



On the predictability of flash floods and their impacts in North Malawi (ECHO-III Project)

FIELD DATA COLLECTION PROGRAM AND PROTOCOLE
LILONGWE AND NORTH MALAWI

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1- Introduction

As part of the 2 years ECHOIII project of the Netherlands Red Cross on Preparedness for response and Early Action in Malawi, focussing on Karonga and Chitipa Districts, a field data-collection can be organised on the predictability of flash flood and their impacts in North Malawi.

Flash Flood context:

Flash floods are recurrent across the globe and responsible for large damage but their root causes, occurrences and impacts are not fully understood. Compared to Riverine floods, flash floods are more challenging to detect, due to their small temporal and spatial extent. The differentiation between flood type events is, however, often not easy at flood forecasting and emergency response scale.

Global and regional available rainfall prediction are often lacking the required details needed to detect flash flood triggering convective events of typically 1-2 km resolutions. In addition, as often is the case in developing countries, the lack of hydrological monitoring data and resources make the development of sophisticated flash flood forecasting systems and their calibration difficult. Often, the only available information comes from post-event humanitarian response reports, and data on vulnerabilities and exposure to flash floods is often insufficient.

Humanitarian actors want to get a better understanding of flash flood processes and occurrences in vulnerable areas and assess the ability to predict flash floods and their impacts to decide in advance and more precisely where to take humanitarian action, but are hampered in this effort considering, amongst others, the limited data availability and access in developing country.

Study objectives:

With this study, we want to develop an approach that can help predicting the occurrence of flash floods and their impact in data poor countries. We need to build an understanding of the factors increasing the probability of occurrence of flash floods, such as geomorphologic, hydrologic and meteorological, and analyse how to relate them to impact-based flash flood severity classes, potentially linked to emergency preparedness actions.

A simple methodology should be considered, easy to use, understand and communicate, integrating communities risk knowledge and interpretation, as well as open-source data, GIS-based and remote sensing technologies. The emphasis should be done on the universality of the method and the independency from stream gauge data, and will be tested in the Northern part of Malawi.

Objective of the research and field data collection:

Can catchment characteristics and global hydro-meteorological conditions, together with local flood risk knowledge help to predict flash flood occurrence and their impacts in North Malawi?

In order to understand what are the main factors that underlie the predictability of flash flood in North Malawi, we first need to build a knowledge base about the spatial and temporal occurrence and impacts of flash floods in North Malawi from different sources. The objective is to collect information on occurrence and impact of flash floods in North Malawi, and deeper explore people's knowledge on flood hazard and the conditions that lead to flash floods in this area.

Justification: There is a lack of records of historical data on location and impact of flash floods in Malawi, which is a crucial information gap for disaster responder (van den Homberg, et al., 2018).

There is no information of flash flood occurrence when there is no or few impacts. In addition, the differentiation between riverine flood and flash flood events in reports and news-paper is not clear.

- Local knowledge would be an extremely valuable additional source of information. Data might also be found in official records from regional offices visit.
- In addition, exploring people's knowledge on the conditions that lead to flood can be a very interesting link to the hydro-meteorological factors leading to flash-flood in Malawi. It might also help communities to build trust on technical warning information if this is based on their observation knowledge.

