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The factors of the recrudescence of floods and their consequences in the Divo district in the municipality of Koumassi

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Abstract

The commune of Koumassi is a local authority with legal personality and financial autonomy. It is a residential commune which has benefited from a development plan. However, despite the preventive measures taken by the public authorities to eradicate flooding in the commune, there has been an upsurge in flooding, especially in the Divo district. The aim of this study is to highlight the factors that amplify this hazard and their consequences. The methodological apparatus used to carry out this work combines bibliographical research, a field survey and interviews. The results obtained show that heavy rainfall, morpho-structural soil conditions and human factors such as the consumption of space in all its forms by urbanisation and the occupation of drainage networks, constitute the basic foundations for the occurrence of flooding in the Divo district. The manifestation of this hazard leads to consequences such as environmental degradation, health problems, material and economic damage.

Keywords: Divo, Koumassi, neighbourhood, floods, Causes, Consequence

Introduction

The flood risks to which humanity is confronted constitute a major concern for all social strata, as global climate change is worrying. Floods are emerging as the category of natural disasters whose impact has experienced the most worrying growth. In fact, it is estimated that between 1980 and 2004 more than 500 million people on average were affected by floods each year around the world, including 400 million in Asia. They cause more than 25,000 deaths per year. Also, the forecasts are still alarming. They show that by 2050, some 2.5 billion people would be vulnerable to catastrophic floods due to factors such as population growth in flood-prone areas, climate change, rising sea levels and rising sea levels deforestation (Collin, 2004).

Located in the south of the Ivory Coast, Abidjan, the economic capital is an area where it rains heavily. The city is located in a subequatorial, hot and humid climatic zone, which has two rainy seasons and two dry seasons (Kerstin et al., 2012). This transitional equatorial climate regime recorded annual average precipitation of 1500 to 2400 mm from 1980 to 1996 (JICA, 2001; Goula, 2005). In addition, on the strength of its many economic and administrative advantages, Abidjan is attracting more and more people. This rapid increase in the Abidjan

population is leading to the birth of spontaneous neighborhoods scattered throughout the city of Abidjan in non-aedificandi areas exposing populations to many natural hazards (floods, landslides, landslides, etc.). With 20.8% of the total population of the Ivory Coast, the urbanization of the city of Abidjan is going at a very accelerated pace. Koumassi, one of the residential communes in the city of Abidjan, is no exception to this situation. Although it benefited from an urban development plan at the time of its construction, the municipality of Koumassi has a host of spontaneous neighborhoods that are recurrently exposed to flooding during rainy periods. The most remarkable are those of June 2005, May 2007, May 2008 and from June 2012 to 2018 (Alla, 2013; Brou, 2007). The Divo district is one of the spontaneous districts of Koumassi where the vulnerability of urban populations to disasters and natural risks increases considerably (ANDE, 2003; Dachary, 1990; Géocarrefour, 2000). They are therefore exposed to serious risks, that is to say to the triggering of destructive natural phenomena, which may affect people and their property (Bailly, 1996; Kassy, 2004).

This work highlights the causes of the floods and their consequences in the commune of Koumassi. To achieve this objective, the following methodological approach was adopted.

Materials and methods

Synthetic aspect of the study area

The Divo district located to the north-east of the commune of Koumassi and bordered by the Ebrié lagoon (figure 1), is a wastewater discharge zone and covers an area of 1,253 km2. This is one of the many spontaneous neighborhoods in the town, which was home to around 16,425 inhabitants in 2014 according to the general population and housing census.

