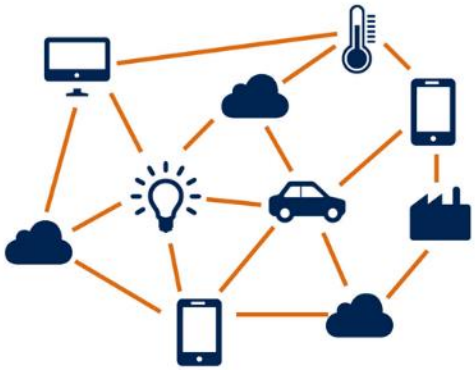
Telecommunication Networks
Internet of Things

Opportunities in Hydro-Meteorology ?
The future of environment monitoring ?

Getting rainfall data from the telephone network



Marielle Gosset IRD (GET) and collaborators

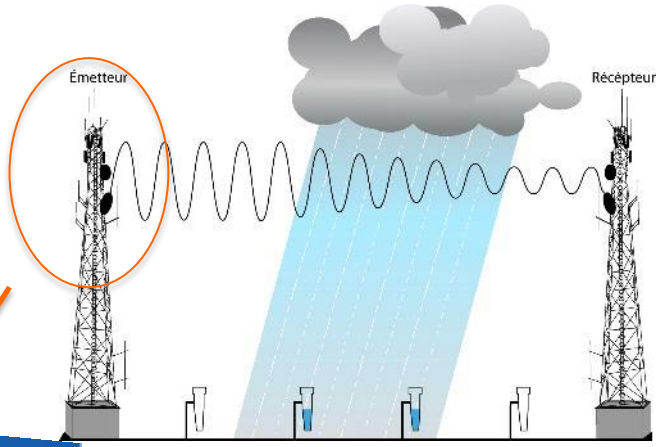
French National Research Institute for Sustainable Development

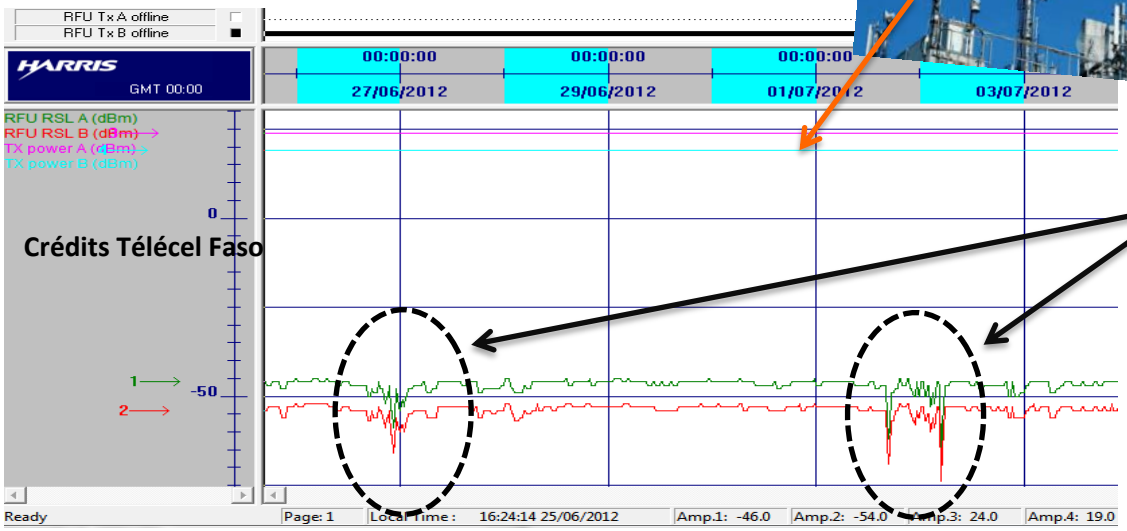
Innovation in Rain Monitoring in Africa
Rain Cell : Monitoring RainFall from Cellular Network Signal !

French National Research Institute for Sustainable Development
Institut de Recherche pour le Développement
FRANCE

M Turko, M Gosset, F Cazenave, M alcoba, N Chahinian, C Bouvier, L Sawadogo, E Ouedraogo, E Bonnet, JP Bricquet

- Radio transmission are used in some part of the mobile telecom network (backhaul)
- Rain attenuates the signal between the antennas
- If we measure these fluctuations we can estimate the amount of rain fall over the given period.

