

EVIDENCE project

« Extreme rainfall events, vulnerabilities and environmental risks: Flooding and water contamination »

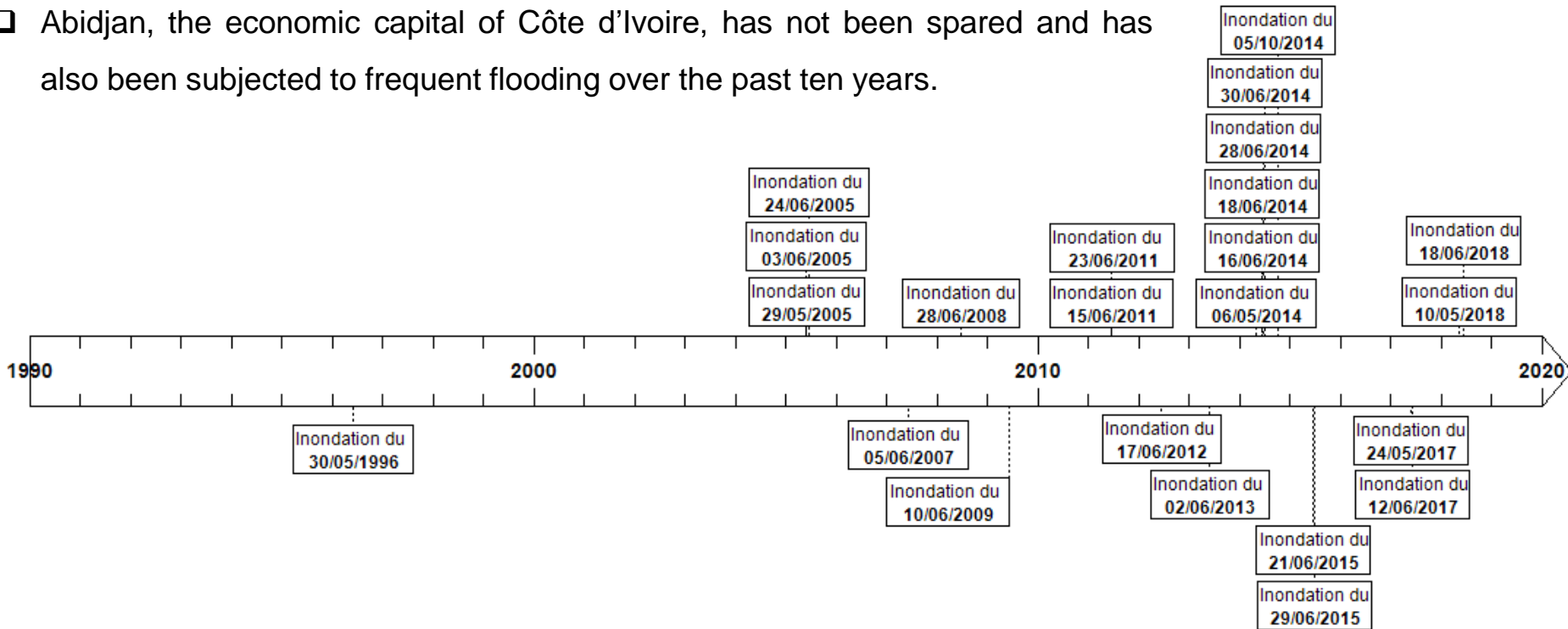
Individual perceptions on rainfall variations versus metric precipitation trends:
an interdisciplinary approach in two contrasted neighbourhoods in Abidjan,
Côte d'Ivoire

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- Global climate projections show that the increasing trends in extreme precipitation will very probably contribute to the resurgence of the risk of flooding in the cities in the course of the coming century (IPCC 2020).

- Abidjan, the economic capital of Côte d'Ivoire, has not been spared and has also been subjected to frequent flooding over the past ten years.



- In Côte d'Ivoire, it would appear difficult to detect a change in precipitation in the country as a whole and at daily scale (Soro *et al.*, 2010 et Goula *et al.*, 2012).
- Yapo *et al.*, 2020 have shown, on the basis of CORDEX-Africa simulations models, that the coastal zone of Côte d'Ivoire will see an increase in extreme precipitation of 50 to 60% between the present and the end of the century

- ❑ In parallel with this uncertainty regarding knowledge of the physical reality of the climate in sub-Saharan Africa, the populations may have their own perception of the variability of precipitation.