Quick first screening of flash flood affected areas in North Malawi

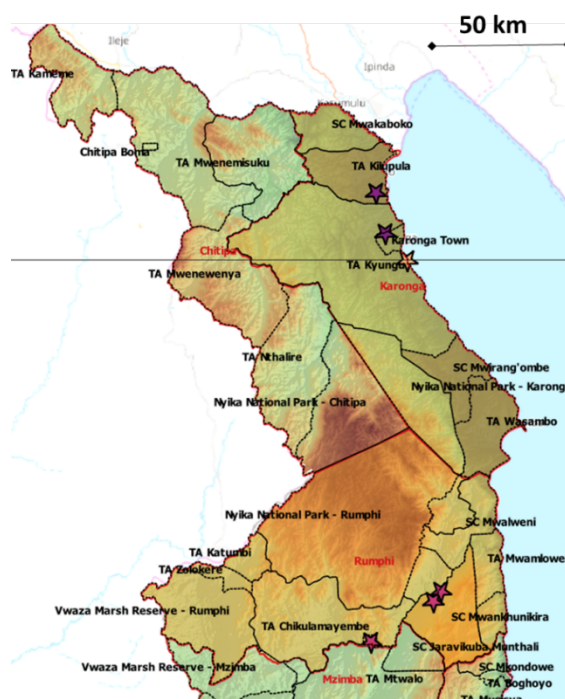


Figure 1: quick preliminary screen of recent flash flood impacted areas (2016-2018) from EM-DAT and floodlist. Light coloured areas are indicative of flash flood prone areas

In April 2017, above normal rainfall affected all Malawi. On 19th of April 2017, extensive flooding affected the Karonga district, damaging infrastructure and displacing families. 55921 people have been affected and 665 houses collapsed (mainly semi-permanent houses). Heavy rainfall from the 12th to 16th April, 2018, resulted in flooding of several rivers in Karonga, affecting 815 households, killing 4 persons and injuring 3. The description: "The rains resulted in flooding of a number of rivers due to bursting or water taking new directions in the process destroying houses, property, injuring people and loss of lives" seems consistent with flash flood processes. Other damaging flash flood events has also been recorded in databases for instance during 2007/2008 wet seasons, around the 5th to 8th of February 2016 in Karonga town and Kilipula TA, and 31st of January 2018 in Kyungu.

A list of rivers and villages affected are described in the Karonga District Council Disaster Contingency Plan (2017/2018).

2- Data collection Program overview:

A program of semi-structured interviews and focus group discussion field data collection of 2-3 weeks is proposed, starting from the National level in Lilongwe, and then held at district, TA and community levels on Northern Malawi.

Type of information to collect:

From National level: Semi-structured interviews

- Information on existing operational local or national Flash flood warning system, SARFFG flash flood guidance map results associated to historical data associated to flash flood
- Rainfall gauge historical data in the North Malawi
- Access to historical database of disaster events and impact for Karonga, Chitipa and Rumphi
- Contact of representative institution at District and TA levels

From District or TA levels: Key Informant Interviews (KII)

- Occurrences of events at different levels: location, frequency, date
- Impact data or proxies that were recorded at village level
- Maybe statistical data at group village level for social vulnerability: population age, sex, gender, activity
- District Contingency Plan
- Name and location of GVH, and contact of village representative

From community level (GHV): Focus Group Discussions (FGD) and KII

- which season it occurs in general (start/end of wet season), duration, extent
- Community knowledge on flash-flood definition and their observation on flood behaviour occurring in the Northern districts
- Conditions leading to flash floods: knowledge on the rivers, river-bed sediments, type of soil or vegetation, observed rain pattern and weather conditions prior to the events, presence of birds or insects; how long before?
- Information on impacts and severity perception: speed, debris, most affected zones, losses, displaced people, crop damage...
- Information on minor events with no or little damage.
- All possibly relevant documentation on the GVH, districts and Ta level should be collected, including: Village Contingency Plans and Action Plans

Field observation:

- Geomorphological observations of rivers and catchment at outlet (width, type of material...)
- Observation on exposure and structural vulnerability.

Where:

At national, district levels Karonga, TA and community levels in Karonga where several villages should be visited. Even though the main focus should be on Karonga district, flash floods processes are all related to the highland topography, therefore the upstream catchments of Chitipa and in Rumphi District on the southern flank of Nyika Mountains.

