UN/Ghana Conference on space technologies for water resources management

Session 1B:Space Technology and Water-related Extremes Floods

Flood Extent Mapping Using Integration of Google Earth Engine and Statistical Thresholding: A Case Study Lare District, Gambella Region, Ethiopia

Presented by: Tsegaye D. Lemma

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Flood Extent Mapping Using Integration of Google Earth Engine and Statistical Thresholding: A Case Study Lare District, Gambella Region, Ethiopia

Tsegaye D. Lemma[*1, 2], Paolo Gamba[3], and Gizachew Kibate[2]

[1]Department of Satellite Research, Development & Operations, Aeronautics and Astronautics Center, Ethiopian Space Science and Technology Institute (ESSTI), P.O. Box 33679, Addis Ababa, Ethiopia;

[2]Department of Remote Sensing Research & Development, Entoto Observatory and Research Center (EORC), Ethiopian Space Science and Technology Institute (ESSTI), P.O. Box 33679, Addis Ababa, Ethiopia;

[3]Department of Electrical, Biomedical and Computer Engineering, University of Pavia, Pavia, Italy; paolo.gamba@unipv.it

[*]Correspondence: meonaddis@gmail.com / tsegayed@essti.gov.et Tele +251911908387

Outlines

- ➢ Background
- ➢ Problems & Objectives
- ➢ Materials and Methods
- ➢ Results and Discussion
- ➢ Conclusion

Acknowledgements

Reference used

Background

- Report shows that Water-Related Disasters (WRD), such as cyclones, floods, and droughts, account for 90% of natural disasters. Since the year 2000, over 5300 WRD have been reported, with over 325,000 fatalities and an economic loss exceeding USD 1.7 trillion globally (Perera et al., 2019).

https://www.bbc.com/news/world-europe-57862894
Germany

Cont'd…

More recently, extreme weather variability has shown a significant increase in the occurrence of floods globally account for approximately 54% of all WRD, causing unprecedented deaths, diseases, and *destruction* of property and crops.

