The utility of semi-quantitative impact-based information to evaluate flood forecast for decision making:

Case studies from Uganda and Kenya

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Supervisors: Ros Cornforth, Liz Stephens, Elena Tarnavsky, Celia Petty, Andrea Ficchi

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FATHUM Forecasts for Anticipatory Humanitarian Action

Rationale/ Why this research?

Environmental changes-
Increased frequency

Economic impact
Rising Expectations

Inadequate data
Information latency

Photos by The Uganda Red-Cross/IFRC/RCCC

Flood impacts in East Africa

Eastern Africa – Over 2.8 Million Affected by Floods Says UN

6 DECEMBER, 2019 BY FLOODLIST NEWS IN AFRICA, NEWS

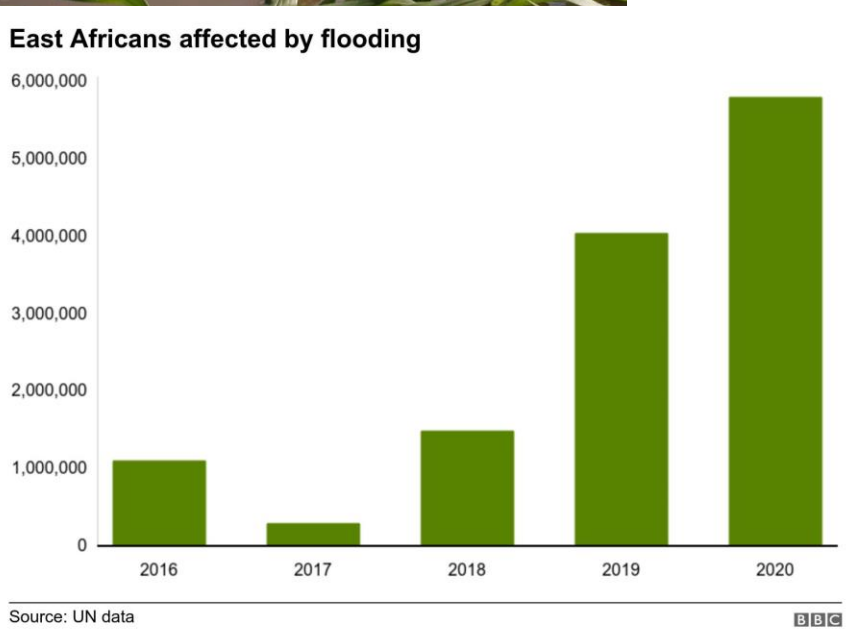
Flooding in Eastern Africa has now affected over 2.8 million, according to a report by the United Nations Office for the Coordination of Humanitarian Affairs (OCHA).

Floods and landslides ripped through areas of West Pokot on 23 November, 2019. Photo; Kenya Red Cross

Flooding will affect double the number of people worldwide by 2030

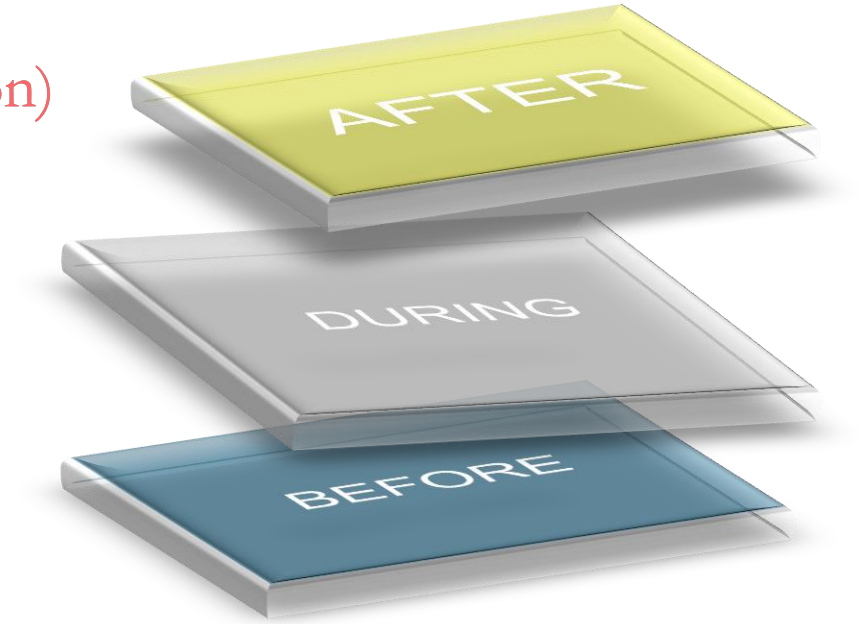
New research finds 147 million will be hit by floods by the end of the decade - 'the numbers will be catastrophic'

Source: The guardian.com

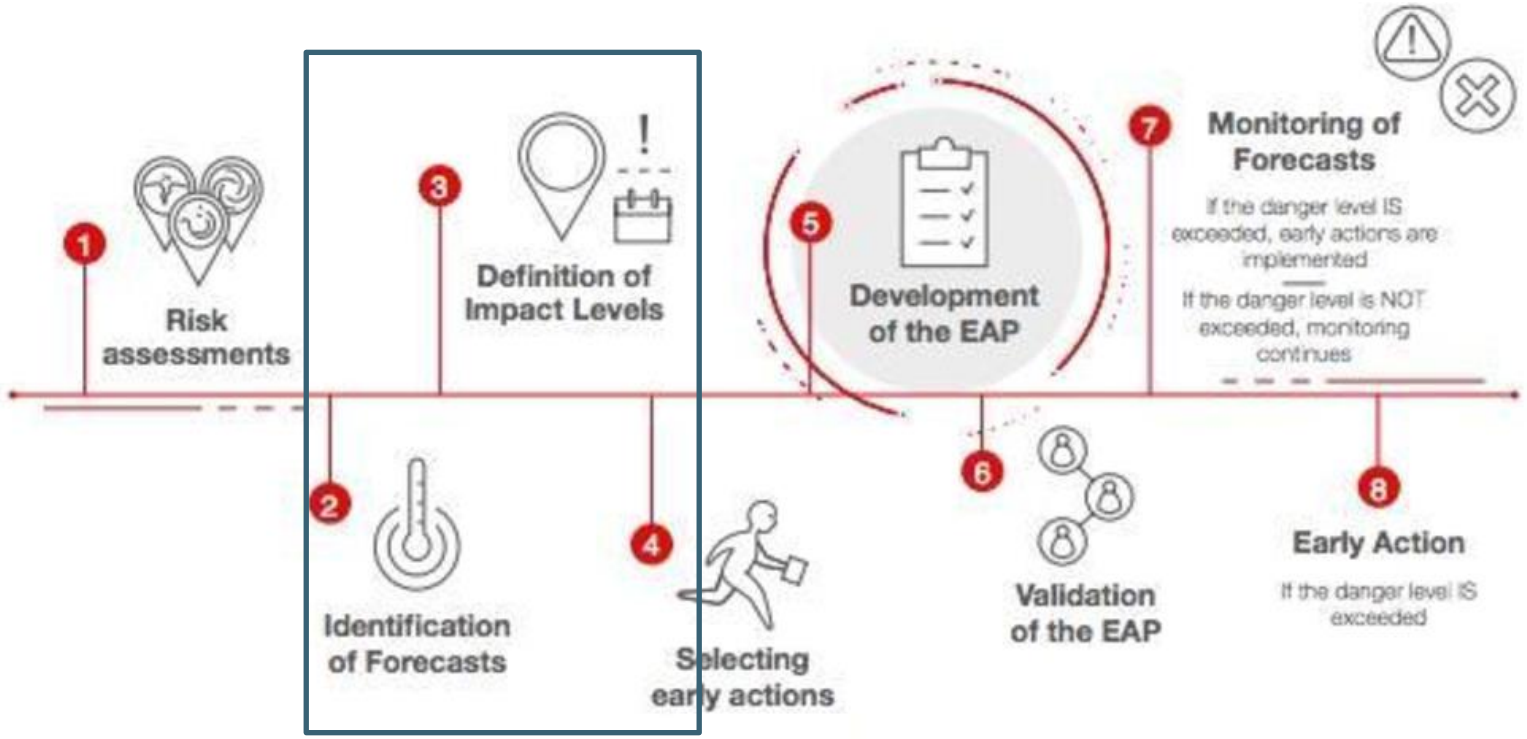


Prior information for preparedness actions

- When the rain will hit
- How much flooding will occur(magnitude, duration)
- Where will it occur
- Who will be affected
- What coping and early actions are required?
- Who needs special care
- Where are the shelters located
- How do we access the areas affected



