Applications of CCI Data in:
ESA's EO4SD Climate Resilience Project

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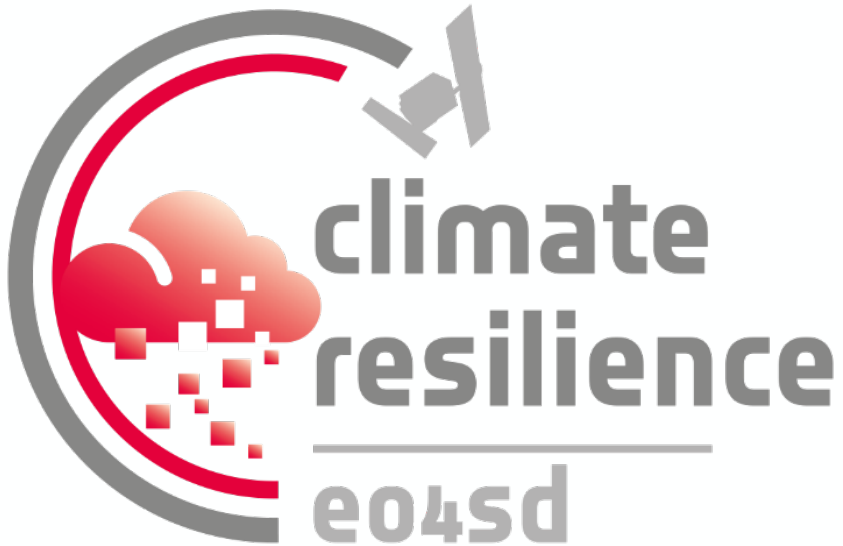
EO4SD Climate Resilience at a glance

- **ESA demonstration activity** from 2018-2021
- Selection of demonstration opportunities by identifying where EO4SD Climate Resilience can have the **highest impact** and help the most.
- Find overlaps in around common themes:
  - **Climate variables & climate impacts**
  - Locations (within regions of interest of the cluster)
  - Projects/programs



How can EO-based information help foster climate resilience?

Overall objective of the EO4SD CR was to integrate EO-based products & services as **'best-practice' climate information** in **the planning and implementation** of development projects, programmes and activities of **IFIs**, together with their respective client states.

Monitoring climate-induced changes

Complement existing data

Consistent data streams

Targeting specific challenges

Hazard & Exposure information

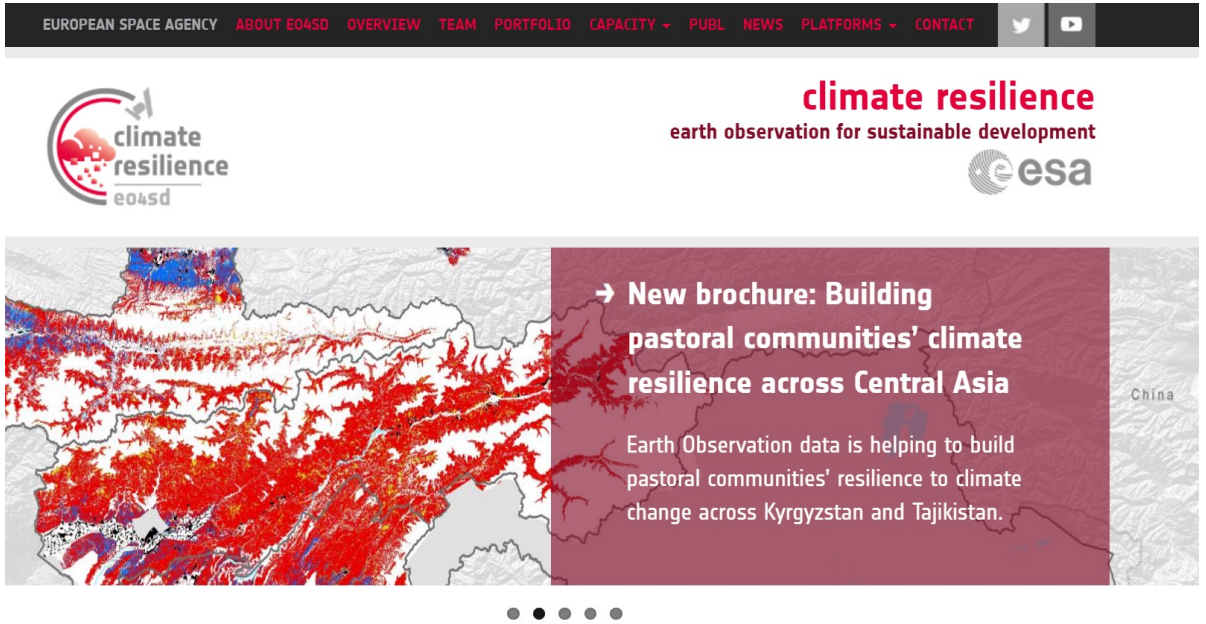
Detailed information

Evidence-based climate resilience decision making

EO4SD Climate Resilience cluster

Highly experienced team combining competency in:

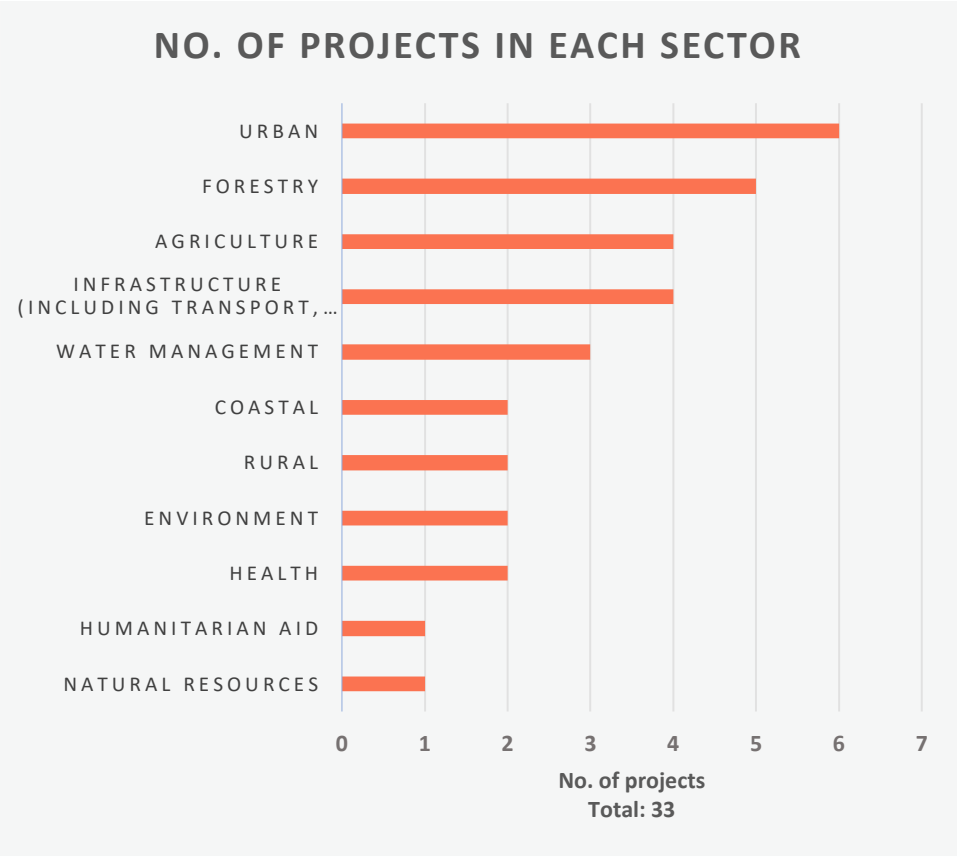
- Geospatial analysis
- Earth observation (EO) data
- Climate risk assessments
- Climate resilience building
- Capacity Building



http://eo4sd-climate.gmv.com

Countries and regions of interest

33 development projects initially proposed as candidates for EO4SD CR support, across 5 regions. Later more projects joined covering also Central Asia



The cluster worked with the **World Bank**, International Finance Corporation (**IFC**), Asian Development Bank (**ADB**), Multilateral Investment Guarantee Agency (**MIGA**), Inter-American Development Bank (**IDB**), African Risk Capacity (**ARC**) and International Fund for Agricultural Development (**IFAD**)

EO climate services & Capacity Building

Climate services portfolio

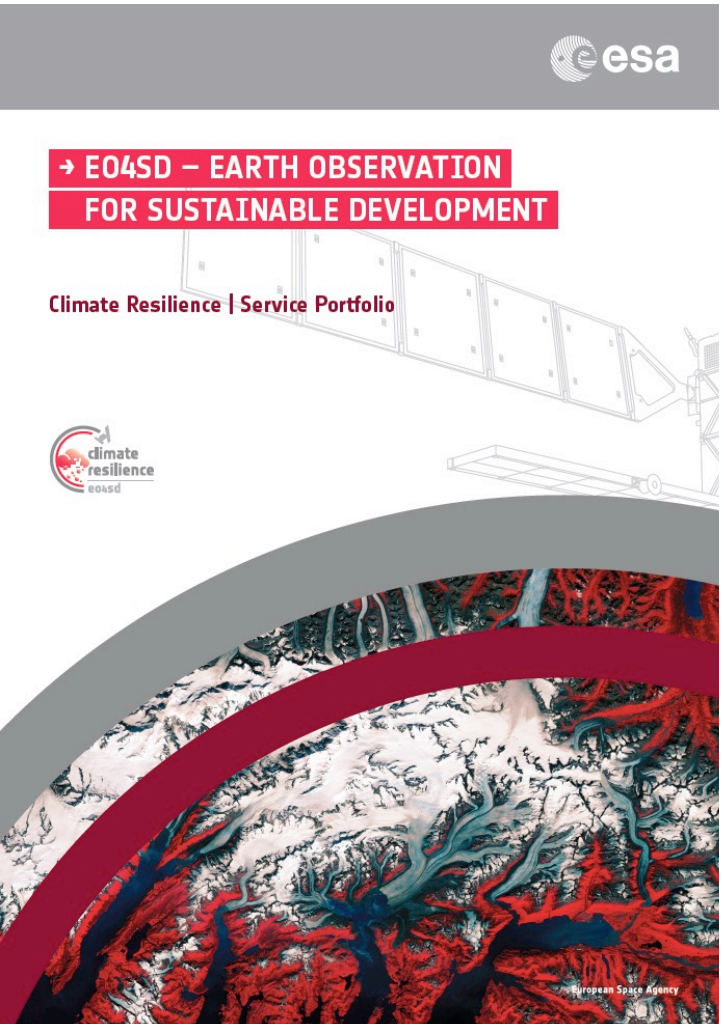
Provision of EO-based
Global climate indicators

Provision of EO-based
Customized climate information solutions

Capacity Building

- Aimed towards **self-sustainability of operations** that can be autonomously executed by local, regional and national bodies
- At two levels: to identified actors in CC (e.g. hydromet agencies) and to IFIs to prepare them for **long-term exploitation of EO-based services** addressing climate adaptation solutions