August 17, 2021 Addis Ababa flood

https://twitter.com/Flood_List/status/1428057813436321804/photo/1

Problems and Objectives

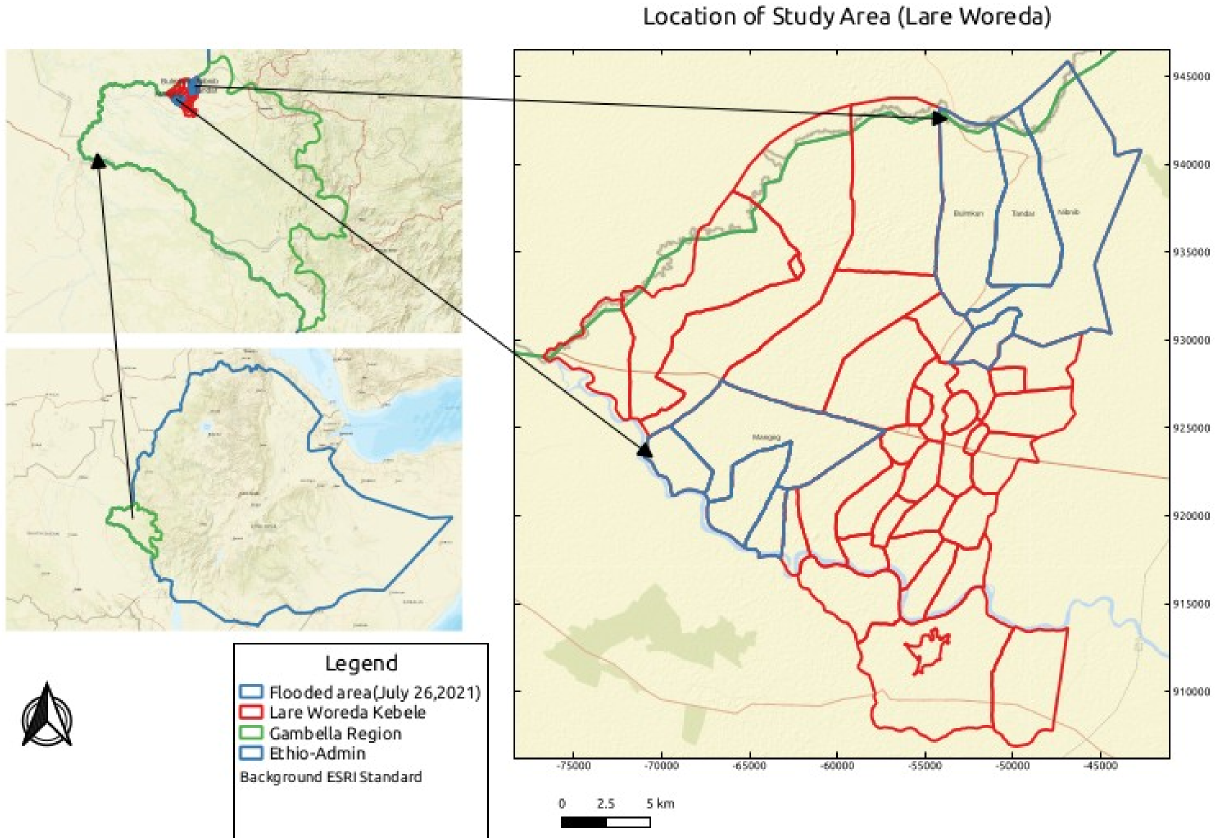
Problems

- Why it is difficult to mapping the actual flood extent?
- ➔ Depends on thresholding techniques?
- ➔ Lack of sufficient economic budget and historical data record.

Objectives

- ➔ Estimate the flood inundated over the study area;
- ➔ Introduce Open Cloud-based flood inundation extent mapping in Lare Woreda

Study Area



Among 25 districts, the four districts(Kebele's) were identified as flooded in July 26,2021 namely, Tender, Mangog, Buimkun, and Nibnib. The districts are located in the floodplain of Baro river.

Materials and Methods

Resources:

Google Earth Engine (GEE)
https://earthengine.google.com/platform/

Sentinel-1 Level-1 Ground Range Detected (GRD) imagery

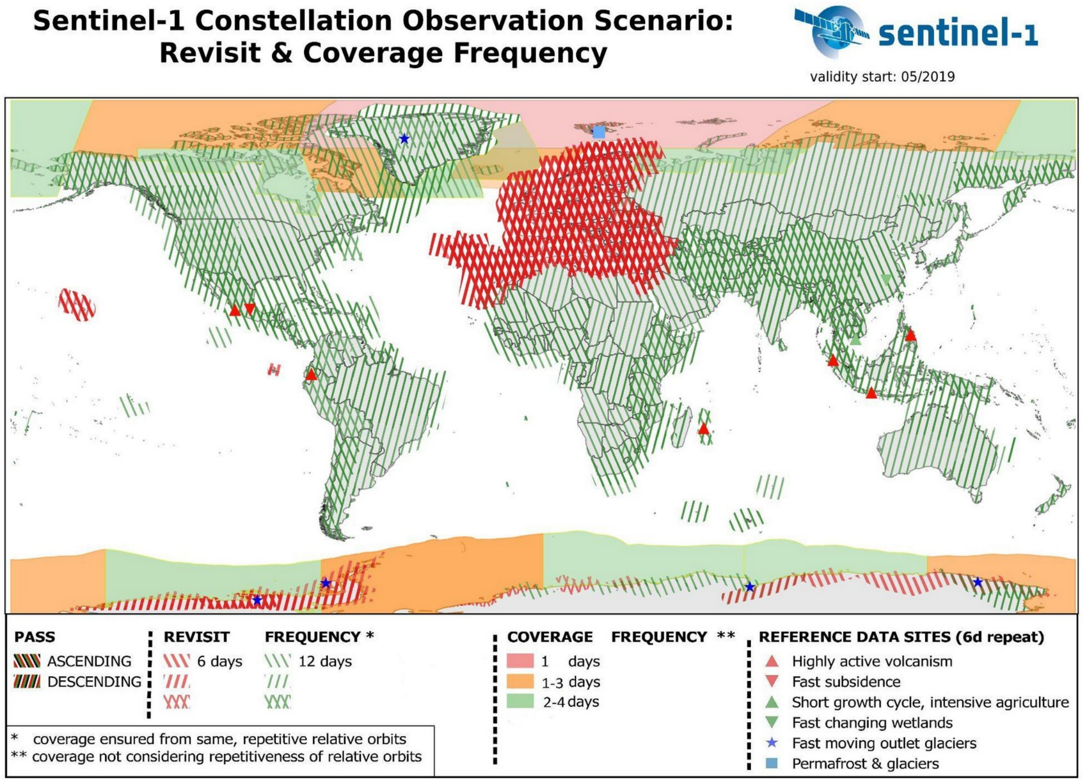
JRC Global Surface Water Mapping Layers, v1.3

WWF HydroSHEDS Void-Filled DEM, 3 Arc-Seconds

QGIS Version 20.