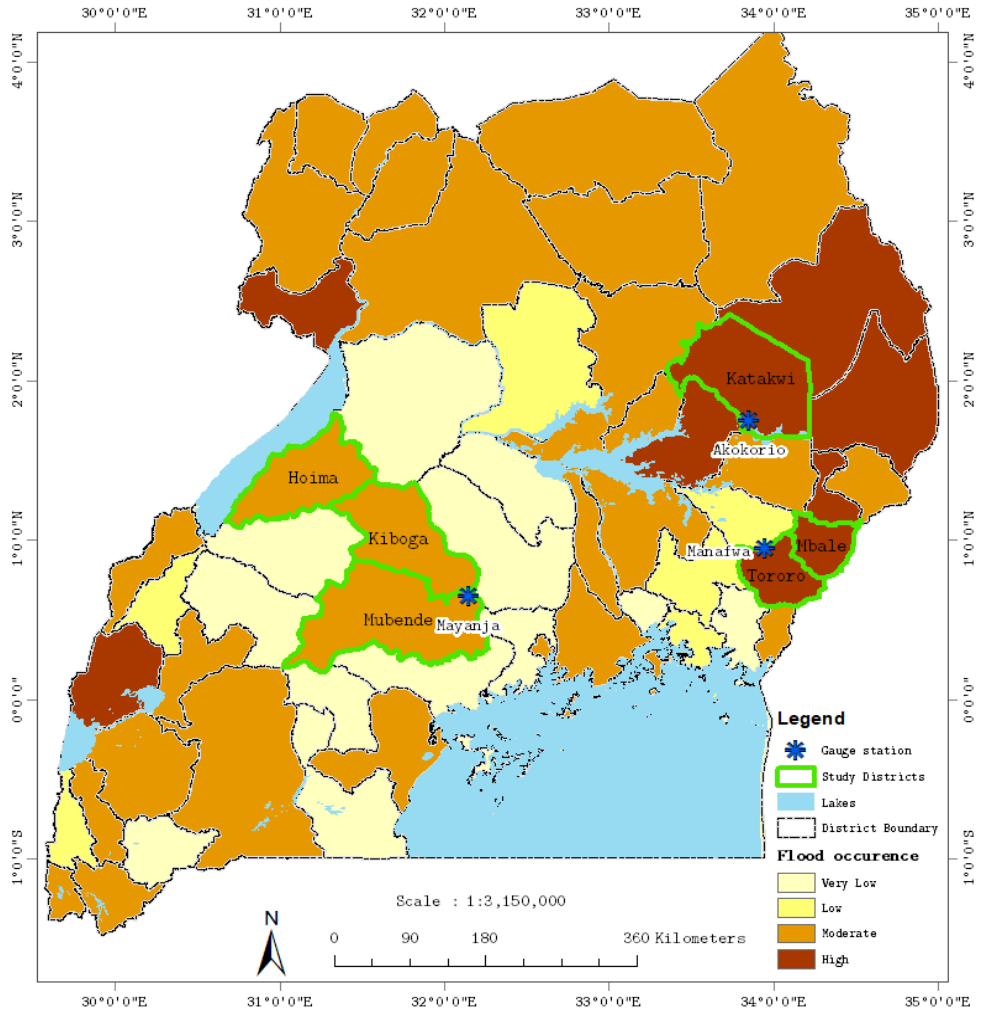
Early warning mechanisms and FbF requires reliable forecast information

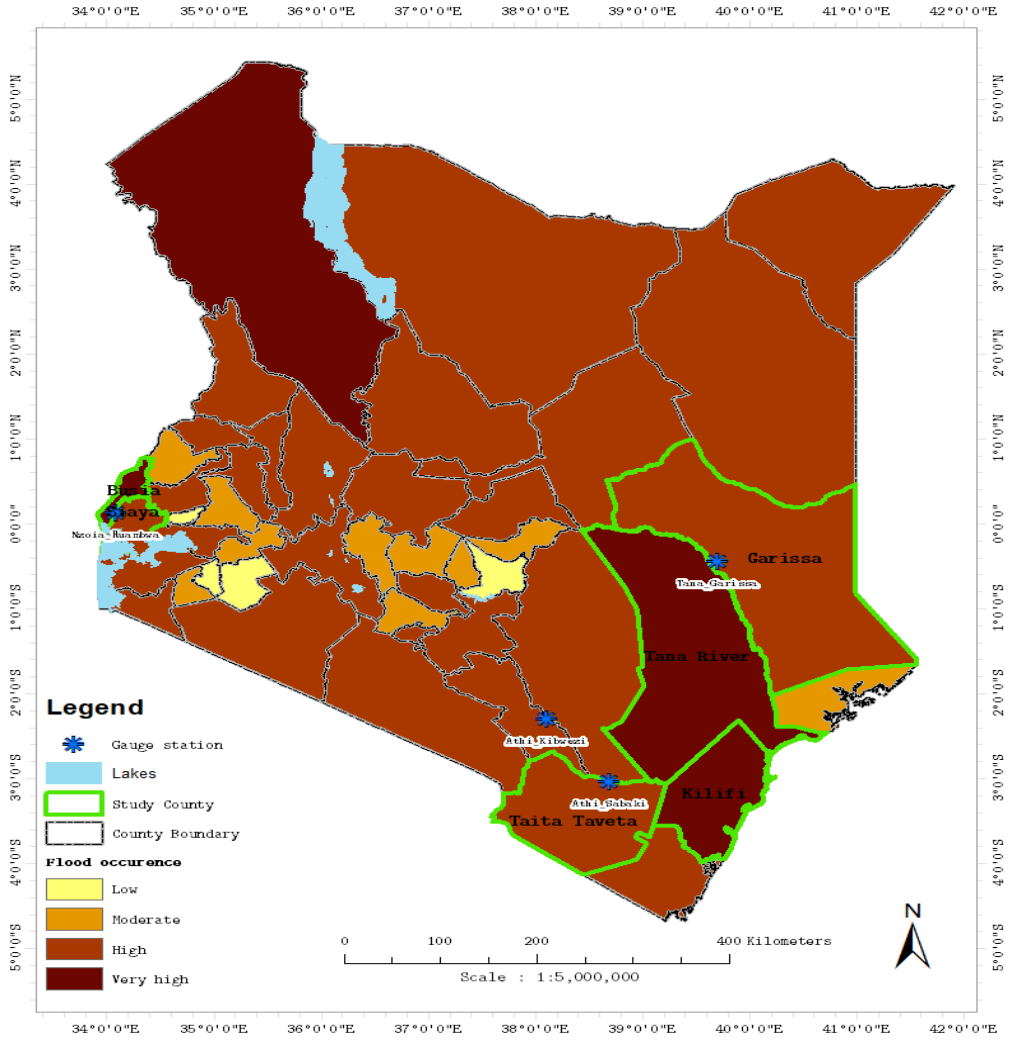


Steps towards FbF-source RCCC/IFRC

- How adequate are the impacts data?
- How useful are the impacts data in evaluating flood events?
- What can we recommend?

Study locations





Flood occurrence maps for Kenya and Uganda showing the study districts/counties and the river gauging locations. The map was created using impact reports collated from various sources from 2007 to 2020. The color scheme represents the number of years in the 14 years when floods occurred ranging from low (1-3 years), Moderate (4-7 years), high (8-11 years) and very high (12-14 years)

Methodology

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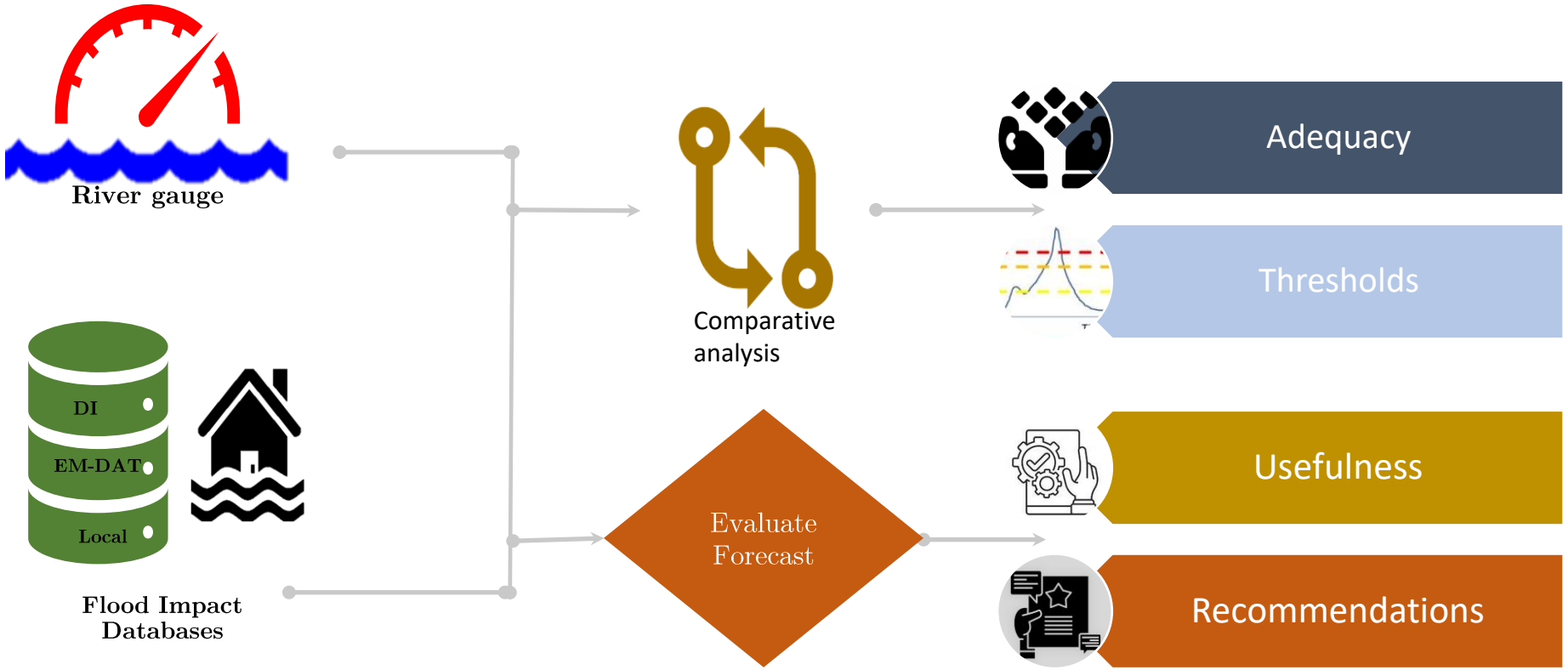
Data collation → Comparison & evaluation → Contextualise