Provision of climate services



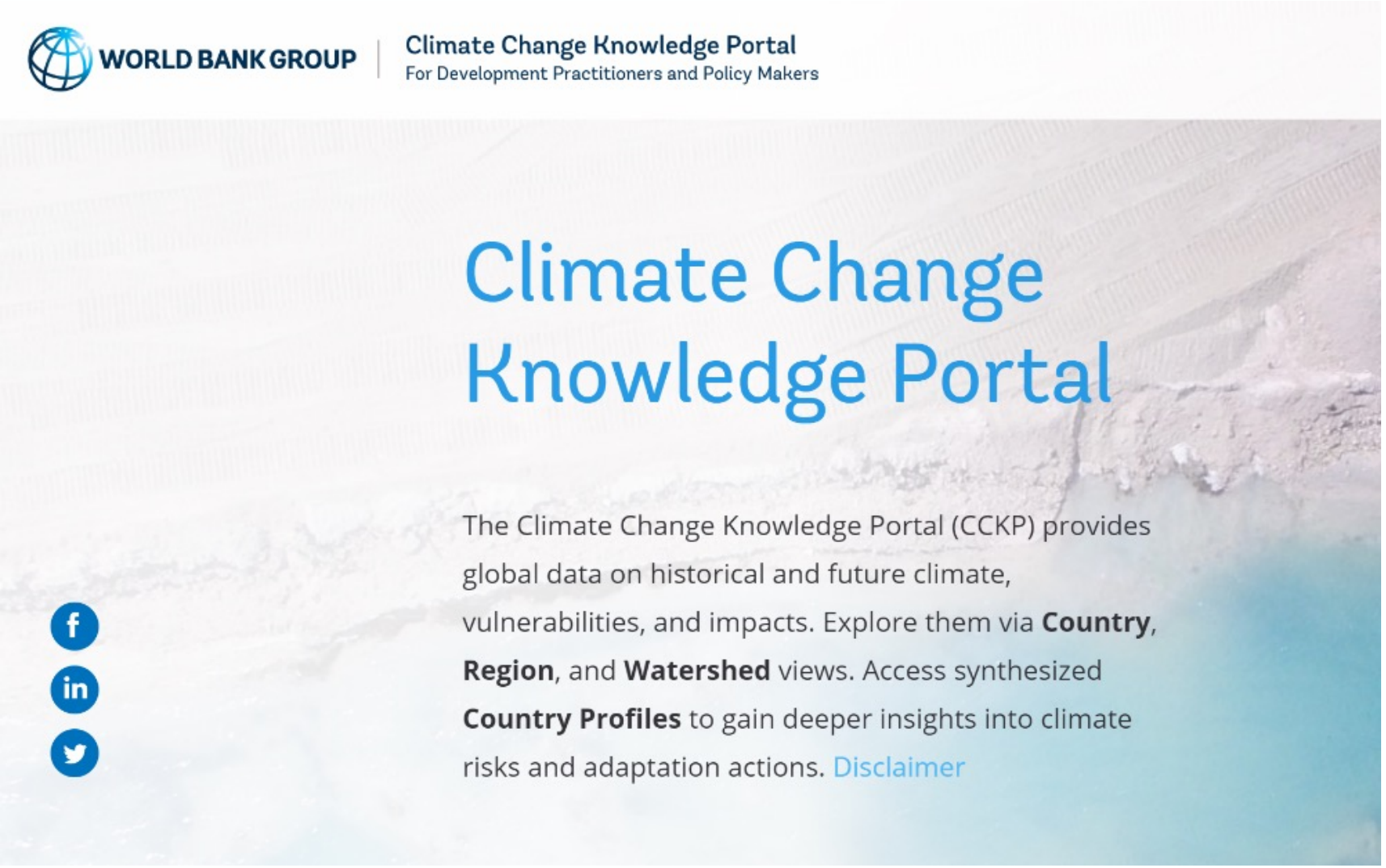
Climate services customized to IFI needs

- Automatic **provision of ECV records** (early 80's to present) to **IFI's climate data portals** via API interfaces
- Provision of sectoral climate services targeted at enhancing climate resilience in IFI's investment projects
  - Assessment of **climate risks** in the AOI;
  - Proposal of **climate adaptation solutions** supported by EO;
  - Provision of customized **EO-based solutions to support climate resilience** plans (project preparation; project implementation)

ESA's CCI data key role to satisfy IFI needs!

Case Studies

Climate Change Knowledge Portal (CCKP)
What does CCKP do to support climate resilience?