National level	District Level	TA level	Village level (GHV)
Lilongwe	Karonga	Kyungu Karonga Town Kilupula SC Mwirang'onbe Wasambo Mwakabobo Nyika	To be defined depending on data gathered and discussion at district and TA levels (mainly area affected in 2018?)
	Chitipa	Only TA levels affected by floods	
	Rumphi ?	If time, only TA affected by floods, like probably : Mwankhunikira Rumphi Boma Mwahenga Kachulu Mwalweni Chikulamayembe	

Data quality control: I will use the COREQ checklist method, using consolidated criteria for the reporting of qualitative research (Tong, et al., 2007).

Preliminary program:

Nov/18	sun 11	mon 12	tue 13	wed 14	thu 15	fri 16	sat 17
Morning	field collection planning	MRCR data team meetings	Interviews-National level	Interviews-National level	Travel to Karonga	Briefing with enumerators	group discussion and KII-GVH 2?
Afternoon	field collection planning	Interviews-National level	Interviews-National level	Interviews-National level		group discussion and KII-GVH 1 ?	group discussion and KII-GVH 3?

Nov/18	sun 18	mon 19	tue 20	wed 21	thu 22	fri 23	sat 24
Morning	Geomorphology/hydrology observations	KII district/TA level - Karonga	KII district/TA level - Karonga	group discussion and KII- GVH 5	group discussion and KII- GVH 7	group discussion and KII- GVH 9	Travel to Lilongwe
Afternoon		KII district/TA level - Karonga	group discussion and KII- GVH 4	group discussion and KII- GVH 6	group discussion and KII- GVH 8	KII district level - Rumphi	

3- Strategy at National level:

Who to interview:

- Initial list of institution and university to approach:
 - Department of Disaster Risk Management (DoDMA)
 - Ministry of Finance, economy and development – Malawi Flood Emergency Recovery Project (MFERP)
 - Department of climate change and Meteorological service (DCCMS)
 - Ministry of Agriculture, irrigation and water development (MoAIWD)
 - University of Mzuzu - Department of Soil, Environment and Land management
- Initial list of NGO to approach:
 - Malawi Red Cross Society
 - UNICEF
 - Salvation Army
 - FOCUS
 - Self Help Africa
 - Save the Children
 - UNDP M-Climes project
- Objective d objectives of National interview for the ECHO-III project on flash-flood:
 - MRCS : Access to flood post-disaster reports, response, and contact in North Malawi.
 - DODMA : access to historical flash flood events database and associated impacts, for Karonga, Chitipa and Rumphi districts.
 - DCCMS : Ask for access to rain gauge database historical records and access to detailed archives reports and data from the SARFFG (South African Flash Flood guidance).
 - MoAIWD : Ask for river stage historical data in North Malawi (not priority)
 - University of Mzuzu: Knowledge on soil data, geomorphology and associated flash flood risks and Malawi climate
 - NGO (including MRCS): knowledge on flash flood response and access to post-disaster response reports
 - In addition, interviews are an opportunity to get some contacts in Karonga

Questions at National level:

1. **Are you familiar with the difference between riverine flood (slow onset flood) and flash floods?** What is the typical duration and extent of flash floods in Malawi?
2. **What is your knowledge on the spatial and temporal occurrence of flash flood in Malawi**
 - Are flash floods frequent in Malawi?

- Which area are experiencing more flash floods in Malawi?
- Is there a period of the year more prone to flash flood?
- What is the specificity of floods in North Malawi and Karonga Districts ?
- Who is responsible for recording flood historical events in Malawi?

3. Are there records of flood impacts in Malawi?

- What is for you the main impacts of flash flood in Malawi? (fatalities, crops, structural damage, long-term?)
- Do you know what kind of impact data or proxies are recorded for floods at village level ?

4. Root causes and pre-conditions :

- Do you know what are the main factor leading to flash floods in Malawi?
- To you, is rain duration and intensity always the main trigger?
- Is there some area where catchment characteristics could be a driver?(ex: Slope, number of stream, land-use...)
- Are flash floods always occurring when the soil is already saturated?
- Are flash floods always occurring in ephemeral streams?