Data availability-River gauge observations

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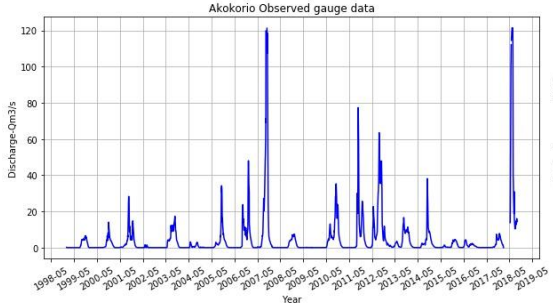
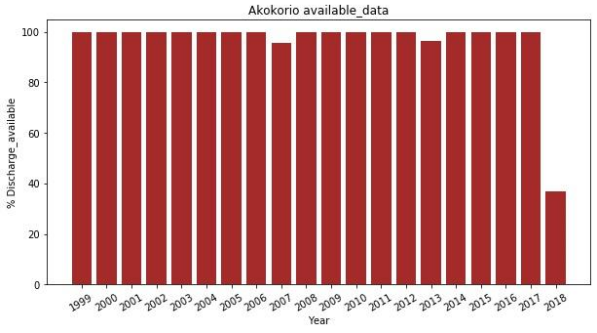
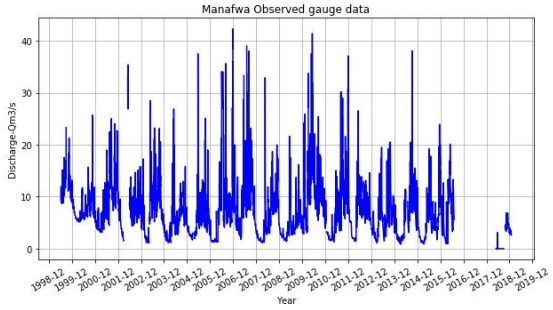
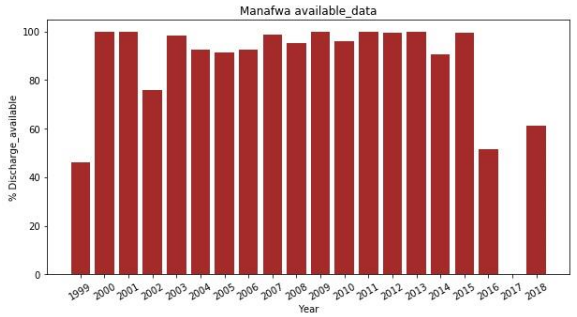
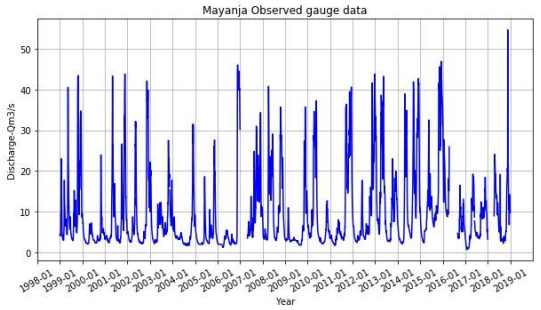
Uganda

