→ EO4SD - EARTH OBSERVATION FOR SUSTAINABLE DEVELOPMENT

Climate Resilience | African Risk Capacity

African Risk Capacity's Africa RiskView (ARV)

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1. INTRODUCTION

The African Risk Capacity's (ARC) Africa RiskView (ARV) tool combines Earth Observation (EO) data with population vulnerability data to provide an early-warning model that measures food insecurity and estimates response costs, enabling decision-makers to plan and respond quickly and efficiently to drought stresses. The partnership between the European Space Agency (ESA) and the EO4SD CR cluster allowed enhancements to the ARV tool with the previously unavailable essential climate variables.

Following extensive consultation and engagement, the EO4SD CR cluster provides monitoring on soil moisture, which helps inform soil water holding capacity estimates, and new datasets on precipitation measurements, which can be used in drought monitoring, and to further improve the ARV tool. In addition to the contributions to ARC's ARV tool, the EO4SD CR cluster also supports validation activities associated with ARC's flood service – the ARC Flood Extent Depiction dataset (AFED).

About ESA's EO4SD Climate Resilience Cluster

Since 2008, the European Space Agency (ESA) has worked closely with International Financing Institutions (IFIs) and their client countries to harness the benefits of EO in their operations and resources management. Earth Observation for Sustainable Development (EO4SD) is a new ESA initiative which aims at increasing the uptake of EO-based information in regular development operations at national and international level.

The ESA EO4SD CR cluster aims to provide insight about the potential of EO to support of climate-resilient decision making at the regional and national scale. In collaboration with several IFIs, the EO4SD CR cluster has developed EO-based integrated climate screening and risk management products and services to help manage climate-related risks and capitalise on the opportunities that climate resilience can create. The EO4SD CR cluster is also working to build the capacity of IFI staff and IFI client states, allowing stakeholders to autonomously use EO-based information for climate resilience decision making.

2. ARC DISASTER RISK PRICING

ARC is an agency of the African Union with the objective to help African governments improve their capacities to plan for, prepare for, and respond to extreme weather events and natural disasters. To meet this objective, ARC aims to price Africa's weather-related food security risk.

ARC's ARV tool combines existing rainfall-based early-warning models on agricultural drought in Africa with data on vulnerable populations to form a standardised approach for estimating response costs to food insecurity across the continent. The ARV tool also provides decision-makers with expected maximum costs of drought-related responses before and during an agricultural season, helping countries to direct their drought response and food security investment.

Rainfall remains the main determinant of food security in Africa. As such, the focus of the ARV software uses a drought index based on a water balance model that was developed by the Food and Agriculture Organisation (FAO). This index compiles data on rainfall estimates, potential evapotranspiration, water holding capacity in the soil, crop type and their water demands, sowing dates, and length of growing period. These are used to estimate the extent to which the water requirements of the crop are likely to have been met. From this, they are able to calculate the likely food security risk. Predefined benchmarks are used to work out if the drought conditions at the end of a season are an anomaly or not. Such information can then be used to inform governmental decisions about managing the risk and providing aid.

3. ARC'S NEED FOR EO DATA

ARC's service in determining and pricing disaster risk depends on reliable data at the correct temporal and spatial scale being delivered in a timely manner. This is especially important as ARC's analysis is used to determine insurance pay outs for flood and drought risk in the region.

"Earth Observation data can support ARC's work in four areas" says François Kayitakire, Director of the Research and Development Department ARC: "Flood hazard mapping, exposure mapping, in season mapping, and decision support".

These four areas cover a broad range of ARC's activities. For flood hazard mapping, for example, ARC requires improved digital-elevation model (DEM) data to input into its hydraulic models for river catchment areas, better resolution datasets to capture localised flash flooding, and new datasets that provide information on surface water extent and soil moisture.

"We hope that advances in EO will lead to improved flood risk modelling." Says Kayitakire, "EO data is improving tremendously the modelling of disaster risk, in terms of both temporal and spatial resolution".