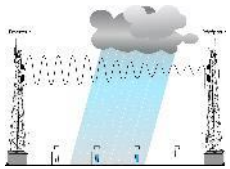




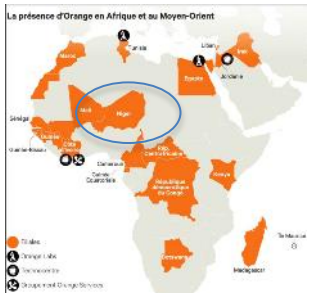
Typical signature of a storm on received (Rx) signal levels

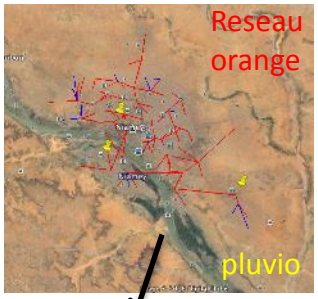
Rain Cell Africa : Quantitative validation - Proof of Concept

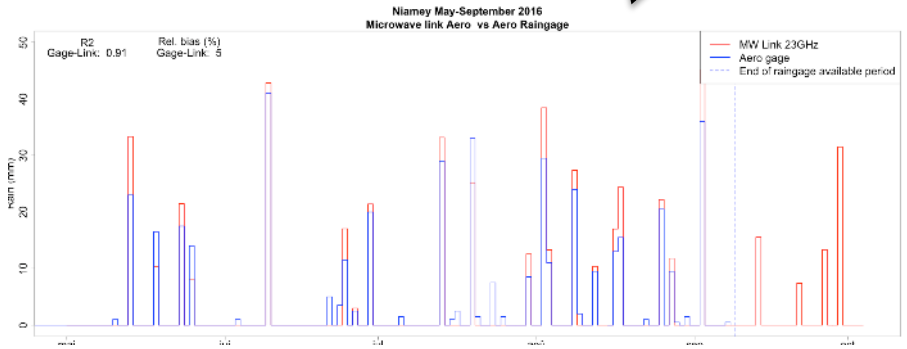
Ouagadougou, Burkina Faso 2012-2014



Since 2016 : Niger - Niamey







Niger – city of Niamey – May August 2016 :

Gauge : 296 mm Link : 280 mm (-5%)

Pluvio vs Lien : r^2 = 0.91

Doumouni, Gosset et al, 2014 , GRL ; Rainfall Monitoring based on Microwave links from cellular telecommunication Networks: First Results from a West African Test Bed. *Geophysical Research Letters*, 10.1002/2014GL060724

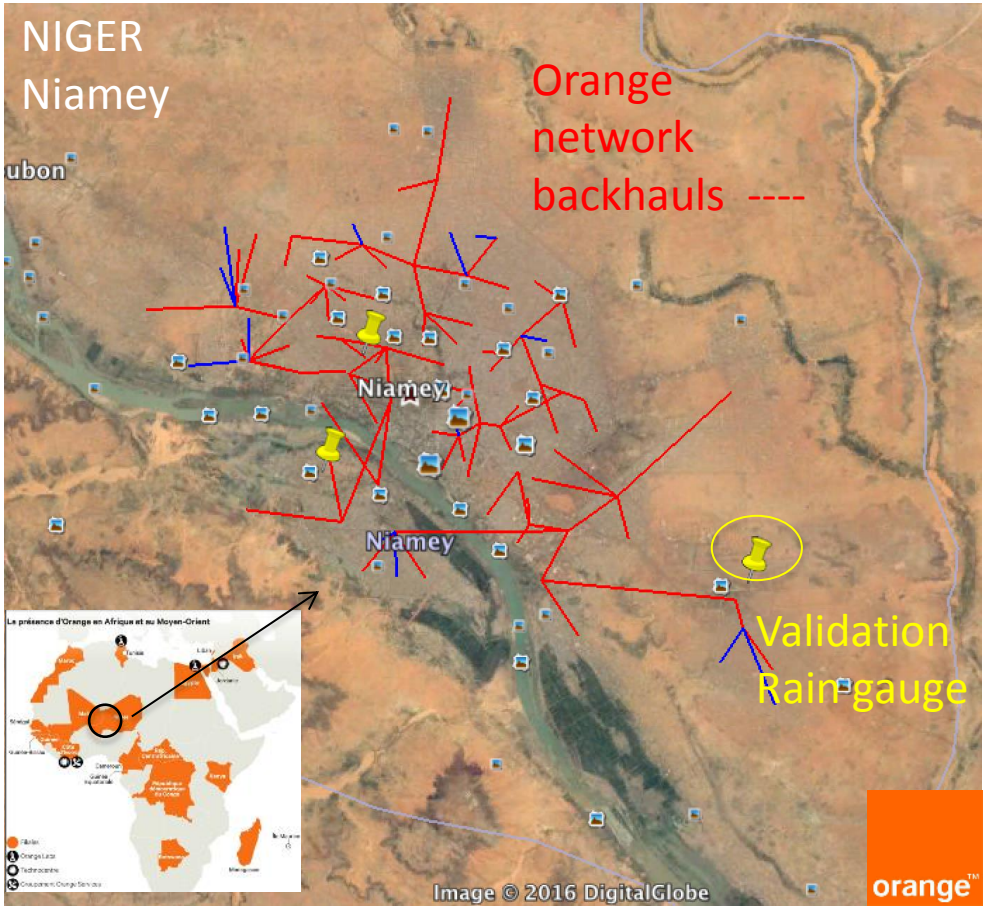
Gosset, M., et al , 2016 BAMS : Improving Rainfall Measurement in gauge poor regions thanks to mobile telecommunication networks, Bull. Amer. Meteor. Soc doi:10.1175/BAMS-D-15-00164.1