Highlights

Scope: Improve integration of scientific data into decision making processes

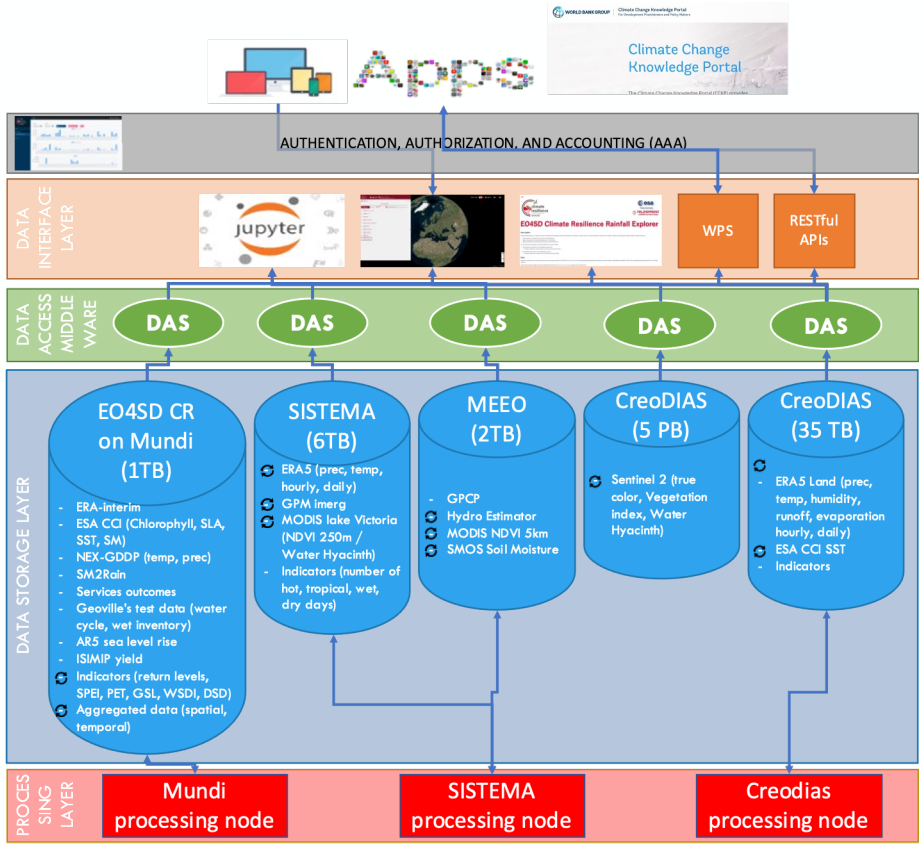
How: through a web-based platform

Data: environmental, disaster risk, and socio-economic datasets, as well as synthesis products

Service provision via API

EO-based climate data being provided automatically from EO4SD CR cluster to the **World Bank's CCKP**

- Access to ECVs (e.g., temperature, precipitation, soil moisture, sea level rise / anomalies)
- Computation of climate indicators (temperature-based, precipitation-based)
- Temporal aggregation of variables and indicators (four 10-year periods starting from 1979)
- Aggregation at a country level for variables and indicators



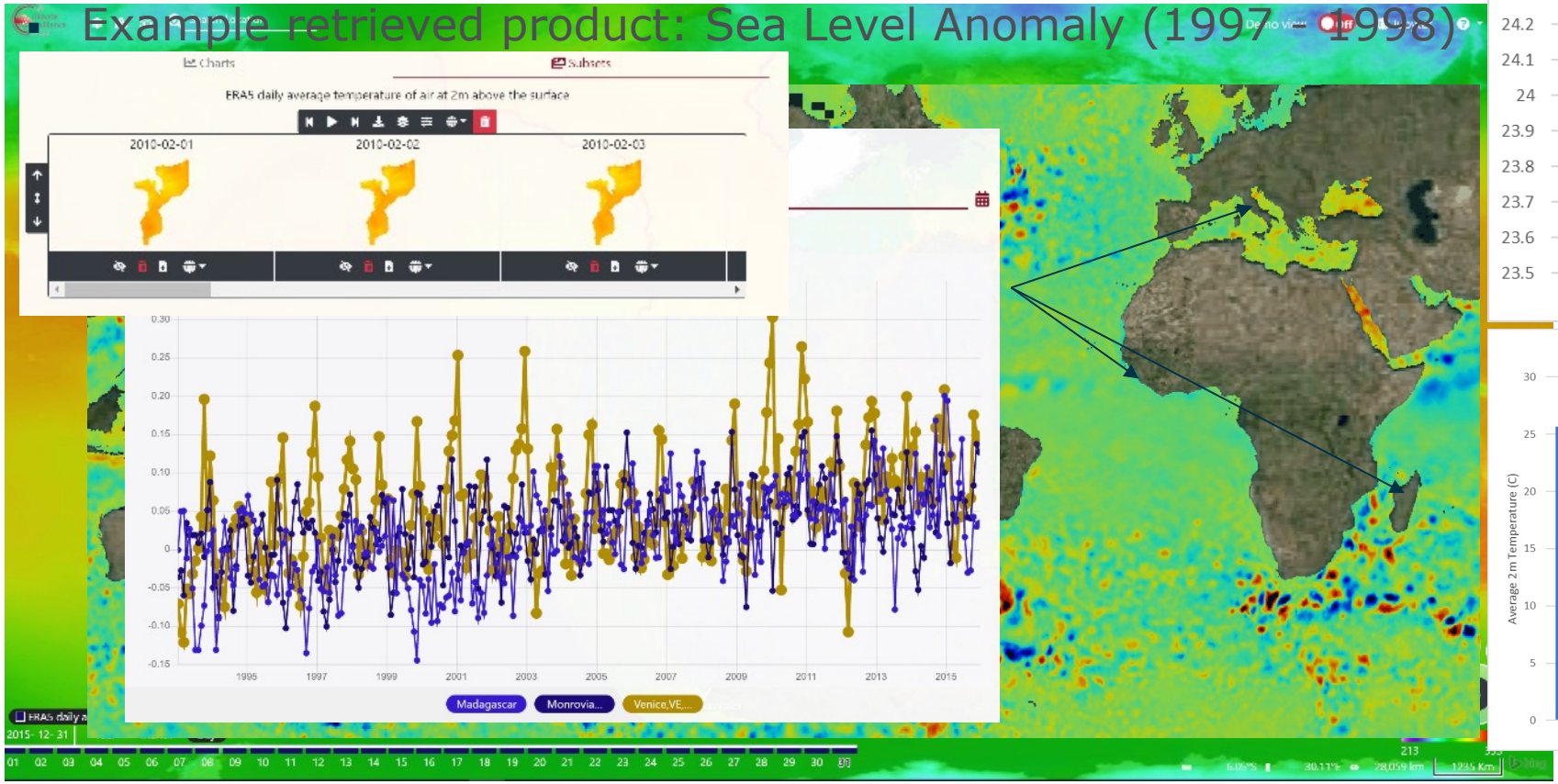
https://explorer-eo4sdcr.adamplatform.eu

