2.4.4 Supporting the implementation of NAPs with Earth observation solutions

Cyber hour

28 March 2023

16:00 – 17:30

GEO GROUP ON EARTH OBSERVATIONS

NAPEXPO CHILE 2023

Sara Venturini, GEO Secretariat

Sara Venturini is the Climate Coordinator at the Group on Earth Observations (GEO) Secretariat.

At GEO she promotes access and the use of Earth observation data and solutions to inform and accelerate climate action by member countries.

She has 15 years' professional experience collaborating with UN agencies and advising governments and organisations around the world on developing and implementing climate change policies, and participating in multilateral climate negotiations.

She holds a PhD in Climate Change Science and Management from Ca’ Foscari University of Venice, Italy.

GEO: the single largest global partnership focused on Earth observations for impact

Evidence-based activities to support policy

GLOBAL POLICY

Earth observations for climate action under the UNFCCC. Disaster risk reduction under Sendai Framework. Land degradation neutrality with UNCCD. Nature-based solutions with CBD. Mercury monitoring under Minamata Convention for Mercury.

NATIONAL IMPLEMENTATION

Capacity development and projects. Agriculture monitoring for adaptation, flood early warning systems, impact of wildfires, coastal areas and ocean health, etc. Supplementary Technical Guidance to integrate Earth observations into National Adaptation Plans (NAPs).

Agenda

Presentations and demos:

- Esther Makabe, Capacity Development Coordinator, GEOGLAM
- Kenneth Mwangi, Climate Monitoring and Early Warning Expert, IGAD - ICPAC, Kenya
- David Ongo, Digital Earth Africa focal point, RCMRD, Kenya
- Jorge Luis Vazquez-Aguirre, WMO

Q&A and open discussion (30 min)

Esther Makabe, GEOGLAM

Makabe is an information management professional with over 6 years of hands-on experience in geospatial information technology and knowledge management in emergency and development contexts.

She is currently Capacity Development Coordinator at the GEOGLAM Secretariat.

GEOGLAM - Earth Observations for National Adaptation Plans (EO4NAPs)

Esther Makabe,
GEOGLAM Secretariat

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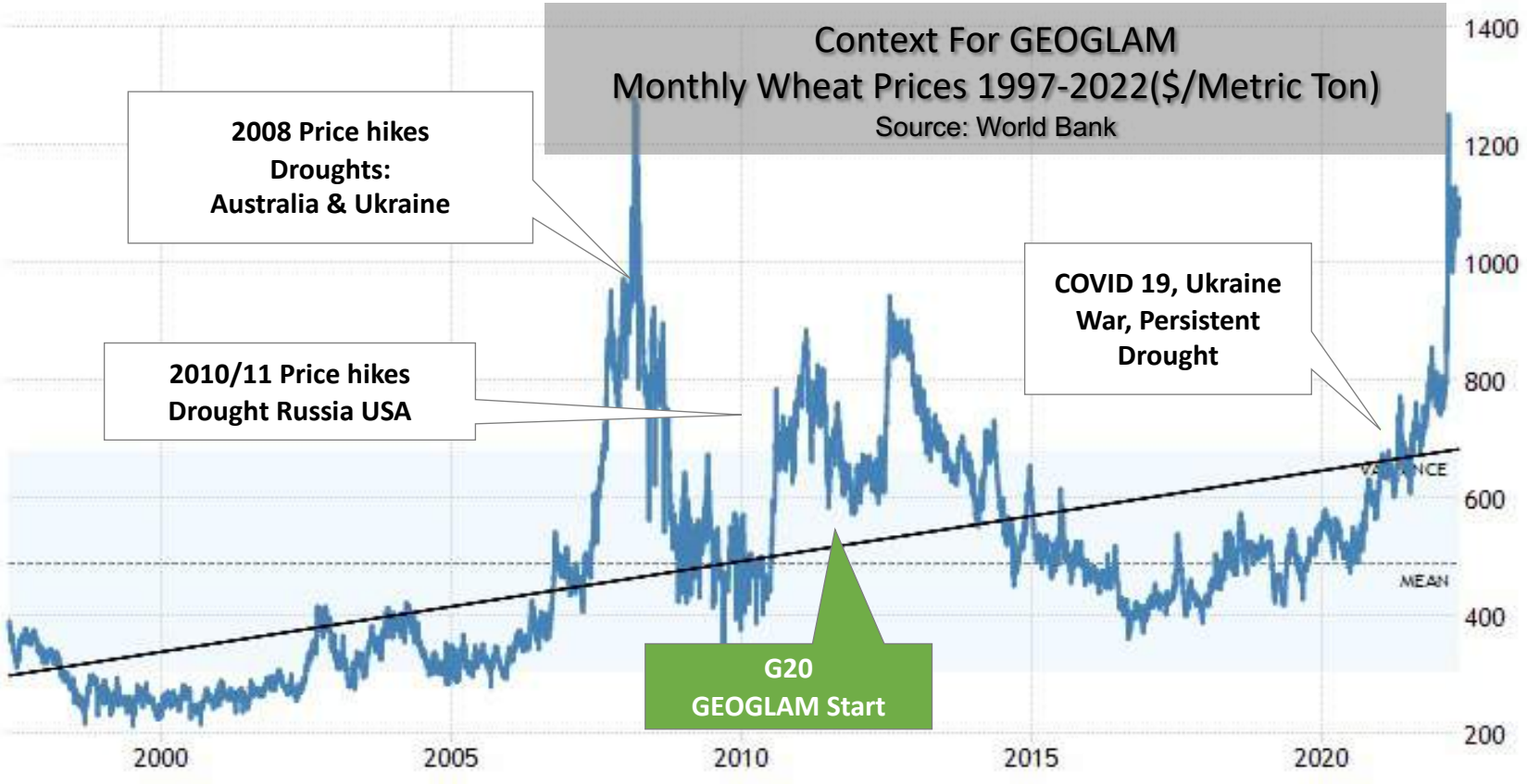
GEOGLAM Launched by the G20 Agriculture Ministers in 2011

Context For GEOGLAM
Monthly Wheat Prices 1997-2022($/Metric Ton)
Source: World Bank



G20 Final Declaration

44. We commit to improve market information and transparency in order to make international markets for agricultural commodities more effective. To that end, we launched:

- The "Agricultural Market Information System" (AMIS) in Rome on September 15, 2011, to improve information on markets ...;
- The **"Global Agricultural Geo-monitoring Initiative" (GEO-GLAM)** in Geneva on September 22-23, 2011. This initiative will coordinate satellite monitoring observation systems in different regions of the world in order to enhance crop production projections and weather forecasting data.

