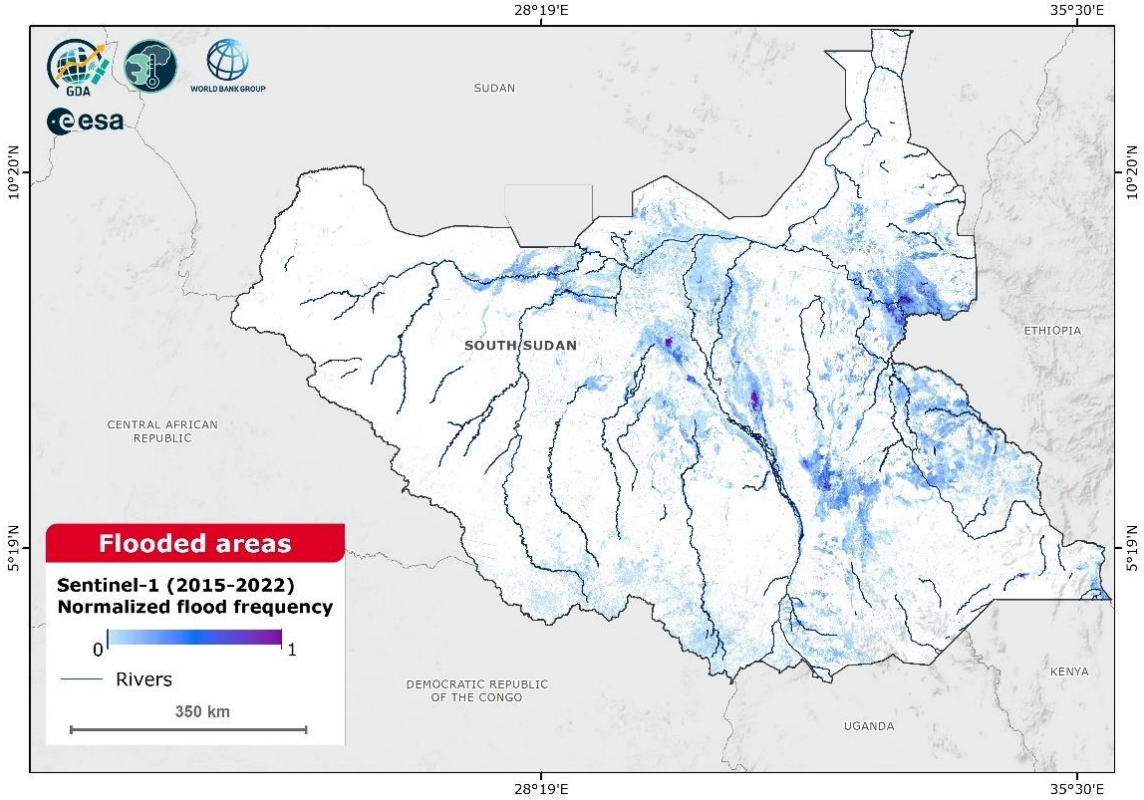
EO-FIN

Identification of Flood Hazard Areas



Normalized flood frequency (Jan 2015- Dec 2022) derived from Sentinel -1 data over South Sudan. (Source: GMV)

Product Category

☐ Land Use	■ Natural Disaster	☐ Coast Management	☐ Earth's Surface Motion
☐ Land Cover	☐ Climate Change	☐ Marine	

Financial Domain(s)

■ Investment management ■ Risk analysis ☐ Insurance management ☐ Green finance

User requirements

UN12: Analysis of potential risks in specific regions.
UN13: Need to geo-map clients.
UN14: Need to screen the feasibility of projects against different hazard criteria.
UN37: Projection of risk to portfolio assets into the future.
UN43: Need to monitor changing precipitation patterns and flood risk in the vicinity of vulnerable assets.

Description

The identification of flood hazard areas refers to the process of assessing and determining the regions that are susceptible to flooding. Flood hazard maps can be generated by analysing historical flood data to determine the frequency of flood events within a specific region over a given time period. The identification of flood hazard areas offers several important advantages for the financial management sector including risk mitigation and planning, for example, avoiding construction in high-risk zones and insurance management to set appropriate premiums based on the level of flood risk. The concept of calculating flood hazard maps involves comparing a temporal composite image representing dry conditions with multiple composites of available images over a specific period. The goal is to detect flooded pixels and subsequently determine the flood frequency for each pixel based on the number of occurrences it was susceptible to flooding. SAR sensors are preferred for flood hazard mapping due to their ability for cloud penetration, which is an important factor to consider for monitoring flood events because they commonly occur during hurricane-related flooding or periods of extended rainfall.

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Spatial Coverage Target
Asset level and its surrounding
Data Throughput
Rapid tasking ☐ High ■ Low Data availability ■ High ☐ Low

Product specifications	
Main processing steps	The process starts by downloading Sentinel-1 images and covers an appropriate time period, it is suggested to use all available images since the launch of Sentinel-1 (2014) and determine the dates with available data. Apply temporal composites within an appropriate number of days. It is recommended to use a time window of two days to avoid the loss of information in a larger time window. If there is more than one image in the time window, the last image is selected. Then it is crucial and critical to select a composite that represents the reference dry condition. The identification of flooded pixels for each composite can be conducted by implementing an UN-recommended practice by comparing each composite to the reference dry condition composite resulting in a different image for each composite. Subsequently, a threshold should be applied to highlight the flooded pixels. Then we should exclude permanent water bodies, areas with higher slopes, and pixels with few flooded neighbours. At this point, the flooded maps for each temporal composite are generated, and a normalized flood frequency map is generated by normalizing the number of times each pixel was identified as flooded using the total number of observations.
Input data sources	Optical: N.A Radar: Sentinel-1, VHR images from different sources like ICEYE, Capella space, Umbra, and TerraSAR-X Satellite-based products: N.A Supporting data: DEM, Permanent water shape file
Accessibility	Sentinel-1: freely and publicly available from ESA. SAR VHR imagery: commercially available on demand from EO providers.
Spatial resolution	Sentinel-1: 20 m SAR VHR: ≤ 3 m
Frequency (Temporal resolution)	Sentinel-1: 6 days SAR VHR: Daily
Latency	Sentinel-1: ≤ 1 day SAR VHR: ≤ 1 day
Geographical scale coverage	Globally
Delivery/ output format	Data type: Raster File format: GeoTIFF
Accuracies	Thematic accuracy: 80-90% Spatial accuracy: 1.5-2 pixels of input data
Constraints and limitations	■ False positives from changes on the land surface, not caused by flooding. ■ Difficulties of detecting flood in urban or densely vegetated areas. ■ No capturing of flood peak due to the Sentinel-1 acquisition frequency. ■ False positives caused by differences in relative orbits of Sentinel-1.
User's level of knowledge and skills to extract information and perform further analysis on the EO products.	Skills: Ample Knowledge: Ample