- ❑ These perceptions are constructed on the basis of frameworks of comprehension (also referred to as frameworks of reference or by the sociologist Erving Goffman experience frameworks), in which are developed the perceptions of a fact or an event.

- ❑ Surveys on perceptions of rainfall change in West Africa show that people perceive (De Longueville *et al.*, 2020 ; Idrissou *et al.*, 2020 ; Kutir *et al.*, 2016 ; Yaro 2013, Bomuhangi *et al.*, 2016 ; Kima *et al.*, 2015) :
 - a decrease in total annual rainfall,
 - an increase in the intensity of precipitation,
 - a change in the start and end dates of the rainy season,
 - a divergence between perception and measured data,
 - a convergence between perception and meteorological data.

- ❑ The divergence between these two phenomena contributes to greater vulnerability in the face of extreme events (Langford 2002 et Solberg *et al.*, 2010).

- ❑ The comparison of perceptions and quantitative pluviometric measurements is a source of knowledge that may reduce vulnerability.

The present study therefore seeks to determine the similarities and the divergences between the perceptions of individuals surveyed regarding the variability of precipitation and the trends observed in the meteorological data at Agbekoi and Palmeraie, two contrasting neighbourhoods (disadvantaged and residential).

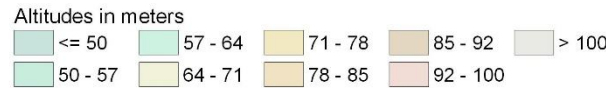
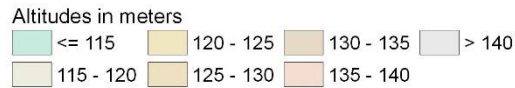
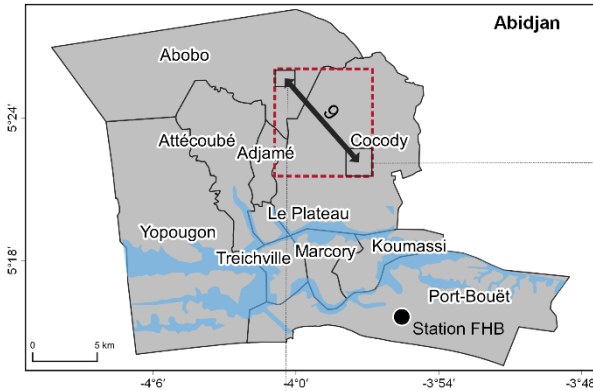
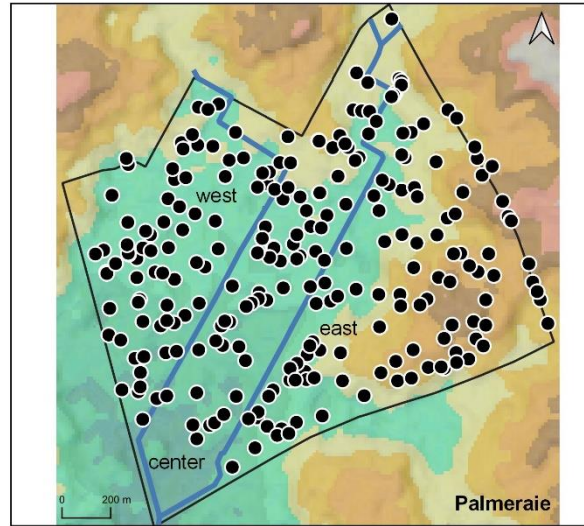
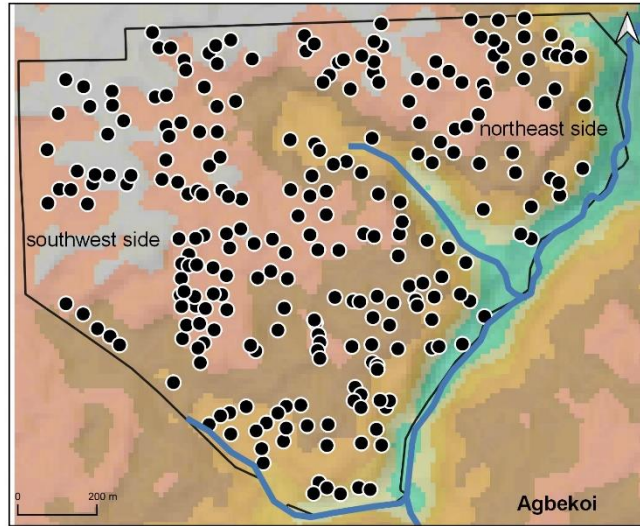
Objectives:

1. Analysing people's perceptions of rainfall variation with survey data.
2. Calculating the trend of precipitation metric indicators with meteorological data
3. Make a parallel between the perception of individuals and the trend of metric indicators.
4. Spatialize individuals' perceptions to show its intra- and inter-neighbourhood heterogeneity.