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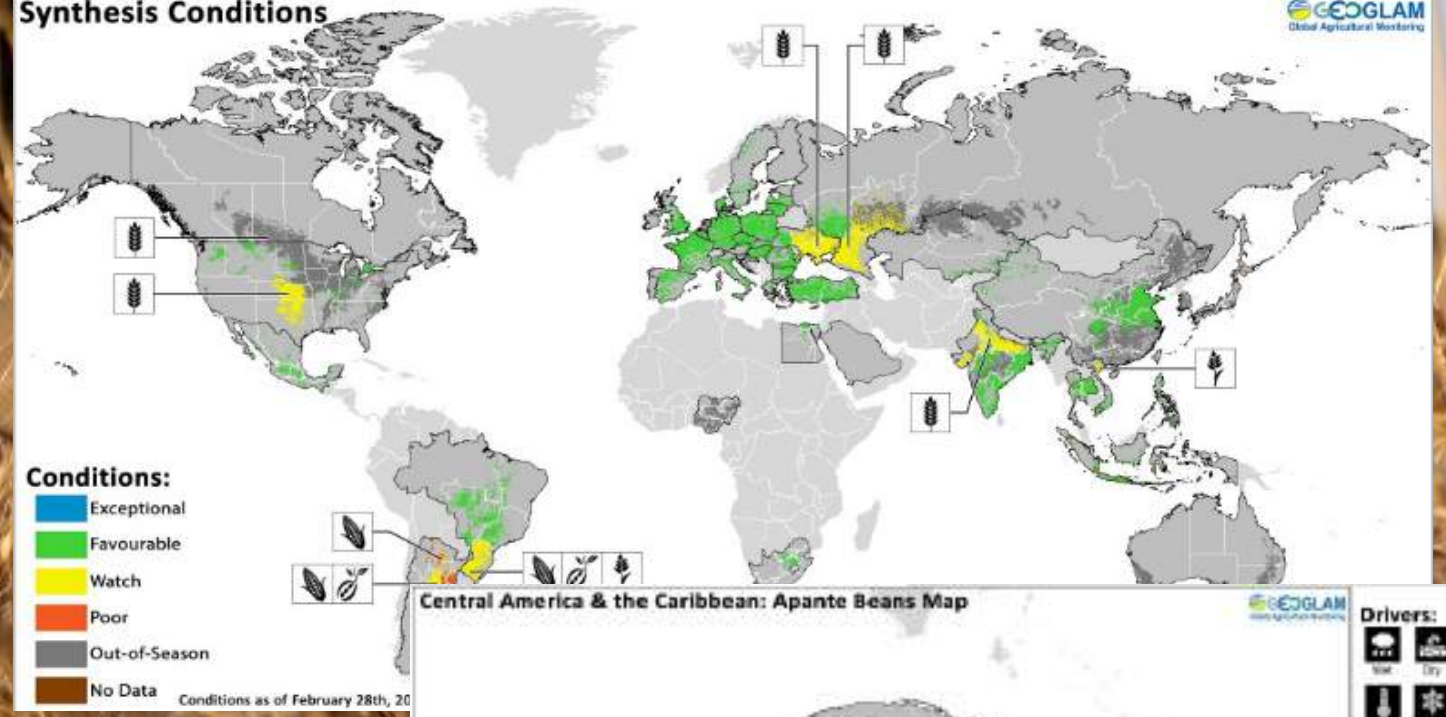
Crop Monitor
a geoglam initiative

Responding to the Challenge Since 2013:



Expanding the Food Security Mandate 2016:

…. and further

SUSTAINABLE DEVELOPMENT GOALS
UNDRR
UN Office for Disaster Risk Reduction
SENDAI FRAMEWORK
PARIS20

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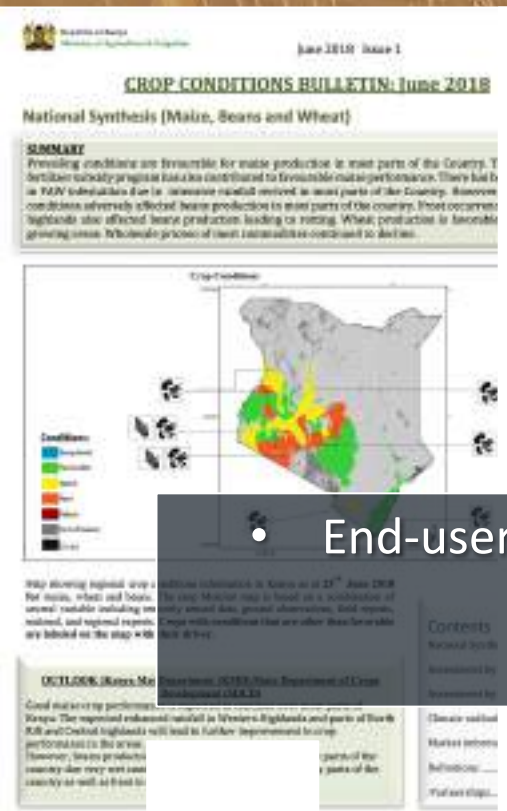
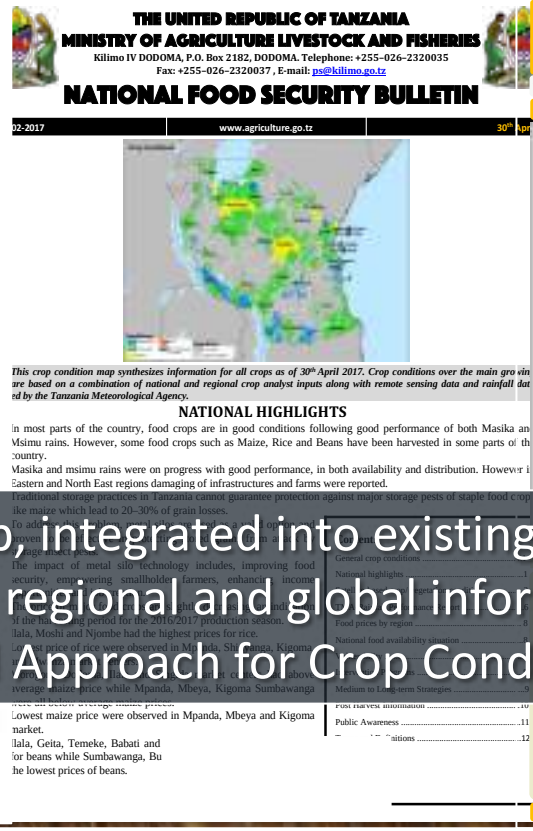
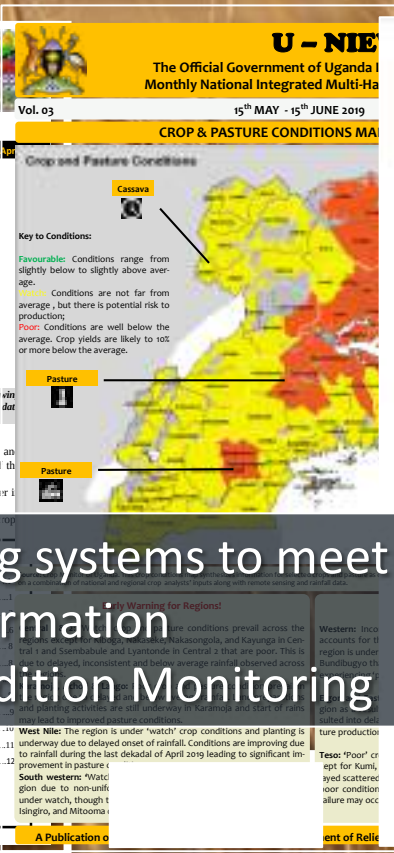
National & Regional Owned & Operated Crop Monitors

