G F P
global flood partnership

POLICY BRIEF
August 2020

Enhancing Nigerian National Flood Management using Global Flood Hazard Maps

Summary

Nigeria has a flood risk challenge. It is a large country, blessed with many rivers, but also has a large and growing economically active population. Managing this national flood risk requires knowledge of exactly where floods may occur and who is exposed to those floods, and their vulnerability. Traditional flood risk assessment methods can be expensive, technically challenging and time consuming. Recently, global flood modelling has become possible and this has resulted in freely available flood hazard maps of sufficient quality to be used successfully in national risk assessments, particularly in data scarce areas where data limitations hamper more detailed modelling approaches. We advocate the use of these flood maps to enhance national flood management in Nigeria.



Figure 1. 2018 Floods as in Lokoja

Flood Risk in Nigeria

Flooding is a major problem in Nigeria, both in terms of human and economic exposure. The National Emergency Management Agency (NEMA) reports that 40 million Nigerians are currently at risk of flooding. In the last decade, three major national flood events in 2012, 2018, and 2019 have collectively displaced over 2 million Nigerians and caused estimated losses of over N 2 trillion.

Properly managing flood risk can save lives and benefit the economy and is usually carried out through a risk assessment. An effective flood risk assessment requires information about where flooding can potentially happen (flood hazard maps) as well as a knowledge of the people and infrastructure that are exposed to the flood (exposure data) and their vulnerability. With this knowledge, it is then possible to have effective and targeted flood management for the most at-risk locations.

Traditionally, flood risk assessments have been done through bespoke river flood modelling assessments, which can be expensive, especially applied over the national scale. With the advent of global flood modelling, we now have flood datasets which can be used at the national scale for flood risk assessments at little to no cost. Hazard maps derived from global flood models have already successfully been applied in countries such as Belize for national scale flood risk assessments.

The Existing Flood Risk Picture

The Nigeria Hydrological Services Agency's (NIHSA) Annual Flood Outlook (AFO) provides a comprehensive view of the national flood risk in Nigeria. Hydrological modelling of extreme river flows across eight drainage basins in Nigeria allows Local Government Areas (LGAs) to be classified based on their flood risk. These risk classifications allow stakeholders, policy makers and government departments to take appropriate action to ensure flood preparedness.

Under the current framework, the AFO communicates flood risk at the LGA level based on an understanding of predicted extreme river flow relative to normal flows in the rivers. However, there is not a simple relationship between river flow and flood risk, as it depends on many location specific factors, such as the height of the floodplain relative to the river and what nearby communities could be affected by flooding. So, while the current approach is effective in identifying that the river flows pose a flood risk, to understand the scale of this risk and what action to take, requires that these river flows are translated into flood risk maps. Combining these flood risk maps with population data can show more detail in terms of who will be affected and by how much.

