DFID – GFDRR Challenge Fund

PHASE II FINAL REPORT TEMPLATE: INCLUDING MONITORING SELF-ASSESSMENT

Please address the following in narrative form, as applicable, to your project.

I. **Name of project, target country(ies), USD amount and time frame of Phase II grant**

Towards an Urban Flood early warning system based on CellPhone Network (Rain Cell App) for African cities – Phase 2

Target countries : Burkina Faso, Niger.

USD amount :149940.55 (for phase II budget - 99937.90 already provided for Phase1)

Contract :from February 6th 2017 to March 14th 2018.

II. **Description of tool, approach, toolkit**

a. Was it demand-led? If yes, how?

Hydro-meteorological hazards have been amplified over the last decade in Africa with an increase of extreme rainfall events. Fast growth of population, chaotic urbanization and the lack of wastewater and drainage network worsen the flood risk and their associated disasters. If everyone has kept in mind the deadly rainfall event of the 1st of September 2009 in Ouagadougou, every rainy season, floods are common and engender significant losses and many victims. The object of "Rain Cell app Ouaga" project is to provide proof of concept for a real time urban flood risk management and decision support tool for Ouagadougou –and scaling elsewhere- based upon Analysis of Attenuation of Cellular Phone Network Signals. Another aspect of the project targeted a better understanding of population vulnerability to flood, their need for information before/during flooding and how to provide that information to reach the targeted/most vulnerable people.

The local authorities and various organizations in charge of population rescue and safety during floods are definitely in need of improved tools to help them in the chain of decision making, before/during [and after] flooding.

b. Did you work with local beneficiaries in Phase II to develop your tool? If yes, how many local beneficiaries and how were they involved?

The main beneficiary of the developed tool is the weather service (ANAM) which is charge of providing the key information (the weather which in turns impacts hydrological response) to the other actors of

the flood alert chain which in turn benefit from the tools. They were associated to the development and provided feedback through the information workshop (see Deliverable 5 and sections below on partners)

Several partners were (and are and will be) involved through training. Several PhD or Master project have been initiated with the project – one of the beneficiary being staff member from the operational wather service ANAM.

The Burkinabe/French start up AFRICAYS was involved in developing the citizen/smart phone based observatory of floods in Ouagadougou described in Appendix.

c. What is 'new'? In other words, what did Challenge Fund monies support in Phase II?

Phase 1 of this project was focused on proof-testing with local authorities (Civil Protection and Weather Services) an innovative tool for mapping and real time monitoring of flood hazard at the scale of Ouagadougou city. A major achievement of the first phase is the acceptance by the stake holders (see support letters from local authorities) of a new concept for Flood Warning System which associates data derived from the Mobile Cell phone Networks and classical hydro-meteorological monitoring tools.

What was new in phase II was to prepare an efficient use by the authorities of the flood warning tool developed in phase I and investigate how to improve it in the future in order to better suit population's needs. Several investigation methods were deployed (by E Bonnet from IRD/Resilience lab and his team) in order to understand population's vulnerability to flooding, their perception of the risk and the type (content and mode of dissemination) of information needed before and during flooding to limit damages. Deliverables 2 and 3 are the results of these investigations.

In phase II we also investigated how the Rain Cell concept could be scaled. Another pilot testing was initiated in Niamey/Niger (and also in other African cities based on other fund than GFDRR). Also the tranfert f the tool to the local authority was achieved (not only physical transfer of the code and data on a computer based at the BF weather service ANAM but also transfer of the coordination for future development and sustained operation of the tool) .

d. How does it support risk identification and decision-making?

The App that was developed and transferred to local authorities and partners is designed for flood risk monitoring based on detection of extreme rainfall event from mobile networks (Deliverables 4 and 5).

Deliverables 2 and 3 which investigated population vulnerability and information needs (before and during flooding) provide keys for decision makers.

e. Describe the degree to which it is openly-available and how users can access it.

As described in Deliverable 5 (The RainCell app Ouagadougou demonstrator Report on the current state of the Ouaga App and its presentation to the authorities.)

The Rain Cell App monitoring of rainfall over Ouagadougou and associated flood risk is accessible through the 3 Web plateforms :

1) http://ouaga.raincellafrica.net:8080/RainCellApp/

This si a duplicate of the application available on the main server at ANAM. 4 maps are available (through single or 4 panel display) . The rainfall intensities and rainfall accumulations since the begining of the event, at each rain measuring station can also be obtained.

2) http://ouaga.raincellafrica.net/RainCell_4win.html

This application is destined for use over a PC screen, by any user. It provides a 4 panel display with all 4 maps for rapid overview of the current situation.

3) http://ouaga.raincellafrica.net/

This is the mobile/tablet version of the application. It provides a reduced size 4 panel display with all 4 maps for rapid overview of the current situation.

Note that information in the app above is displayed in real time only (no post analysis presentely) – Maps are therefore visible only during rainy events (i.e. from May to october approximatly).

f. Discuss how it enables (or will enable) users to make more effective disaster management and resilience decisions.

Combining the information on the rainfall/flood hazard (phase I and II) and the information on population vulnerability and information needs (phase II) will help the authority take timely decision, provide the appropriate (content and mode of dissemination) warning and to optimize the dispatching of rescue/support teams towards the populations with most risk exposure.

III. Description of partnerships (active in Phase II, but which could have started in Phase I), in particular those involving local partners.

Did you work in partnership(s) with a local partner(s)? If yes, please provide the name(s) of the local partner(s) and the nature/strength/sustainability of the partnership.

The demonstrator Rain Cell app Ouagadougou is a demo tool for early warning on floods developed by IRD and implemented at the Burkina Faso National Weather Service (ANAM) as part of the Rain Cell project funded by the GFDRR. The platform (server) is physically installed at ANAM but the visualizations of the alerts are also accessible to other local authorities involved in the project (main users : Civil Protection Agency , Ouagadougou township authorities) through web.

The main partner to the project is the Burkina Faso Weather Agency ANAM. As described in the conclusions of the Ouagadougou Rain Cell App workshop, detailed in Deliverable 5 the General Direction of ANAM is committed to continue the collaboration with the Rain Cell team beyond the end of the present project.

