Vulnerability Assessment of Human Settlement to Floods

Integrating Google's Open Buildings Geospatial Data with Earth Observation Systems for Floods Preparedness and Response

Report Submitted for Zindi Competition on

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ABOUT ME

I am Emmanuel KIPNGETICH, Kenyan by Nationality, 3rd year student Pursuing Bachelors of Science Degree in Geospatial Information Science and Remote sensing, in the Institute of Geomatics, GIS and Remote Sensing at Dedan Kimathi University of Technology, Nyeri, Kenya.

Currently on Industrial Attachment at the Regional Center for Mapping of Resources for Development (RCMRD), Nairobi Kenya.

ABOUT THE SOLUTION

I have done a Vulnerability Assessment of Human Settlement to Floods

Through Integrating Google's Open Buildings Geospatial Data with Earth Observation Systems for Floods Preparedness and Response

Objective

This objective of this approach aims to be a quick tool for users of any experience level to create information about flooding. The code is to be input into Digital Earth Africa Analysis Sandbox and run according to the area and dates specified by the user in the analysis parameter section. After the process has run, the code will create a delineation of flood extent using Sentinel 2 Level 2 Surface Reflectance data and change detection methodology. The code will also produce information about urban areas and population density exposed.

Disaster type

Flood - an overflow of a large amount of water beyond its normal limits, especially over what is normally dry land

Floods impact on both individuals and communities, and have social, economic, and environmental consequences.

Water-Related Disaster Management (SDG 11.5) targets to significantly reduce the number of deaths and the number of people affected and substantially decrease the direct economic losses relative to global gross domestic product caused by disasters, including water-related disasters, with a focus on protecting the poor and people in vulnerable situations.

This report, through analysing the flood prone-zone along River Nzoia Budalangi Kenya in Digital Earth Africa Analysis Sandbox, focuses on The United Nations Sustainable Development Goal (SDG) 6: CLEAN WATER AND SANITATION, and directly addresses Indicator 6.6.1 - Change in the extent of water-related ecosystems

Disaster Cycle Phase

Recovery & Reconstruction

Relief & Response

Test Site

Budalangi Sub-County, Busia County, Western Kenya, Africa

Context

A report by SKY News, wednesday 6 May 2020 20:49, stated that 'Severe flooding across parts of Kenya has killed nearly 200 people and left tens of thousands of people homeless, according to the country's government'

On March 05 2020, Musoma primary and secondary schools in Bunyala South, Budalang'i constituency, were likely to be closed by the public health department due to flooding.

The floodwater ware from the rains currently falling in most parts of the country that time. Pit latrines in the two learning institutions were flooded, putting the health of the children at risk.

Pupils said were forced to wade through the floodwater to reach their respective schools. Early childhood education pupils are most affected as they are unable to wade through the floodwater and need their parents and guardians to take them to school

In this context, quick and accessible information is critical for the disaster community to build a comprehensive plan on how to respond rapidly so that more communities, crops and lives aren't lost as the country works to rebuild. This tool is built to be used to provide that information.

Above, March 05 2020 - Flood victims in Budalangi, Busia [The Star News]

Above, Budalangi region , residents have had to carry their belongings away from their submerged houses using boats and motorbikes, after the River Nzoia burst its banks, spilling over the land for miles around.*01:12, 07-May-2020 Sky News*

Applicability

Being a script-based approach, it is highly reproducible in other regions. Its ability to performing analysis without downloading satellite data, gives a chance to the user to apply it in different regions, only changing the analysis parameters (time and location)

This tool can be used to provide a comprehensive overview of a flood, across any size area of interest – from small communities to states. In addition to the outline of flood areas, this code produces data about major population centres, providing information to be used by rescue and response operations.

This tool is built to provide instant and near real-time information about flood extent, settlements and urban areas affected. It can be used in any areas affected by floods in Africa.

PLATFORM

Digital Earth Africa Analysis Sandbox

DE Africa Platform includes infrastructure and tools that support data visualization, discovery and analysis and enable users to interface with DE Africa data and services.

The DE Africa Sandbox is a cloud-based computational platform, accessible to users for open-source scientific notebook development, that operates through a Jupyter Lab environment. It provides users with access to data and analysis tools, democratizing access to remote-sensing data to allow for ad-hoc report generation and rapid development of new algorithm

Digital Earth Africa (DE Africa) aims to improve the lives of Africans by providing planners and policy makers with tailored Earth observation information to support better decision making and enhance sustainable development outcomes.

The Mission of DE Africa is to provide a routine, reliable and operational service, using Earth observations to deliver decision-ready products enabling policy makers, scientists, the private sector and civil society to address social, environmental and economic changes on the continent and develop an ecosystem for innovation across sectors

DATA

• Administrative Boundaries

The Kenya level 3 (Country, County and Subcounty) administrative boundaries, source : IEBC, Contributor: OCHA Regional Office for Southern and Eastern Africa (ROSEA) , updated : 28 September 2021 , were obtained from The Humanitarian Data Exchange, and uploaded to DEA Sandbox https://data.humdata.org/dataset/cod-ab-ken

• Satellite Data

Surface Reflectance Sentinel 2 Level 2 A are pre-loaded together with other earth observation data in DE Africa enabling users to immediately start performing interactive analysis on the data without downloading the raw data.