Once hazards have been mapped, ARC also needs to understand the level of exposure to climate hazards of different magnitudes. EO services for exposure mapping such as land use data and high-resolution products that characterise urban environments (such as providing building heights) would increase ARC's ability to model exposure.

EO services that support in-season monitoring allows ARC to verify its models against, for example, observed flood events. This requires high resolution, detailed flood extent mapping products of the sort provided by Sentinel satellites. Finally, EO data can be used as decisions support to inform the planning of disaster response agencies and other relevant government departments.

4. PARAMETRIC INSURANCE: THE PAN-AFRICAN FLOOD EXTENT DEPICTION SERVICE

The ARC flood team developed the pan-African Flood Extent Depiction (AFED) service to show the distribution of large-scale river flooding. AFED is used to underpin parametric flood insurance offered to ARC Member States. It converts flood extent maps into an economic impact value in US dollars, creating an Africa RiskView flood index.

The AFED service makes use of Satellite-based Microwave Data in combination with Digital Elevation and Persistent Water Distribution data. The ARC Flood team is looking to use EO data to improve AFED service. The EO4SD CR cluster has worked with the team to validate its models, providing an on-demand flood mapping service known as Flood Mapper.

The objective of this service is to assess the accuracy of the ARC Flood Model by comparing the modelled inundated area of the AFED product against the inundated area as observed by the Flood Mapper based on high-resolution Sentinel data.