Co-Developed, Replicable and Adaptable







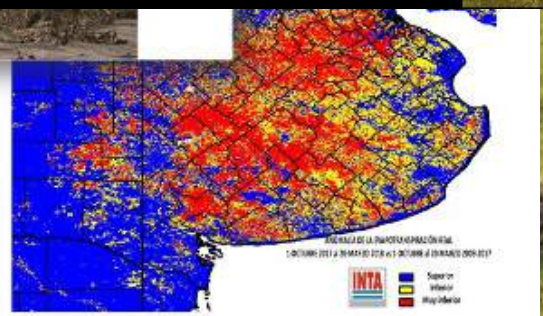
- End-user Driven, National ownership, integrated into existing systems to meet national needs
- Enhancing regional and global information
- Standardized Global Approach for Crop Condition Monitoring

National Impact Examples

National Impact Stories, Major Producer - Ar

Argentina Drought 2017-2018

- Argentina suffered one of the **worst droughts** in its history in 2018
- Agriculture Ministry needed **objective scientific evidence** of drought to enact policy
- Working with INTA (GEOGLAM national partner) the government was able to declare an "**agricultural emergency**" with great spatial precision, **triggering financial safety net programs**



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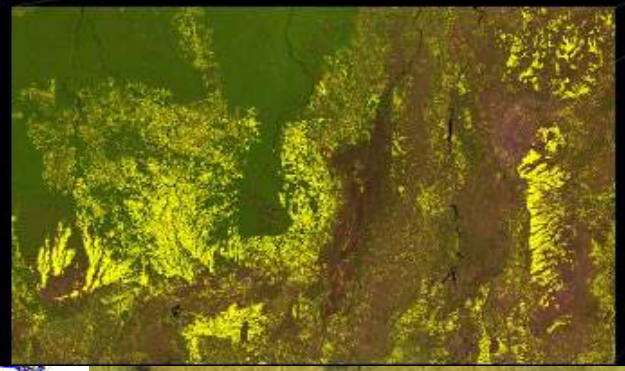
National Scale Cropland Mapping

- National capacity to operationally use EO for within-season monitoring
- Sparking international coordination (Mexico, Brazil, Chile, Argentina)
- Developing state-of-science baseline products

Conab SIAP INIA Ministerio de Agroindustria Presidencia de la Nación

2017 national cropland extent with 30m spatial resolution
80% initial accuracy



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GEOGLAM
GLOBAL AGRICULTURAL MONITORING

GEO GROUP ON EARTH OBSERVATIONS

GEO Supplement to integrate Earth observations into NAPs

Key steps to establish a National Agriculture Monitoring System and support the implementation of NAPs with timely and accurate EO-based information for food security programmes and policies

Aug 2022

Validation and demos at NAP Expo 2022

Oct-Nov 2022

Launch at GEO Week 2022 and COP27

Feb 2023

Dissemination and capacity development started at LEG writing workshop, Comoros

March 2023

Follow-up dissemination and training at NAP Expo 2023

Countries can access the GEO guidance, as well as technical assistance and capacity development for project proposals generation

EO Applications in Agriculture

Rangeland Mapping
- Livestock production potential
- State and changes in land used for livestock production
- Early warning for food security

Cropland Mapping
- Food production potential
- State and changes in land used for food production

Crop Type Mapping
- Crop production potential
- State and changes in land used for food production
- Farm support programs
- Greenhouse gas reporting

Field Boundary Delineation
- Food production estimation
- State and changes in land used for food production
- Farm management and support

Crop Condition Assessment
- Early warning for food security
- Crop pest and disease surveillance
- Inform markets and trade
- Targeting mitigation measures

Crop Yield Forecast/ Estimate
- Early warning for food security
- Inform markets, trade and humanitarian activities
- Targeting potential mitigation measures