Evidence Survey 2018 : Location of neighbourhoods and individuals surveyed

n=252

n=251



- Households surveyed
- Rainwater flow or drainage
- District borders

Sources :
 - Administratives : openstreetmap.org
 - SRTM NASA

Questions on perceptions of the precipitation:

In the last 10 years (2009 - 2018), is there any change in the amount of rainfall in your district?

In the last 10 years, what is your appreciation of the rainfall intensity in general?

In the last 10 years, extreme rainfall, which is rare, has:

In the last 10 years, what is the rainiest year in your opinion?

Meteorological data :

- Daily CHIRPS data ($0.05^\circ \times 0.05^\circ$):
- Monthly data from the Abidjan Station (DIAP) from 1984 – 2012
- Daily data from the evidence project at St Foi Station from 2016 - 2019

Validation of CHIRPS data :

- The Pearson correlation coefficient
- RMSE (Root Mean Square Error)
- Biases

Calculation of ETCCDI climate indicators (1984-2018)

(http://etccdi.pacificclimate.org/list_27_indices.shtml)

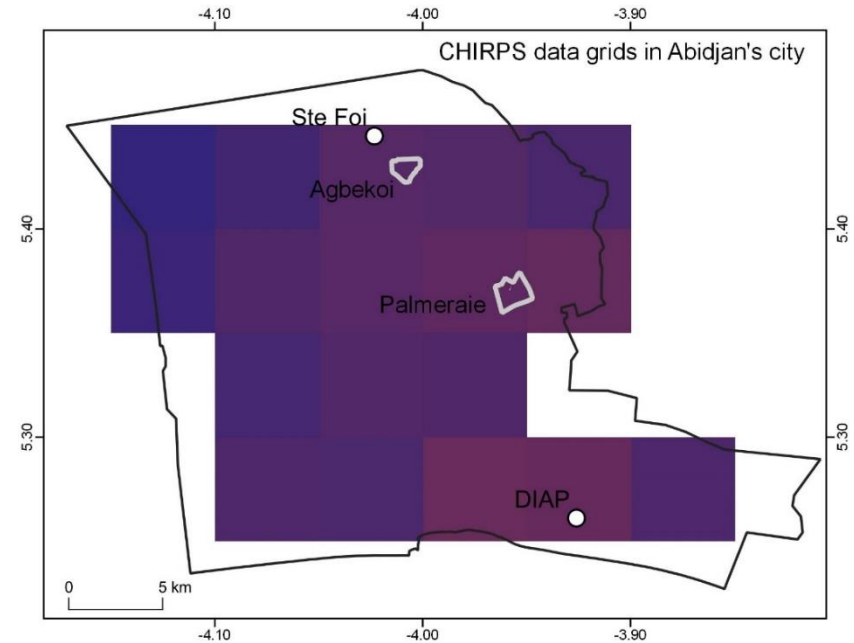
- « PRCPTOT » et « PRCPTOT \geq 50 mm »
- « SDII »
- « R95pTOT » et « R99pTOT »
- « R20mm » et « R50mm »

Calculation of the trend of the climate indicators :

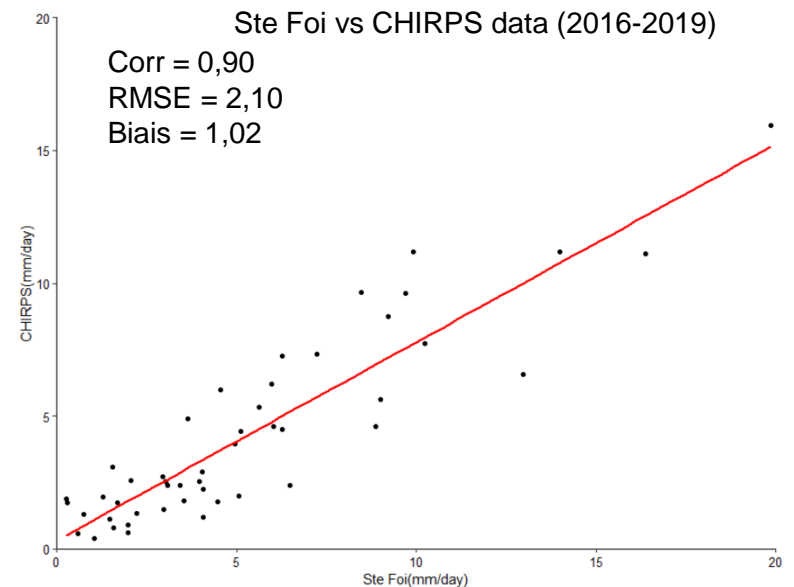
the non-parametric Mann-Kendall test was applied to examine whether or not there is stationarity in the series of indicators.