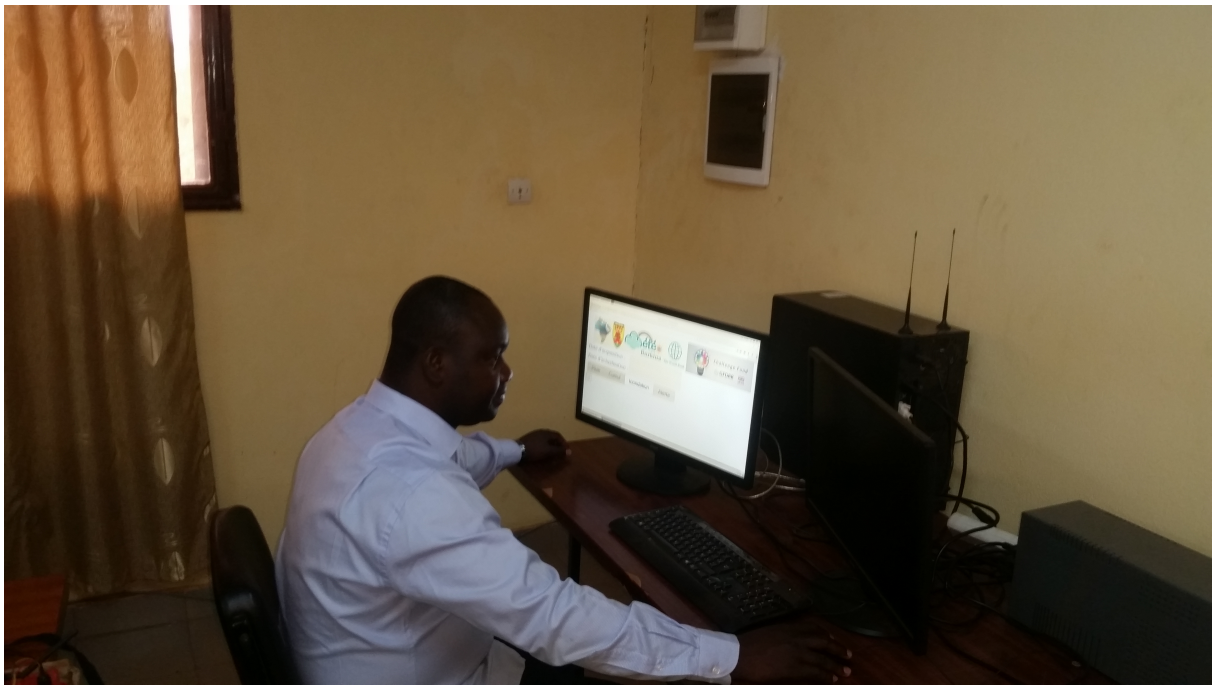
The DG E Ouedraogo has expressed the will to integrate the Rain Cell based monitoring in their operational system – ANAM has expressed their intention to include the Rain Cell Approach in the ongoing modernization of the HydroMet services in Burkina Faso and to seek for funding for sustaining the project beyond the current pilot testing, for instance through the CREWS or similar climate/green fund initiatives.

One ANAM staff member (L Sawadogo) is scheduled for an extended stay in France during the first trimester 2018 in order to deepen his training on the tool and become the local Rain Cell operational Expert in Burkina Faso. This is another sign of the strength of ANAM commitment in the project and collaboration, and will further ensure the sustainability of the collaboration.

The signing of a formal agreement between Orange Burkina Faso (DT) and the ANAM and IRD was initiated after the Ouagadougou workshop held in Sept 2017. This agreement is a strong sign from Orange of their will to cooperate on the Rain Cell concept development in a sustained way.

Other strong partners in Burkina Faso are : The authorities in charge of civil Protection (DGPC) end-user of the Rain Cell App and which has expressed their will to collaborate further with ANAM to improve the tools and alart dissemination in Ouagadougou. Also academic partners such as the INSS/CNRST have been involved and rained through the project and will participate to further development, improvement of the tool in the future.

Rain cell App demonstration in Africa (here with civil security officers –top- and at the Burkina Weather Service Agency, ANAM)



IV. Description of capacity building of local stakeholders.

Did you conduct training in Phase II for local communities or beneficiaries in the use of your tool? If yes, please describe the type of the training and the number/type of beneficiaries trained. Did you measure change in knowledge as a result of your training? If yes, please provide results. Did you follow up in any way after the training to see if what you discussed was put into practice? If yes, please explain.

Extract from Deliverable 5 : the Trainer/Trainees team at ANAM in Ouagadougou in Sept. 2017.

As described in Deliverable 5 a workshop dedicated to the presentation and discussion of innovative tools for monitoring and anticipating urban flooding risk was jointly organized by the Burkinabè Met services (ANAM) and the Institut Français de Recherche pour le Développement (IRD). The workshop was held in Ouagadougou on October 10th, 2017 at ANAM headquarters.

Tools for the real time monitoring of flood hazard and for the analysis of populations vulnerabity, developped by IRD in the framework of the project RainCell App Ouaga phase 2, funded by the Global Facility for Disaster Reduction and Recovery (GFDRR/World Bank Group), were presented to the members of the cellule de suivi et de veille pour les extrêmes hydrométéorologiques (extreme hydrometeorological events monitoring committee) initiated in Burkina Faso in 2017. The panel made of 38 participants (list in appendix) included members from local authorities (Ministère de l'Urbanisme et de l'Habitat, Ministère de l'agriculture et des Aménagements Hydrauliques ; Direction Générale de la Protection Civile ; Direction des Ressource en Eau ; Conseil National pour le Développement Durable ; Conseil National de Secours d'Urgence et de Réhabilitation ; Institut Géographique du Burkina Faso ;

Agence Nationale de la Météorologie), Research Institutions from Burkina and France (CNRST ; IRD) and two members of the mobile operator Orange Burkina Faso .

The main conclusions were :

The interest for a RT monitoring platform such as presented is confirmed by all attendants. A lead time of an hour or more would be preferred if possible.

The urban hydrology model presented by IRD would be an interesting tool for research/training/operational purposes and several operational services (water resources ; CONASUR) have expressed interest for further training in the future (funding/resources needed).

The Rain Cell approach for rain monitoring based on the mobile network is considered by all attendants, and particularly by the weather services ANAM, a very important element of such an urban monitoring tool because : i) of the advantage for ANAM of using an existing network that is maintained to high standards by the telecom operator itself and ii) the high density of the network in urban areas makes high resolution rain maps possible.

Consequently : a meeting between IRD-ANAM and Orange was held in Orange following the workshop. Discussions have been held over the last month and the principle of an agreement to include Orange in Rain Cell Ouagadougou App effort has been reached. The redaction of a formal agreement contract is ongoing.

This is a great outcome from the workshop and the Rain Cell App demonstrator.

All parties have also aknowledge the interest of the vulnerabilities survey and preliminary analysis which have been briefly presented. A workshop dedicated to this topic was organized in Ouagadougou (cf associate deliverables). One suggestion was to extend the vulnerabilities studies also to the socio-economic actors in Ouagadougou and not solely to population. This would be beyond the scope of the present project scope and competences .

One of the important outcome from the population survey that is of direct interest for further development of the Rain Cell App and flooding risk monitoring is the following : web base services are not the preferred way of getting information from the population point of view - many families do not have access to internet and would prefer the alerts to be transmitted through radio forecast (choice number 1) or through SMS.

These important considerations have to be included in the design and future operational evolutions of the flood monitoring system.

A will to build from the Rain Cell App pilote experiment and upscale it to an operationnal system for Ouagadougou/BF has emerged.

The framework and resources to develop and maintain such a system need to be sought in BF

Burkina institutions that attended the workshop would be in good position to coordinate and push such an initiative – ANAM seems the best and more relevant institution to carry on such a project given its expertise.

IRD would be willing to continue helping further development and transfer of expertise to ANAM and other local partners.