Earth Observation Application

– Policy Application

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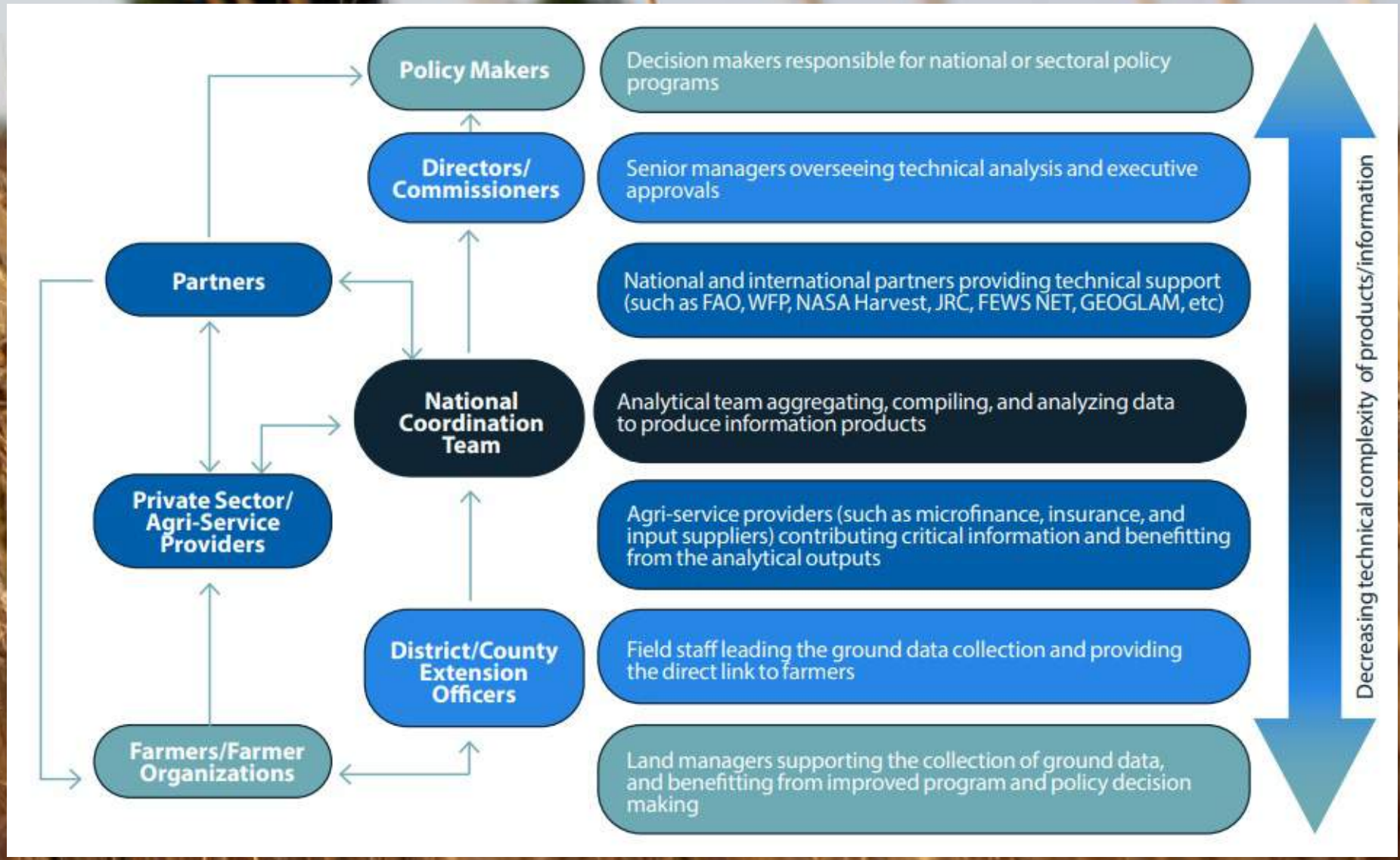
Institutional Framework



National Coordination Team

Roles	• Data compilation, aggregation and analysis • Report findings to directors/commissioners
Composition	• Multi-agency/multi-disciplinary teams • Examples: Food security, Agriculture monitoring, Statistics, Early Warning
Skills	• Crop resources/food security assessment, pest management, agro-meteorology, data analysis, GIS/Remote Sensing, etc.
Products/ Outputs	• Food Security Bulletins • Crop monitor Reports • Food Balance Sheets • Production Forecasts • etc.

Other Stakeholders

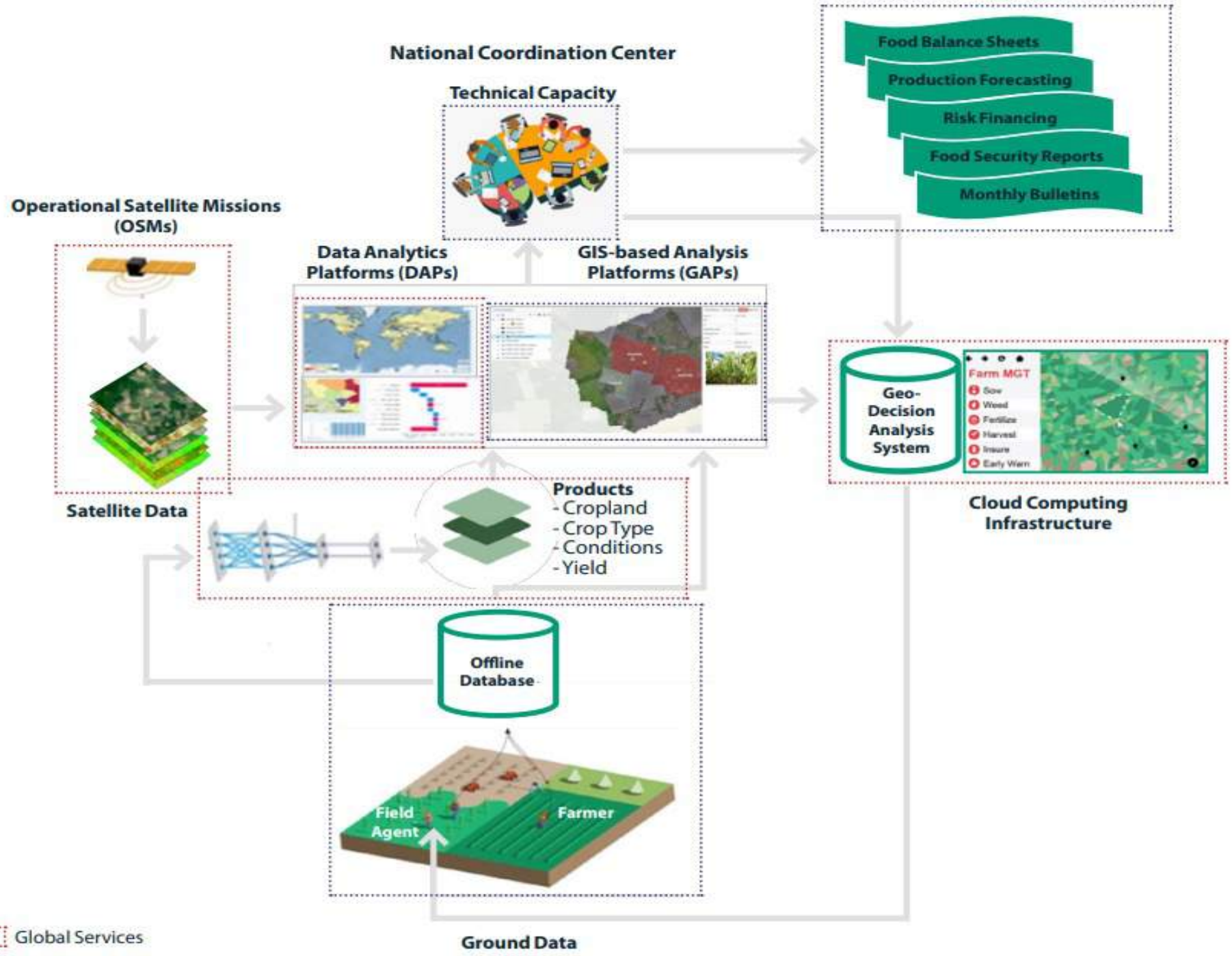
Stakeholder	Role
Policy Makers e.g., Ministers	• Provide legislation/policy direction on agriculture and related matters
Directors/Commissioners	• Provide executive oversight and direction to the National Coordination Teams/Center • Liaise/report the findings of the analysis teams to the policy makers • Provide relevant recommendations to policy makers
National and International partners e.g., FAO, WFP, GEOGLAM, FEWSNET, NASA Harvest etc. *Includes private sector service providers e.g., Agri-Insurance, manufacturers, microfinance, etc.	• Provide technical support and supplementary data and assessments to complement the national crop monitor system.
Field/Extension Officers	• Provide link between farmers and the National Coordination Team • Lead field data collection activities • Provide on-the-ground agriculture expertise/information
Farmers and/or Farmer Organizations	• Provide ground data/farm reports to be integrated into the national system • Provide critical feedback on the effectiveness of agriculture-related policies and programs