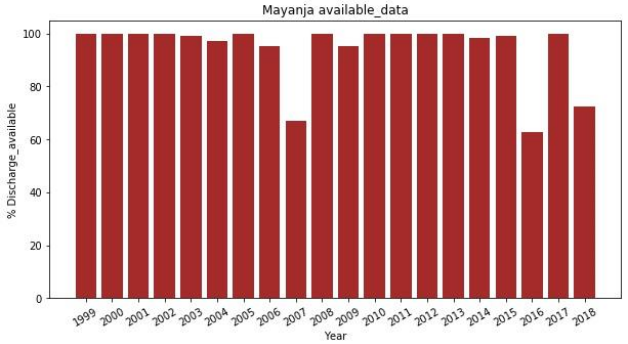




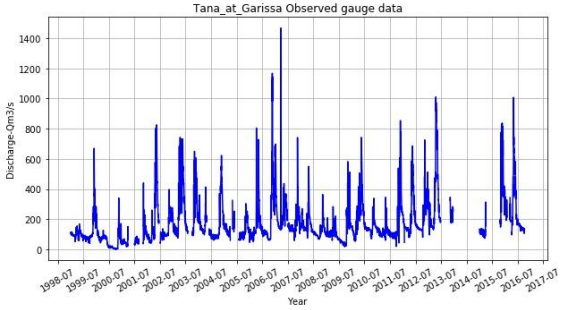


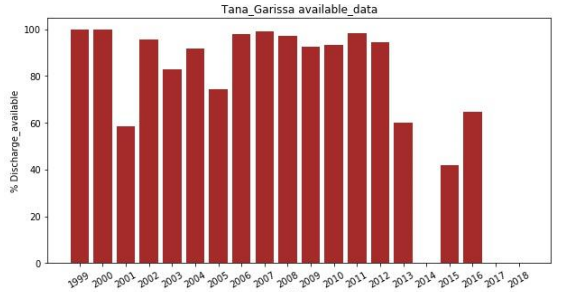


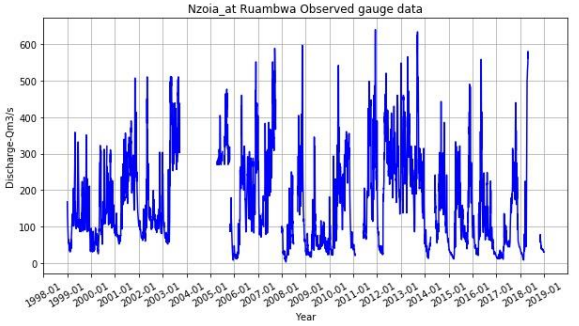


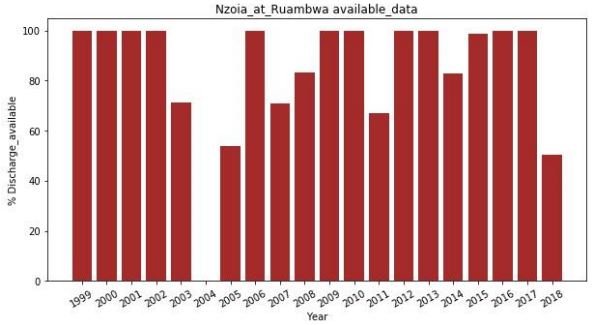


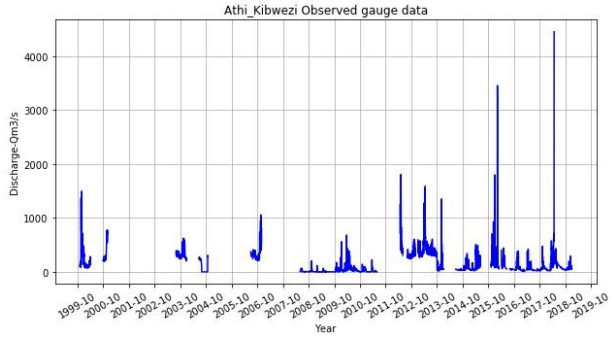
Kenya

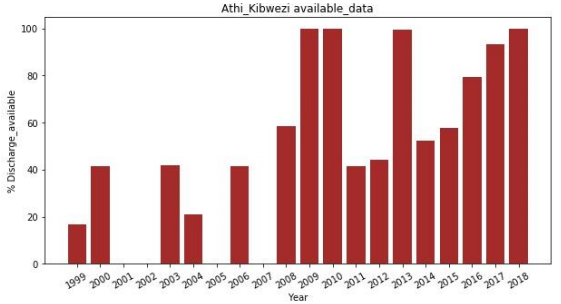




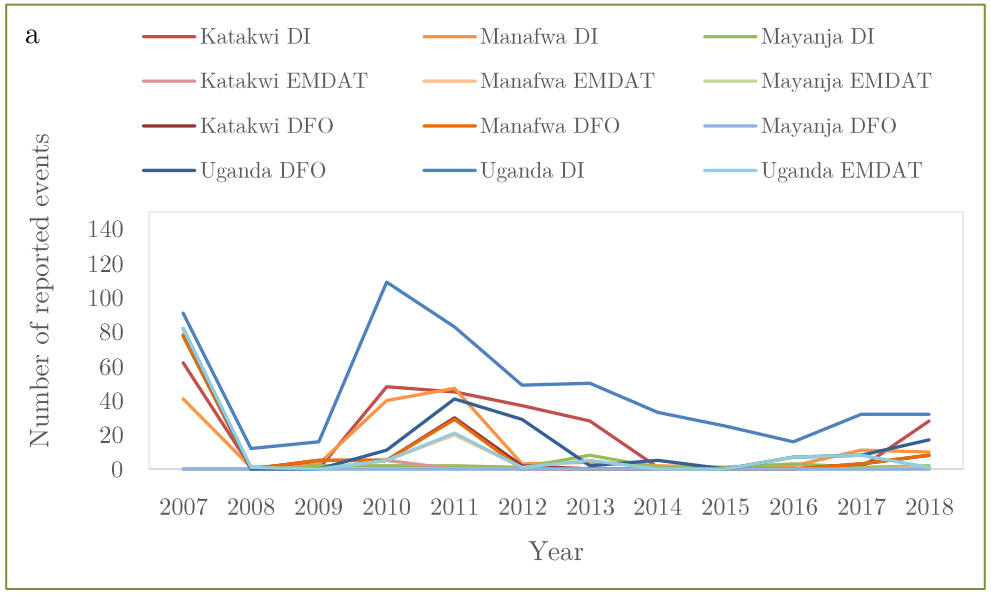


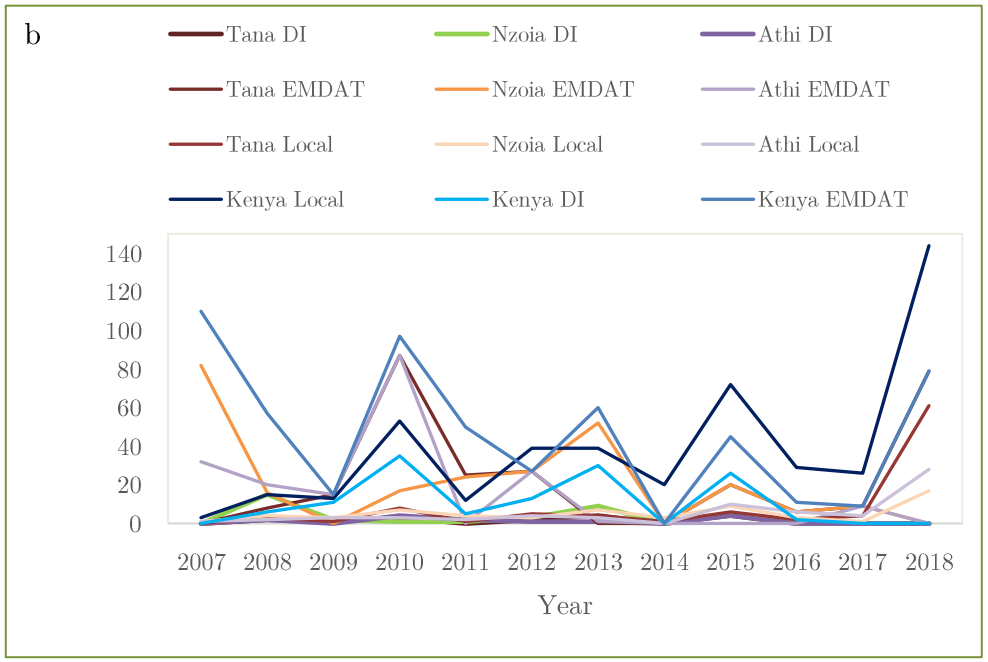






Data availability- flood impacts(loss and damage)





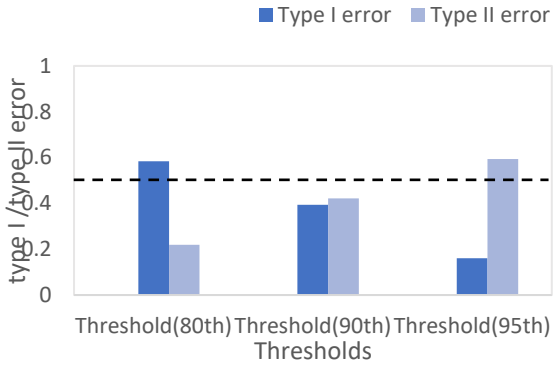
Sources	Katakwi (434)	Manafwa (304)	Mayanja (102)
Uganda	**% Coverage**		
EM_DAT, DI, DFO	11.06	4.28	0
EM-DAT, DFO	6.91	**28.29**	0
DI, DFO	8.29	5.59	0
URCS, DI	3.46	0.00	0
EM_DAT, GWHB	0.00	0.66	0
DI	**36.41**	**32.57**	**22.55**
EM-DAT	1.38	13.82	77.45
DFO	18.89	12.5	0
Local sources	13.59	0	0
GWHB	0.00	2.30	0

Kenya	**Nzoia (316)**	**Tana (359)**	**Athi (251)**
EM_DAT, DI, local	2.22	0.28	0.40
EM-DAT, DI	3.48	0.56	1.20
EM-DAT, Local	6.01	5.85	3.19
EM-DAT	**69.94**	**70.75**	**72.11**
DI	6.33	3.34	3.19
Local sources	**12.03**	**19.22**	**19.92**

Adequacy of impacts data- using all impact databases-I and II error- Window of 7days

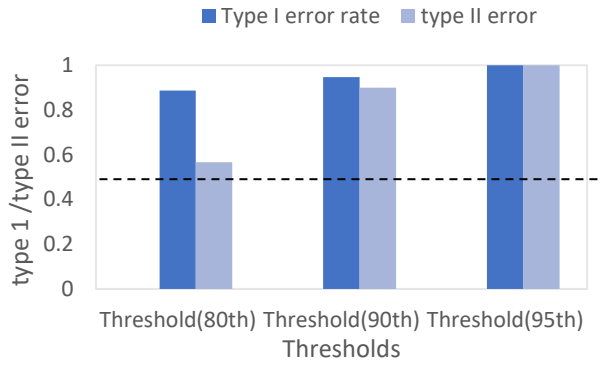
	Impact Yes	Impact No
Observed (Yes)	Correct(yes)	TI error
Observed (NO)	TII error	Correct(no)

$$ER_I = \frac{Number\ of\ observed\ flood\ events\ with\ no\ impacts\ reported}{Total\ number\ of\ observed\ flood\ events}$$



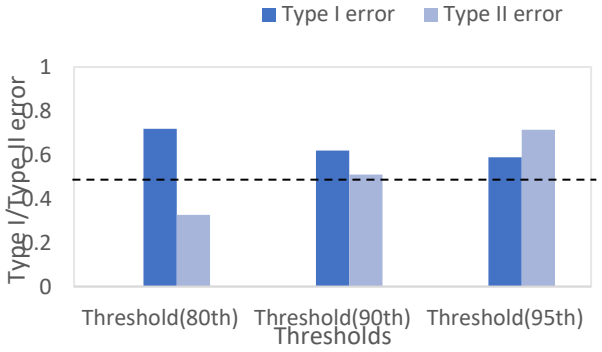
Katakwi

Manafwa

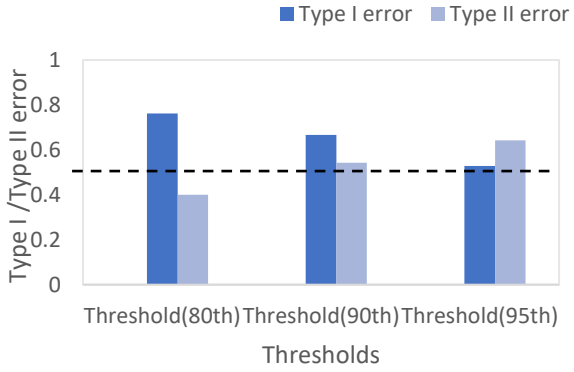


Mayanja

$$ER_{II} = \frac{Number\ of\ \text{reported}\ flood\ impacts\ with\ no\ observed\ floods}{Total\ number\ of\ \text{reported}\ flood\ impacts}$$



Tana

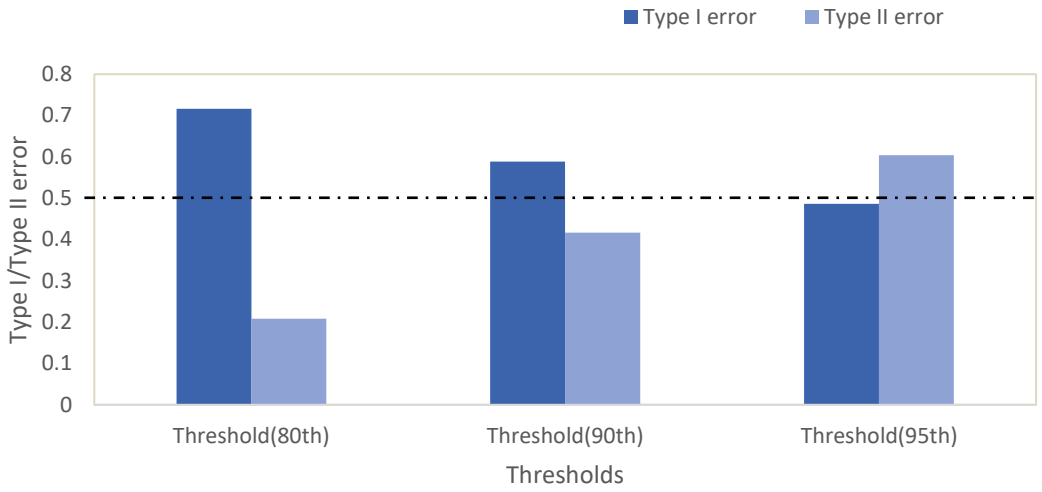


Nzoia

Athi_Kibwezi

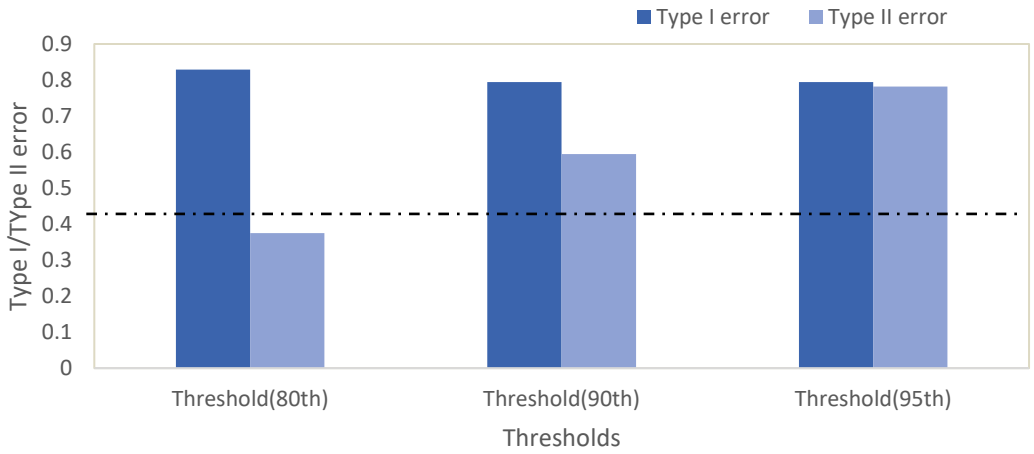
Key:
ER1- Type 1 error
ERII-Type II error