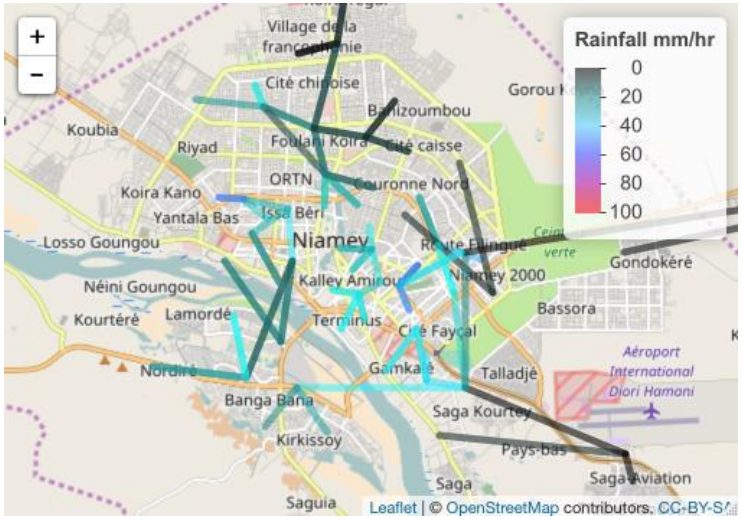
Quantitative evaluation done in Africa (versus gauge or weather radar) :

Good results at daily and down to 15 minutes time step. Dense network in towns : high resolution.

Rain Cell App : 2

Collecting data over the network to produce high resolution Rain Maps



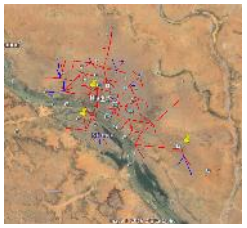


A dense network of antenna in Niamey
Niger's capital city -Very prone to flooding

Rainfall monitoring since April 2016

15 minutes time step

Rain Cell App : 2
NIAMEY interface web :



https://malcoba.shinyapps.io/Shiny_Niamey_Raincell2017/

Raincell Niamey 2016/17

Daily stats | Raw Attenuation | Microwave Link Network | Interpolation

Day: 2017-08-21

Daytime slot (15min)

T0
06:15

T0+15 minutes

T0+30

T0+45

T0+ 1 heure

T0+ 1 heure 15 min.

Rainfall mm/hr: 20, 40, 60, 80, 100

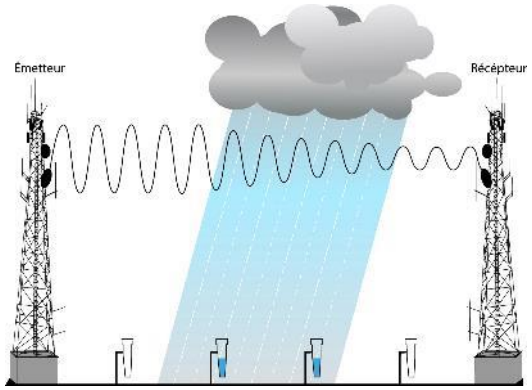
Leaflet | © OpenStreetMap contributors, CC-BY-SA

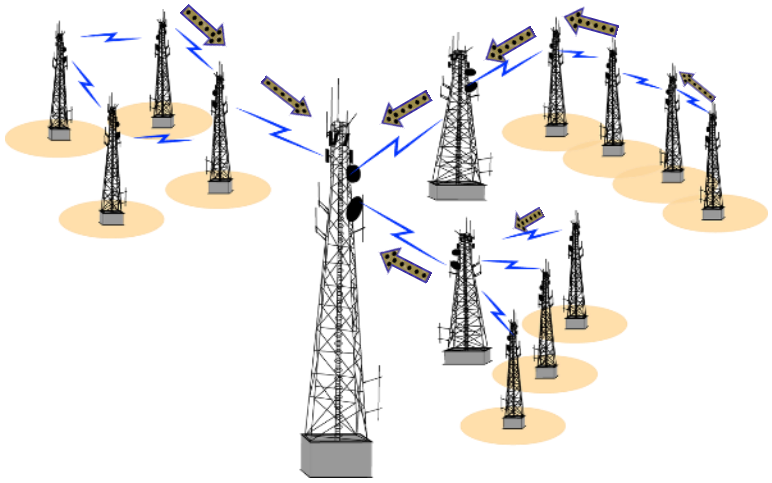
15 minutes
Time step
evolution
Of rain maps
over the city :

Case 21
August 2017

Courtesy
Matias
Alcoba

Rain Cell Africa : urban flood risk alert demonstration





Mobille network as entry to Rainfall events monitoring system

- Flood risk
- Other rainfall related risk

- Several Pilot studies ongoing in Africa in collaboration with Orange