Examples

Table 2 - Current crop monitor set-up with examples from Kenya, Rwanda, Uganda and Tanzania

COUNTRY	NATIONAL COORDINATION	ANALYTICS PLATFORMS UTILIZED	GROUND DATA / TOOLS AND TEAMS	MAIN PUBLICATION / PROGRAMS SUPPORTED / ACCESS TO REPORTS
Kenya	State Department of Agriculture, Ministry of Agriculture, coordinating with County Extension Officers	GLAM, EWX, Custom-built Kenya Crop Monitor Kenya, Weather Forecasts from Meteorological Department	Via County Extension Officers	Kenya Crop Conditions Bulletin, Crop Insurance Program, Rapid Response to Pest/Disease Infestations
Uganda	National Emergency Coordination and Early Warning Center with inputs from Ministry of Agriculture, Uganda National Meteorological Authority, Ministry of Health, FAO, FEWS NET, Uganda Red Cross	Uganda Crop Monitor, GLAM, EWX, Weather Forecasts	Via District Extension Agents, rapid food security assessments, and OpenDataKit	UNIEWS Bulletin, Disaster Risk Financing
Tanzania	Ministry of Agriculture-Food Security Division coordinated with Tanzania Meteorological Agency (TMA), Ministry of Trade, National Bureau of Statistics (NBS)	GLAM, EWX, Tanzania Crop Monitor System	Via District Extension Agents, Regional Officers	Tanzania National Food Security Bulletin
Rwanda	Ministry of Agriculture and Animal Resources with Rwanda Meteorology	GLAM, EWX, Rwanda Crop Monitor System	Via District Extension Officers	Rwanda Crop Monitor Bulletin

Technical Framework



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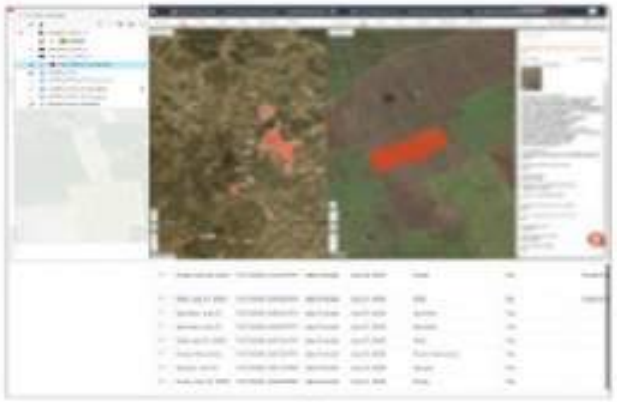
Ground Data

Figure 9 - Ground Data System

Paper Records

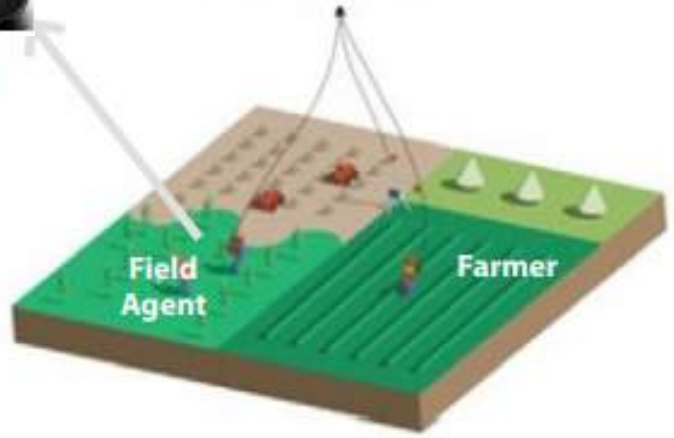
GPS Equipment

Data Visualization/Analysis



Mobile Data Collection and Relay

Offline Aggregation Database



Ground Data

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Capacity Co-Development

- Fully utilize/leverage EO capabilities in agriculture-related decision-making e.g.Reading and Interpreting Ready EO information and products
- Adapt organizational workflows to exploit or improve the use of EO in agriculture
  - Identify the best EO Data Application Platforms to use according to your needs and existing resources
  - Develop ground data collection applications and workflows (in case there are none in use)
  - Integrate and adapt your workflows for RS and in-situ data

Financial Support

gef

Least Developed Countries Fund - LDCF

Additional technical resources

- GEO Knowledge Hub Resource packages
  - Data
  - Data Analysis Protocols
  - Software
  - Expert support
  - Training/Workshops

- Leveraging EO capabilities in other sectors of national development

e.g. Biodiversity and Ecosystems, Coastal Zones DRR and Adaptation, Flood Risk Management etc.

Contacts

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Twitter:

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Kenneth Mwangi, IGAD - ICPAC

Kenneth works at IGAD Climate Prediction and Applications Centre (ICPAC) in the East Africa region as a Climate Monitoring and Early Warning Expert. He specialises in geo-information and earth observation applied in environmental monitoring, agriculture, and climate change vulnerability assessment.

As part of GEO Climate Change Working group Mwangi offers support to African countries in their NAP process and approaches by exploiting the potential of Earth observations for the monitoring and assessment of climate change impacts, vulnerability, risks and adaptation responses.