Using specific impact databases-I and II error- Window of 7days



Katakwi using DI

Type I error increases:
90th-33%
95th-67%



Tana- Using EMDAT

Type I error increases:
90th-22%
95th-26%

Evaluating forecast data using river-gauge and impact data-7days

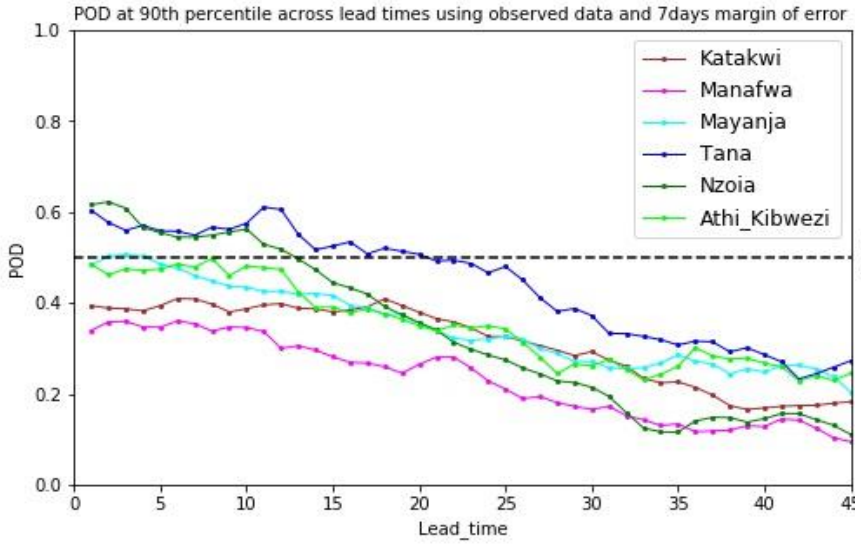
	Impact/obs Yes	Impact/obs No
Forecast(Yes)	Hit	FA
Forecast(NO)	Miss	CN