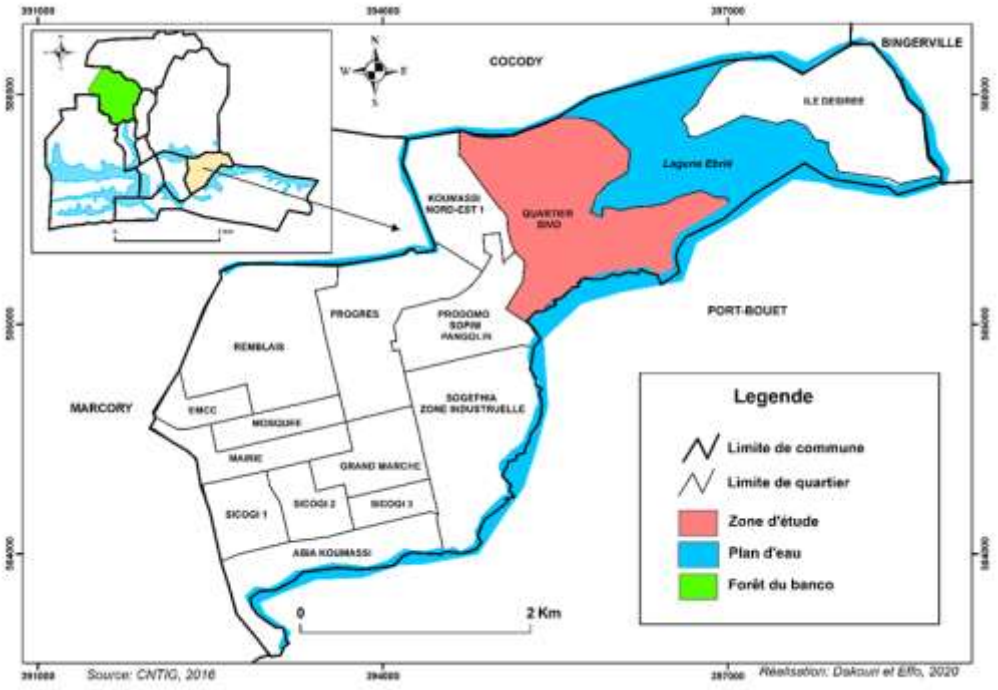

Figure 1: Location of the Divo district

Data collection technique

The methodology used for this study is a qualitative approach that combines documentary research, field observation and investigation, and interviews. Documentary research was done in libraries and on the Internet. The documents consulted are theses, theses, dictionaries, books and scientific articles relating to the theme of floods. This documentation, which offers a global and theoretical perspective on the theme, has made it possible to highlight the causes and consequences of flooding in the Divo district of the municipality of Koumassi.

The observation was a participant and made it possible to verify the information contained in the literature in order to lay the foundations to help make a rigorous argument. The direct observation and the questionnaire survey took place through several field visits and often even while it was raining heavily. The field surveys took place from July to September 2018. These made it possible to collect a great deal of information from the populations and to take photos. Interviews conducted with agents from the town hall's technical service provided information on flood management in the town.

In the absence of an official database on the Divo district, the non-probability approach was adopted to define the sample. This used the reasoned choice approach, which consisted in choosing households on the basis of criteria deemed relevant. These include, among other things, being a resident of the neighborhood, being the head of the household,

education level, age, gender, profession, etc. Sixty (60) people in total were interviewed. This sample results from the information saturation principle of A. Pires (1997, p.67), that is to say the threshold from which the answers provided by traders no longer vary, is reached.

The data obtained were used using Word software for entering text and Excel for the construction of tables and graphs. Arc view software was used for making the maps. This adopted methodology made it possible to structure this work around the following points: the factors triggering the floods in the Divo district and their consequences.

Results and analyzes

The factors triggering the floods in the Divo district of Koumassi

Favorable natural factors

The space covered by this study is the Divo district located in the northeast of the commune of Koumassi. Analysis of the geographical context of this area clearly shows that there is a risk of flooding. On the topographic level, the relief is a coastal plain, the weakness of the slopes (0 to 2%) and altitudes make any flow of rainwater difficult.

Geologically, the plain is made up of argillaceous sands and Quaternary marine sands, as well as fluvio-lagoon formations as also attested by the work of D. A. Alla (2013, p.7). Therefore, the existence of marshy areas and the proximity to the water table make it a particularly difficult area to build, due to the problems of drainage of rainwater. The town is heavily watered with rainfall that can reach about 676 mm (Figure 2).

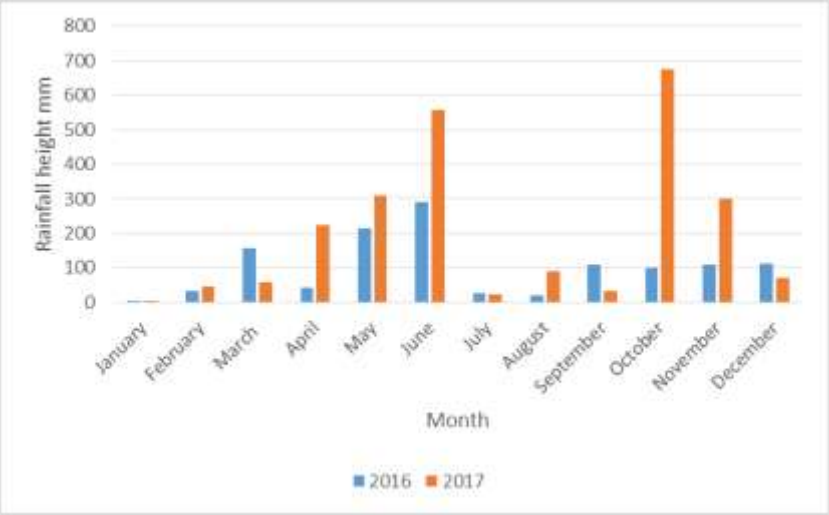

Figure 2: Distribution of 2016 and 2017 rains in the commune of Koumassi
Source: SODEXAM