Administrative shapefile level (0-4)

ESRI-LULC 2020

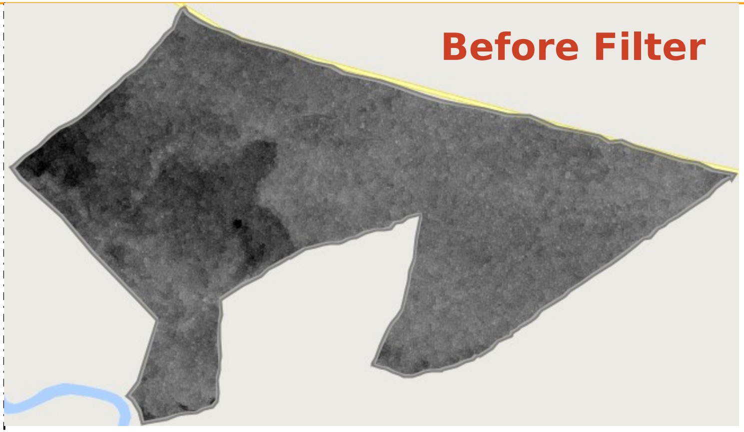


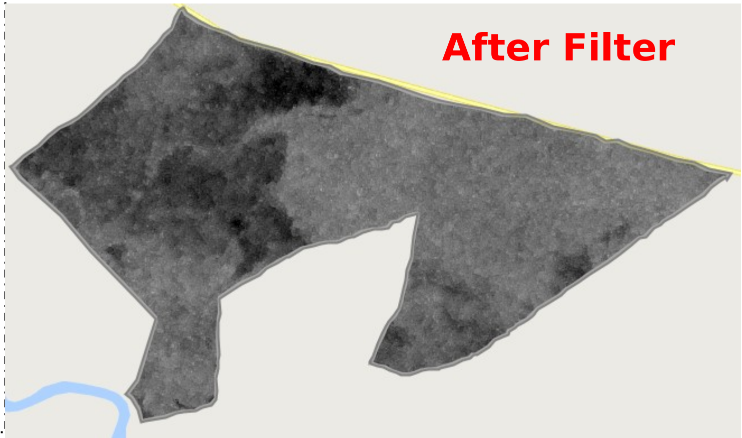
Source: [*https://sentinel.esa.int/web/sentinel/missions/sentinel-1/observation-scenario*](https://sentinel.esa.int/web/sentinel/missions/sentinel-1/observation-scenario)

Methods

Preprocessing

- Apply-orbit-file (updates orbit metadata)
- ARD border noise removal (removes low intensity noise and invalid data on the scene edges)
- Thermal noise removal (removes additive noise in sub-swaths)
- Radiometric calibration (computes backscatter intensity using sensor calibration parameters)
- Terrain-correction (orthorectification)
- Conversion of the backscatter coefficient (σ°) into decibels (dB)
- Smoothing filter to reduce the inherent speckle-effect of radar imagery (i.e Refined Lee Speckle filter)
- Change Detection approach followed