5. What do you know about the operational Flash Flood guidance in Malawi, part of the Southern Africa Regional Flash Flood System (SARFFG)?

- Any information on existing operational local or national Flash flood warning system...
- Could we access SARFFG flash flood guidance map results associated to historical flash flood data?

6. How to get more information on flash flood occurrences and impacts in North Malawi?

- Could we have access to Rainfall gauge historical data in the North Malawi ?
- How to get historical database of disaster events and associated impact for Karonga, Chitipa and Rumphi Districts ?
- Do you have some contact at Karonga, Chitipa and Rumphi district level who could help up understanding Flash flood risks and access historical records?

4- Strategy at District and TA levels (KII):

Who to interview :

We expect to find participants in Karonga district by snowballing sampling approach

Ideal list of KII At district level :

- Representative of Karonga District Council Civil Protection Committee (DCPC): the technical committee on Disaster Risk Reduction which advise the District Executive Committee on issues related to disasters
- Heads of government sector
- Representative NGO in Karonga
- Malawi Red Cross local team
- District commissioner
- DoDMA District Desk Officers
- Representative from Department of Agriculture
- Representative from Department of Forestry
- Representative from Department of Community Development
- Representative from Meteorological Services
- Representative from Department of Water Resources

KII At Traditional Authorities level: Area Civil Protection Committee (ACPC), responsible in DRR should be contacted:

- TA Kilipula ACPC
- TA Mwakaboko ACPC
- TA Mwirangombe ACPC
- TA Kyungu ACPC

Sampling approach for KII at district and TA levels

- Try to Arrange meetings in advance: people tend to be busy!
- Interviews preferably conducted in English

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Questions at Districts and TA levels:

- 1. Are you familiar with the difference between riverine flood (slow onset flood) and flash floods in your district/TA ?**
- 2. (if experienced) What is the spatial and temporal occurrence of flash flood in your district/ TA**
 - What are the characteristics of floods in your Districts/ TA (extent and duration of a flash flood) ?
 - Which area, which rivers are experiencing more flash floods?
 - Is there a period of the year more prone to flash flood?
 - Do you remember a major recent flash-flood event you could describe ?
 - Who is responsible for recording flood historical events ?
- 3. Root causes and pre-condition:**
 - Do you know what are the main factors leading to flash floods in your district/TA?
 - To you, is rain duration and intensity always the main trigger?
 - Is there some area where catchment characteristics could be a driver?(ex: Slope, number of streams, land-use...)
 - Are flash floods always occurring when the soil is already saturated?
 - Are flash floods always occurring in ephemeral streams?
 - Is there some indigenous knowledge on signs prior to flash flood : Meteorological, animal behaviour, plants and soil moisture...
- 4. Are there records of flood impacts in your district /TA?**
 - What are the main impacts of flash floods? (fatalities, crops, structural damage, long-term?)
 - Do you know what kind of impact data or proxies are recorded at village level
 - Which villages are more vulnerable and why ?

5- Strategy at Community level :

We will conduct Focus group discussions (FGD), in different Group Village Heads (GVH), involving different representatives of the Village Civil Protection Committee (VCPC).

1- Focus group discussions:

The sampling strategy for the FGD at community level is defined as followed.

- Eight to ten participants per FGD were selected.
- Participant selection based on prior consultation with community leaders, focussing on the elderly whom had lived in a village most of their lives.
- As many women as possible were encouraged to participate

Tong, et al. (2007) created a list of consolidated criteria for the reporting of qualitative research, named COREQ. Elements of this list were utilised during the preparation of the FGD protocol to ensure the best data quality. The following criteria has been systematically reported:

- The participant sampling selection, sample size, participant occupation, gender, age, living time in the community,
- The duration of the interview, time of the day, and method of recording,
- The facilitator name and language of the interview,
- The transcription and translation quality,
- The observation on how the group were communicating,
- The observation on the facilitation of the FGD (for example the degree of guidance).

