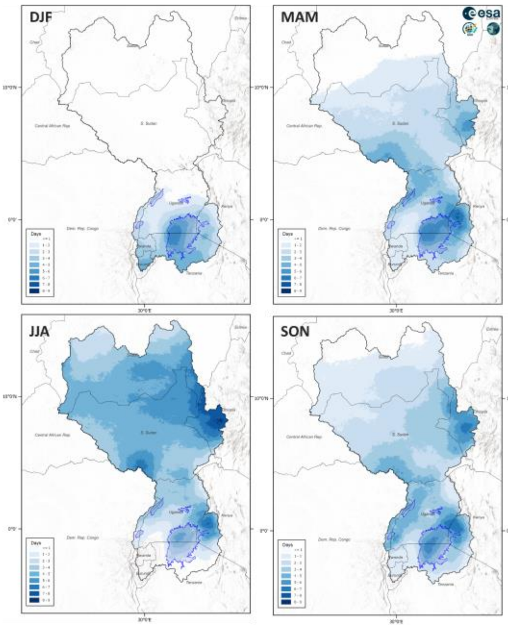
Identification of Trends Related to Shifts in Rainfall Patterns



Seasonal distribution of average number of days with precipitation above 90th percentile of the reference (1983-2022) 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 hazards criteria.
UN43: Need to monitor changing precipitation patterns and flood risk in vicinity of vulnerable assets.

Description

Amidst climate change, the importance of identifying trends related to shifts in rainfall patterns becomes even more crucial due to the severe impact of extreme precipitation events, leading to a multitude of natural disasters like landslides and flash floods. Knowing the extreme precipitation trends is important for crop productivity by helping agricultural companies to adapt their cropping patterns, irrigation practices, and water management techniques. In addition, the benefits of analysing extreme precipitation events are not only limited to the agricultural sector but also important for risk analysis and insurance management for other sectors such as real estate, infrastructure planning, and Tourism. To determine the probability of occurrence of extreme rainfall events, the return period (a measure of the rareness of extreme events), and frequency of extreme precipitation events are computed through a statistical analysis of historical time series data. For precipitation estimation, satellite-based precipitation and reanalysis products offer significant advantages over traditional in-situ observations. These methods provide continuous spatial and temporal coverage, which is particularly beneficial for remote regions and developing countries where traditional in-situ observations may have limitations in terms of both spatial and temporal coverage.

Spatial Coverage Target

Asset level and its surrounding

Data Throughput

Rapid tasking	☐ High	■ Low
Data availability	☐ High	■ Low

EO-FIN

Product specifications	
Main processing steps	Long-time series of historical precipitation data should be acquired through validated sources with long periods of observations and appropriate spatial resolution such as ERA5-land, CHIRPS, and TAMSAT. The performance of these products can be evaluated over the study area to select the most appropriate product for the region. The return level is calculated for the return periods for multiple sampling sizes, based on the study, such as 1-day, 5-day, and 30-day maximum precipitation. One way to analyse the general precipitation trend is to generate the Simple precipitation intensity index (SDII). This index is used to indicate the average daily rainfall on wet days (with daily precipitation > 1mm) for a period. It is calculated by dividing the total amount of precipitation in wet days over the number of wet days. The trend can be analysed by plotting the time series of SDII, the analysis can be seasonally and annually or any time interval. Besides SDII, we can calculate the annual total precipitation on wet days (PRCPTOT). Combining information from both SDII and PRCPTOT, we can have an overview of the mean and amount of precipitation on wet days. To further assess the spatio-temporal variation of precipitation, we can perform a frequency analysis based on the number of days where the daily precipitation is above the 90th percentile (may change) of the reference period. Thus, we can have a comprehensive insight into the trend of extreme precipitation events over a long period over the study area.
Input data sources	Optical: N.A Radar: N.A Reanalysis products: ERA5-land Satellite-based products: CHIRPS, TAMSAT Supporting data: In-situ precipitation data
Spatial resolution	ERA5-land: 0.1° CHIRPS: 0.05° TAMSAT: 0.0375°
Accessibility	ERA5-land: freely and publicly available from ECMWF. CHIRPS: freely and publicly available from Climate Hazard Centre in University of Santa Barbara. TAMSAT: freely and publicly available, it was developed by the University of Reading.
Frequency (Temporal resolution)	ERA5-land: Hourly CHIRPS: Daily TAMSAT: Daily
Latency	ERA5-land: ≤ 1 day CHIRPS: ~ 45 days TAMSAT: 5-6 days
Geographical scale coverage	ERA5-land & CHIRPS: Globally TAMSAT: Africa
Delivery/ output format	Data type: Raster File format: GeoTIFF, NetCDF
Accuracies	Thematic accuracy: 80-90% Spatial accuracy: 1.5-2 pixels of input data
Constraints and limitations	■ Low spatial resolutions of the precipitation products. ■ Uncertainties related to precipitation estimation of the products due to the sensors, or the methodology to calculation precipitation amount. ■ Lack of in-situ data to evaluate the products.
User's level of knowledge and skills to extract information and perform further analysis on the EO products.	Skills: Essential Knowledge: Essential