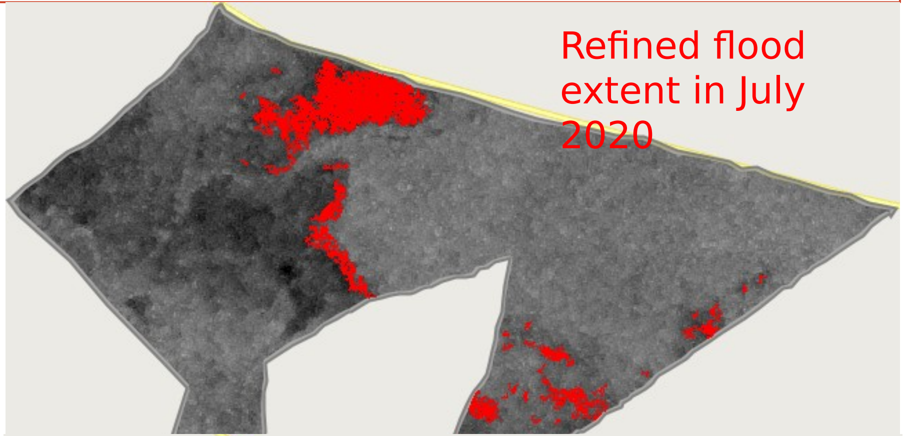


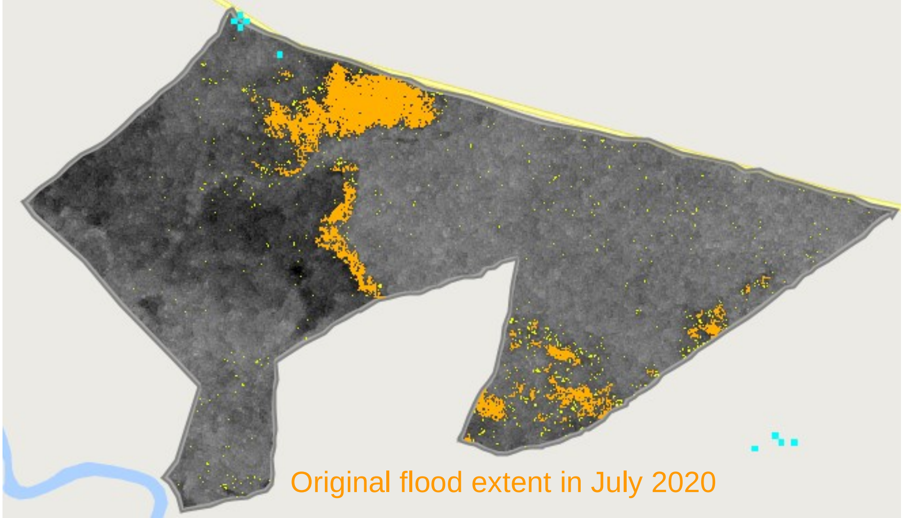
Results and Discussion

★ After basic preprocing steps we applied additional refining techniques such as;

❖ JRC Global Surface Water Mapping Layers, v1.3 (used to Mask out permanent water(>10 months)

❖ WWF HydroSHEDS Void-Filled DEM, 3 Arc-Seconds (remove areas with over 5 % slope)





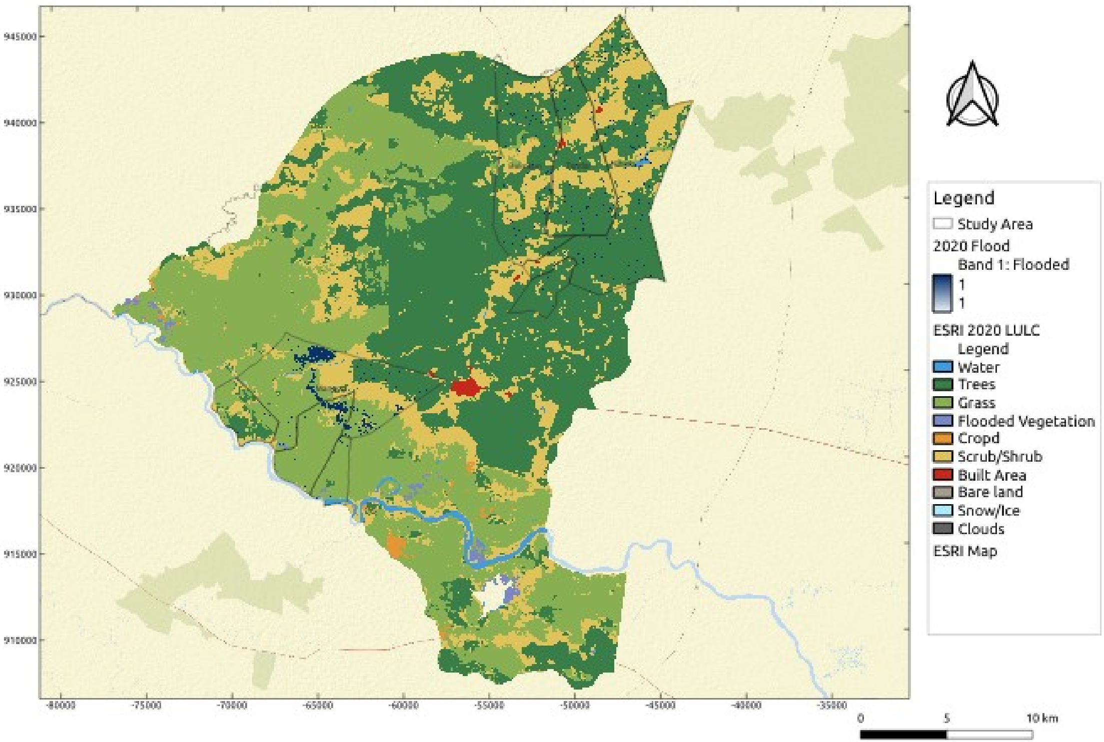
Results and Discussion

- Recurrent flooding has caught the attention of disaster relief agencies;

- Preparing quick flood extent map
- Providing near real-time flooding information to relief a gencies and localgovernment.