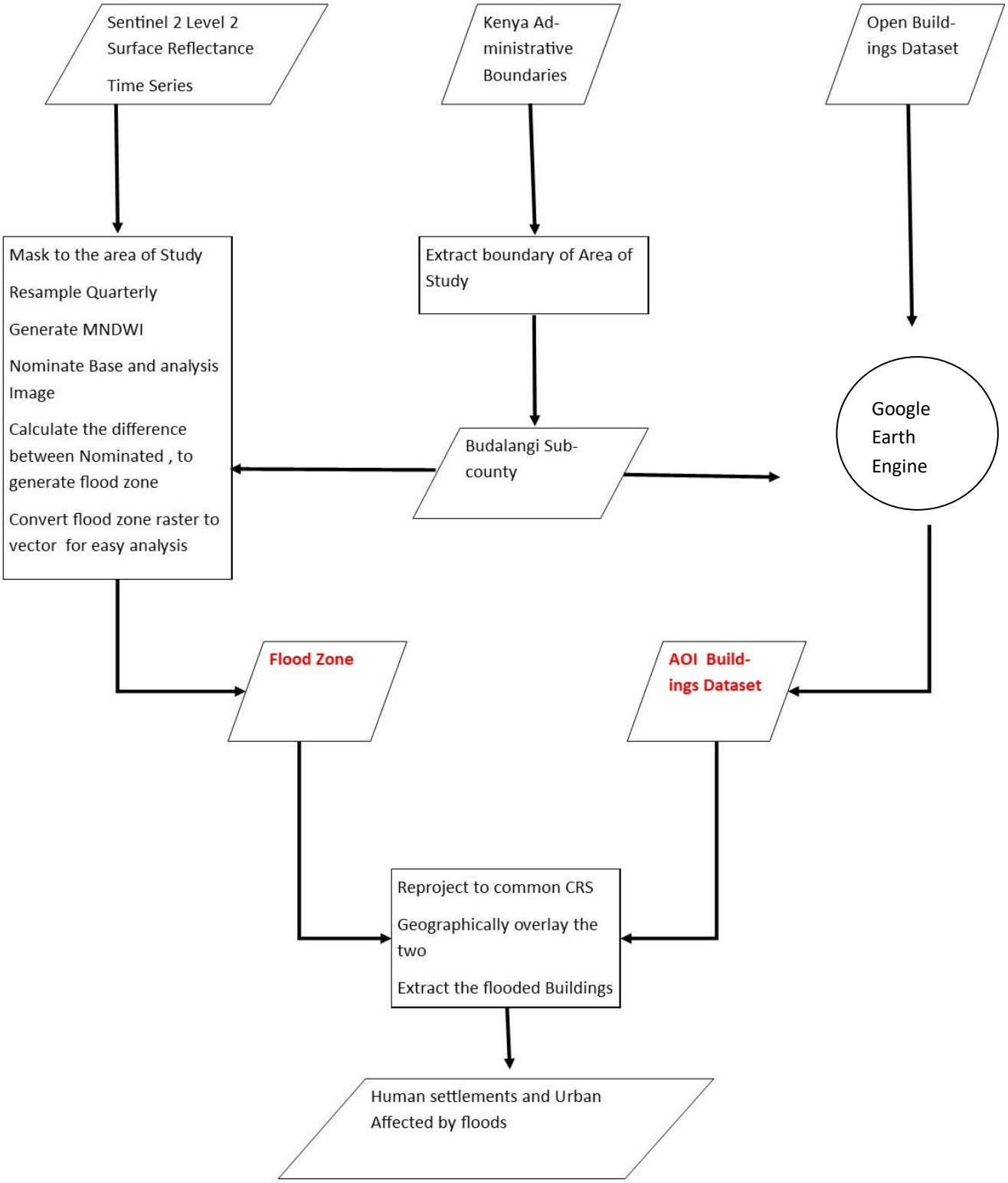
• Building's Dataset

Open Buildings V1 Polygons dataset of the area of study was obtained through Google Earth Engine GEE (https://code.earthengine.google.com/12209646ee7b17a7d36cb885bd2810d2) and uploaded to DE Africa Sandbox

METHODOLOGY

An analysis done in Digital Earth Africa, provided for delineation of flood prone zones in Budalangi Constituency as per the flood occurrence on 01 March, 2020 in this area

Through overlaying with Open Building Dataset, the affected built-up regions and potential hazardous built regions neighboring the flood zones are able to be pin pointed, thus facilitating measures to curb adverse effects of floods



VISUALIZATION

https://storymaps.arcgis.com/stories/ac7c462a809f4938acfad4f888a3b67d

https://deku.maps.arcgis.com/apps/instant/interactivelegend/index.html?appid=c3678ca4fe2a4115a0722b2a865c9457