parameters:
Forecast probability -60%
Margin of error- 7days
Acceptable FAR-0.5

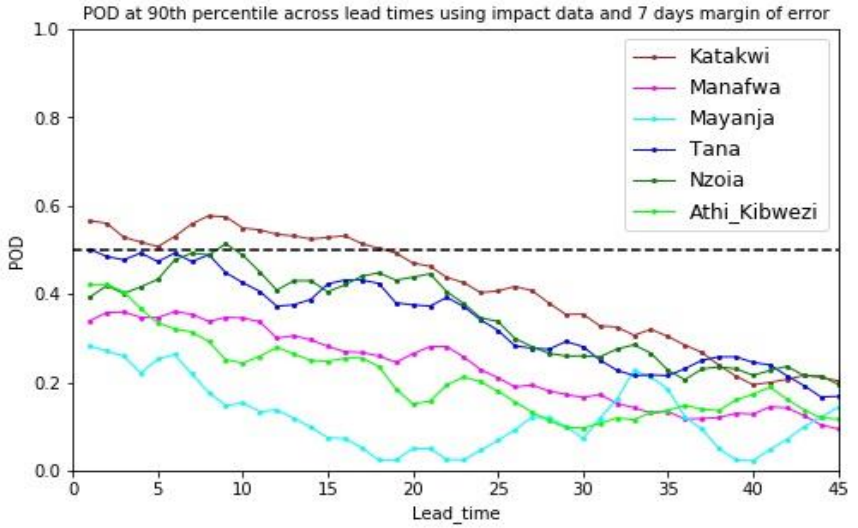
$$POD = \frac{Hit}{Hit + Miss}$$

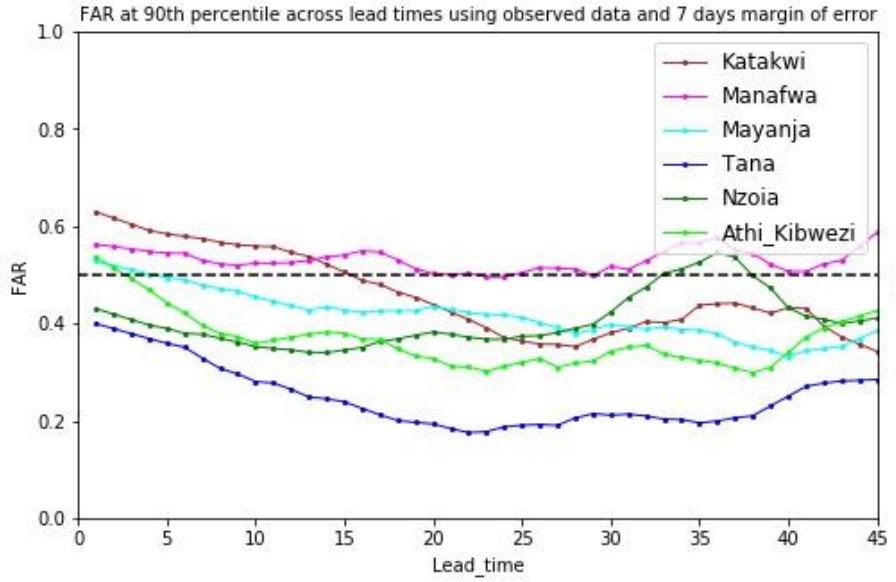
$$FAR = \frac{FA}{Hit + FA}$$

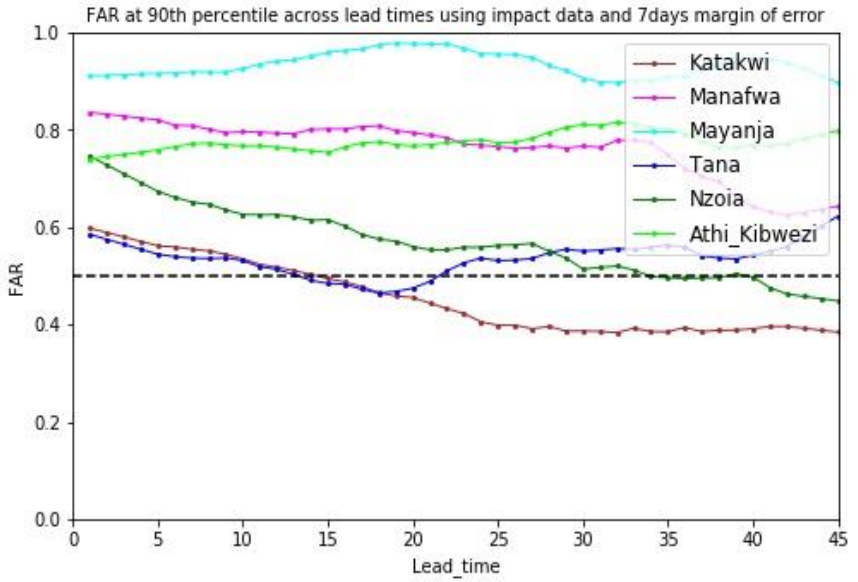
Observed data



IMPACT data







Evaluating forecast data using river-gauge and impact data-10days

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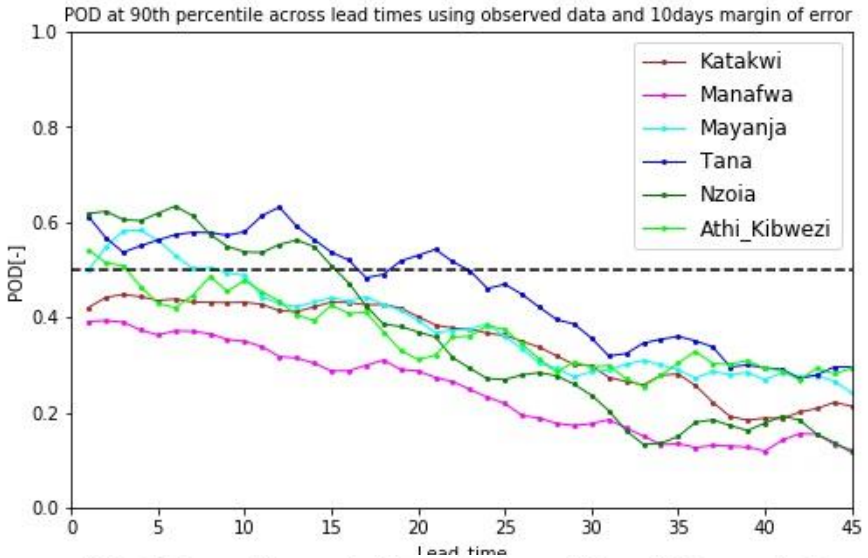
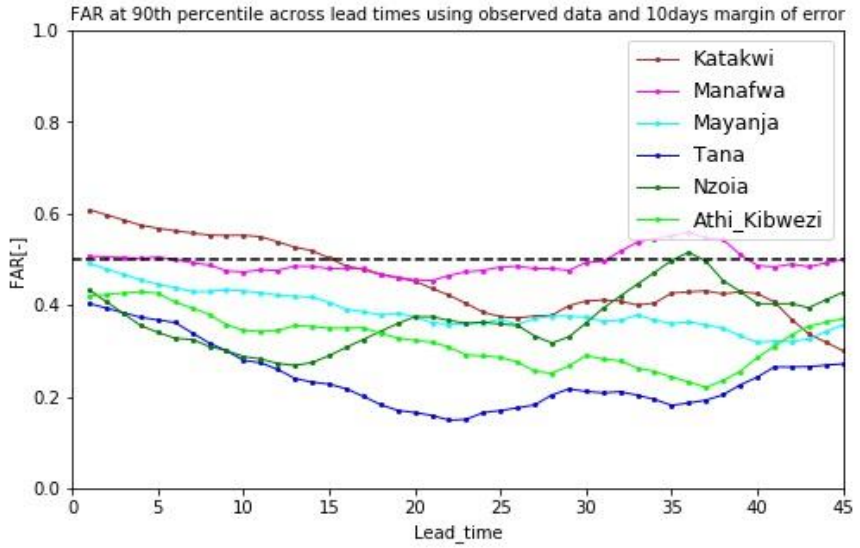
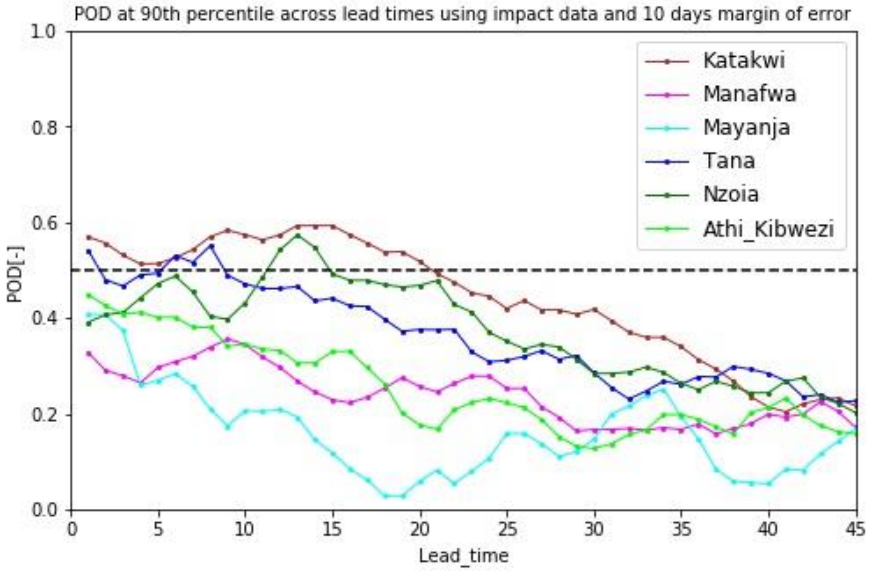
parameters:
Forecast probability -60%
Margin of error- 10days
Acceptable FAR-0.5

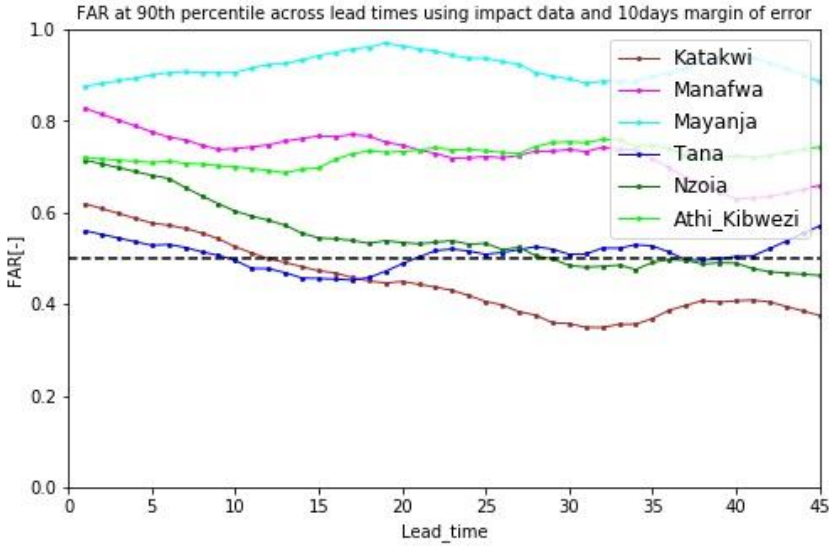
Observed data





IMPACT data





POD and FAR differences(observed and impact data)-7days

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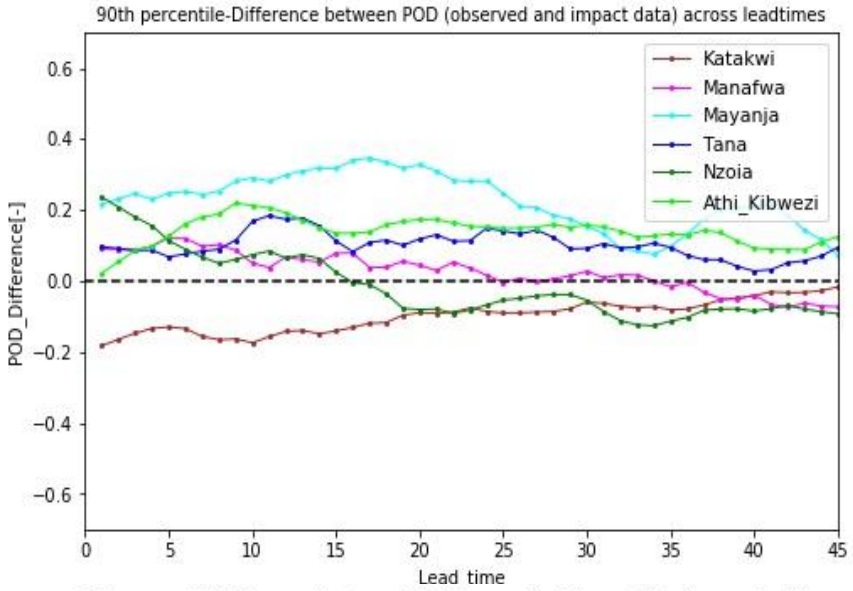
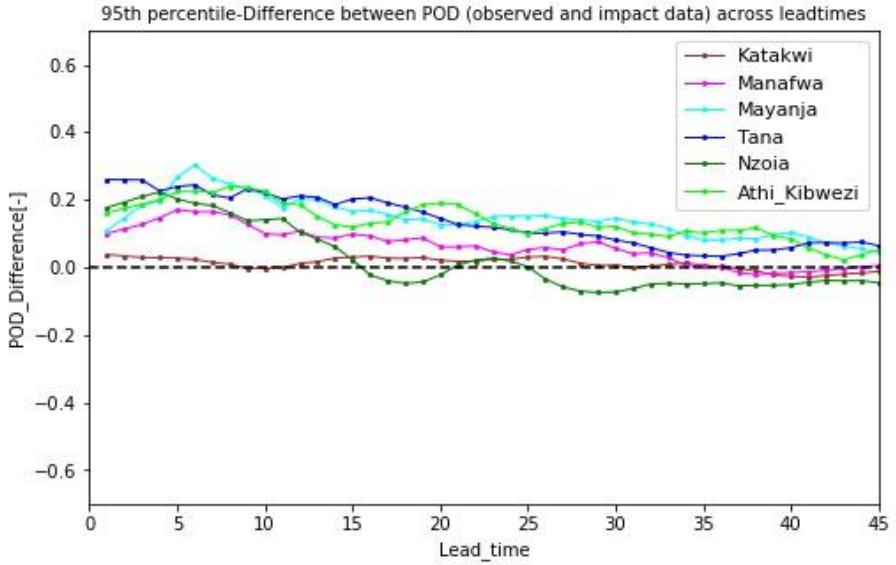
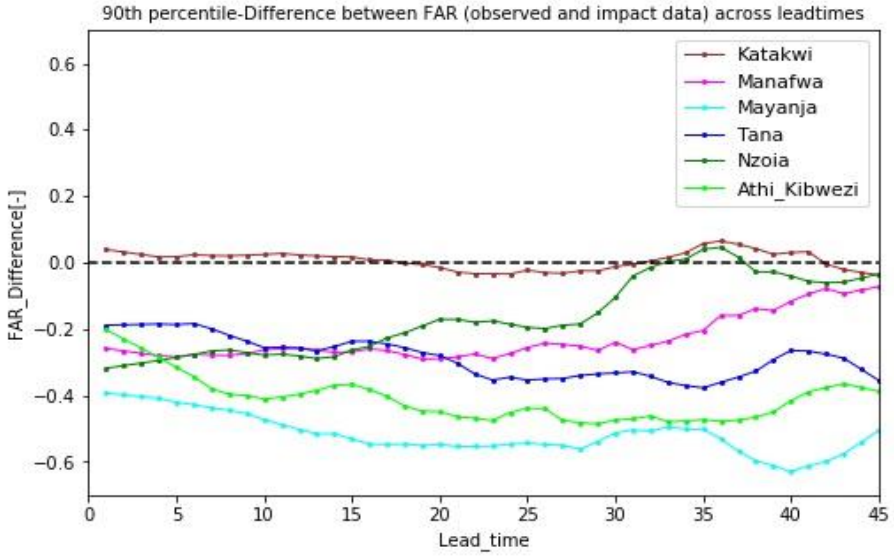
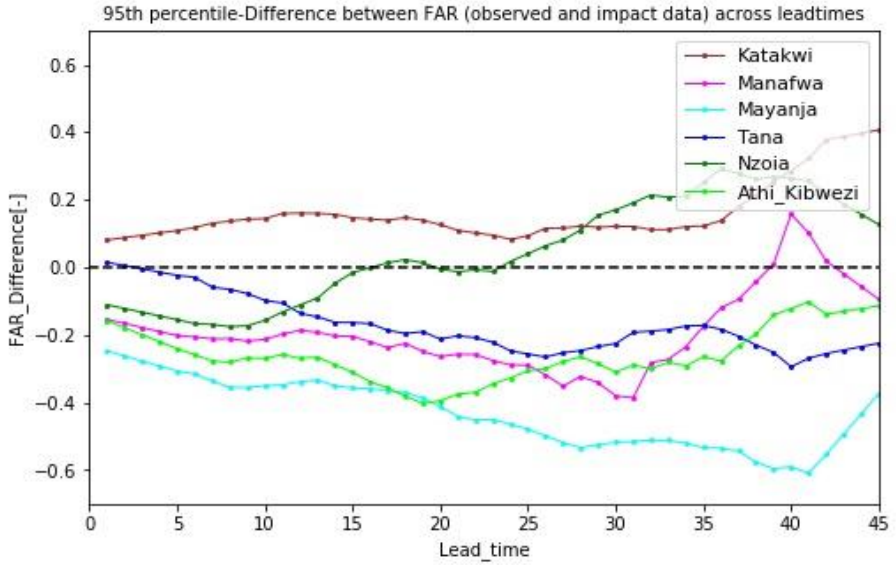
Parameters:
Forecast probability -60%
Action-life time- 7days
Difference POD/FAR= observed-impact