Perception and flood mapping:

calculation of the global and local Moran's I index to determine the similarity of perception between individuals and the spatial autocorrelation of household flooding or runoff frequency.



○ meteorological station □ district borders □ Abidjan's city border

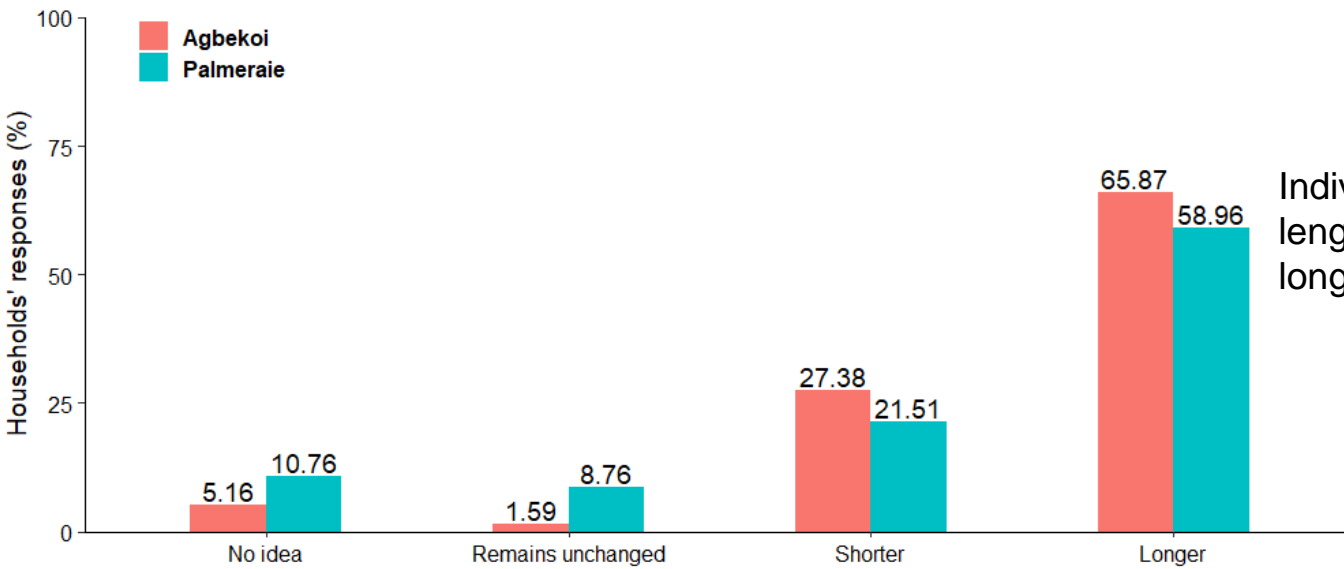
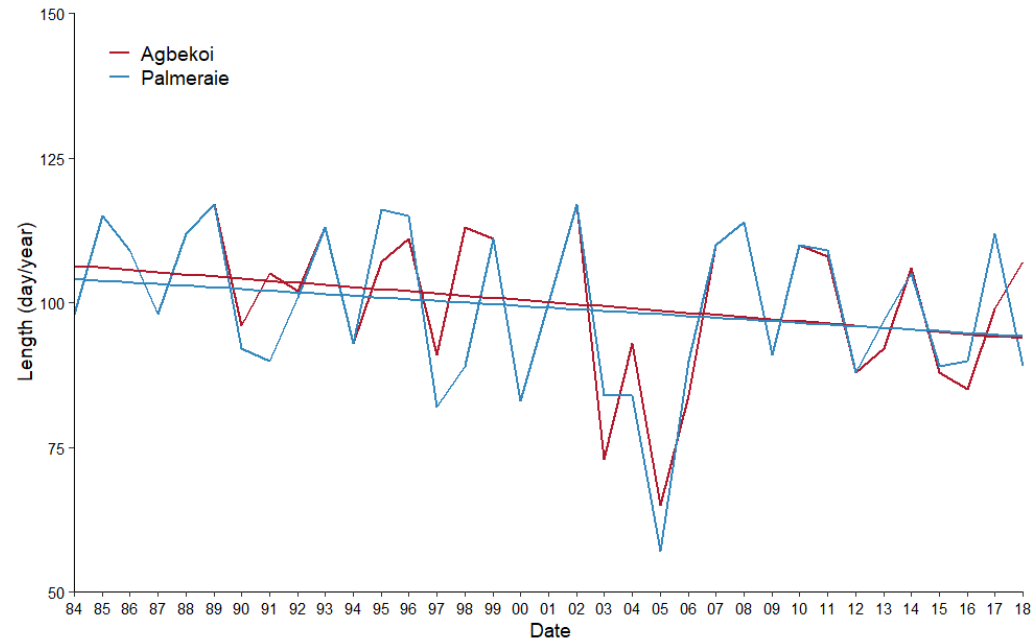


