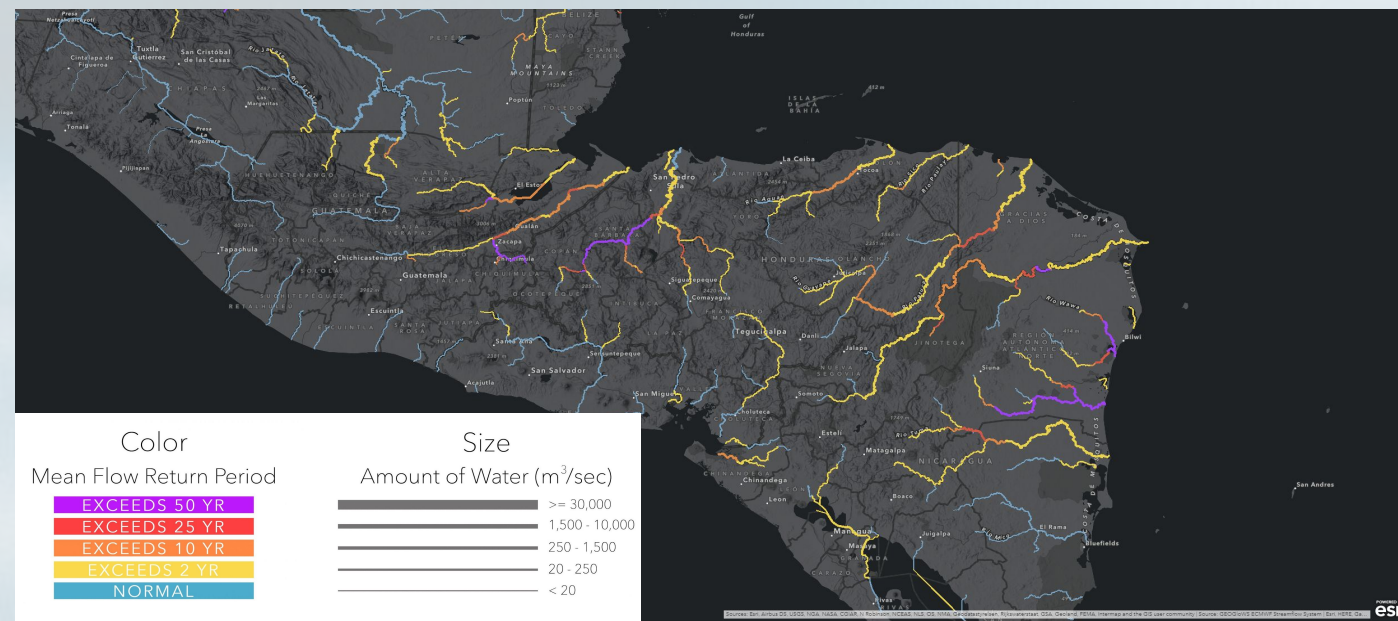




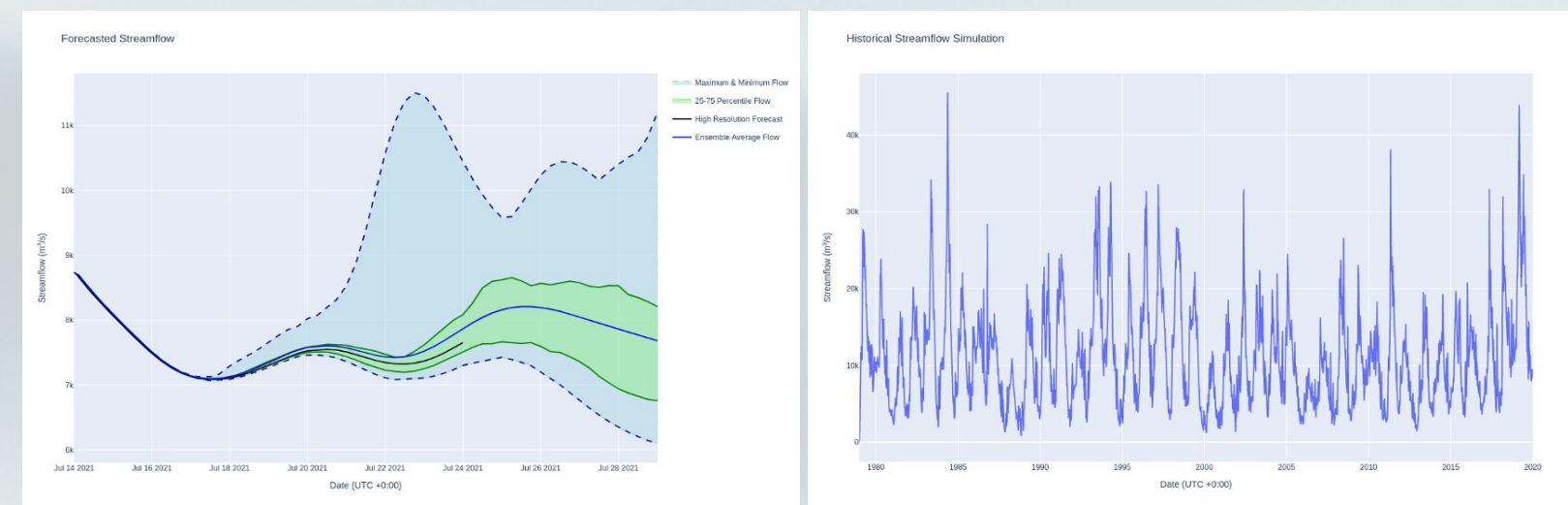
# In support of Malawi's Community-Based Flood Early Warning System (CBFEWS) for Effective Disaster Preparedness & Recovery

