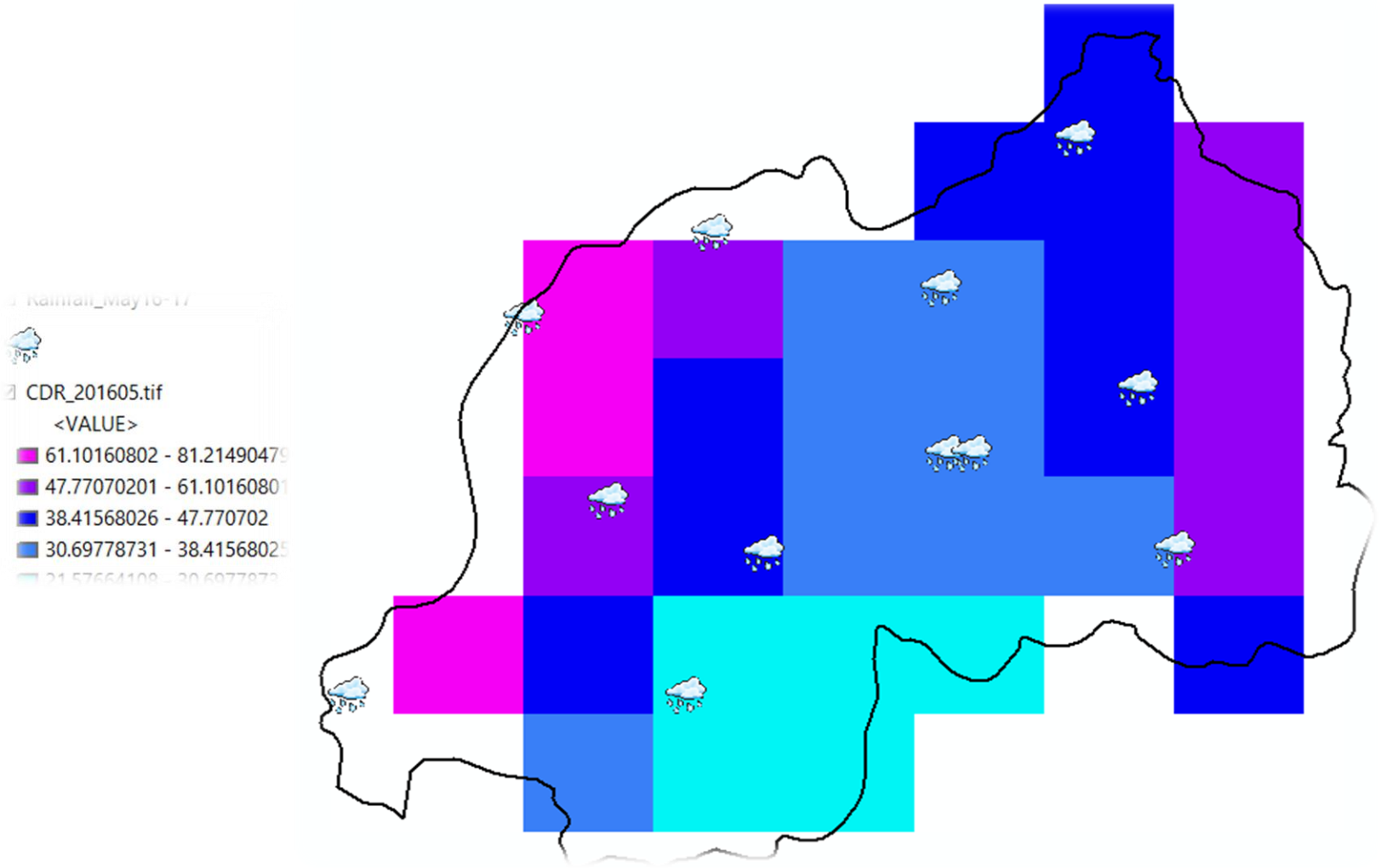


1st – 20th August 2018

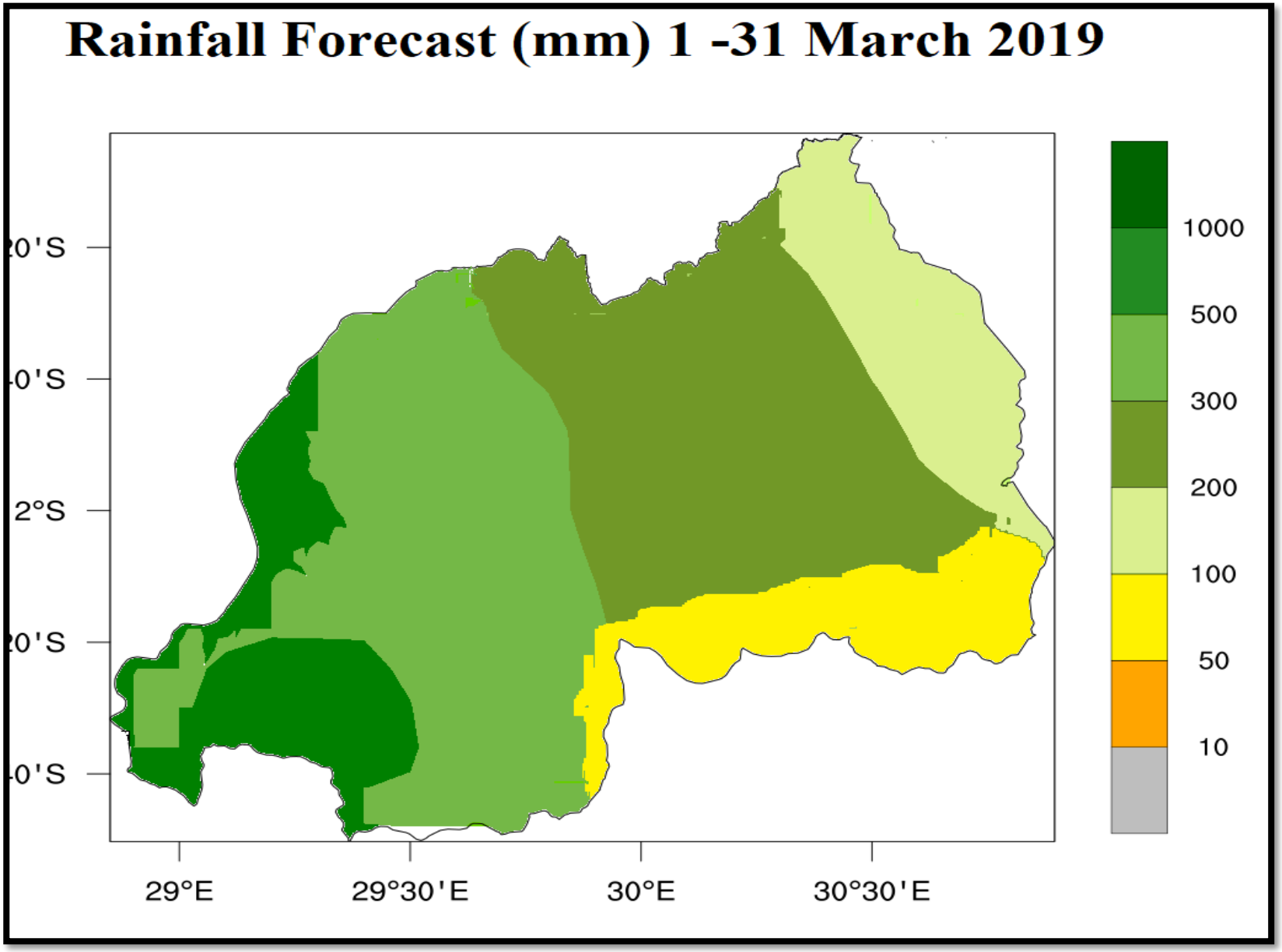


July 2018

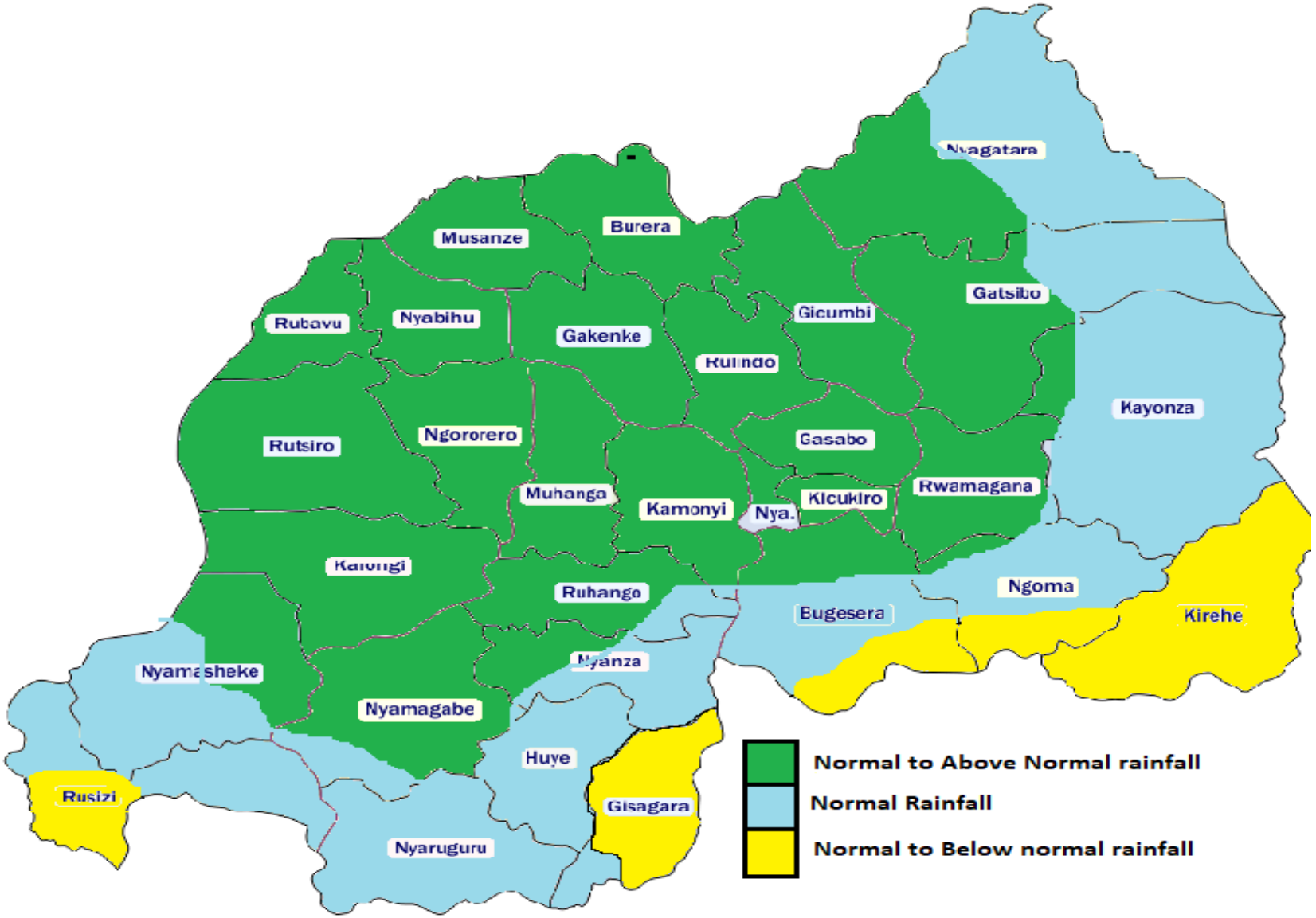
Rain Gauges vs iRain data



Rainfall Forecast (mm) 1 -31 March 2019



Consensus MAM 2019 Forecast



Recommendation

- Since, the training has ToT (Training of Trainers) purposes, it is recommended to plan as soon as possible a national ToT training on Precipitation Estimation from Remotely Sensed Information using Artificial Neural Networks in Rwanda for different Institutions; especially Meteo-Rwanda for bias adjustment;

- For further implementation and sustainability of this project, researches and publications on collected data should be included and promoted by the Rwandan UNESCO National Commission and International Hydrologic Programme (IHP) National Committee planning in collaboration with Rwanda Meteorology Agency;

- All activities related to International Hydrologic Programme (IHP) should be communicated to the Ministry of Environment and related institutions to avoid any duplication and to negotiate means for usage and implementation;

- Working in interdisciplinary way and providing training's in GIS, MATLAB, R-Tool, ArcSWAT and other related modelling are compulsory and supplementary for more efficiency;

- Since this methodology to collect climatology data has a high resolution of 4 km^2, data from meteorological stations should be completed by those from this methodology collecting at well-known point with location using GPS to respond to microclimate report issues especially where data or accuracy are missing.

Thank you for your kind attention