The FGD is conducted in local languages (Nkhonole and Chichewa), according to the questionnaires presented in annexe, and recorded. FGD facilitators have to be first trained and briefed, and the FGD questions will be translated into the local language. Three recommendations are suggested for the facilitation of the FGD: 1) keep the questions as open as possible to enable people to describe what they experienced in their own words; 2) keep the FGD dynamic and make sure the participation is balanced to get different point of views; 3) limit the FGD duration to less than 1h30min.

2-Community drawing of the GVH:

This drawing exercise is a way for the community to summarise the information mentioned during the FGD about flash flood occurrences and impacted areas. We will ask participants to draw the main rivers, roads, mountains, as well as the affected area and associated event date. It is also a moment of sharing knowledge and the resulting map was used as support for discussion about risk perception.

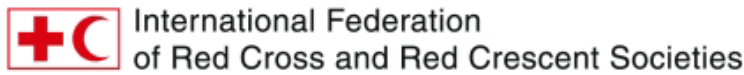
3-Transect walks in the community:

Participants are asked to join the research team on a walk through the area. These walks are an opportunity to know more about the exposure and vulnerability of people. Walks should cover affected zones where buildings had been swept away. Discussions will focus on what was experienced and the type of damage recalled. All observations during the transect walks will be recorded digitally using mobile Map.me application. GPS data for every observation is stored in the app, as well as pictures taken from the field, allowing to analyse directly the results on Google Earth or QGIS.

Example of outcome template of information to extract from FDG

			GVH 1	GVH 2	GVH 3	GVH 4	GVH 5	GVH 6	CCL
<div>Number of people</div> <div>gender balance</div> <div>average age</div> <div>oldest person</div> <div>max time leaving in community</div> <div>Language</div> <div>Recorded interview</div> <div>disaster record book</div> <div>RANKING : talkative</div>									
Occurrence	Period of the year / of the day								
	frequency								
	Return period								
	Intensification								
Description of the event	Duration of the FF event	Time for the River to go back to normal							
		Max Time for the land to dry up							
	Sudden of graduated flood onset								
	Intensity of FF								
	mudslide or landslides								
	River behaviour	debris							
		river water intensity							
Associated weather	Weather type								
	spatial / temporal shift between rain and FF								
Causes of flood and aggravating factors	River characteristic factors								
	River width observation								
	Human factors								
	climate change								
	Geomorphology								
	Soil type								
Knowledge on the signs leading to flash floods	Meteorological signs before the FF	rain							
		Wind							
		Clouds							
		Temperature							
	River behaviour before the FF								
	Soil moisture observation prior to flood								
Direct impacts	animals behaviours ?								
	buildings								
	crops								
	cattle / livestock								
	fatalities								
	Other impacts								

Interview Information	
Facilitator's Name	
Date of Interview	____/____/____ (DD/MM/YY)
Start Time	
End Time	
Interview Code	(ADD Name_District Name_ Interview No_DDMMYY)



Participants' Information		
Participants' Names and Sex	Number of years living in the community	occupation
District Municipality		
TA		
Village Name		
GPS Coordinates		

Introduction of the group discussion :

Thank you for accepting to participate in and contribute to this exercise conducted as part of the ECHO-III European Red Cross project, which is being undertaken by the Malawi Red Cross Society.

EXPLANATION : different type of flood exist. Some are more surprising than others, with more devastating and fast water, and last less time than other. These rapid (flash) floods, more sudden, can be very devastating. We would like to know what type of flood and impact you are experiencing in your community to be able to better understand how to predict them and allocate the right response, based on your observation before and during the flood. Through the project we hope to build with you an understanding of flash flood occurrences and impacts in Karonga in order to contribute to improve flood preparedness for humanitarian and disaster response organisations. This meeting is designed to collect your experience and knowledge of floods events in your community, as well as the associated hydro-meteorological condition, and observation during and before the flood events. It will be based on discussion and collective drawing.