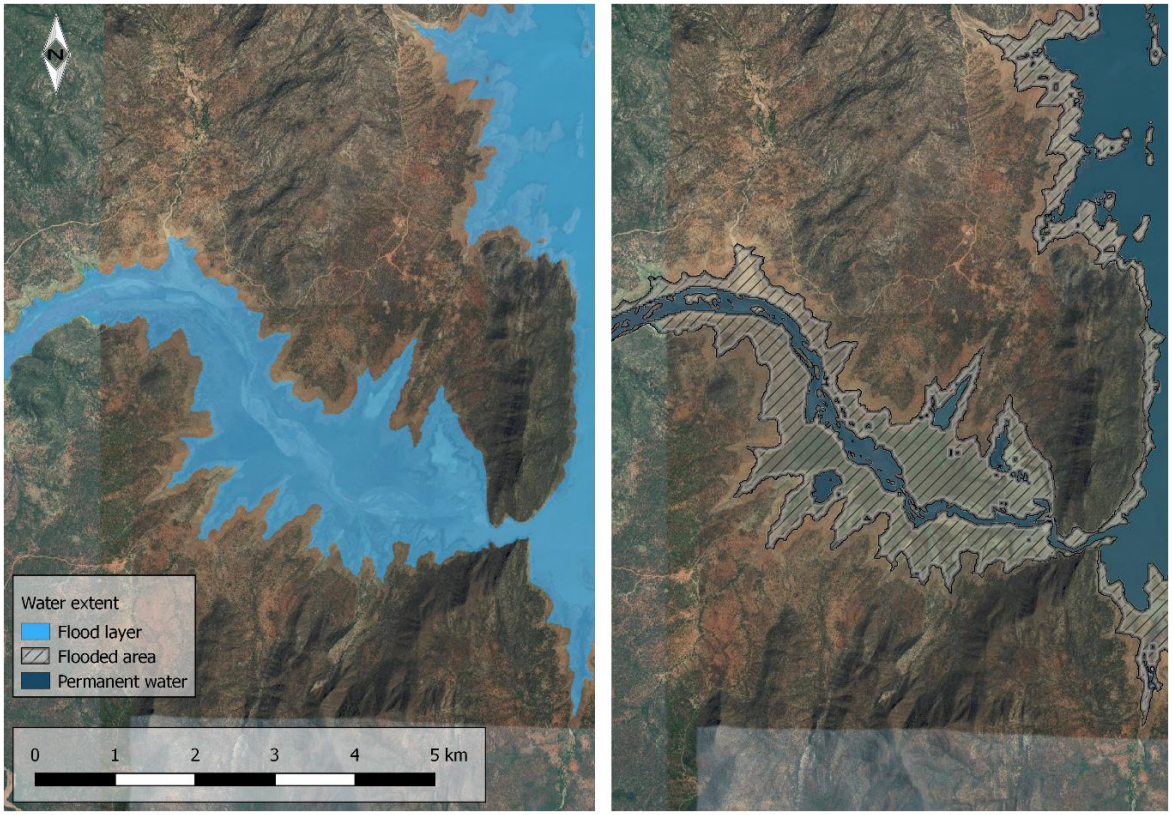

Image 1 Example of a flood plain near Lake Turkwel (Kenya). Flooded area (left) and the flooded area extracted from the permanent water extent (right). Flood extent mapping provides information on the total water covered area (binary water/ non-water map). Subtracting permanent water bodies from that allows the identification of temporarily flooded areas (hatched). The flood product also provides a direct comparison of the EO4SD Flood Map with the AFED Flood Map as well as statistical information on flooded landcover. Source: Geoville

5. ENRICHING THE AFRICA RISK VIEW TOOL WITH EO DATA

To improve the accuracy of ARV tool, the EO4SD CR cluster identified EO-based data covering several climate variables that can be incorporated into the tool. Identifying the most appropriate indicators to complement the ARV was essential.

Starting in 2018, the EO4SD CR cluster began an extensive consultation process with ARC to understand how the ARV processed and used existing data. The EO4SD CR cluster provides EO-based long time-series and monitoring data for soil moisture content to help improve the ARV tool's water holding capacity estimates. New datasets have also been made available covering precipitation measurements that can contribute to ongoing drought monitoring. The specific products being made available to ARC include:

1. Observed and projected climate indicators: including daily 5-day and 30-day maximum rainfall for 10/20/50/100 year return periods from reanalysis and satellite data, daily SMOS Soil Moisture, daily ESA CCI Chlorophyll-a concentration, 30 minute, hourly and daily NOAA Hydro-Estimator and NASA Global Precipitation Mission precipitation;

2. Drought monitoring indicators: Provision of the Standardised Precipitation Evapotranspiration Index (SPEI) for 6, 9, 12, and 18-month timescales and Potential Evapotranspiration (PET) using EO precipitation and ERA5 Reanalysis data;

3. Flood model validation: An on-demand high resolution flood model validation service.

EO data can be grouped within the ARV tool to make a particular shape that corresponds to an administrative region, agro-ecological zone, or crop growing region, making it easier to observe specific areas over time. The frequency and scale of these observations make it possible for the ARV to provide early warnings of drought and indicate which areas in a region, country or province have received minimal rainfall, water deficits, or excess water at the various stages of crop growth (Image: 1).