- Furthermore, integrating with other socioeconomic data (i.e LULC, Population density, … etc) allow us to predict the total damage (Cao et al., 2019)

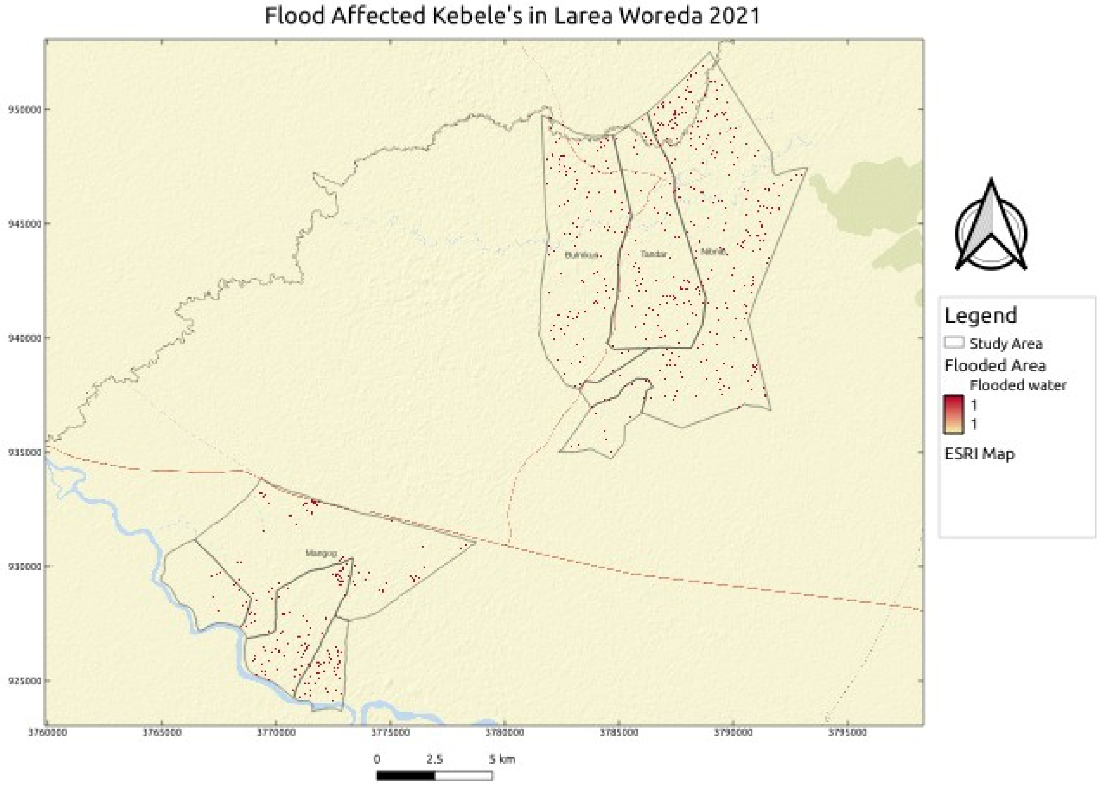
Flood afected Kebele's in Lare Woreda in 2020



Results and Discussion

In this work we tried to map the flood extent, and calculate the total area which area affected by flood. And compare the results with previous one.
(Mehmood et al., 2021)

The summary table shown in next slide.



The flood extent map of study area July 26, 2021

Summary Table

K-name	Ttotal Area in Hectare	Threshold	The flooded area in Hectare in month of July only					
			2021	2020	2019	2018	2017	Avg
Tandar	3307.34	1.25	71.64	50.17	49.58	74.79	91	67.43
Bulmkun	4909.94	1.25	100.6	127.87	144.84	74.67	69.83	103.56
Mangog	4399.89	1.25	36.35	268.31	434.94	107.46	40.26	177.46
Nibnib	7057.1	1.25	147.35	105.66	132.12	192.7	104.3	136.42
Total	19674.27		355.94	552.01	761.48	449.62	305.38	484.87

Conclusions

- We understood that, even though lack of high resolution data and forecasting models in developing country like Ethiopia, using the open and freely available fine resolution data and “Potential” processing platform (i.e GEE) offering a unique solution for researcher, DRRM and Decision makers.
- From this research work, flood extent map derived from Sentinel-1 SAR provides a reliable information for “Before”, “During”, and “After” flood event.
- Integrating satellite derived information and socioeconomic dataset will minimize the risk of natural disasters like floods.

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- ❖ UN/Ghana, 2022 Conference Organizers
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Thank you!!!

If you have additional comments or questions

Contact us through;

meonaddis@gmail.com/ tsegayed@essti.gov.et