A divergence between the individuals' perception and metric trend

Mann-kendall test confirms a downward trend in the length of the long season in Agbekoi.

Agbekoi ($\tau = -0.22$; $p\text{-value} < 0,05$)**

Palmeraie ($\tau = -0.17$; $p\text{-value} > 0,05$)



Individuals are in agreement that the length of the main rainy season is longer

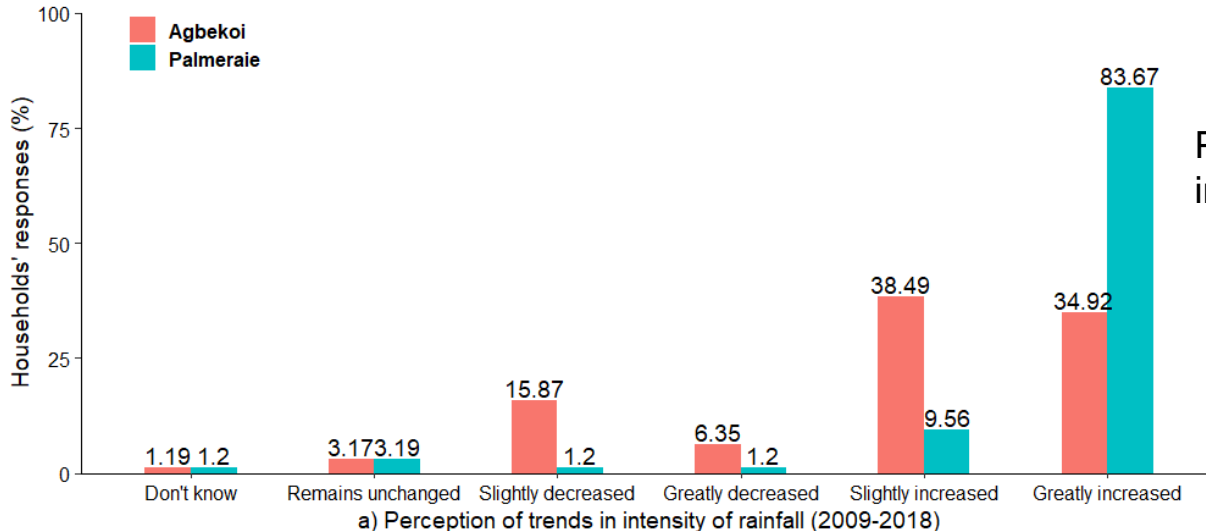
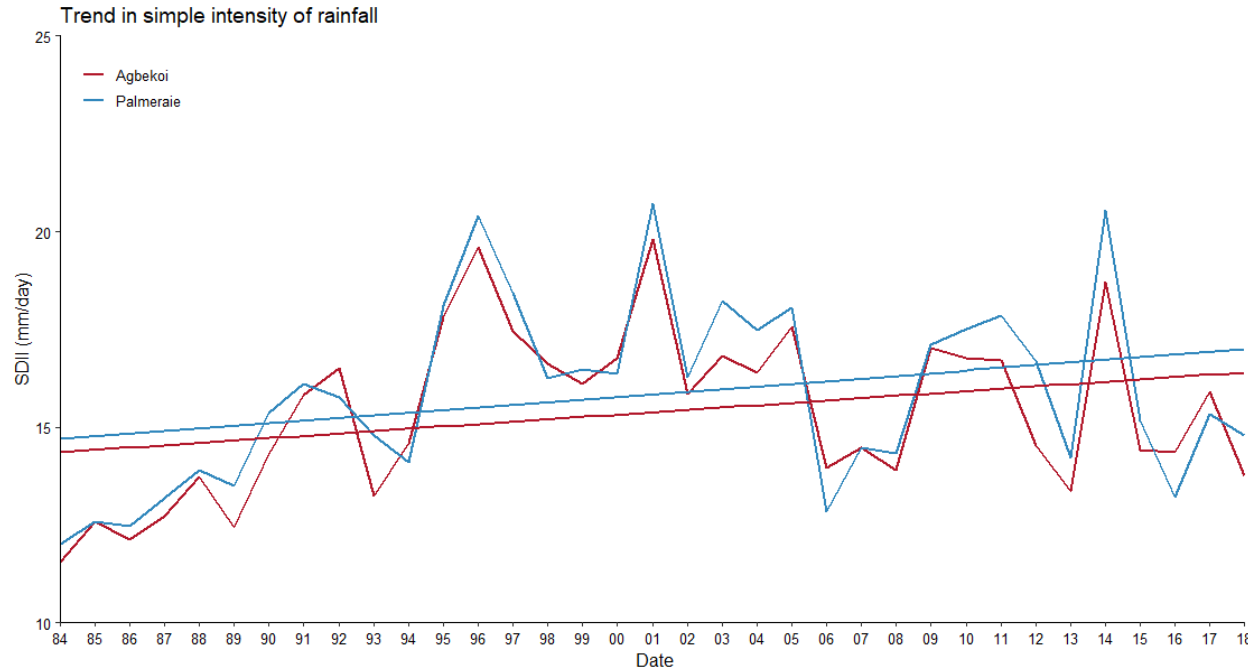
a) Perception of trends in length of long rainy season (2009-2018)