## GEOGLOWS ECMWF Streamflow

The GEOGLOWS ECMWF Streamflow model is a global hydrologic model and the flagship of the GEOGLOWS program. GEOGLOWS provides river discharge at about 1 million reporting points. The two principal datasets provided include a 15-day ensemble forecast, derived from the same land surface runoff estimates as GloFAS, and a deterministic historical simulation from January 1980 to near real time (2-3 months lag).



The GEOGLOWS model data can be visualized with a free map service provided by Esri Living Atlas. The map is updated daily to reflect the latest forecast data. Stream are styled by color and size to show flow magnitude and return period exceedance. These styles can be animated across the forecast period to visualize the propagation of flows through time.



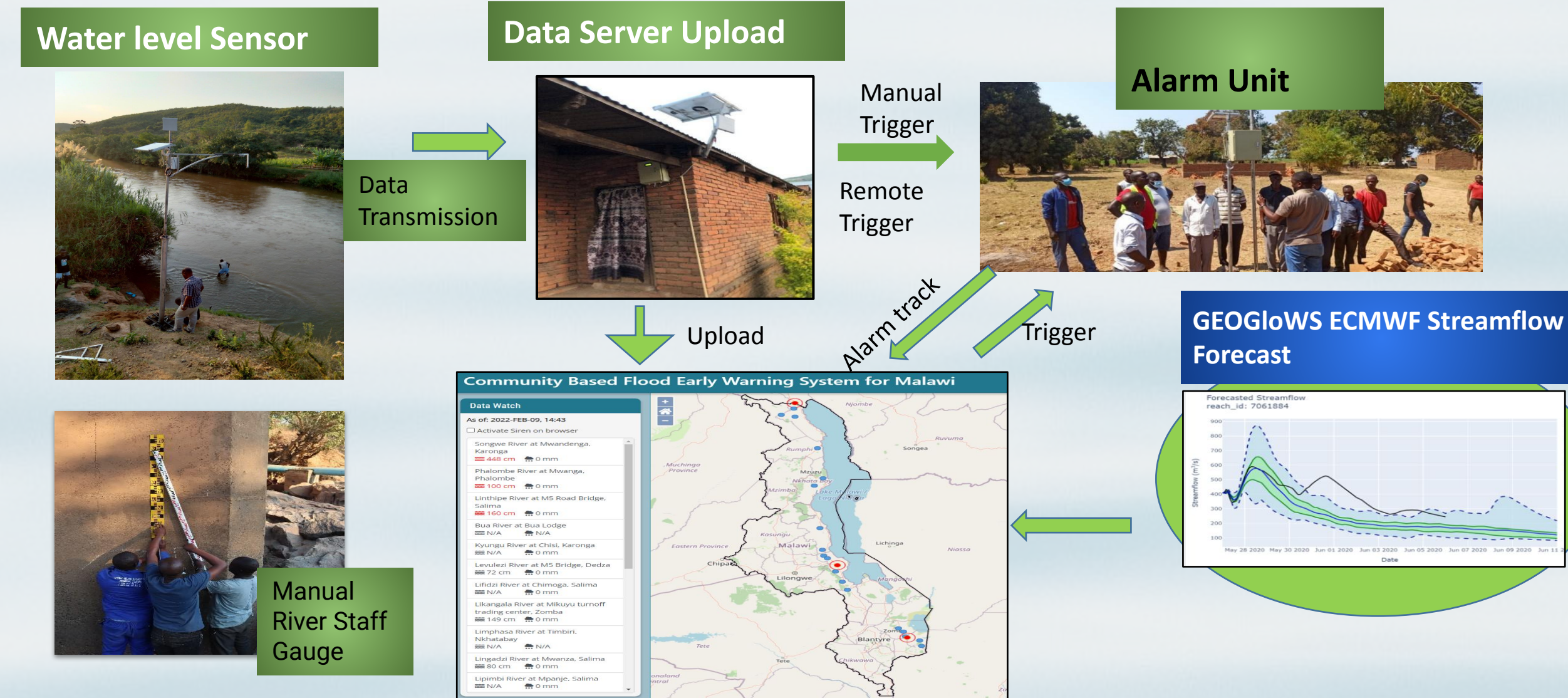
The forecast and hindcast discharge data are free to access. A web data service is available to retrieve these results for specific river segments. In addition to the raw results, several derived datasets are available such as averages, return periods, and flow duration curves. Bulk downloads are available in NetCDF format by contacting the model developers at BYU.