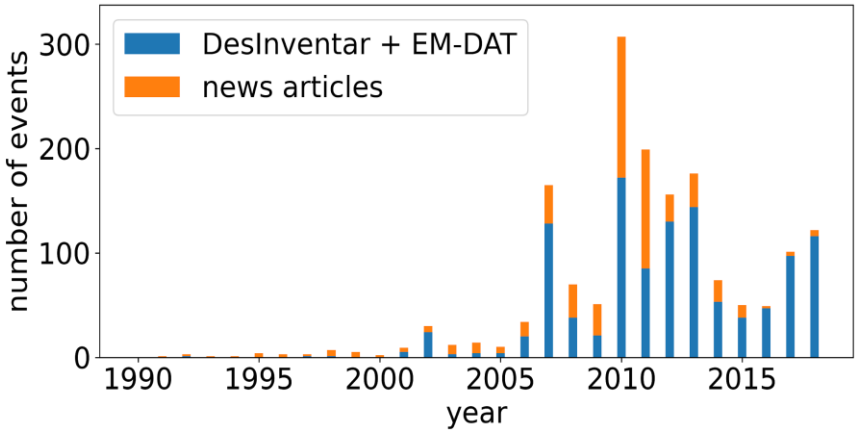


What does the impact data tell us? How adequate are they?

- Impact data varies- events
- Using more than one source improves the reliability
- Most of the impacts reports are aggregated to a bigger area.
- With improvements, these database can be used to identify flood thresholds and also evaluation of forecast information in data scarce regions

RECOMMENDATIONS

- Using more than one source improves the reliability
- Taking into considerations the uncertainty in the data can reduce the actions in vain
- Strengthening in-country activities on impact data collection
- Harmonizing the parameters used across the databases
- Expanding of the available databases- text mining, private companies



Source: Marc et al 2021: GAR report

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THANK YOU

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Identifying the weather and climate information(WCI) needs of smallholder farming communities in flood risk preparedness

RIC 2021

17 – 19 AUGUST 2021

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NERC Science of the Environment

Outline

- Introduction/Background
- Research aim, Questions
- Study area and Methods
- Results
- Conclusion/Key takeaways
- Expected Application Areas

Introduction/Background

Disaster Risk Management(DRM) organisations

Communities and farmers

- Weather-driven shocks such as floods are becoming more extreme and frequent.
- The bulk of the impacts are felt by the rural populations
- These communities have their traditional ways of coping

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Research aim, questions

- Assess the information needs of the main disaster actors at the national and local level in preparedness and response to flood risk.

Understanding the communities

- Livelihoods(crops, livestock)
- What Coping activities they use?
- What WCI do they require?

Understanding the national Disaster agencies

- How do they respond to the communities needs?
- What hinders effective provision of required information?

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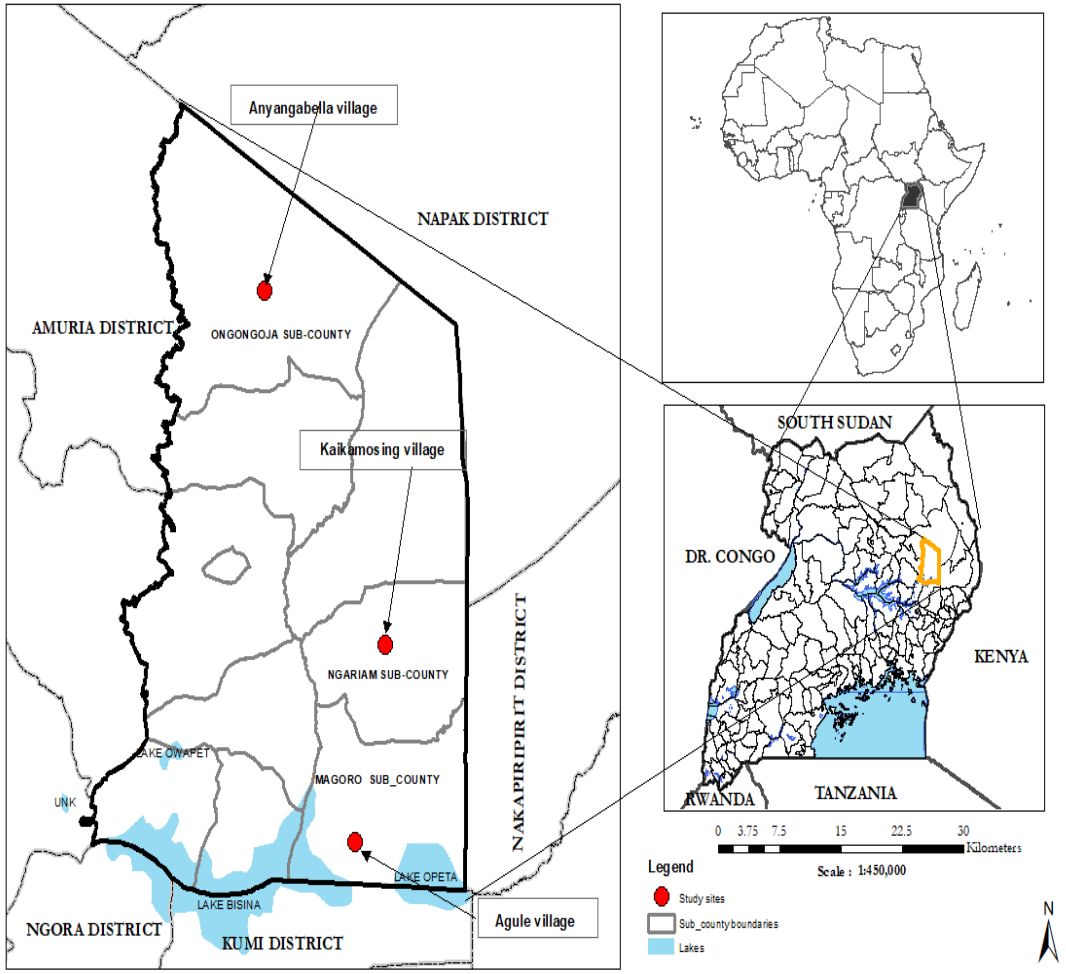
Methodology (Study area & Methods)



- Katakwi district, Eastern Uganda
- 81% of the population earn their living through subsistence farming.

- **Qualitative semi-structured interviews** and farmers discussion at the local level
- **Online semi-structured interviews** with National disaster management agencies

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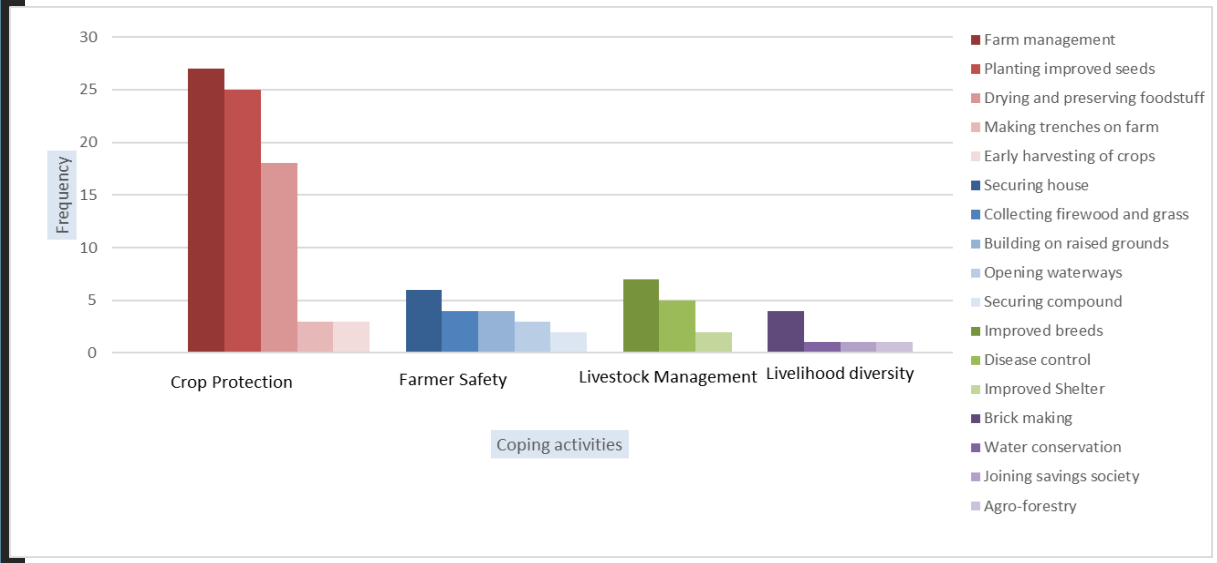
Results



Common coping activities

"We require weather information 1-2 months before the start of the season to help us plan our farm activities". farmers: 3 villages.