A similarity between individuals' perception and metric trend.

Mann-Kendall test confirms an increasing trend in rainfall intensity in Palmeraie.

Agbekoi ($\tau=0,20$; $p\text{-value}>0,05$)

Palmeraie ($\tau=0,24$; $p\text{-value}<0,05$)**



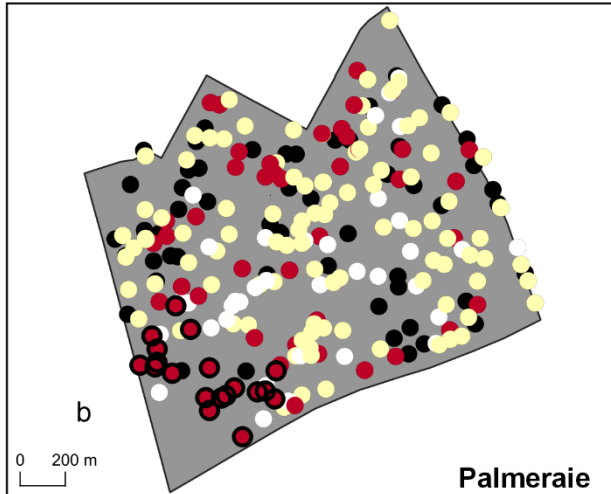
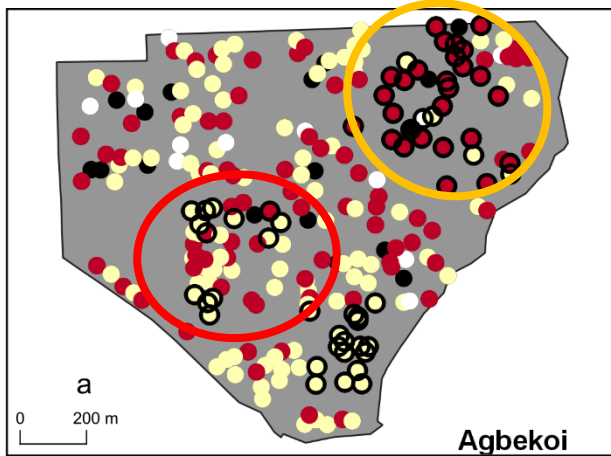
People perceive an increase in the intensity of rainfall.