V. **Did you leverage private or public sector resources**? If yes, please describe the source of the leverage as well as the total USD amount of combined cash and in-kind contributions. If relevant, please describe the nature of your relationship with the source(s) of leverage.

Here the private sector provided data rather then a direct financial support. The equivalent value of this contribution can be calculated by considering that what was done is replacing costly and high maintenance equipment such as a weather radar by 2D rainfall maps derived from telecommunication network with data provided at no cost by the mobile operator (here Orange). Typical cost for a weather radar range from 0.2 to 5 (or more) M$, and the yearly cost of their operation and maintenance is about one tenth of this initial cost (figures provided by Meteo-France).

VI. **How did your project consider gender in any aspect of project planning or implementation? Was a gender analysis or assessment conducted?** If yes, did your project address any gap identified in the assessment? If yes, please describe how. All Phase II projects are required to integrate gender into their work. *Please use what you wrote in your inception report on gender as the starting point for this section.*

Gender was taken into account in the vulnerability study and investigations on populations needs before/during flood events as described in Deliverables D2 and D3. The survey on vulnerability and risk perception was carried over a sample of more than 2000 persons, 51% being female and 49% male. Specific instructions were given to the survey assessors to help overcoming woman cultural shyness and encourage them to express themselves during the surveys. The participative workshop that gathered a sample of 20 citizens from 2 flood exposed districts of Ouagadougou also included both genders. Some of the questions discussed in the interviews and workshop dealt explicitly or implicitly with women. For instance the best way for flood related information to reach and provide shelter to women (and also the children and eldery the women are themselves taking care off) was risen. Also one outcome from the surveys, interviews and workshop was to point out that the way before/during flood information is currently provided to populations by the authorities is not well suited for the people who stay at home

during the day and for the people who are illiterate, both being in majority women. Some of the propositions made during the workshop on this topic (such as more images rather then written information – also oral information in local languages) will directly benefit women.

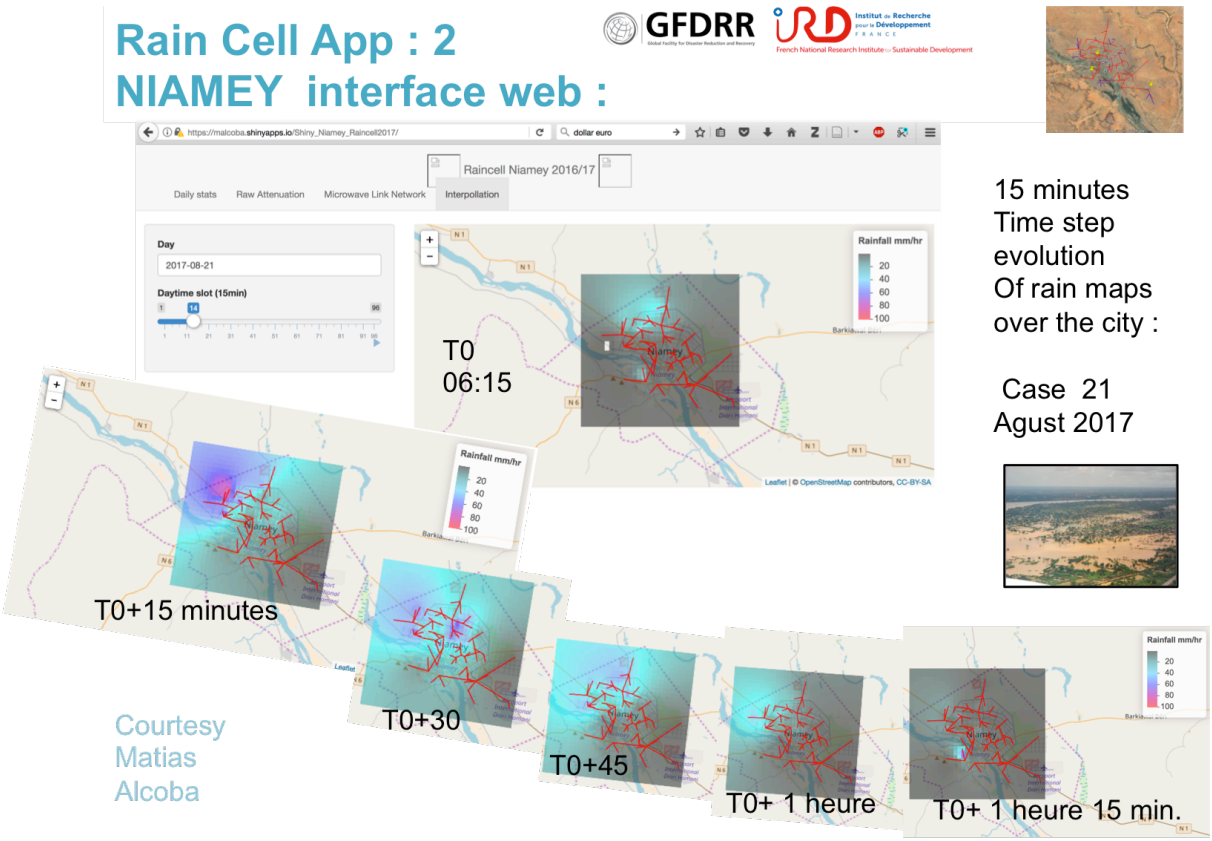
VII. Discussion of how tool or approach can be brought to scale in the future.

One objective of phase 2 was to analyse prospect and start actions towards bringing the Rain Cell concept to scale in other countries and cities in Africa.

As detailed in phase 2 deliverable 4 (« Analyzing potential of RainCell scaling to Niamey ") following the success of the Rain Cell concept in Ouagadougou, contacts have been initiated and preliminary work towards developing a Rain Cell App for Niamey has started.

A collaboration with Orange Niger is ongoing. It led to the collection of raw data over Niamey, and production of rain maps for the whole rainy season 2017. As in Ouagadougou, the hydrological model ATHYS was set up over the city of Niamey for flood prediction based on the raincell maps.

Discussion with the authorities (in particular the Niger basin Authority) in order to integrate a Rain Cell demonstrator in the future development of their improved hydrometeorological monitoring system are initiated. Work will be continued in 2018 and beyond the present project.



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

Case 21
Agust 2017

Extract from Deliverable 4: illustration of step by step evolution of an extreme event (here the August 21rst 2017 case) over Niamey.

The objectives of the RainCell App phase 2 project, regarding Niamey were i) rising stake holders awareness on the benefit of the proposed Flood Early Warning System and consolidate the collaboration with the Orange operator, ii) initiate the adaptation/transfer of the Rain Cell App tools to Niamey, as a demonstration.

Deliverable 4 showed that these objectives have been reached, thanks to GFDRR support. Below is a summary of the main outcomes from the scaling to Niamey study.

