Innovative solution for monitoring climate variables in observation poor regions: Rain Measurement based on cellular phone networks in Africa
TOP-RAINCELL
Technique des Ondes pour la Pluie

CONSORTIUM FUNDED BY FONRID

ANAM - INERA - LAME
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Why is it essential to know the rainfall distribution?
Pressure on water resources + water-related risks are increasing.

Rainfall information over the continental tropics is essential to tackle these questions.
What is now in use?

National Meteo network

Weather radar

gauge

research centers

Satellites (GPM illustrated)
Satellite = very useful information on rainfall

But uncertainties and performance at high resolution are still investigated
Accurate and robust ground based rainfall measurement remains a crucial element.

Unfortunately in many parts of the Tropics, especially in Africa, the ground based gauge networks are sparse, often degrading.
10 stations synoptiques; 20 stations agrométéo;
09 stations climato ; 16 stations météo automatiques ADCON
130 postes pluvio ;

Source : Direction de la Météorologie (Janv. 2015)
Bénin :
06 stations synoptiques; 19 stations Climato; 55 pluvio

Niger :
15 stations synoptiques; 21 stations climato; 
3 stations agrométéorologiques; 
+ de 600 pluvio

Mali :
• 19 stations Synoptiques (ASECNA art.2 et 10)
• 19 stations agroclimatologiques (Mali Météo)
• 35 stations agroclimatologiques secondaires (Mali Météo)
• 250 postes pluviométriques (Mali Météo)
• 04 radars météorologiques (Mali Meteo)
• 01 station de réception satellitaire (Mali Météo)

Source : Direction de la Météorologie du Mali, du Niger et du Bénin (Janv. 2015)
Here a novel approach is presented:

The technique is based on measuring microwave signal attenuation by rainfall.

RAINfall estimation based on CELL phone microwave.
if $\lambda=4.3 \text{ cm}$ then $\nu = 7\text{GHz}$

ergy : $E = h\nu$
Electromagnetic wave versus Precipitation

=> Attenuation

Scattering and Absorption
telecomm signal

transmitter

receiver

telecomm signal attenuated

Atténuation du signal
Test bed, Burkina 2012

Korsimoro/Kaya  29 km  7GHz  H
• High agreement with a correlation of 0.82;

• Detection is 91% for rain 3.5 mm/day, and 95% for rain above 5 mm/day.
RainCell benefits

- Emergency response improvement
- Gender and vulnerability reduction
- Capacity reinforcement
- Reinforcement public private partnership
- Rainfall, runoff knowledge enhancement

- bring a greater resilience against climate change and climate-related disasters
- reduce disaster risk mainly for underprivileged groups
- planning and design of infrastructures
- contribute to ensuring more resilient, social and physical urban structures for continued sustainable economic growth
INTERNATIONAL SUPPORT !!!!
Trophée de la Recherche Publique
Énergie – Environnement – Climat  Lauréat 2015
PREVIOUSLY

* One Link : Korsimoro-Kaya (2012)
14, Gosset et al., 2015; Sawadogo et al., 2015; Zougmore et al., 2015

** Dozen links : Ouaga city
(Boose et al., 2018; IPWG, 2018; Zougmore et al., 2018; Doumounia et al., 2018)
Data available in 2019 Ouagadougou
TOP-RAINCELL: data collection, Processing and Dissemination

Microwave Link
TELECEL - LAME ROOF

FTP - http

LAME + ANAM + INERA + TELECEL + WASCAL

data Processing
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Thank you so much for your attention!