Results

Spatially heterogeneous perceptions

Diverging perceptions between the two sides of Agbekoi: "the north-east side" and "the south-west side"

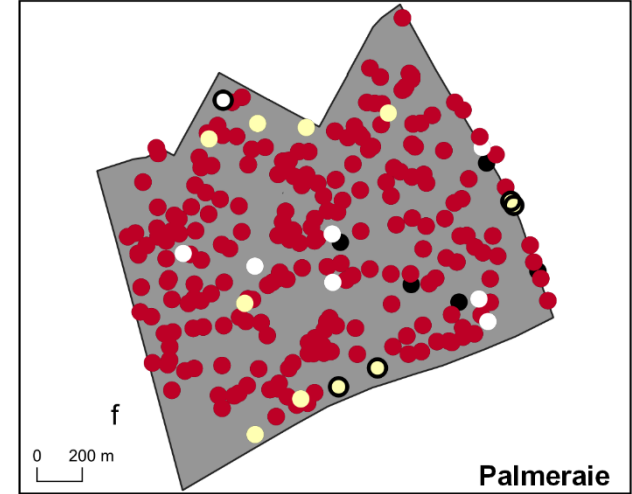
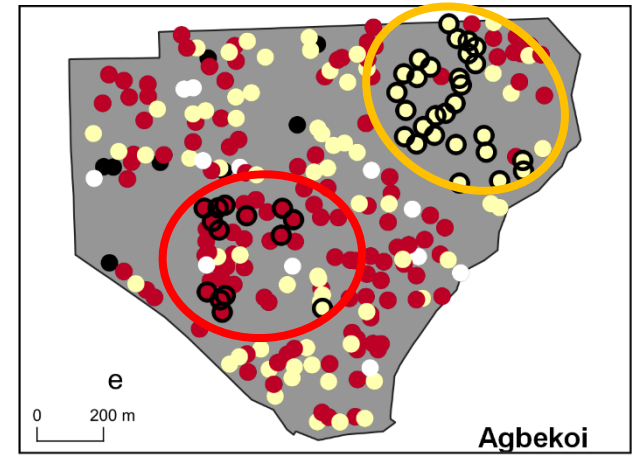
Onset of the long rainy season's perception



Onset of LRS

- Don't know
- Significant cluster
- Early
- District borders
- Similarly timed
- Later

Perception of extreme rainfall



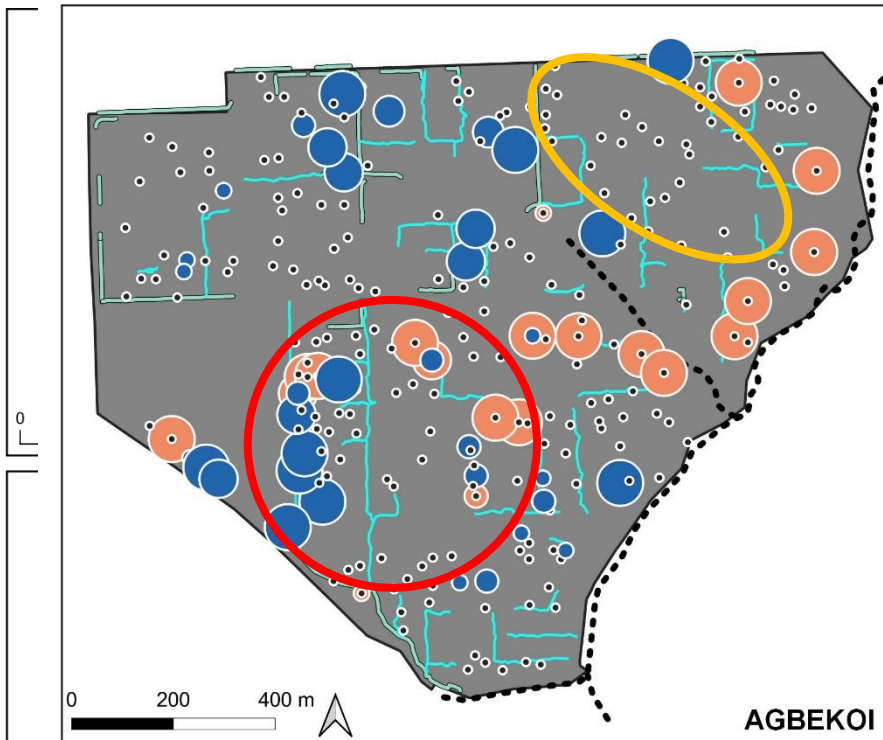
Extreme rainfall

- Don't know
- Significant cluster
- Decreased
- District borders
- Remains unchanged
- Increased