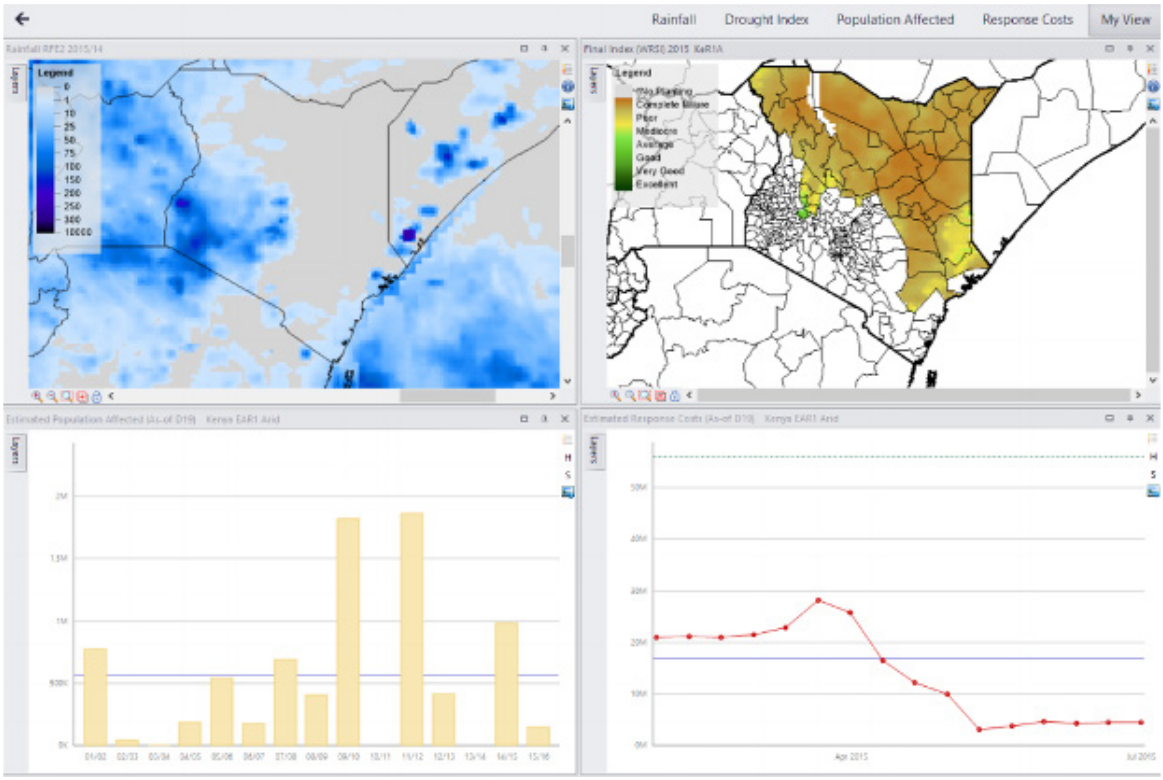

Image 2 Africa RiskView default My View showing Kenya EAR1 Arid (long rains) season. Source: Sistema and Geoville

In addition, access has been given to additional products available through the EO4SD CR Platform[1] (Image: 3) that can deliver precipitation, soil moisture, and sea surface temperature data. The EO4SD CR cluster has also developed APIs[2] which will deliver EO data seamlessly to the ARV tool, allowing it to be fully integrated into ARC's service offering.

1 EO4SD CR EO platform: https://explorer-eo4sdcr.adamplatform.eu/

2 An application programming interface (API) is a computing interface which defines interactions between multiple software intermediaries.

