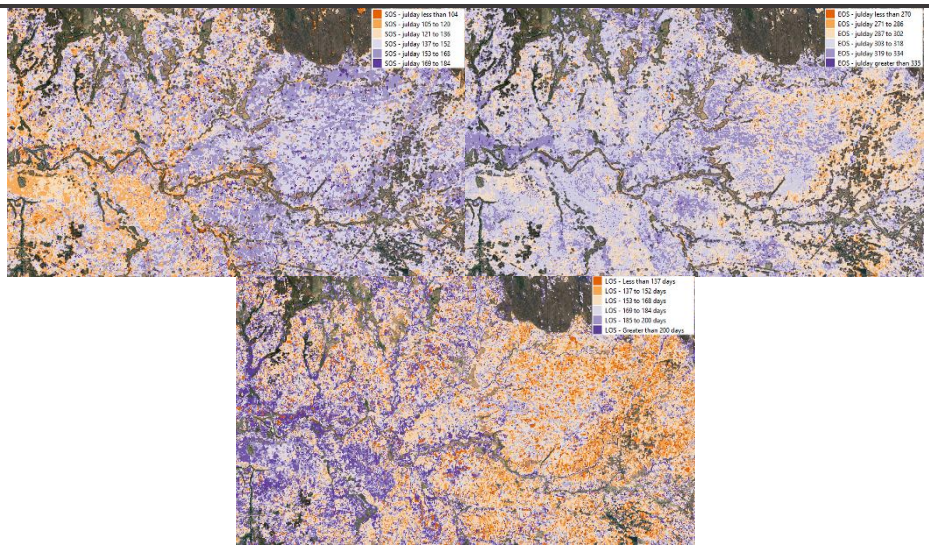

LSP metrics: start of season (SOS), end of season (EOS), and length of season (LOS) in Nigeria using Sentinel-2 (Source: GMV).

**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**

UN18: Need to monitor crop productivity.

**Description**

Crop phenology refers to the study and observation of the timing and sequence of distinct stages in the life cycle of a crop from germination to the final maturity and senescence. Phenological stages are anticipated to happen consistently at the same time every year within a particular bioclimatic region. Nevertheless, it is important to acknowledge that certain advancements or delays (measured in weeks) might be observed due to varying climatic conditions. Understanding the seasonal patterns in satellite time-series data and their correlation with dynamic vegetation characteristics, like phenology (growth stages) and temporal growth patterns, is a crucial process for developing more advanced crop-specific products. These products may include information related to crop rotation, the number of growing seasons, tillage practices, green biomass, and yield estimation. Crop type and acreage maps, along with vegetation indices, serve as the primary inputs for calculating land surface phenology (LSP) metrics, including the start of the season (SOS), end of the season (EOS), length of the season (LOS), and the peak of the season (POS). Additionally, local observations of crop phenology can be utilised for calibration purposes.

**Spatial Coverage Target**

Individual farm level

**Data Throughput**

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

| Product specifications | |
|---|---|
| **Main processing steps** | After generating the vegetation indices, linear interpolation will be used to fill in the gaps in the time series of vegetation indices. Afterwards, a temporal smoothing algorithm is employed to average matched images that fall within a predetermined time window. Then LSP metrics will be calculated based on the concept and methodology behind the Timesat software which has been used widely for phenological analysis and was applied to the generation of European high-resolution vegetation phenology and productivity data for Copernicus (HR-VPP). |
| **Input data sources** | Optical: Sentinel-2, VHR based on the availability like Pleiades 1A/1B & NEO, WorldView2&3, and SPOT6/7<br>Radar: Sentinel-1<br>Supporting data: Crop phenology observations |
| **Accessibility** | Sentinel-1&2: freely and publicly available from ESA.<br>Optical VHR imagery: commercially available on demand from EO service providers. |
| **Spatial resolution** | Sentinel-2: 10 m<br>Optical VHR: ≤ 1 m<br>Sentinel-1: 20 m |
| **Frequency (Temporal resolution)** | Sentinel-2: 6 days<br>Optical VHR: Sub-daily to Daily<br>Sentinel-1: 6 days |
| **Latency** | < 1 Day |
| **Geographical scale coverage** | Globally |
| **Delivery/ output format** | Data type: Raster<br>File format: GeoTIFF |
| **Accuracies** | Thematic accuracy: 80-90%<br>Spatial accuracy: 1.5-2 pixels of input data |
| **Constraints and limitations** | ■ The lack of local in-situ data<br>■ Cloud presence<br>■ The limited temporal resolution can make it challenging to capture specific phenological changes or detect short-duration crops accurately.<br>■ Capture complex phenological events.<br>■ May not directly capture the underlying physiological processes driving phenological stages, limiting the understanding of crop responses to environmental stressors. |
| **User's level of knowledge and skills to extract information and perform further analysis on the EO products.** | Skills: Essential<br>Knowledge: Essential |