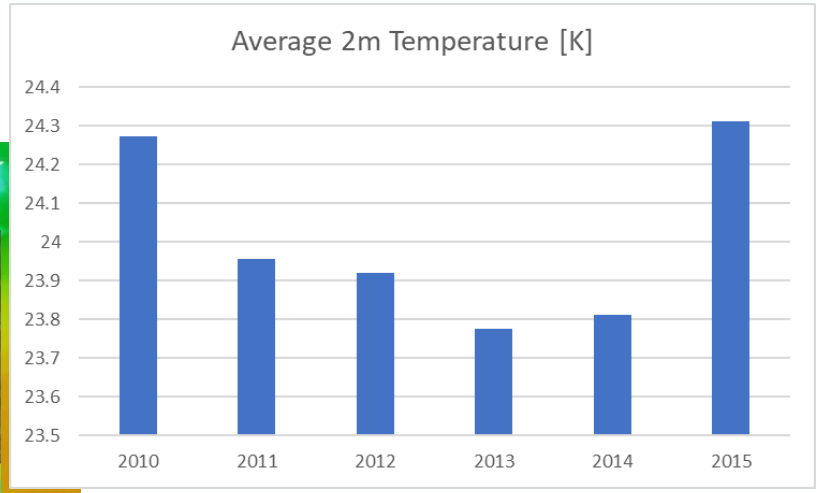
- Provision of APIs for visualization within CCKP (maps, grid points, country aggregation)

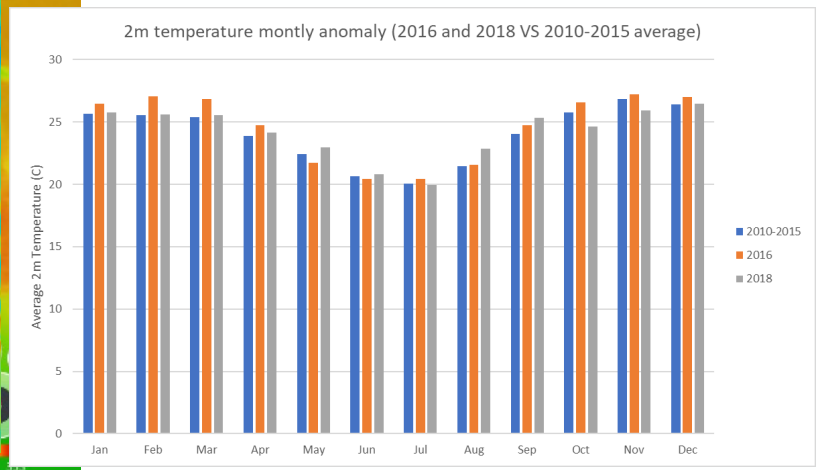
ESA CCI products provided

Products	Spatial coverage	Time coverage
Sea Surface Temperature	Global	1981 - 2016
Sea Level Anomaly	Global	1993 - 2015
Soil Moisture	Global	1978 - 2020

- Example retrieved product: 2m Temperature (2016 and 2018 VS 2010 - 2015)
- Example retrieved product: Sea Level Anomaly (1997 - 1998)





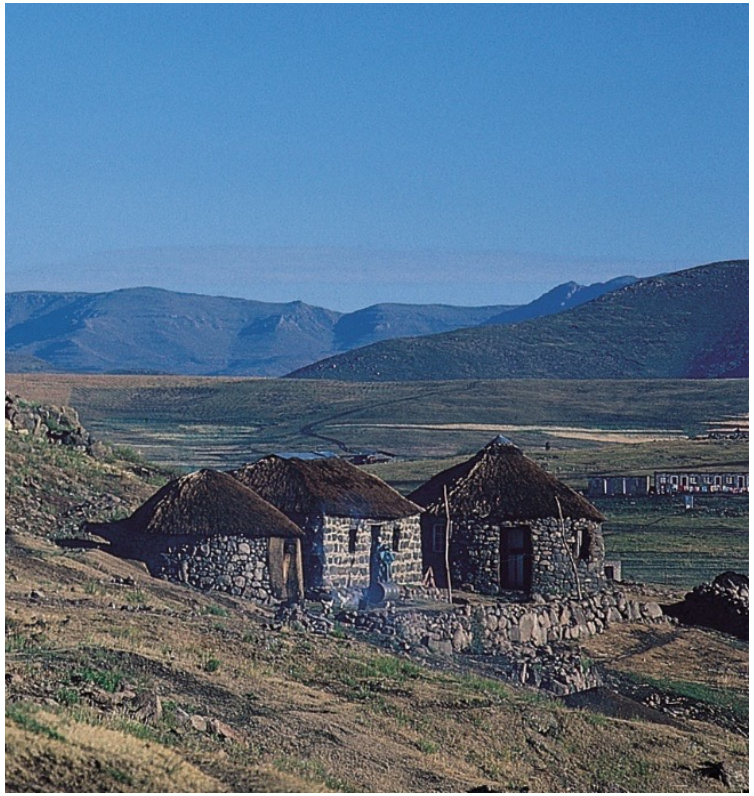


Wetland and land degradation monitoring for restoration and rehabilitation plans in Lesotho

Service: The EO4SD CR cluster derived soil loss rates due to water erosion to analyse annual soil erosion trends in different periods on a national scale. The service delivered also include the wetland identification and monthly monitoring of the wetlands extent on a national coverage. All products were aggregated at sub-catchment level to facilitate the identification of hot spots.