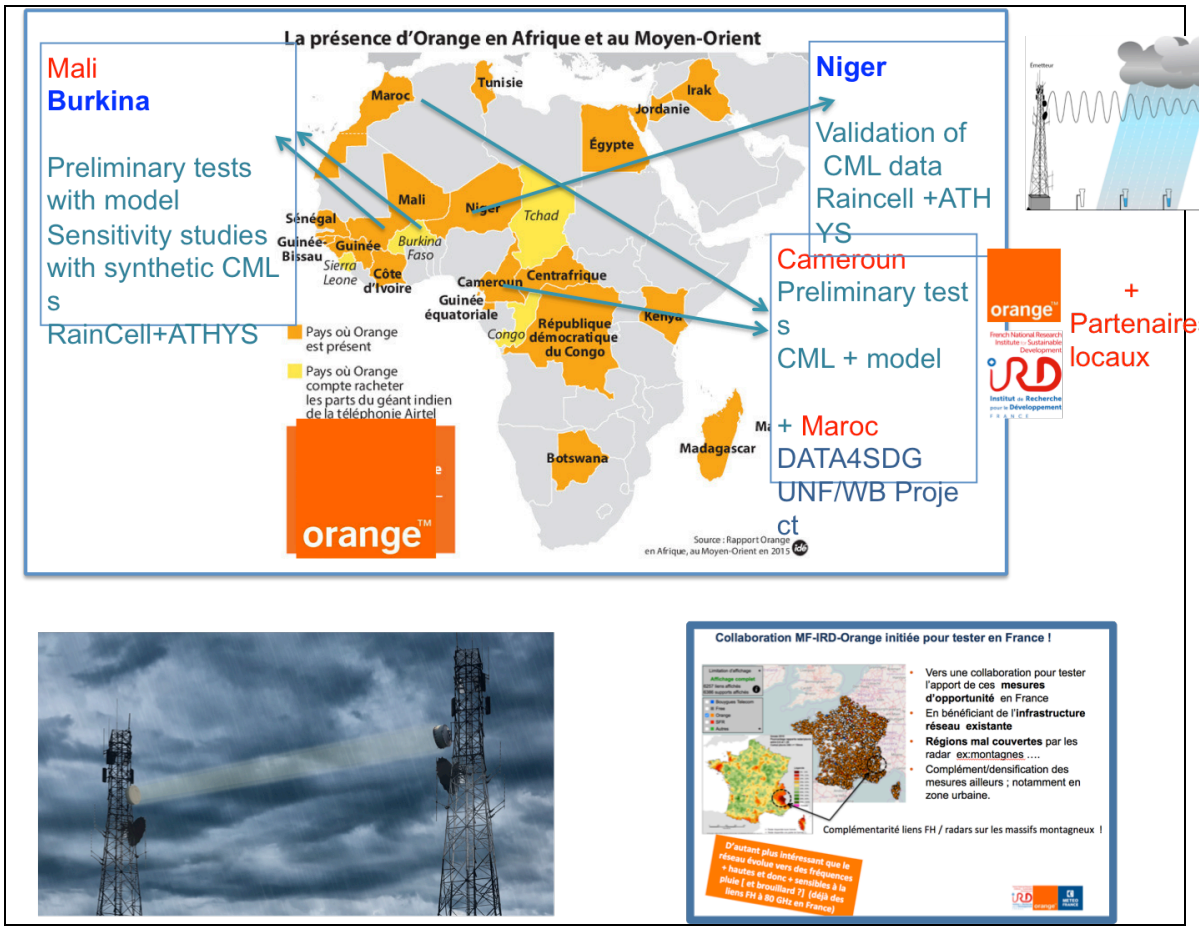
- The processing chain that can transform raw data from the mobile operator Orange into rain maps is validated and operationnal. The collaboration with Orange is at this stage informal (no commitment from the Operator) but has been successful and lead to the continuous monitoring of rainfall over Niamey since May 2016, with a 15 minutes time step and a weekly update. This is a unique achievement in Africa !
- The ATHYS modeling platform which can ingest the rain maps to produce discharge and subsequently flood risk indication has been set up for Niamey and is now ready to be tested for quantitative validation of the output, better understanding of the uncertainty and sensitivity to the input (rain and geographical data). This is a good base for further improvement and collaboration with other projects and experts working on the problem of flood in Niamey.
- The demonstration of these tools to local users and authorities (water ; weather ; basin agencies) has been initiated but need to be further done.
- Discussions on the possible integration of the proposed tools for operational hydrometorological monitoring should be organized, with local authorities, the coordinators of

other projects related to flood risk in Niamey/Niger - all of course, together with Orange.

- The IRD/RainCell team is willing to continue the effort and help further development by contributing to training, awareness building on the proposed innovative techniques and technical improvements of the tools.
- The IRD/RainCell team is planning to hold a small workshop in Niamey within the first semester of 2018 in order to demonstrate the tools, present the work already accomplished and have feedback from all potential users (academic and operational).
- Help from the WB to organize these next steps and help reaching out to the relevant teams in Niamey would be appreciated.

In addition and as illustrated below the team was able to build beyond the GFDRR funded project and to initiate several actions in Africa – with the Orange operator.

Further scaling and going beyond pilot testing, towards widespread operationalization and insuring sustainability of this innovative approach would require a long term private-public partnership between telco operators and hydrometeorological services, with the elaboration of a mutual interest or business model. This requires further investigation.



Summary of current Rain Cell related initiatives in Africa (and France) .

VIII. What were main points of learning from this phase of the project?

Rain Cell App project was developed along 3 axis :

i) validating/transferring to local partners an innovative method for mapping rainfall and extremes events using data from the mobile telecom (i.e. signal fluctuations due to rainfall on the network that can be recorded and provided in real time by telco operator), ii) integrating the raincell maps into an urban hydrological/flood model towards RT monitoring of flood risk and the possibility to deliver alerts ; and iii), started in phase II another aspect of the project targeted a better understanding of population vulnerability to flood, their need for information before/during flooding and how to provide that information to reach the targeted/most vulnerable people and protect them better against these risks.

Concerning points i) and ii), phase II confirmed the lessons from phase I : the Rain Cell concept based on assessing flood hazard in urban areas based on the mobile network is a cost-effective solution which is well suited and well accepted by the relevant services and authorities in Ouagadougou and other African countries. All actors in the flood risk information chain are in strong favor of such a solution including the population which is willing not only to use but also to contribute to this information through citizen observatory/crowd sourcing.

Concerning point iii) on vulnerability, population's perception of the risk and how to reduce it, and the type of information (content and mode of dissemination) best suited to protect population including the most vulnerable (like women, children, elderly and the least wealthy) and reduce damages, the 3 complementary investigation methods (survey ; interviews and participative workshop) lead to some interesting findings. They confirm the relevance of the mixed approach that was chosen to reach population but also the authorities and intermediary organizations such as NGO involved in people's protection.

Some of the main findings from the vulnerability study are summarized below (and see also the extended conclusions in Deliverables 2 and 3)

Which geographical sectors are the most vulnerable ?