They focus on two periods: April to June, during which 46% of the total rainfall for the year falls, and October-November. But more significant are their violence and intensity, with daily rains that can reach 10 mm. These heavy rains, in an environment where the relief is too flat and the soil too fragile in view of their low resistance, quite naturally exposes the Divo district to flooding (photo 1).

Photo 1: View of the flooded Divo district
Photo: Doumbia, 2018

Although these hazards are evident, the growing pauperization, the consumption of space in all its forms due to the lack of building land in the municipality and the vertiginous increase in the population, push it to occupy marshy areas, thus exposing to flooding.

Human factors as a source of flooding in the Divo district

In urban planning, according to EK Kra (2014, p. 86), the precariousness of a district is defined as a space marginalized in two distinct aspects by: - the absence or insufficiency of basic social infrastructures, in particular primary establishments and / or secondary, health centers, modern drinking water distribution systems, electricity, housing development and / or sanitation, access roads, etc.; - the poverty of the populations who live there, the inaccessibility to basic social services, housing built with recovered materials, materials of the plant or earth type (mud) with wooden frames, etc. Thus, during the surveys for this study, 80% of the dwellings enumerated in the Divo district are houses built in precarious materials (wood, metal sheets, black bags, bricks) and lacking in convenience (photo 2).

Photo 2: Precarious housing in Quartier Divo
Photo: Doumbia, 2018

These makeshift dwellings, built in the absence of a real previously designed urban plan, have become familiar with an unhealthy environment characterized by the flow of wastewater and garbage that lies here and there. In addition, the only gutter that is still in good condition is constantly blocked by sand and plastic bags. Inside the district, the open pipes planned to evacuate domestic and rainwater wastewater are mostly occupied by buildings (houses, shops, containers, etc.). In addition, there is garbage accumulated especially at the level of constructions on the gutters. The conjunction of these two factors namely: constructions on pipes and heaps of garbage prevent the correct flow of effluents. Thus, wastewater flows constantly all over the neighborhood and during heavy rains, the water from these precarious structures follows the same furrows of wastewater to flood the streets of the neighborhood (photos 3 and 4).

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Photo 3 : Waste water flow
Photo: Doumbia 2018

Photo 4: Constructions on the pipes
Photo: Doumbia, 2018

The outlets and scuppers which are the last points of passage for any type of water coming from their upstream and which lead directly to the lagoon, have unfortunately become veritable spillways of all kinds of garbage to the point of blocking them (photo 5 and 6).

Photo 5: Clogged outlet near the Fanny Mosque

Photo 6: Clogged outlet in the Divo II district

Photos: Doumbia, 2018

The obstruction of these outlets and scuppers also preventing the normal flow of rainwater is one of the recurring human factors that is at the base of the floods in the Divo district during the rainy seasons. To this, we must add that the drainage network of the commune of Koumassi, which dates from the 1960s, from which the Divo district benefits, is obsolete and obsolete, and cannot meet the needs and expectations of the populations.

Multiple consequences and at several levels

At the human level

Unlike other communes in the city of Abidjan where the floods have been deadly, Koumassi has so far recorded no loss of life. However, the 2017 floods during which some outlets had disappeared under the water causing an incredible overflow of the lagoon and the flight of most of the lagoon residents show that the Divo district is not immune to deadly floods. At the end of the investigations, the human consequences of the floods in the Divo district boil down to discomfort, hunger, pain and trauma of the populations, and even health.

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Health consequences

The significant urban development in the Divo district, a flood-prone area, has considerably increased the exposure of the population. Various health consequences were recorded during the floods. Some of them occurred during the hazard, others after, including during the clean-up phase. Some of these consequences lasted only as long as the flooding occurred, while others evolved slowly or appeared after a while.