Impact: The EO-based products provided evidence related to soil erosion and wetlands condition that supports the priorization of catchment and sub-catchment areas for landscape and wetlands restoration and rehabilitation.

annual soil loss changes over the last 20 years and to evaluate degradation of wetlands due to the climate variability.



Credit: Chris Johnson/The Hutchison Library, London

Soil erosion rate estimation

- Soil loss is estimated with a modified version of the Revised Universal Soil Loss Equation (RUSLE) model (*Panagos et al. 2015*)
- Factors impacting the loss calculation: rainfall erosivity, soil erodibility, cover-management, topography and support practices

$$E = R \times K \times LS \times C \times P$$

Where:

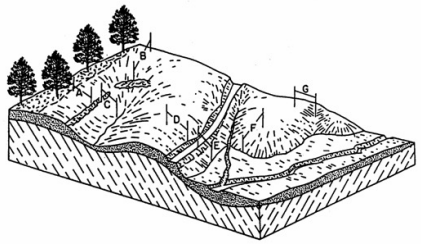
- E – Annual average soil loss per unit area per year (t/ha/year);
- R – Rainfall erosivity factor;
- K – Soil erodibility factor;
- LS – Slope length (L) and steepness (S) factors;
- C – Cover management factor;
- P – Conservation support practice factor (not applied!).

Model inputs: K-, LS- & R-factors

- **Soil erodibility factor** obtained applying *Bin Wang et al., 2016* using digital soil mapping based on global compilation of soil profile data and environmental layers (SoilGrids).

ISRIC
World Soil Information

- **Slope length and steepness factors** represent the effects of topography on soil erosion. Obtained applying *Panagos et al. 2015* using digital elevation model from SRTM.



- **Rainfall erosivity factor** is a measure of the erosion force of rainfall. Derived from Rainfall Estimates from Rain Gauge and Satellite Observations (CHIRPS) data.

Model inputs: C-factor

- The **cover management factor** reflects the effect of cropping practices, and land use and management on erosion rates.

- Following approach from *Panagos et al., 2015*, that differentiates **arable** from **non-arable land**
  - For arable lands, C-factor estimated from crop composition
  - For non-arable lands, C-factor estimated from vegetation density

- **Surface and biophysical attributes derived** from Copernicus Vegetation Fraction Cover, **ESA CCI Land Cover** and USGS GFSAD (crop typing) programmes

Use of ESA CCI data

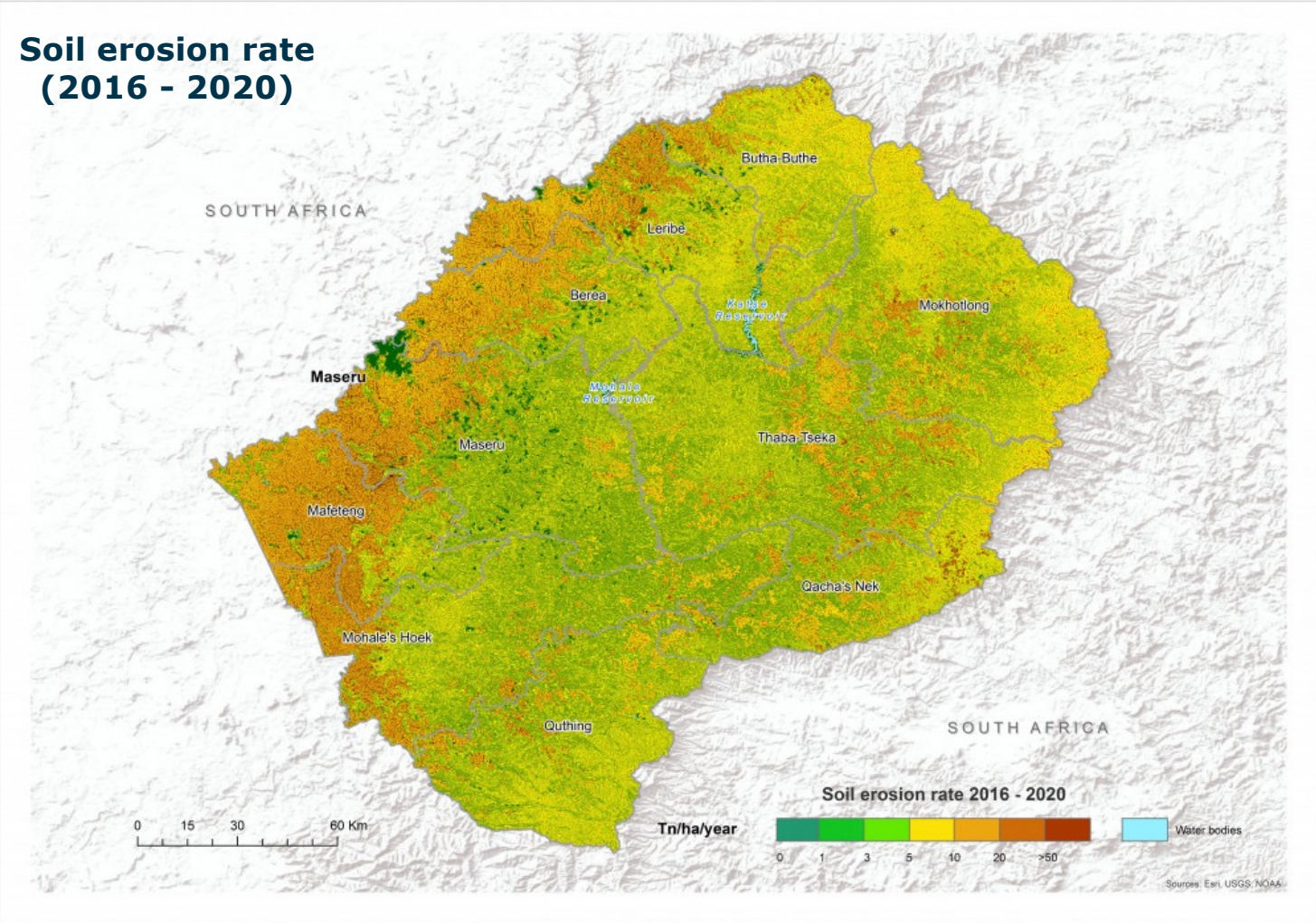
- Information on crop typing from USGS GFSAD is not accurate enough. Used instead to categorize the main crop types in the country.
- Annual ESA CCI Land Cover maps employed to assess a crop typing (rainfed vs irrigated). 10 years (2001 – 2005 & 2016 -2020) of data **key to estimate changes in crop management**.
- Average C-factor value for existing rainfed and irrigated crop types used to estimate soil erosion.