The chief interface for the model is the GEOGLOWS Hydroviewer web app. A series of other apps are available which utilize the mapping and data services for several specific applications and local customizations.

GEOGLOWS ECMWF Streamflow <https://geoglows.ecmwf.int>  
GEOGLOWS Toolbox (Web Apps) <https://apps.geoglows.org>  
GEOGLOWS Toolbox (Other Content) <https://training.geoglows.org>

## Community Based Flood Early Warning System (CBFEWS)



The elements of the integrated and operational Community-Based system include: at the upstream locations, there are Water Level Sensors with a Data Acquisition unit and a manual staff gauge installed within the river; at the downstream locations and within the floodplain, we have caretakers and alarm units with access to tipping bucket rain gauges and Data Upload units. All this information is transmitted to a centralized location and visualized through a platform. When the flood warning threshold is reached at the upstream location and is verified by the Community Caretaker, the downstream Alarm/Siren is triggered through an SMS for community members to evacuate to higher grounds and the established rescue centers. This manual system provided lead time information in the order of hours.

This system was **enhanced with the implementation of the GEOGLOWS ECMWF streamflow forecast**, which provides information for potential floods 15 days ahead and allows the community and decision makers to prepare better.

## The GEOGLOWS Partnership



The GEOGLOWS-ECMWF streamflow forecast service is an essential tool in reducing vulnerabilities and flood risk, it was initially funded by NASA and the World Bank with strong support from Brigham Young University, Esri, and NOAA. Today, this partnership has grown to more than 30 institutions, and the service is hosted by the European Centre for Medium-Range Weather Forecasts, ECMWF.

This partnership and the resulting operational services at ECMWF have been foundational in ministerial and national decision-making during flooding events worldwide, including 2022 Cyclone Ana in Malawi.

Since 2017, global partners under the Group on Earth Observations Global Water Sustainability (GEOGLOWS) Initiative have pioneered transdisciplinary collaboration of experts and organizations to establish the **GEOGLOWS-ECMWF Streamflow forecasting** service that provides a 15-day ensembled streamflow forecast on every river in the world.

## Malawi and the Green Climate Fund



Climate change is one of the biggest challenges that humanity is facing today, with implications for food security, economic development, and eradicating poverty in developing countries, especially for Least Developed Countries (LDCs) like **Malawi**.



Malawi's National Adaptation Plan process was launched in September 2014 under the auspices of the Environmental Affairs Department (EAD) in the Ministry of Natural Resources and Climate Change. In 2014, Malawi applied to the Green Climate Fund, and in 2016 the funding was awarded for implementing the M-CLIMES project, which commenced in July 2017.

M-CLIMES by GCF and UNDP is helping to scale up and modernize Climate Information and Early Warning Systems in Malawi. The integrated Community-Based Flood Warning system (CBFEWS) supports Malawi's efforts to expand the use of M-CLIMES throughout the country.

The Malawi Department of Disaster Management Affairs (DoDMA) is a government agency responsible for coordinating and directing disaster risk management (DRM) programs in the country to improve and safeguard the quality of life for Malawians. **DoDMA coordinates the provision of early warnings**, drawing on hydrologic information produced by the Department of Water Resources (riverine floods) and the Department of Climate Change and Met Services to provide climate and flash floods information.

With support from the World Bank, DoDMA has planned to upscale the integrated CBFEWS into ten flood-prone districts frequently impacted by cyclones in the Southern part of Malawi, targeting 40 river systems.



### Poster authors and contributors:

**Samuel J. Gama and Fedson Chikuse** - Office of the President and Cabinet/Department of Disaster Management Affairs - Malawi

**Calvince Wara** - Regional Centre for Mapping of Resources for Development (RCMRD) - Kenya

**Jim Nelson and Riley Hales** - Brigham Young University, USA

**Angelica L. Gutierrez** - National Oceanic and Atmospheric Administration (NOAA)

**Sara Venturini** - Group on Earth Observations Secretariat

[info@geoglows.org](mailto:info@geoglows.org)