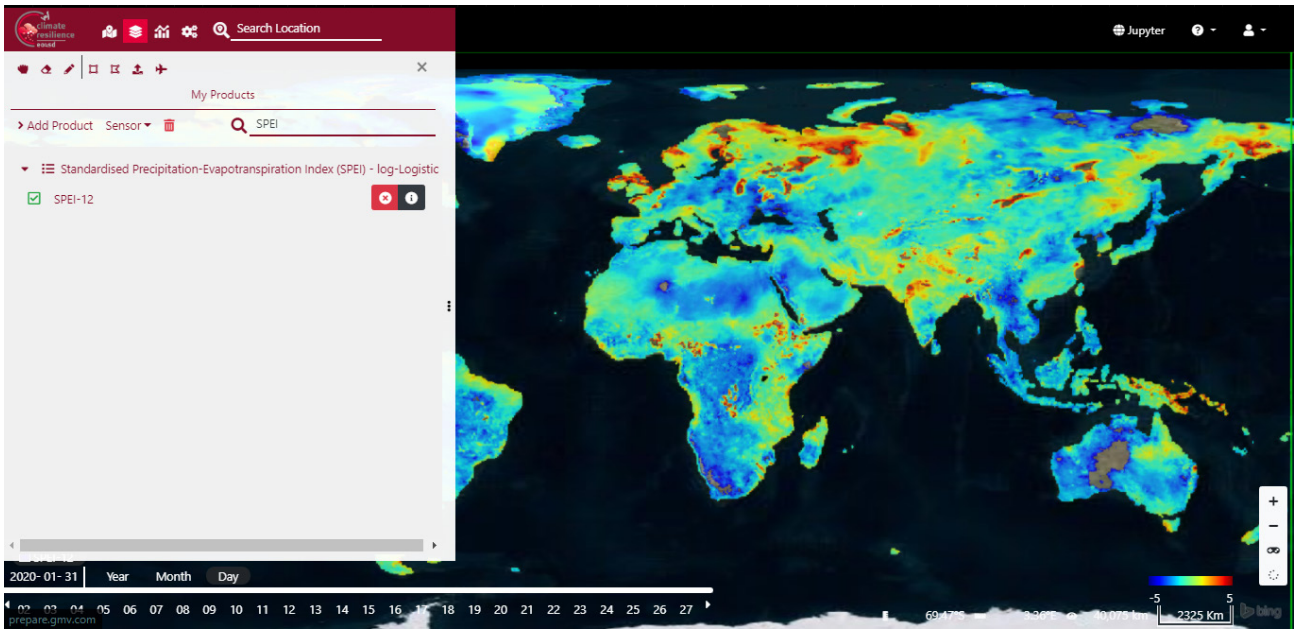

Image 3 A screenshot of the EO4SD CR Platform.[3]

6. CAPACITY BUILDING

Alongside the EO service provision, the EO4SD Climate Resilience Cluster delivers capacity building support to foster the sustained uptake of EO-based data and services by IFIs and Client States to support climate change resilience. The goal of the capacity building is to enable the sustainable and autonomous application and use of the provided services and data.

Led by the National Observatory of Athens' Centre of Excellence BEYOND with support from EO4SD Climate Resilience Cluster partners GMV, Acclimatise, Telespazio VEGA UK and GeoVille, the capacity building activities provide both targeted support through practical training, and awareness raising and knowledge transfer through online courses and webinars.

One of the core mandates of ARC is to provide capacity building activities to African governments in order to increase the effectiveness of climate and disaster risk management. This can be done through the introduction of tools and processes that enhance the multidisciplinary response of governments to natural disasters. In order to do this effectively, ARC works to increase the capacity of its staff to be able to provide better services and tools to local stakeholders.[4]

Dedicated capacity building activities were organised and combined with provided services to African Risk Capacity. As part of the activities, the EO4SD Climate Resilience Cluster delivered a webinar series to raise awareness, acceptance and understanding of EO-based information services and the associated benefits, impacts and usefulness with regard to the specific priorities of the stakeholders.

The seven-part webinar series, delivered in June and July 2020, is aimed at all those interested in developing a foundational knowledge of EO and how it can be applied practically in the context of climate-resilience projects and programmes. The series included sessions targeted at ARC which focused primarily on the use of the EO4SD CR platform. This providing ARC's staff with training on how to access, visualize and extract EO derived data.

The series draws on the EO4SD Climate Resilience Cluster's experience working with IFIs including the Asian Development Bank, The World Bank, the International Finance Corporation, Africa Risk Capacity and the European Bank for Reconstruction and Development, to provide 'hands-on' sessions and guided tutorials for existing climate resilience platforms. Over the course of the series, participants learned the basics of EO data in the context of climate resilience; how, why and when to use EO data to inform decision making,; how to applying EO data to manage key climate risks including flooding and drought; and practical skills about accessing and using EO data tools and platforms.

3 EO4SD CR EO Platform: https://explorer-eo4sdcr.adamplatform.eu/
4 The presentations and recordings from the webinar series is available from the EO4SD CR website's "Capacity" section. V
Visit here: http://eo4sd-climate.gmv.com/

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