- The vulnerability profiles are organized according to the planned and unplanned town or between the centre and the periphery. The most vulnerable people are clustered in the outskirts of the town. However in these very exposed neighborhood, some most experienced people present a profile with good adaptation to extreme weather conditions.
- In the planned neighbourhood the profiles appear as not very vulnerable but there remain numerous pockets of high vulnerability, together with non-precarious and wealthy people. The most precarious, who resettled in unbuildable (according to regulations) areas, are the only individuals presenting very vulnerable profiles.
- Near other regulatory areas of the town, often associated with unplanned neighbourhoods, the profiles are mostly very vulnerable.

Measures taken to raise awareness and measures of prevention must be made widespread on a city-scale throughout the town, and reinforced in areas of very high vulnerability associated with high-risk areas characterized by regulatory zoning.

Are people aware of flood risk zone regulations ? Is the information on flood from Authorities reaching the targeted population ?

- Surveys show that people who leave in flood prone areas are not aware of the regulations
- Similarly the information provided by the government on behavior and precautions to adopt in case of floods are usually not known from the vulnerable populations. The places where the information is available, the inadequateness for illiterate or poorly educated people was expressed by may participants to the participative workshop (see Deliverable 3).

A real effort is needed from the authorities and other actors in the flood risk communication/prevention chain to communicate better with populations. Participative workshop such as organized in the framework of phase II are useful to understand better the needs and how to respond to them – This kind of workshop should be organized on regular basis.

IX. Additional Monitoring Data regarding Tool Uptake

a. Is your tool openly available to the broader user community? If yes, please provide the name of the platform.

The Rain cell app can be freely accessed through the web interface http://ouaga.raincellafrica.net/

The ATHYS hydrological model can be downloaded from the IRD/ATHYS web site http://www.athys-soft.org/

The citizen/smart phone based observatory of floods in Ouagadougou can be accessed through the web site http://raincell-crowdsourcing.africasys.com

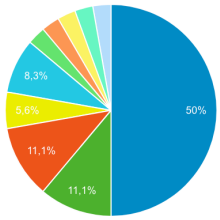
All tools were developed based on open source code, as described in the specific deliverables and can be shared openly.

b. How many downloads of your tool have occurred throughout both Phase I and Phase II? How is this being measured?

The tool was installed at the end of phase I and started to be accessible only during phase II. Note that some of the modules (like the citizen/smart phone based monitoring of flood) were set up late during phase II and covered only partially the rainy season 2017. Also 2017 was a relatively dry season in Burkina Faso and no major flooding occurred this year after set up of the tool. However the tools will continue being used beyond the end of the present funded project and it is expected that the use of the tool will rise as the collaboration around Rain Cell will be sustained.

The figures below extracted from Deliverable 5 provide an indication of the use of the Rain Cell/ATHYS rainfall monitoring/flood prediction Web App since August 2017 (again, partial coverage of the rainy season – which happened to be dry and with no floods)

Pays	Sessions	Nouveaux utilisateurs	Contribution au total : Nouveaux utilisateurs
	141 % du total: 100,00 % (141)	36 % du total: 100,00 % (36)	
1. France	91	50,00 %	
2. Burkina Faso	24	11,11 %	
3. Mali	12	11,11 %	
4. Côte d'Ivoire	5	5,56 %	
5. Martinique	4	8,33 %	
6. United Arab Emirates	1	2,78 %	
7. China	1	2,78 %	
8. Guadeloupe	1	2,78 %	
9. Greece	1	2,78 %	
10. Italy	1	2,78 %	



Rain Cell Ouagadougou Web App access from July 2017. (see more details in Deliverable 5)

In addition direct feed-back from the weather services confirmed their interest for the tool, as confirmed by the following quote from the Weather service director following the set up of the Real time in Ouagadougou (Aug 2017) :

'Felicitations pour ces produits qui, de prime abord repondent aux attentes de l'ANAM (Ex DGM). Je vais les regarder avec le concours des services techniques et te revenir. Nous avons en effet mis en place une cellule de suivi et de veille pour les extremes hydrometeorologiques composee de la DGPC, du SP-CONASUR, de l'HYDROLOGIE, de l'IGB et des MEDIAS. C'est donc dire que vos produits nous seront fort utiles. '

'Congratulations for this tools which are good response to the needs of ANAM (weather services). We will carfeuly examine them with our technical services and get some feed back. We have indeed put together in 2017 a cellule de suivi et de veille pour les extremes hydrometeorologiques (comittee for the monitoring/alert for extreme hydrometeorological events) with the Civil security (DGPC), SP-CONASUR, Water services, the geogrephical institute and the medias. This to say that your product is being useful ! '

Concerning the newly developed citizen/smart phone based flood observatory, 499 accesses to the tool for uploading information were recorded in 2017 (see also the appendix to this report). Given that the tool was implemented in mid-July -thus after the main flooding period in 2017- and the rest of the season was quite dry this high number illustrates the strong interest for the application and the will of the citizens to be an active part of the flood risk assessment in their city.

c. How many decision makers have accessed your tool throughout Phase I and Phase II? Of these, how many access your tool on a regular basis? How is this measured? (it can be through conversations, email, direct observation or another way)

Different modules of the Rain Cell tools are accessed by different type of users including decision makers.

As detailed in Deliverables 2 and 3 decision makers were fully involved in the analysis of vulnerability / best practice before and during floods. They were provided with Policy briefs following the vulnerability survey (deliverable 2) ; they also participated and were given feedback from citizens and civil organizations during the flood vulnerability / population needs before/during flood workshop (deliverable 3).

In addition, the Rain Cell App module for real time monitoring of rain and flood risk is installed at the weather service (ANAM) and integrated among the operational suite of products/tools they use to elaborate alert decision together with the civil security services. There again, because the period following the installation of the tools was dry -with no floods- only the use of the tools for several seasons will allow to derive robust statistics on the effective use.

d. Have any policies, plans or investments been informed/influenced by your tool? If yes, please provide a bit more detail on how your tool has informed/influenced investment/policy/plans; if possible, provide USD amounts of local budgetary changes or other investments. If the influence was policy-based, please describe the policy change your tool informed. If the influence was in planning, please provide detail.

One outcome of the survey and participative workshop (see deliverables -- and --) was the need to modify/improve the way the populations are informed before and during flooding events. During the participative workshop were populations, NGOs and representants of the authorities were present the decision to act on this was taken and some actions scheduled at short to longer term (see conclusions of working groups in Deliverable 3).

Other important outcomes from the project and from the September 2017 workshop in Ouagadougou were the monitoring tool was presented to a panel of various authorities involved in flood alert and also to Orange are : i) Decision was taken by ANAM to fully include the Rain Cell approach in the *cellule veille des extremes hydrometeorologique* a multi-authority/multi-organization initiative that ANAM is coordinating for risk prevention in Ouagadougou/BF. ANAM is also investigating the way to include Rain Cell in the suites of actions/equipment that are being funded through various programs in link with climate or green funds (WB/OMM CREWS for instance). ii) Orange took the decision to collaborate with ANAM (and IRD) to find a way to sustain the Rain Cell App effort to provide real time monitoring of Rain/flood events through their telecom network beyond the present phase. A formal collaboration document is being written by the three parties (see also deliveable 5).

e. Was your sustainability goal for the project achieved? Please provide the metric used and explain the results achieved.