Demos

Demo of two crops currently on season (Maize and Wheat) in Uganda and Ethiopia:

- https://cropmonitor.org/interfaces/earlywarning/ma_batch.php

Demo of a remote sensing data source used to identify hotspots for crop rapid analysis:

- https://earlywarning.usgs.gov/fews/ewx/index.html?region=af

David Ongo Nyang’acha, RCMRD, DE Africa

David Ongo is an experienced Geospatial Expert specialized in Environmental and Natural Resources Monitoring and Management.

His experience spans from using GIS and Remote Sensing to participating in numerous multidisciplinary projects geared towards delivering services that meet international standards in industries that include, Water Resources Management, Infrastructure and Utility Mapping, Agriculture and Food Security, Mining, Forest Resources Monitoring, Urban Planning, Air Quality Monitoring, Land Administration.

He is the currently champion for the Regional Centre For Mapping Of Resources For Development (RCMRD)’s GeoHub Africa, an innovation, incubation and research. He’s also the Digital Earth Africa focal point.

Linking Agricultural Practices with Adaptation Policy and Earth Observations in Africa

David Ongo,

Regional Centre for Mapping of Resources for Development,

RCMRD

About RCMRD

The Regional Centre for Mapping of Resources for Development (RCMRD), previously known as Regional Centre for Services in Surveying, Mapping and Remote Sensing was established in Nairobi, Kenya in 1975 under the auspices of the United Nations Economic Commission for Africa (UNECA) and the then Organization of African Unity (OAU) now African Union (AU).

RCMRD is an intergovernmental organization with Head offices in Nairobi, Kenya.

RCMRD has twenty (20) Contracting member States and six (6) Non-Contracting member States

FOCUS THEMES

AGRICULTURE AND FOOD SECURITY

LAND ADMINISTRATION AND MANAGEMENT

WATER AND WATER RELATED DISASTERS

WEATHER AND CLIMATE

KNOWLEDGE MANAGEMENT

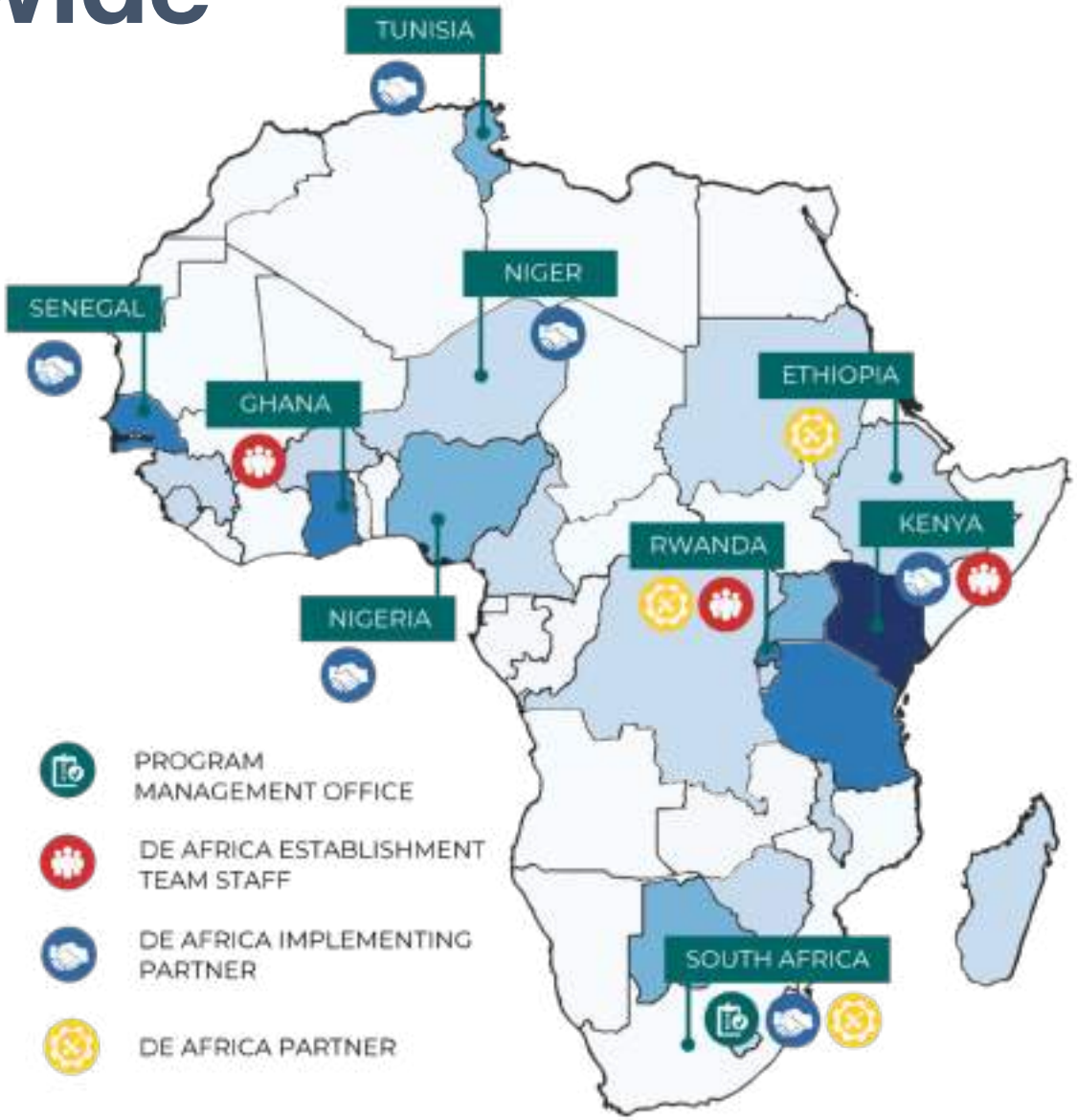
ADVISORY SERVICES

Activating a continent-wide community

Digital Earth Africa (DE Africa) is a continental-scale, not-for-profit program focused on improving access to Earth observation (EO) across sectors in Africa.

DE Africa is built on partnerships with African governance and in-country expertise to create sustained capacity development in Africa.