Among the impacts noted during the survey, as confirmed by the work of Tairou (2011), there are in particular injuries, poisoning, gastrointestinal illnesses and psychological distress. These consequences or health risks are linked to possible contamination through contact with water, which has been contaminated by human and industrial waste discharged from the sewers. It may contain microorganisms, such as bacteria, viruses and parasites, which can cause dermatitis and infections. Thus, the consequences of the floods in the Divo district on the health of the populations are multiple and grouped into three categories. These are infectious diseases, psychological illnesses and physical injuries. Analysis of Figure 3 shows that the most common illnesses among surveyed flood victims are infectious diseases (75%), physical injuries (20%) and psychological illnesses (5%).

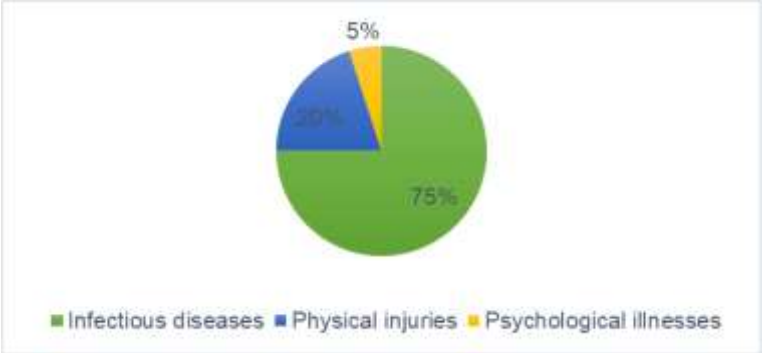

Figure 3: Distribution of the health consequences of flooding in the Divo district
Source: Doumbia, 2018

Similar more detailed results were obtained by Assogba (2010) during his work on the influence of Lake Nokoué and the channel on flooding in the city of Cotonou. He maintains that dermatoses (51%), malaria (50%), respiratory diseases (26%), cholera (18%), diarrhea (17%) and ENT infections (17%) are the health consequences the most important ones related to flooding. Only a few cases of chronic fatigue due to hunger (10%), injuries from accident, electrocution or bite (7%), ulcer (6%) and typhoid fever (2%) were mentioned. Infectious diseases (cholera, malaria / malaria, disease, leptospirosis, yellow fever) and skin or respiratory infections can be caused directly after the flooding or following a lack of hygiene (Coulombier et al., 1998; Khandlhela and May, 2006). In its summary report of the day of reflection on the socioeconomic and health consequences held in 1998, the Initiative for an Africa Solidarity (IAS) identifies as the main health consequences of floods, malaria, diarrheal diseases, typhoid fever, dermatosis and conjunctivitis. A study by Soton (1995) to determine environmental health indicators in Cotonou showed that people living in flooded areas had six times more malaria than others. This same study maintains that people living in neighborhoods established in swampy areas or on the edge of Lake Nokoué have twelve times more diarrhea than those living in healthier places.

The vulnerability to gastrointestinal diseases during floods is therefore very real in the Divo district. However, it depends on various risk factors, in particular the state of health of the person and their gender, since women are more at risk of diarrhea than men (Tairou F., 2011). Other factors include, in particular, exposure factors, including contact with water in the flooded area, the water level in the disaster area and the type of drinking water source. In fact, the field survey revealed that 102 in contact with contaminated water were infected with respiratory and skin infections as well as transmissible diseases. The study of the Center for Disease Control and Prevention, (2005) and that of L. Brown and V. Murray, (2013) lead to the same conclusion.

Psychological illnesses result from a mental worsening that can be observed within a population, as a result of floods (loss of relatives, material goods, etc.). These diseases are characterized in many ways (loss of reality, nightmare, etc.) and can play a major role in the deterioration of a person's physical condition (Alderman et al., 2012).

As for physical injuries, this refers to fatal traumas that occur during evacuation or clean-up operations. These traumas are small tears or punctures due to the presence of nails or broken glass. There can also be electrocutions and even poisoning. Contamination by toxic chemicals during flooding is theoretically possible, but to date no verifiable correlation has been observed or measured in this area at Cocody.

In addition, the survey revealed that 61% of those questioned confirmed the presence of mold in their homes after the floods. However, these have many impacts on the health of the inhabitants, as argued by M. A. D'halewyu, (2002) and the environment.