Rain Cell contributes to the following sustainable development goals :

SDG 6 Access to water : Rain Cell contributes by providing tools for generating/exploiting data for better monitoring of water resources and water quality – rainfall being the main entry to ground water storage systems.

SDG 11 sustainable city : a tool for a smarter city able to monitor its own flood risk and better prevent the impacts on populations – by better information dissemination and decision making.
SDG 12 responsible production : through an example of frugal innovation, recycling telecommunication information in another domain and exploiting existing infrastructure (telecom links from cell network) rather then investing in costly instruments.
SDG 13 Climate change : contribution to observing a key variable of climate : rainfall and help diagnosing its variability and the occurrence of extreme events.
SDG 17 partnership : Rain Cell triggered contribution from the ICT sector in the field of climate/water risk, for public benefit .

f. Do you have an exit strategy for your project? If yes, please explain.

The seeds planted thanks to the GFDRR support are already growing and the Rain Cell initiative is continuing. Examples have been given throughout this report of the new initiatives which are emerging in different countries/cities (Niamey/Niger ; Bamako/Mali ; Yaounde-Douala Cameroun ; Fez/Tanger Morocco). The team together with local partner is loking for funding to continue scaling the project and lead it to autonomy. The current pilots set up in several sites in Africa and the workshops/communication around the Rain Cell concept will help building awareness on the services which could be derived by the public and private sectors from Rain Cell Rain maps and clarifying which benefit the Telecom Operator could get from providing this RT data. The elaboration of such an interest or business model will need further investigation.

X. Please detail how the budget was spent through the course of phase II?

	GFDRR Funding	*In kind Funding*	*Other Funding*	**Total Funding**
CONSULTING SERVICES (fees, travel, per diem)	45000	50000	(French space agency) 60000	155000
TASK TEAM SUPERVISION (List key personnel and their related expenditure)		15000		15000
DISSEMINATION (Translation, editing, publication, etc.)	16000	35000		51000
LOGISTICS (Training, workshops, consultations, etc.)	75000	40000		115000
GOODS AND WORKS	14000			14000
OTHER (please specify): Indirect Cost				
TOTAL				***350000***

XI. Please attach any additional project related documents you may have to the final report.

APPENDIX :

D7 – An unscheduled deliverable on a citizen/smart phone based observatory of floods in Ouagadougou based on open source solution.

(http://raincell-crowdsourcing.africasys.com)

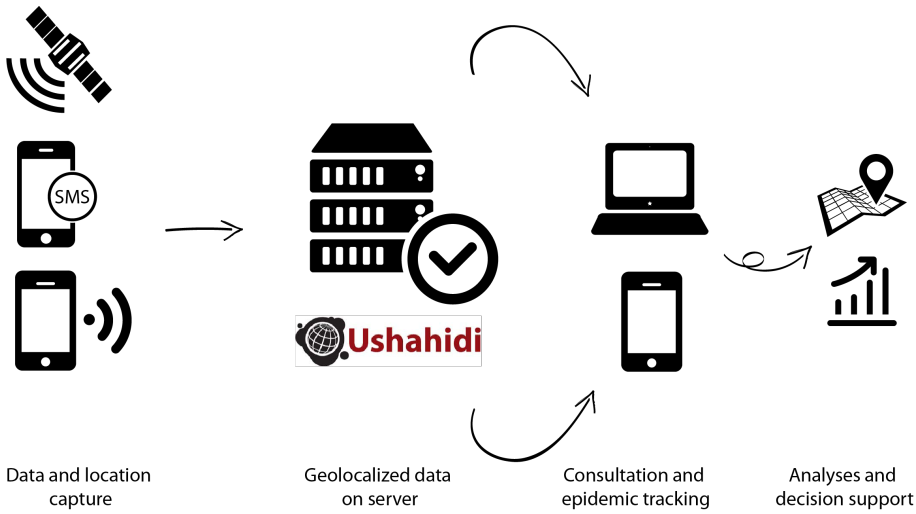
Introduction

During phase II development and from discussion with experts as well as local partners, arose the need for information in complement of the Rain Cell monitoring App in order to validate the hydrological model (ATHYS, included in the Rain Cell App) and complement the real time data on rainfall with real time data on water levels in the streets. Given the small budget available and the difficulties to install (and ensure safety) classical hydrometric stations inside Ouagadougou it was decide to use an innovative and low cost solution based on a crowd-sourcing approach or citizen observatory and smart phones. IRD collaborated with the Burkinabe-french start up Africasys based in Ouagadougou in order to develop and implement such a tool in Ouagadougou starting in 2017.

More details on this app which is now operational in Ouagadougou and will be used in the next rainy seasons for Rain Cell validation/complementarity are given below.

Methods

We implemented a tool for rainfall surveillance and spatial-temporal monitoring which we developed using Ushahidi, an open-source tool that applies the crowdsourcing concept to mapping and geographic information. Ushahidi ("witness" in Swahili) uses SwiftRiver, a free open-source platform that allows information to be extracted very rapidly and then restored after being filtered and verified. The sources include a variety of channels such as Twitter, SMS, email, and RSS.



The dengue and rainfall surveillance platforms were developed with Ushahidi using 3G data transmission. Data are sent to the platforms in real time with an smartphone application, integrated into the Ushahidi interface, and then mapped. The platforms are accessible via Internet.

Results

10 observers hired by the project (smart phone provide by the program)

9 voluntary observers (smart phone owners) also collaborated after being informed about the project through the official observers.

Observation period : 10 juillet – 10 octobre 2017

499 témoignages/user report

26 témoignages en moyenne sur les 19 observateurs / 26 reports per observer on average

36 témoignages en moyenne sur les 10 observateurs recrutés / 36 reports per observer on average for project hired observers