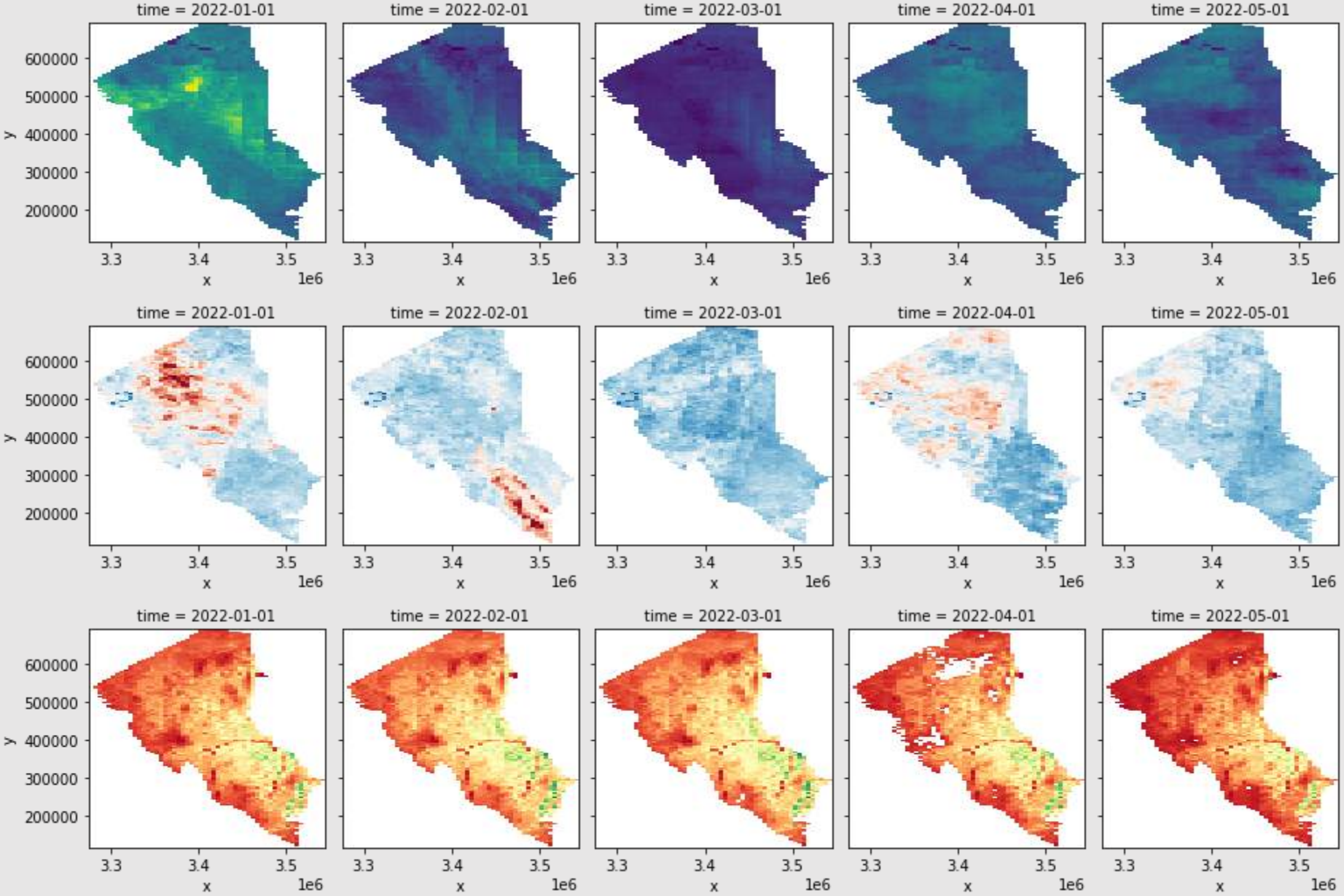
Platform and services provide free, open and accessible analysis ready satellite data



Digital Earth AFRICA

GEO

Agrometeorological Monitoring



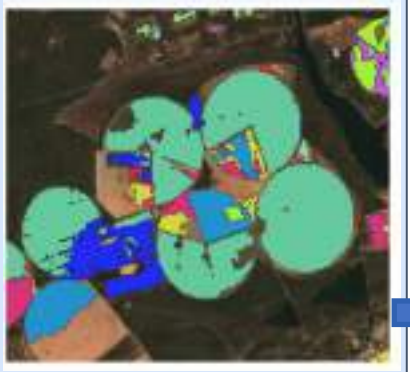
When to Plough
When to plant
When to harvest

Other Components

- **Soil Moisture – ASCAT**
- **Evapotranspiration**

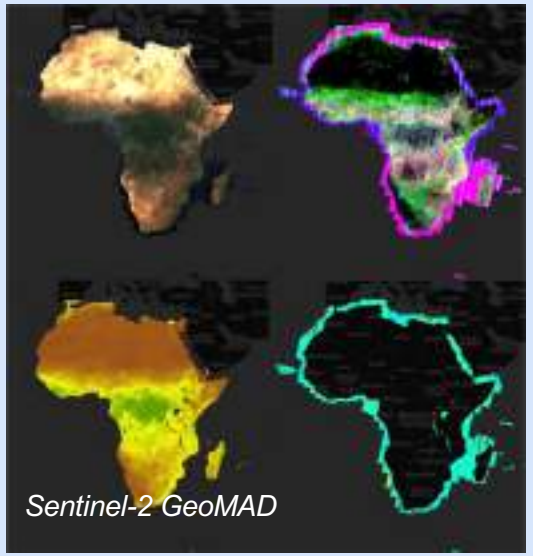
Use case 1- Agriculture and food security

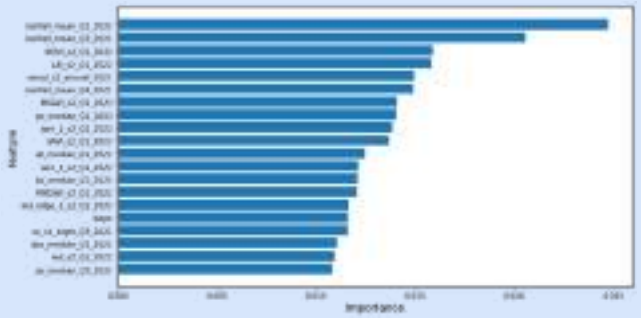
1. Sampling design - notebooks



2. Field data collection – ECAAS ODK toolkit.

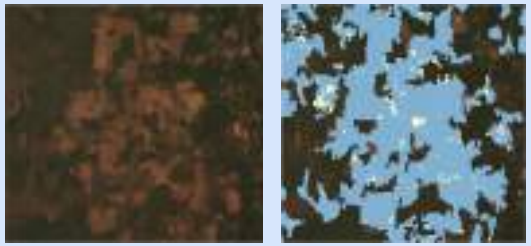
3. Data preparation - notebook 4. Feature extraction - notebook 5. Feature exploration - notebook

