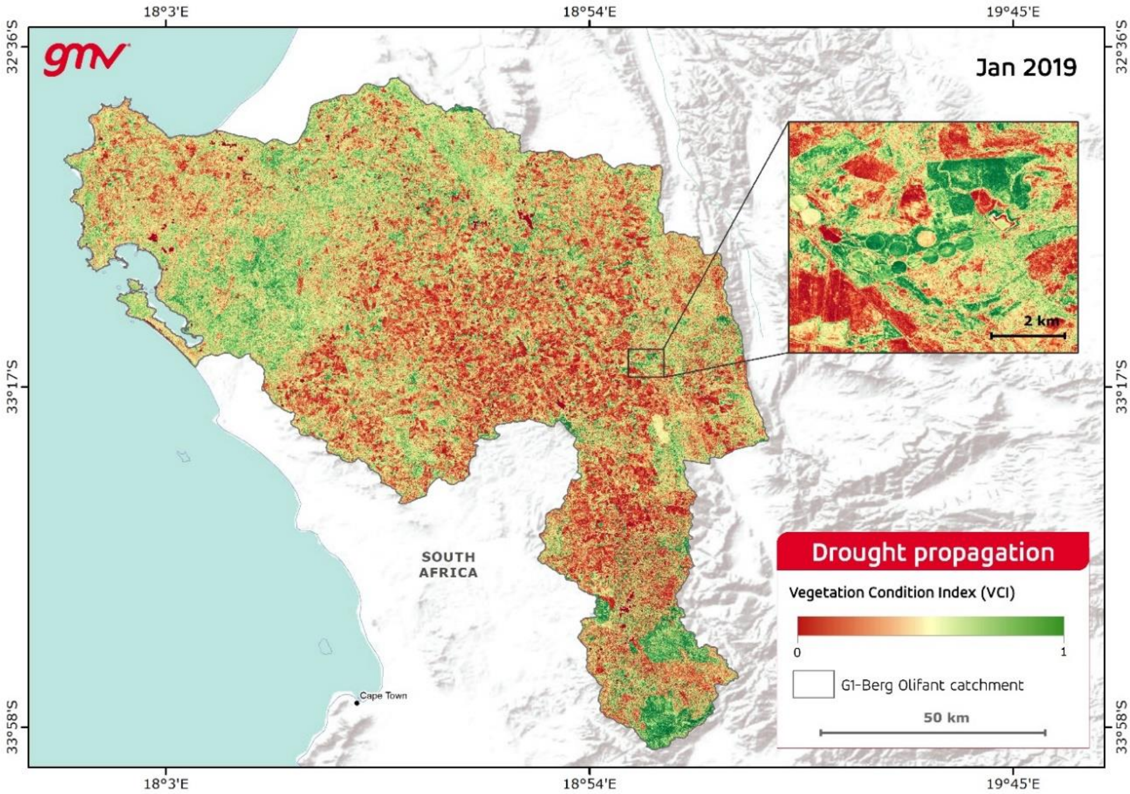
EO-FIN

## Drought Monitoring at Assets Level




VCI at 10m resolution based on Sentinel-2 data over a secondary catchment in South Africa (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.
UN37: Projection of risk to portfolio assets into future.
UN42: Need to monitor the impact of droughts on assets.

**Description**

Drought is a natural disaster or climatic phenomenon characterized by an extended period of abnormally low precipitation, resulting in a significant water deficit in a particular region. It leads to reduced water availability, soil moisture depletion, and a range of negative impacts on agriculture, ecosystems, water resources, and human communities. Considering the extensive range of factors that can cause and effects that can result from droughts, droughts are classifies into four main categories 1) Meteorological Drought 2) Agricultural Drought 3) Hydrological Drought 4) Socioeconomic Drought. As drought has complex environmental impacts and can affect numerous ecosystems components in parallel, it is important to monitor droughts using different indicators which correspond to each type of droughts. Standardised Precipitation Index (SPI) and Standardized Precipitation Evapotranspiration Index (SPEI) can be used as indicators for Meteorological Drought. Vegetation Condition Index (VCI) and Combined Drought Index (CDI), which is based on FAPAR anomaly, soil moisture anomaly, and SPI can be used to monitor Agricultural Droughts. For hydrological drought, indices such as Standardised Groundwater Index (SGI), Standardised Streamflow Index (SFI), and Integrated Drought Index (IDI) can be used. Beside using such indicators for drought monitoring and drought damage assessment, seasonal forecast of some of these indices can be generated.