At the environmental level

The consequences of floods are first of all environmental before they are sanitary (S. N. Jonkman et al., 2009). Thus, we can succinctly retain: accentuated insalubrity due to the mixture of household waste, sanitary water (septic tanks) with strongly nauseating odors. In fact, solid and liquid waste ends up outside the pipes during floods, remaining in the maze of the neighborhood and dirtying the ground, the initial color of which changes and becomes blackish. The floods provide the Divo district with an altered landscape (photos 7 and 8) with the presence everywhere of garbage ((plastics, animal frames, cooked food, scrap metal, wood, etc.) and wastewater after torrential rains.

Photo 7 : The Divo district after flooding

Photo 8 : Garbage dump on lagoon borders

Photos: Doumbia 2018

In addition, the water table, without sparing the lagoon, which is the reception point for all waste, is very quickly polluted by wastewater which infiltrates it due to its proximity. Although sharing the results of this study on the negative consequences of floods, according to Kaman the Awareness Guide on Disaster Risk Reduction in Côte d'Ivoire (2011, p. 49) reveals that floods have some positive impacts. First, they are responsible for the deposits, enrichment and moisture so necessary for fertile soils. The soils of flood-prone areas are the most productive sectors of the market garden. Then, the floods allow the retention of water and the recharging of the underground aquifers and finally, they supplement the level of the water reservoirs and therefore guarantee the generation of hydroelectricity.

Numerous material and economic damage

Floods sometimes have disastrous and worrying repercussions on the lives of victims. Life is therefore the first and most important thing to safeguard in these serious and benign situations. Thus, in the event of threatening floods, families seek their own salvation first. The rescue of material and economic goods relegated to the background, causes them to suffer a lot of damage. Thus, as shown in Figure 4, almost all of the respondents, i.e. 95%, suffered enormous material and economic damage.

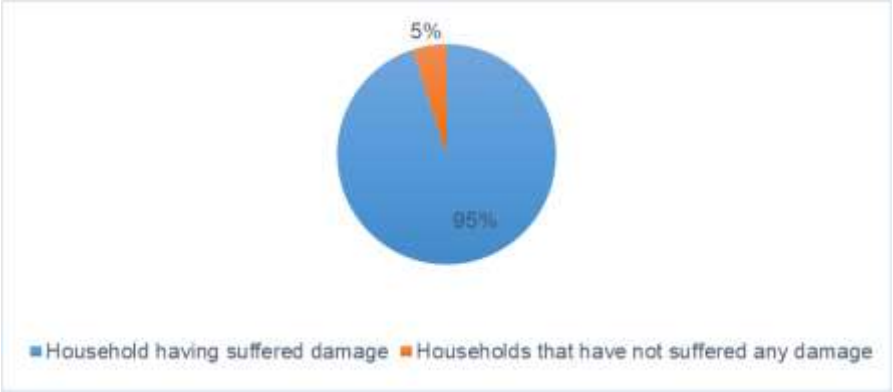

Figure 4: Distribution of households according to damage suffered or not

Source: Our field survey, 2018

The nature of damaged goods includes appliances, furniture, clothing, documentary goods, food products and real estate. The most serious of all is the subsidence or sinking of houses due to the high humidity in the soil and the lack of technical expertise in favor of the types of constructions suitable for this type of land. The work of AD Alla (2013) reveals the same consequences while underlining that in a plain zone, whether on the lagoon edges where the backfills made by the populations are not always solid or on the sandy and fluvio-lagoon formations. Of the island of Petit-Bassam, there is a subsidence of houses. Likewise, in addition to dwellings, floods destroy rice and cassava fields in the district of Blokosso 1 in the city of Man, K. M. Brou, (2015, p. 172 - 173).

As for the economic consequences of floods, they encompass those of all areas, that is to say: the material, human and environmental consequences. Indeed, the degradation of all these areas generates undeniable economic losses and their rehabilitation requires significant financial resources. The economic damage also concerns the many bitterness caused to people through the exercise of their various activities. Indeed, during or after the rains most of the streets of the Divo district are flooded and impassable. This has the corollary of the temporary interruption of local activities, the difficult movement by foot or by vehicle (cars, motorcycles, bicycles and carts) thus causing delays or absences from work.

Conclusion

At the end of this study, it emerges that the flooding is a natural disaster which seriously threatens the inhabitants of the Divo district in the commune of Koumassi. These poor populations who live in this precarious neighborhood are increasingly vulnerable because of the too close proximity of the Ebrié lagoon. The upsurge in flooding in this area is a combination of both natural and human factors. The plain relief characterized by the weakness of the slopes and altitude, the texture of the soil made up of clayey sands and Quaternary sea sands as well as the fluvio-lagoon formations and the high rainfall constitute the natural factors. Whereas the human factors boil down to construction on the pipes, the dumping of garbage on the passage of water and non-compliance with the urban planning regulations in force. Environmental degradation, health problems, material and economic damage are all negative effects generated by the floods in the Divo district. In view of the extent of the damage caused by the floods in the Divo district, the public authorities are therefore called on to remedy it very urgently.