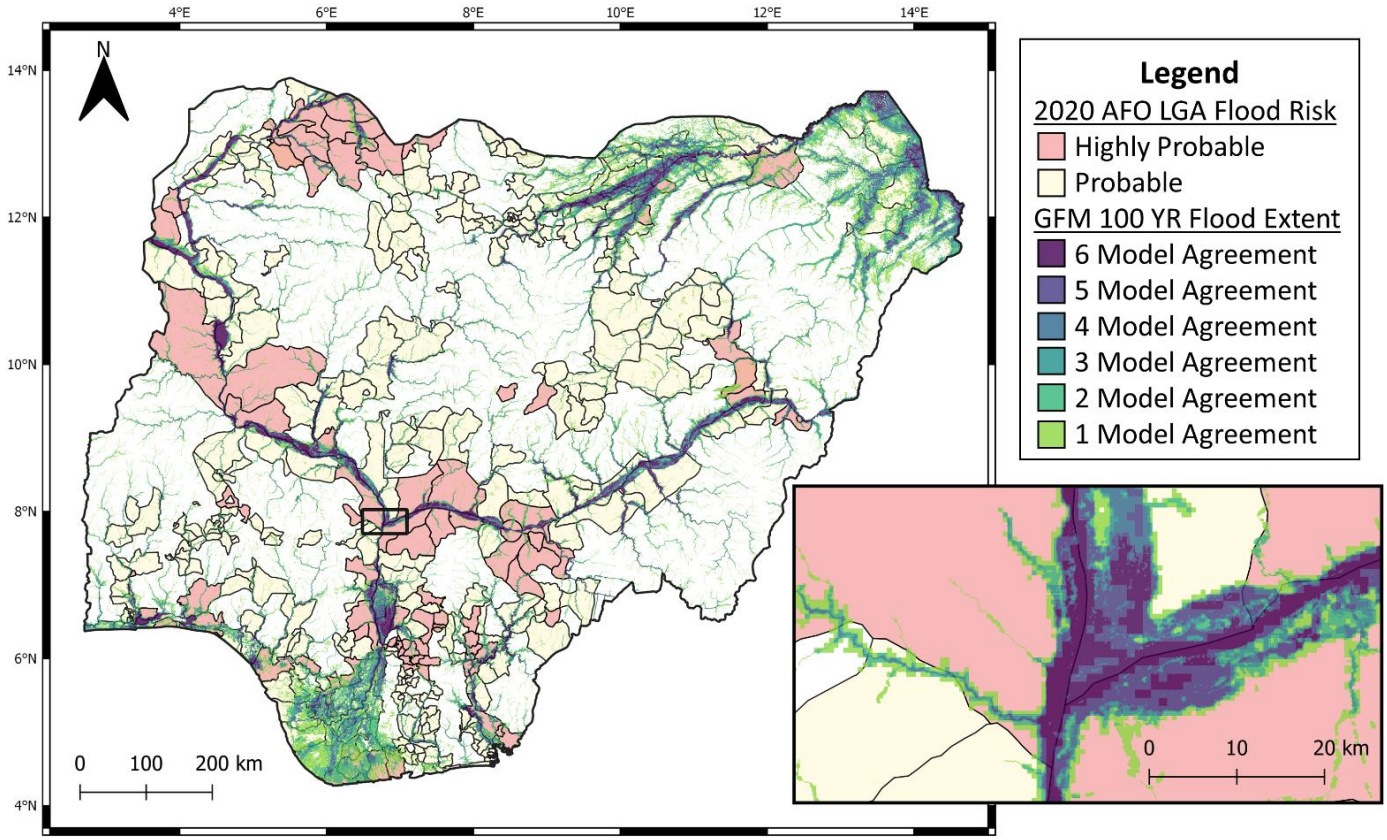


Figure 2. Comparison of the National Hydrological Services Agency (NIHSA) 2020 Annual Flood Outlook (AFO) flood risk per Local Government Area (LGA) map with the 1-in-100 year return period flood extent from 6 Global Flood Models (GFMs). Includes detailed view of the confluence of Niger and Benue rivers near Lokoja.

Applied at a national level, this assessment will give an overview of states exposed to the largest risk and how to best use and place national resources to respond to flood events. At an LGA level, pinpointing where the flood risk zones are means communities at risk can be warned, and future construction in flood zones can be more effectively controlled.

In its 2020 AFO report NIHSA states it "is currently exploring other models for a more robust analysis". We recommend incorporating global flood hazard maps to assess flood risk nationally in Nigeria to compliment and build on the existing analysis already carried out by NIHSA. For example, Figure 2 shows how a 1-in-100 year return period flood extent map predicted by 6 different global models compares to the NIHSA 2020 flood outlook for Nigeria. The extra detail that the flood extents provide brings added meaning to the NIHSA flood risk zones.

Applying Global Flood Hazard Maps at a National Scale

The flood extent shown in Figure 2 can be downloaded for free from the University of Leeds website (http://archive.researchdata.leeds.ac.uk/id/eprint/79). A preliminary national flood risk assessment can be carried out using this dataset and national population data such as Facebook's High Resolution Settlement Layer (HRSL) (https://www.ciesin.columbia.edu/data/hrsl/) or local population data where it is available. This analysis can be carried out with the same Geographical Information System (GIS) software, resources and skills that have been used to create the existing NIHSA AFO reports. See the CHARIM link in the references below for an example of how these methods could be applied for Nigeria.

Research comparing different global flood model outputs shows that there is good agreement between the models in terms of flood hazard for Nigeria. This means that their use would be appropriate at this scale and location. While the global models are improving every year in terms of resolution due to improving datasets and methods, currently they are best utilised at national and state scales rather than at an individual house level. Once flood risk hotspots have been identified, more detailed flood risk assessments using local measured data and knowledge of the vulnerabilities of at-risk communities can be carried out for further confidence in predicted flood risk zones.

Free advice on the current status of all the global flood models and availability of flood data and their application is provided by members of the Global Flood Partnership (GFP). To stay up-to-date or request help from the GFP you can subscribe to the GFP google group by sending an email to global-flood-working-group+subscribe@googlegroups.com.

Further Reading

A paper comparing the output of 6 global flood models in Africa. The data source for the 6 model map in Figure 2:
The credibility challenge for global fluvial flood risk analysis, Trigg et al. (2016)
https://doi.org/10.1088/1748-9326/11/9/094014

A review paper on the usefulness of global flood models:
Usefulness and limitations of global flood risk models, Ward et al. (2015)
https://doi.org/10.1038/nclimate2742

A paper validating the output of 6 global flood models against the 2012 Nigerian and 2007 Mozambique floods:
A first collective validation of global fluvial flood models for major floods in Nigeria and Mozambique, Bernhofen et al. (2018)
https://doi.org/10.1088/1748-9326/aae014

The Caribbean Handbook on Risk Management (charim.net) provide lots of online practical advice on flood hazard assessment, including a step by step national level analysis for Belize using a global flood hazard model:
http://www.charim.net/use/62

CONTACT

The Global Flood Partnership is a cooperation framework between scientific organisations and flood disaster managers worldwide to develop flood observations and modelling infrastructure, leveraging in existing initiatives for better prediction and management of disaster impacts and flood risk globally.
https://gfp.jrc.ec.europa.eu/

You may also contact Dr. Mark Trigg, m.trigg@leeds.ac.uk, directly for further information on this policy brief.