Sampling strategy for FGD at community level:

- 4-8 (max 10) participants per FGD
- Participants selection based on prior consultation with community leaders: focus on elderly people within the community, living in the village for most of their lives
- Chiefs are NOT to be present during the FGDs

Questions for FGD or KII at community levels (open discussion)

1- What is the flood occurrence in your community?

- Can you draw you community, river name, roads, mountains, lake...
- How often floods occur in your community?
- Can you recall major flooding events in your community during your lifetime? What year, in which month?
- In which periods of the year is it more frequent (month)?

2- What are the flood characteristics in your community?

- What is generally the flood duration ?
- Is the flood occurring suddenly or gradually ?
 - is the flood always having the same behaviour ?
 - On what does it depend?
- Can you describe the meteorological conditions associated to flood event?
- Are floods sometime associated to land or mudslides?
- Can you remember and describe a rapid (flash) flood events? Which date? Time in the day?
- Can you draw on the map which area are most affected by flood and discuss why?

3- Have you noticed some pre-condition associated to sudden flash flood?

- Meteorological condition :
 - o Rainfall patterns, rainfall intensity? Isolated storm or long duration rain?
 - o Do winds blow from specific directions or a specific way?
 - o Are temperature changing?
 - o Any specific cloud movements or shapes?
 - o How long (days) before the flood happens this occurs?
- River behaviour: colour, speed, raising rate, ephemeral
- Have you observed a link between flash floods occurrence and landscape characteristic : slope, vegetation, soil type
- Are flash floods always occurring when the soil is already saturated?
- Are animal / plant or celestial behaviour changing before the floods ?
- Have you noticed some human factors that could increase flash flood risks?

4- What are the main impacts of flash-floods on your community?

- Are flash floods always damaging?
- Are Roads affected?
- What are the impacts on buildings? Which buildings are mostly affected?
- What are the impact on crops and cattle?
- Have you lost some members of your community because of Flash Flood?
- Other impacts?

5- What do you do when a flash flood strike? Do you have any early warning system in your community?

		GENERAL KNOWLEDGE
Affected area	Villages names / area affected /roads	Use drawing / maps
Rivers/ stream affected	River/stream names	Use drawing / maps
Occurrence	Flood occurrence/ frequency (period of the year/ of the day)	
Description of the flood events : DURING the flood event	Duration of the flood	
	Sudden of graduated flood onset ?	
	Associated meteorological condition (heavy rain, wind, storm...)	
	Other: landslides/ mudslides	
Affected area	Which area are more affected by flood?	Use drawing / maps
Knowledge on the Factors leading to flash floods and observation BEFORE the event	Meteorological Pre - condition (rainfall, wind, temperature?)	
	River behaviour	
	landscape factor? slope, vegetation, soil types ...	
	Soil moisture observation prior to flood	
	Other remarks : animals, celestial behaviour	
	Human factors ?	
Direct impacts	buildings	
	crops	
	fatalities	
	people affected / displaced	
	Other impacts	

		Flash-Flood EVENT Specific (rapid onset)		
Occurrence	Flood event occurrence (period of the year, period of the day)			
Affected area	Villages names / area affected /roads	Use drawing / maps	Use drawing / maps	Use drawing / maps
Rivers/ stream affected	River/stream names	Use drawing / maps	Use drawing / maps	Use drawing / maps
Description of the flood events : DURING the flood event	river condition (rapid or slow onset?)			
	Meteorological condition			
	Duration of the flood			
	Other: landslides/ mudslides			
Knowledge on the Factors leading to flash floods and observation BEFORE the event	Meteorological Pre - condition (rainfall, wind, temperature?)			
	River behaviour			
	landscape factor? slope, vegetation, soil types ...			
	Soil moisture observation prior to flood			
	Other remarks : animals, celestial behaviour			
	Human factors ?			
Direct impacts	buildings			
	crops			
	fatalities			
	people affected / displaced			
	Other impacts			