Results provided to Lesotho's agencies

The satellite-based approach provides an estimation of the rate of **soil loss** (tonnes per hectare per year) **due to water erosion**

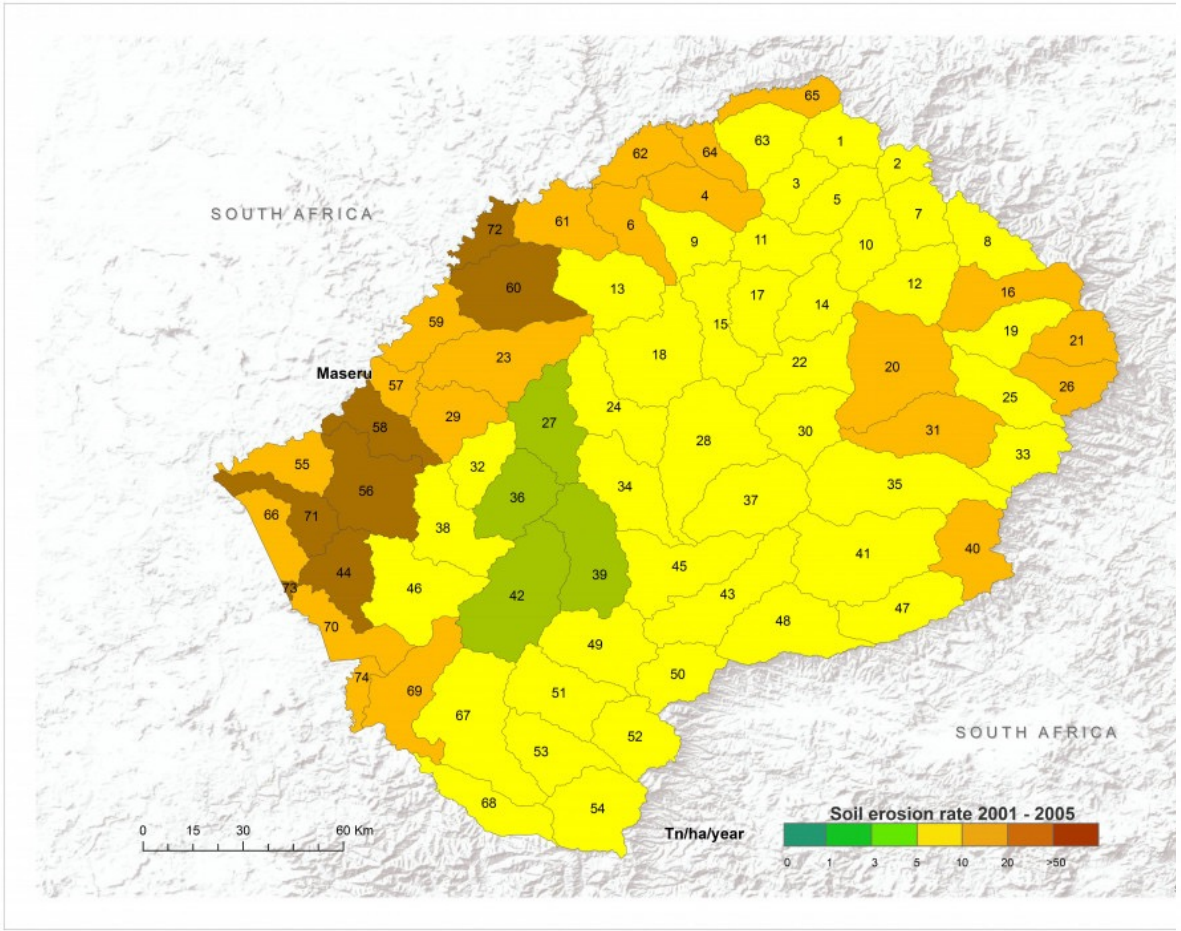
In this methodology erosion values are **driven by rainfall** but erosion changes are also impacted by **land use management practices** and **canopy density changes**

This method allows quantifying the **impact** of land use and **conservation management scenarios**