**Spatial Coverage Target**

Asset level

EO-FIN

| Data Throughput | | |
|---|---|---|
| Rapid tasking | ☐ High | ■ Low |
| Data availability | ■ High | ☐ Low |

| Product specifications | |
|---|---|
| **Main processing steps** | Meteorological Drought: SPI is generated based on precipitation data which can be obtained from satellite-based precipitation products such as CHIRPS pr reanalysis products such as ERA5-Land. The SPI is calculated by comparing the accumulation of precipitation on a location over a period, to the same period through the historical precipitation data at that location. SPEI differs from SPI by calculating precipitation and Evapotranspiration to indicate the severity of drought based on water demand besides the amount of precipitation. Therefore, it is essential to calculate potential evapotranspiration (POT) which requires a lot of data such as precipitation, land temperature, wind speed and direction, and surface pressure. Such information can be acquired from ERA5-Land.<br>Agricultural Drought: VCI evaluates the current NDVI about the range of values seen during the same period in preceding years. The VCI provides a sense of where the observed value falls about the extreme values (minimum and maximum) from prior years. NDVI data can be obtained based on the desired spatial coverage. Moderate spatial resolution NDVI (300m) based on Sentinel-3 can be obtained directly from Copernicus Land Service, on the other hand, high spatial resolution NDVI (10m) can be calculated from Sentinel-2. CDI is calculated based on SPI, FAPAR anomaly, and Soil moisture anomaly. FAPAR anomaly can be calculated based on FAPAR data from Copernicus Land Services, and Soil moisture anomaly can be calculated also using Soil Water Index data from Copernicus Land Service.<br>Hydrological Drought: SGI and SFI can be calculated using in-situ data. IDI combines data from various sources (some of them are described above) and uses statistical methods or models to produce a single index value that represents the overall drought situation. |
| **Input data sources** | Optical: Sentinel-2<br>Radar: N.A<br>Reanalysis products: ERA5-Land<br>Satellite-based products: CHIRPS, Copernicus Global Land Service, MODIS.<br>Supporting data: Stream flow and groundwater in-situ data. |
| **Accessibility** | Sentinel-2 & Copernicus Global Land Service: freely and publicly available from ESA.<br>CHIRPS: freely and publicly available from the Climate Hazard Centre in the University of Santa Barbara.<br>ERA5-land: freely and publicly available from ECMWF.<br>MODIS: freely and publicly available from NASA. |
| **Spatial resolution** | Sentinel-2: 10 m<br>Copernicus Global Land Service: 300 m<br>CHIRPS: 0.05°<br>ERA5-land: 0.1°<br>MODIS: 250 m |
| **Frequency (Temporal resolution)** | Sentinel-2: 6 days<br>Copernicus Global Land Service: 10 days<br>CHIRPS: Daily<br>ERA5-land: Hourly<br>MODIS: 16 days |
| **Latency** | Sentinel-2: ≤ Day<br>Copernicus Global Land Service: ~ 3 days<br>CHIRPS: ~ 45 days<br>ERA5-land: ≤ Day<br>MODIS: 1-2 days |
| **Geographical scale coverage** | Globally |
| **Delivery/ output format** | Data type: Raster<br>File format: GeoTIFF, NetCDF, HDF |
| **Accuracies** | Thematic accuracy: 70-90% (depends on the input data sources)<br>Spatial accuracy: 1.5-2 pixels of input data |

| Product specifications | |
|---|---|
| **Constraints and limitations** | ▪ Low spatial resolution of precipitation data<br>▪ Lack of in-situ data for stream flow and groundwater data<br>▪ Lack of validation due to the lack of in-situ data |
| **User's level of knowledge and skills to extract information and perform further analysis on the EO products.** | Skills: Essential<br>Knowledge: Essential |