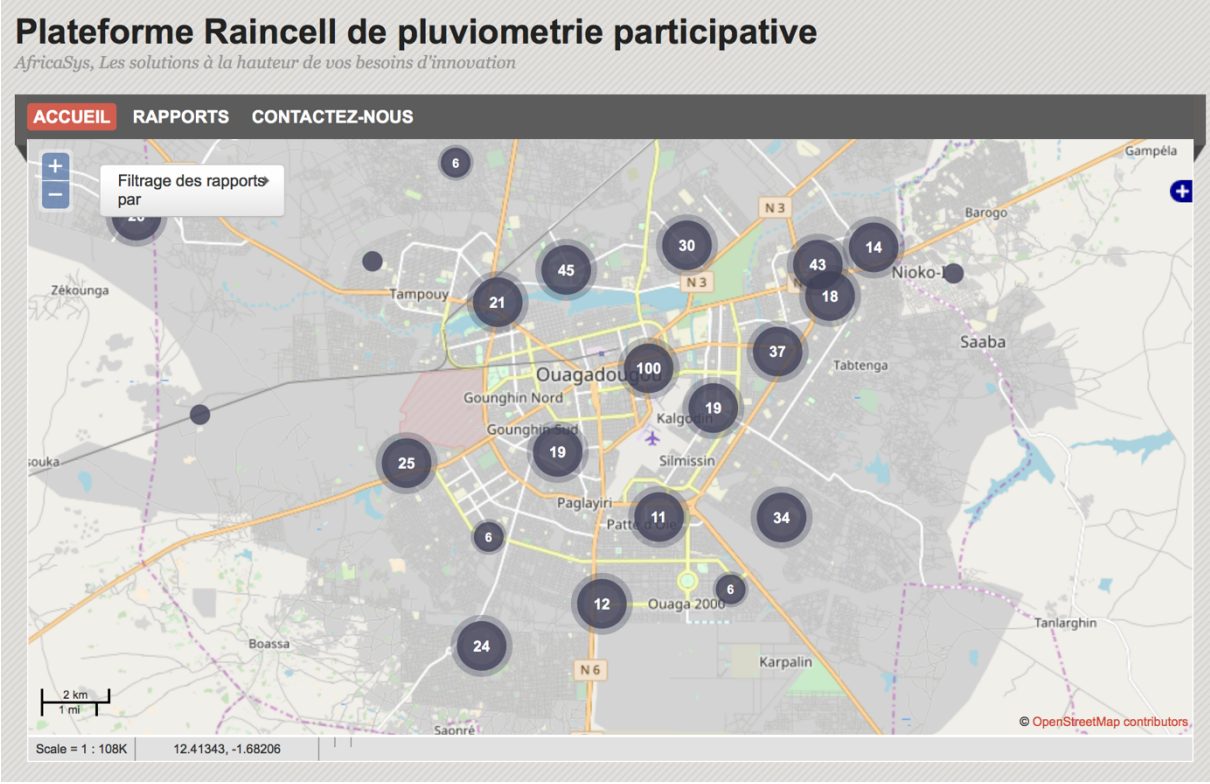
315 témoignages au niveau du pied (flaque d'eau au sol) / 315 report for 'foot level'

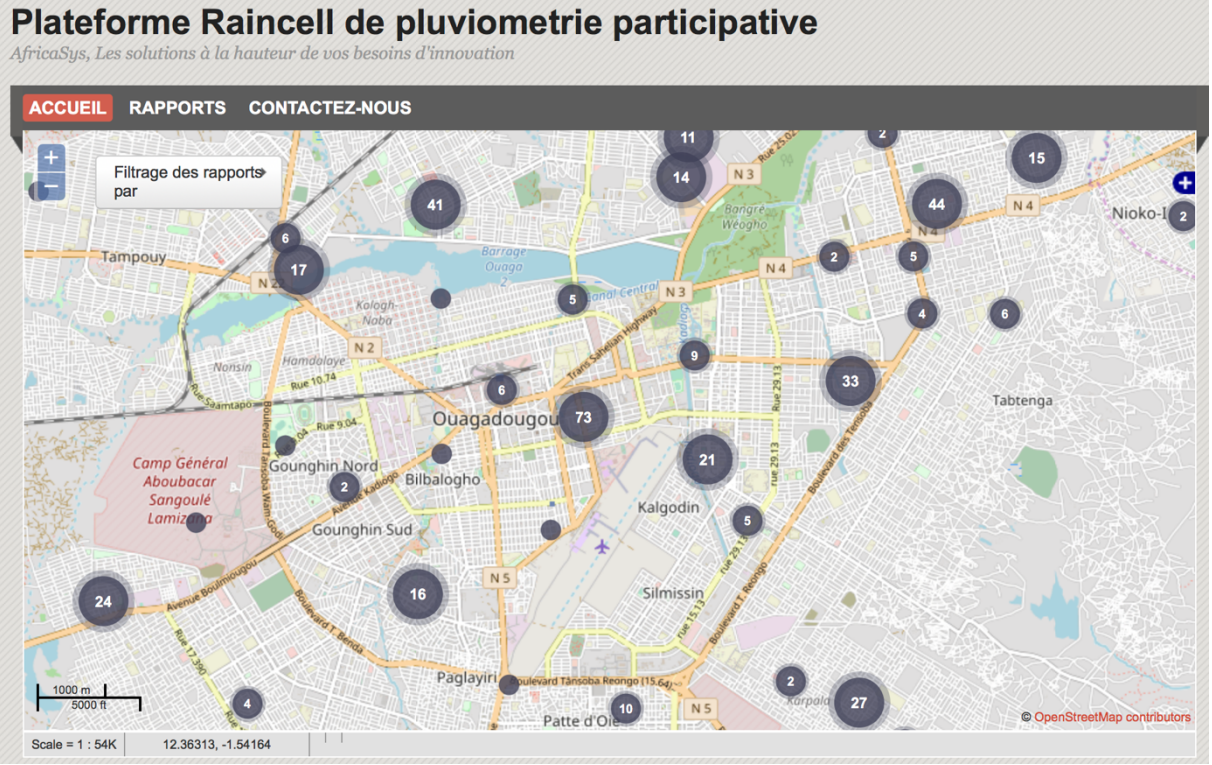
151 témoignages à la cheville / 151 report for 'anckel level'

18 témoignages au mollet / 18 for carf level

15 témoignages au genou / 15 for knee high

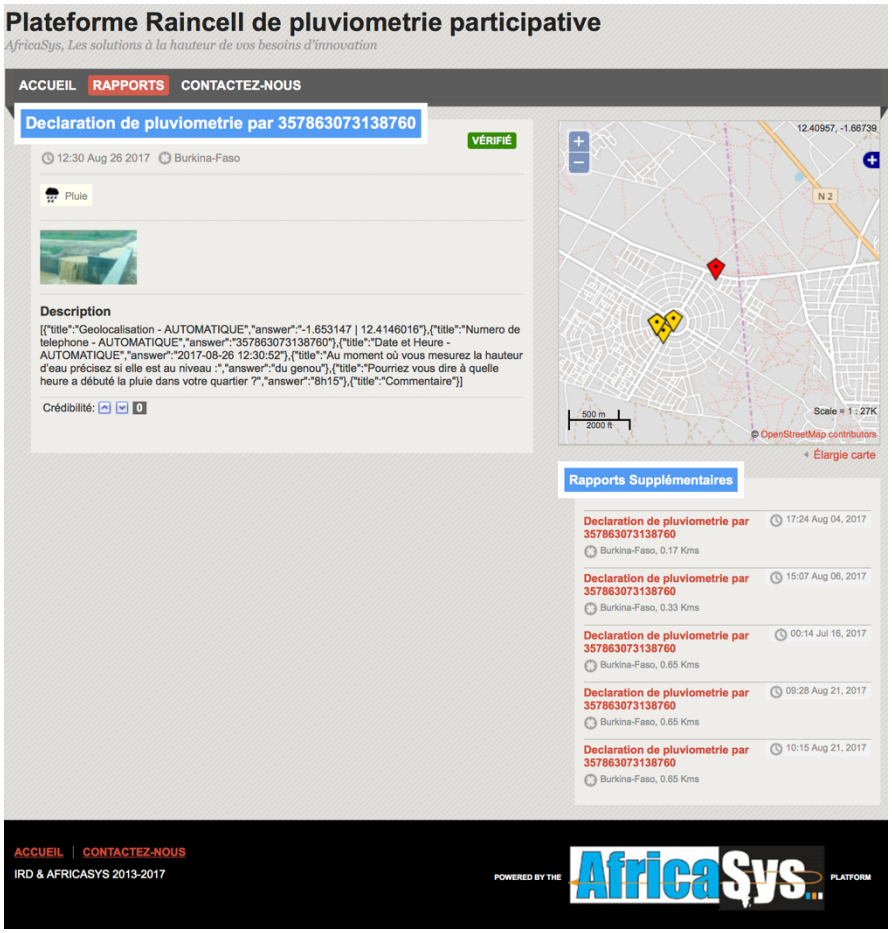
Platform : Web access





Backoffice access

Exemple d'un témoignage au dessus du genou => Photographie / Exemple of report acces to the photography.