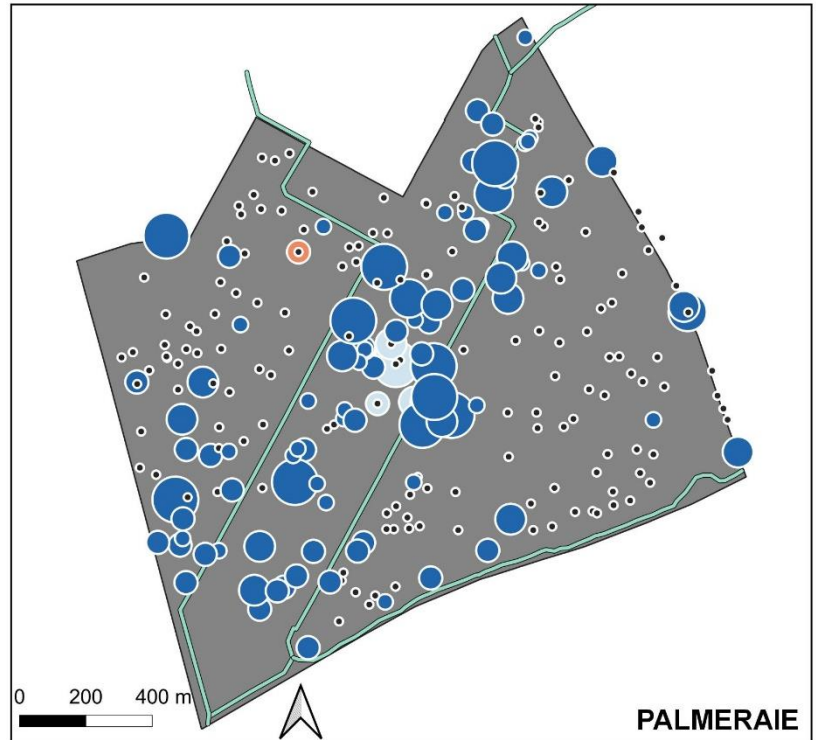
Diverging perceptions between the two sides of Agbekoi: "the north-east side" and "the south-west side"

Onset of the long rainy season's perception

Perception of extreme rainfall



AGBEKOI



PALMERAIE

flooding frequency

runoff frequency

frequency of both events

hydrographic system

• none

• none

• none

— water channels

• 1

• 1

• 1

— streams

• 1 - 3

• 1 - 3

• 1 - 3

--- gully

• 3 - 5

• 3 - 5

• 3 - 5

0

0

0

• 5 - 8

• 5 - 8

• 5 - 8

• 8 - 10

• 8 - 10

• 8 - 10

Discussions

- The individuals surveyed perceive a later end and a longer duration of the long rainy season in the period 2009 to 2018, whereas the measured trends show an earlier end and a shorter duration of the long rainy season :
 - The majority of persons surveyed practice a profession in urban environment in the public or private sector, professions that are relatively little dependent on the variability of precipitation.
 - In contrast, studies show that farmers seem to perceive the changes in the variability of the climate with a certain precision, since their activity is dependent on the precipitation and the temperatures(Idrissou et al., 2020 ; Kemausuor et al., 2011 ; Nyanga et al., 2011).

- Individuals perceive some events of intense rainfall variability associated with flooding :
 - Leclerc et al (2013) showed that there is an association between the perceptions of individuals surveyed and the experience of the impact of climate change.
 - Other studies have shown that the experience of flooding results in an overestimation of changes in climatic conditions, of the perception of risk and of vulnerability(Demski *et al.*, 2017 ; Haque *et al.*, 2012).
 - Results obtained in the United States have shown that perceptions regarding climate variation may be expressed differently from one neighbourhood to another according to whether the residents live in a flood zone or a non-flood zone(Tripathi *et al.*, 2014).

- ❑ Individuals perceive the extreme aspect of certain climatic events, a perception that is conditioned by their experience of flooding.
- ❑ This study provides evidence of the sensitivity of populations regarding changes in climatic variability.
- ❑ The strategies and the measures of adaptation against climate change should take into account this sensitivity among the populations.

Acknowledgements!

IUSSP and its partners: conference host organization

Financial donors:

- ❖ MESRS de La République de Côte d'Ivoire (CIV)
- ❖ Agence Française de Développement (AFD)
- ❖ Institut de Recherche pour le Développement (IRD)

Partners:

- ❖ SODEXAM
- ❖ Emmanuel Paturel