References

Alla D. A. (2013). *Risques naturels dans l'agglomération d'Abidjan (Côte d'Ivoire).* Thèse de doctorat d'Etat en Géographie, Université Félix Houphouët-Boigny. 385 p.

Assogba L. P. (2010). *Etude de l'influence du lac Nokoué et du chenal sur les inondations dans la ville de Cotonou au Bénin.* Diplôme d'ingénieur de conception en aménagement et protection de l'environnement, Université d'Abomey-Calavi Bénin, 44p.

Bailly S. A. (1996). *Environnement, risques naturels, risques de société in risques naturels de Société.* Paris. Economica, 103 p.

Boubchir. A. (2007). *Risque d'inondation et occupation des sols dans Le THORE (région de LABRUGUIER et de MAZAMET*, mémoire de master1, Université Toulouse le Mirail, 64p.

Brou K, M. (2007). *Les risques d'origine naturelle en milieu urbain : Le cas des inondations dans la commune de Cocody*. Maîtrise de Géographie, Institut de Géographie Tropicale (IGT), Université de Cocody, 163 p.

Brou K. M. (2015). *Croissance urbaine et risques naturels en milieu de montagne : l'exemple de Man (Côte d'Ivoire).* Thèse unique de Géographie, Université Félix Houphouët Boigny de Cocody-Abidjan, 304P.

Brown L., Murray V. (2013). "Examining the relationship between infectious diseases and flooding in Europe: A systematic literature review and summary of possible public health interventions". *Disaster Health*, vol. 1, n° 2, pp.117-127

Centers for disease control and prevention (2005). "Infectious disease and dermatologic conditions in evacuees and rescue workers after Hurricane Katrina--multiple states", *MMWR Morb Mortal Wkly Rep,* vol. 54, n 38, pp.961-964

Coulombier D., Ledrans M., Malfait P., Valenciano M. (1998). *Mission épidémiologique sur les conséquences sanitaires du passage de l'ouragan Mitch en Amérique Centrale*. Institut National de Veille Sanitaire [en ligne, consulté le 22 mars 20], 306 p.

D'halewyu M.A. (2002). *Les risques à la santé associés à la présence de moisissures en milieu*. Institut National de la Santé Publique du Québec, Canada, 166p.

Geocarrefour. (2000). *L'interface nature-Sociétés dans les hydro systèmes fluviaux*. Revue de Géographie de Lyon, Volume 75, n°4, 382 p.

Initiative pour une Afrique Solidaire (I.A.S.). (1998). *Les inondations au Bénin : conséquences socio-économiques et sanitaires.* Rapport de journée de réflexion, 53p.

Jonkman S. N., Maaskant B., Boyd E., Levitan M. (2009). Loss of life caused by the flooding of New Orleans after Hurricane Katrina: analysis of the relationship between flood characteristics and mortality. *Risk Analysis,* vol 29, n° 5, pp.676-678

Kaman Paul. (2011). *Guide de Sensibilisation sur la Réduction des Risques de Catastrophe en Côte d'Ivoire.* Ministère de l'environnement et des eaux et forêts, ISDR, 115p.

Kassy L. P. (2004). Site urbain, assainissement et risques naturels à Grand-Bassam. Mémoire de maîtrise, Institut de Géographie Tropicale (IGT), Université de Cocody, 196 p.

Khandlhela M. et May J. (2006). "Poverty, vulnerability and the impact of flooding in the Limpopo Province, South Africa". *Nat Hazard*, 39, pp.275–287. [en ligne, consulté le 22 mars 18]

Pires A. (1997). *La recherche qualitative. Enjeux épistémologiques et méthodologiques*. Montréal: Gaëtan Morin, Éditeur, 405 pp.

Soton A. (1995). Analyse des indicateurs de santé environnementale pour une prise de décision. Etude de cas à Cotonou pour l'OMS.

Tairou F. (2011). *Proposition d'indicateurs aux fins de vigie et de surveillance des troubles de la santé liés aux précipitations non hivernales, aux inondations, aux glissements de terrain et à la sécheresse.* Institut National de Santé Publique du Québec, Canada, 91p.