Plateforme Raincell de pluviometrie participative
AfricaSys, Les solutions à la hauteur de vos besoins d'innovation
ACCUEIL
RAPPORTS
CONTACTEZ-NOUS
Declaration de pluviometrie par 357863073138760
VÉRIFIÉ
12:30 Aug 26 2017
Burkina-Faso
Pluie
Description
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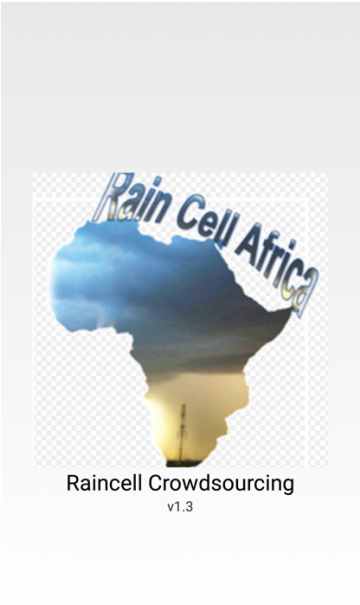
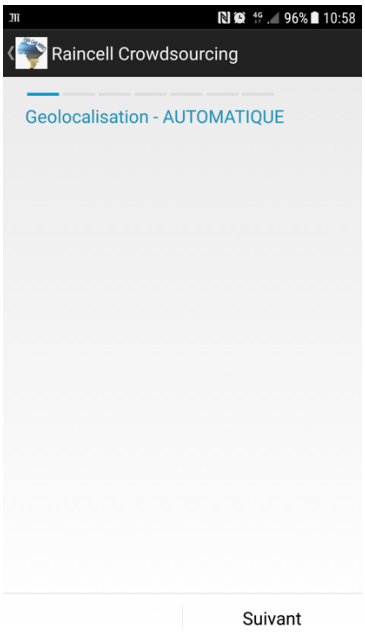
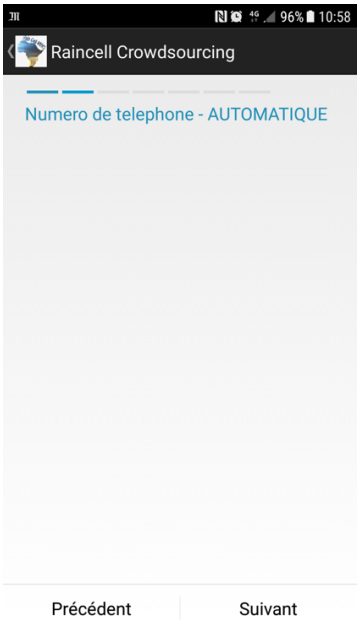
Crédibilité:
0
12.40957, -1.66739
N 2
500 m
2000 ft
Scale = 1 : 27K
© OpenStreetMap contributors
Élargie carte
Rapports Supplémentaires
Declaration de pluviometrie par 357863073138760
17:24 Aug 04, 2017
Burkina-Faso, 0.17 Kms
Declaration de pluviometrie par 357863073138760
15:07 Aug 06, 2017
Burkina-Faso, 0.33 Kms
Declaration de pluviometrie par 357863073138760
00:14 Jul 16, 2017
Burkina-Faso, 0.65 Kms
Declaration de pluviometrie par 357863073138760
09:28 Aug 21, 2017
Burkina-Faso, 0.65 Kms
Declaration de pluviometrie par 357863073138760
10:15 Aug 21, 2017
Burkina-Faso, 0.65 Kms
ACCUEIL
CONTACTEZ-NOUS
IRD & AFRICASYS 2013-2017
POWERED BY THE
AfricaSys
PLATFORM

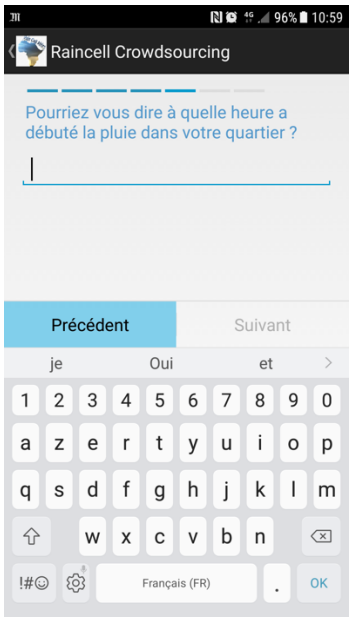
Application Android

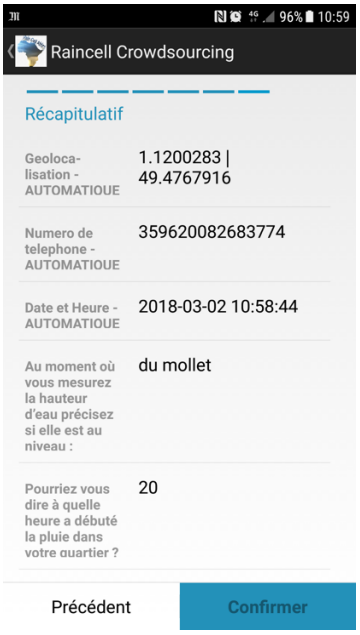







96% 10:58
Raincell Crowdsourcing
Au moment où vous mesurez la hauteur d'eau précisez si elle est au niveau :
du pied (flaque d'eau au sol)
de la cheville
du mollet
du genou
de la taille
des épaules
Précédent
Suivant


96% 10:59
Raincell Crowdsourcing
Pourriez vous dire à quelle heure a débuté la pluie dans votre quartier ?
Précédent
Suivant
je
Oui
et
Français (FR)
OK


96% 10:59
Raincell Crowdsourcing
Récapitulatif
Geoloca-lisation - AUTOMATIQUE
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Numero de telephone - AUTOMATIQUE
359620082683774
Date et Heure - AUTOMATIQUE
2018-03-02 10:58:44
Au moment où vous mesurez la hauteur d'eau précisez si elle est au niveau :
du mollet
Pourriez vous dire à quelle heure a débuté la pluie dans votre quartier ?
20
Précédent
Confirmer