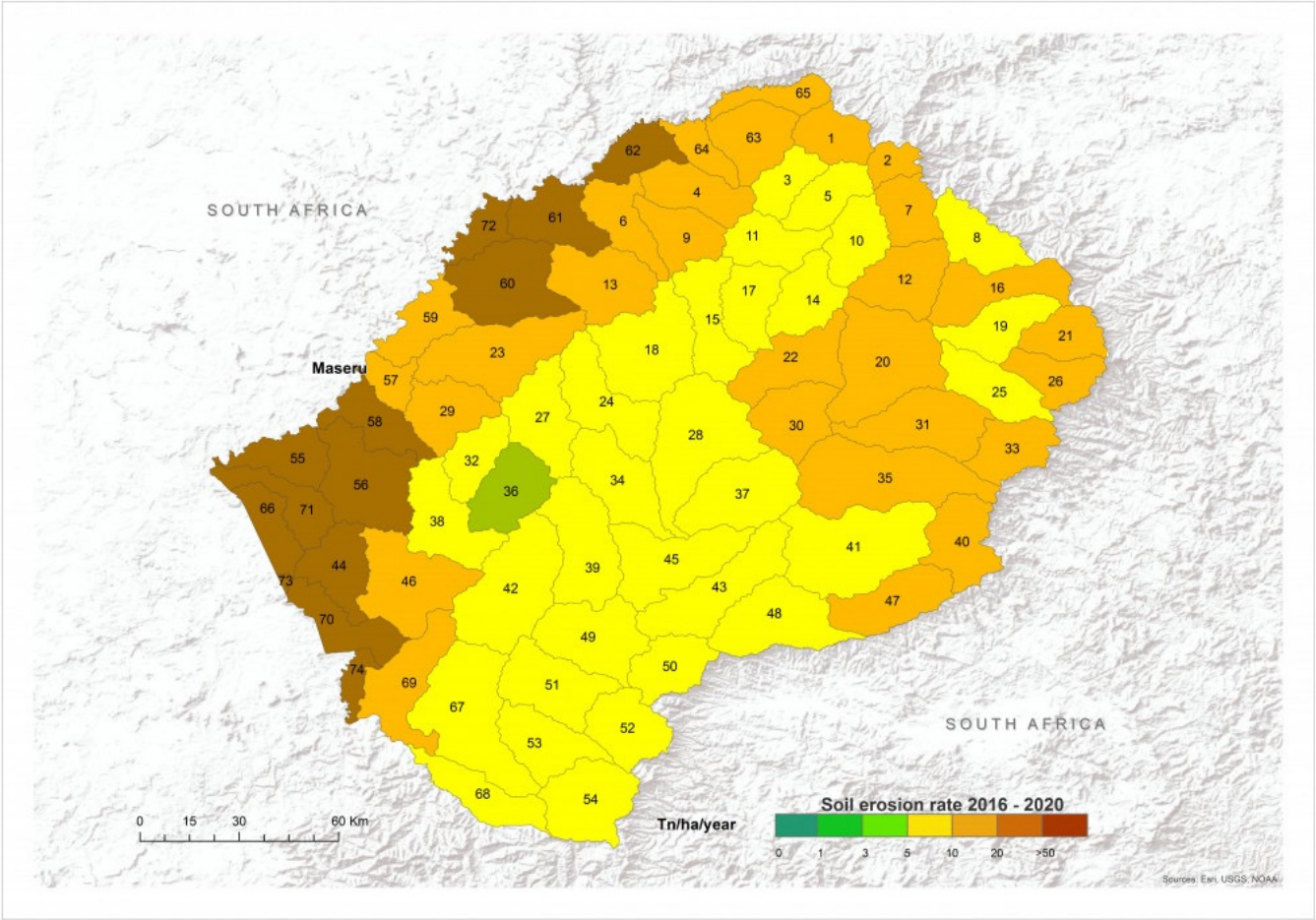


Erosion rates aggregated per sub-catchment

Soil erosion rate (2001 - 2005)



Soil erosion rate (2016 - 2020)



THE VALUE OF OUR INTERVENTIONS

- **Accuracy Integrated:** Global, high-resolution extreme rainfall statistics seamlessly integrated into corporate risk screening tools increase the accuracy of investment risk management (e.g. IFC Climate Risk Management Tool).

- **Accessible Insight:** Removal of barriers to IFIs being able to visualise and use high-quality rainfall statistics to fill gaps in risk models related to global assets' exposure to rainfall-related hazards (e.g. Rainfall Explorer).

- **Model Validation and New Indices**: Improved targeting of parametric natural catastrophe insurance through use of Earth Observation to calibrate natural hazard models (e.g. African Risk Capacity's African Flood Extent Depiction Model, NGDI).

- **Our Climate Present:** Easy access to timely, global, high-quality data through transformational EO-driven upgrades to climate data portals, including the world's most trafficked public-facing climate portal, the World Bank Climate Change Knowledge Portal, and African Risk View, UR-SCAPE, and EO4SD CR Platform.

THE VALUE OF OUR INTERVENTIONS (II)

- **Building the Investment Case:** High-resolution, county-scale climate, ecosystem (e.g. pastureland), and soil condition data fill data large gaps, enabling IFIs and beneficiaries to harness the evidence required to unlock and channel climate finance for maximum resilience impact (e.g. IFAD Kyrgyzstan, Lesotho, Tajikistan).

- **Monitoring and Management:** Enhanced management of river catchments and risks to food security through deployment of high-resolution EO-driven monitoring of surface water, wetlands, and soil moisture (e.g. AGRHYMET West Africa and Lake Victoria Basin Commission).

- **Visualising and Managing Risk:** Efficient, high-resolution urban risk indices and hotspot maps leveraging EO-driven hazard (e.g. shoreline erosion and riverine flood) and non-hazard (e.g. land use and asset location) data (e.g. World Bank Monrovia)

Thank you!