"We need to also know if rainfall will result to flooding so that we choose appropriate crops" [farmers: 3 villages].

Information needs

Static Information	Dynamic Information	Dynamic (Depends on the season)
Baseline • **Topography of the area** • **Soil types** • **Land covers (e.g. forests, grasslands around the farmlands** • **Post-harvest handling methods** • **Livelihood diversity methods** • **Land management practices**	**Flood and weather** • Rainfall magnitude, intensity, timing • Rainfall predictions • Flood duration • Flood peaks • Inundated areas • Risk areas	**Agricultural practices** • When to harvest • Types of seeds (improved, early maturing, water-tolerant, etc) **Locations & accessibility** • Shelter for animals • Shelter for people • Agrovet locations • Drinking water locations • Location of Health facilities • Roads accessibility • Market information • Market accessibility

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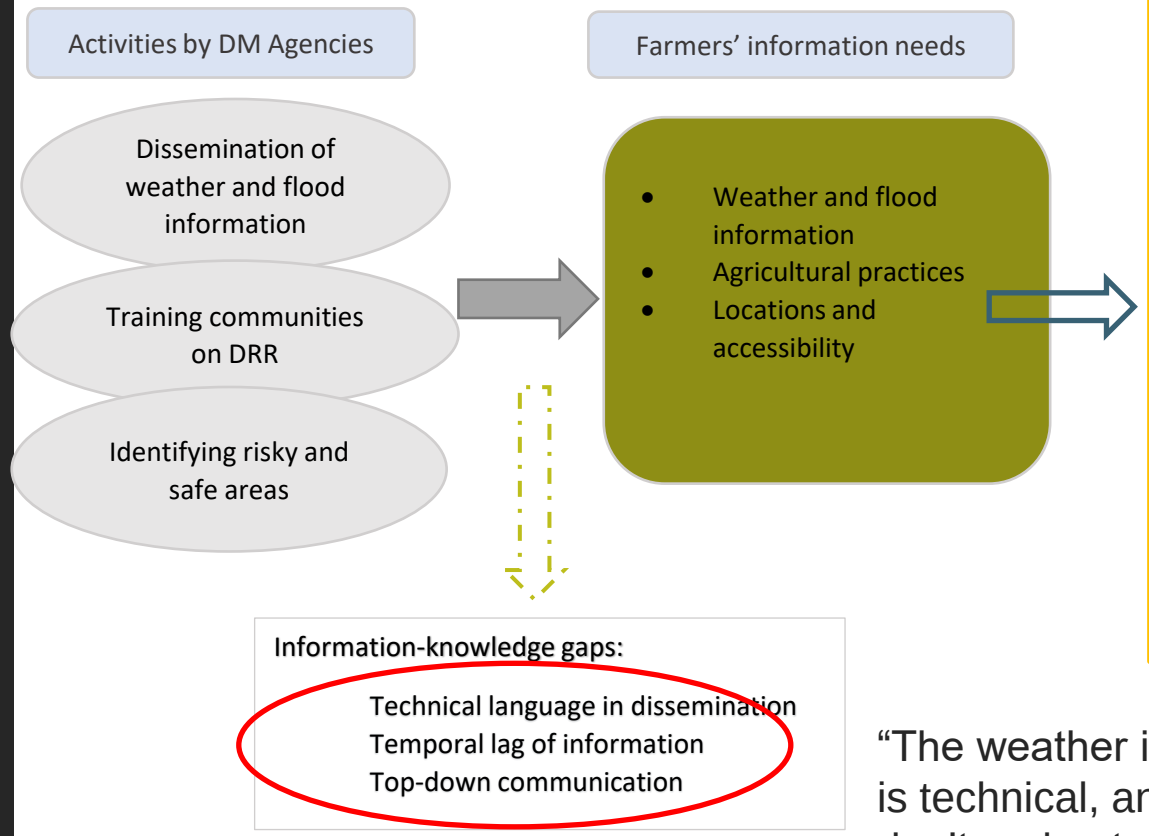
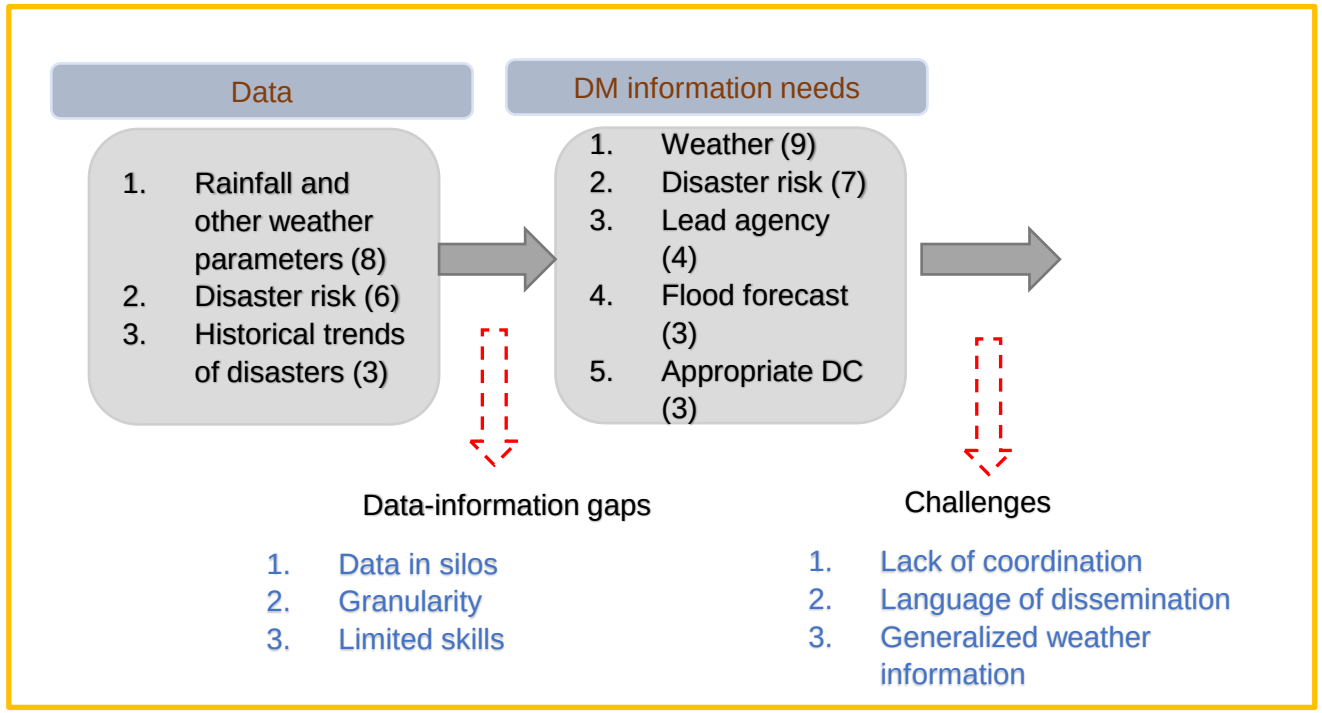
Results cont.…

Role of DRM in information provision



Gaps that hinder effective provision of information



"The weather information is technical, and the farmers don't understand what normal and above normal means" [Disaster Responder 014].

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Conclusion/ Key takeaways

Understand the specific users WCI needs at scale

Creating useful information will require understanding decision-making contexts and needs of the information users and ways to deliver the information.

Engage the users in the co-production of the WCI

Participatory communication and engaging the local communities in production of WCI can ensure tailored and useable information is produced and communicated in ways that are understandable.

Mainstream the local capacity and information needs into existing disaster management plans

An enabling environment for preparedness actions can be achieved through supportive institutions with appropriate policies and plans that incorporate the needs and capacities of the local at-risk communities.

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Expected application areas of the research

- This study forms part of our broad research under the NIMFRU project[1] on 'impact-based flood early warning to build resilience among rural communities in flood risk preparedness'.
- Provides a stepping stone towards improving the usefulness of weather information among the local communities.
- Informs the development of early action Protocols for flood risk

1 The NIMFRU project is co-funded by the UK Foreign, Commonwealth and Development Office and the UK Natural Environment Research Council under the Science for Humanitarian Emergencies & Resilience (SHEAR) programme (http://www.walker.ac.uk/research/projects/nimfru-national-scale-impact-based-forecasting-of-flood-risk-in-uganda/)

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Thank You

Questions?

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