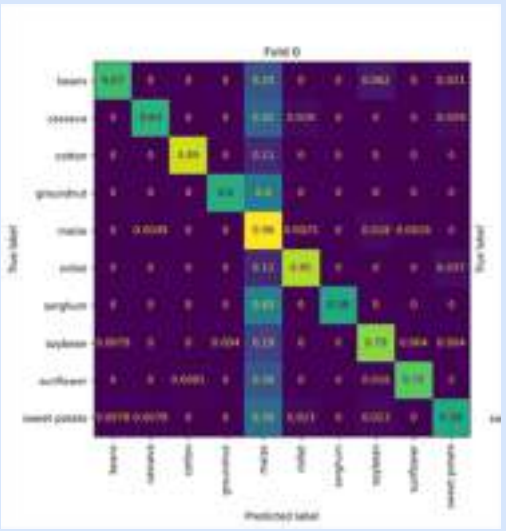




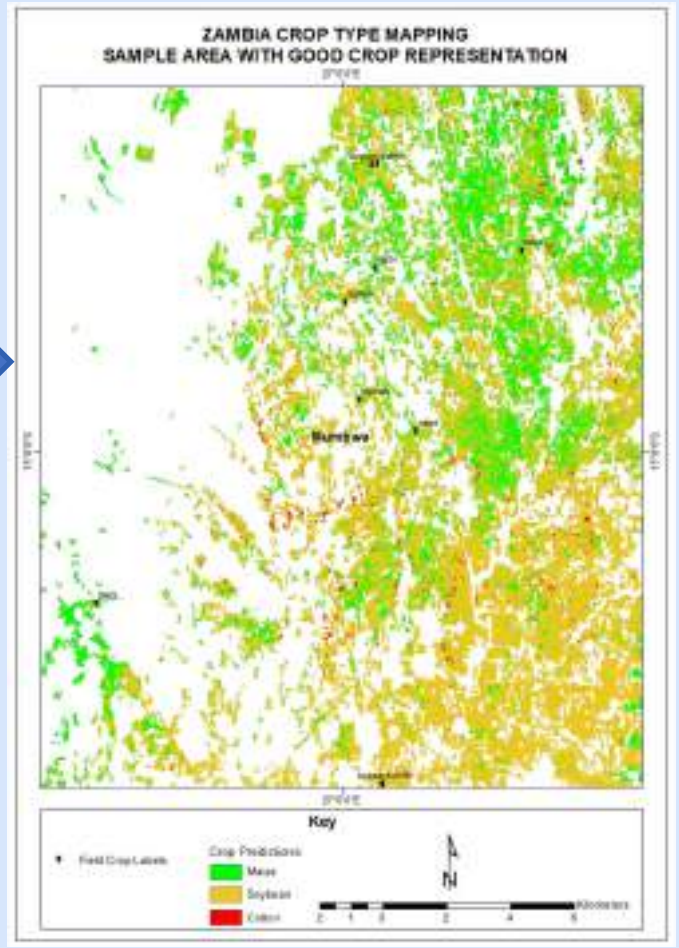
6. Machine learning training and performance estimation - notebook

7. Review of trained model on test areas - notebook

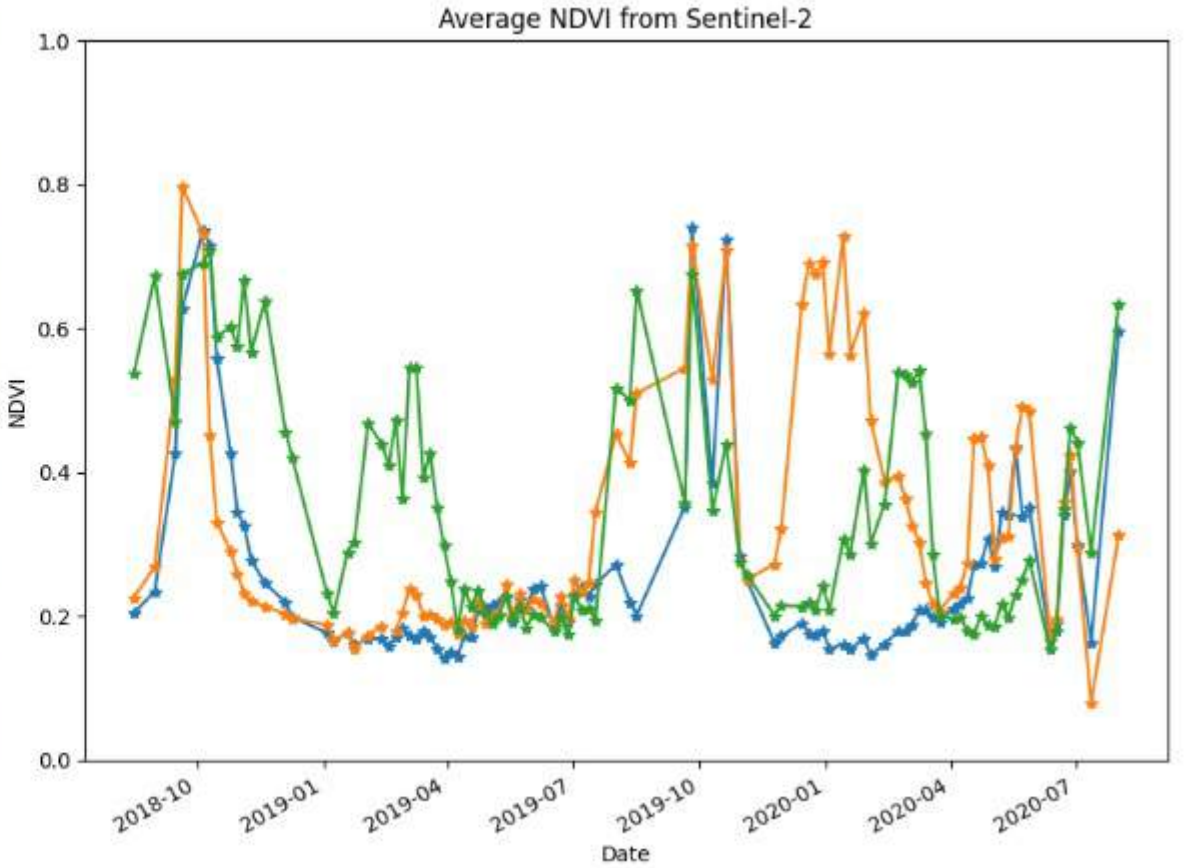




8. Production of crop type map for area of interest – notebook



Use case 2- Crop Health
Crop Health Monitoring



Use case 3- Hydrology and Water Resources (Fresh Water Resources)

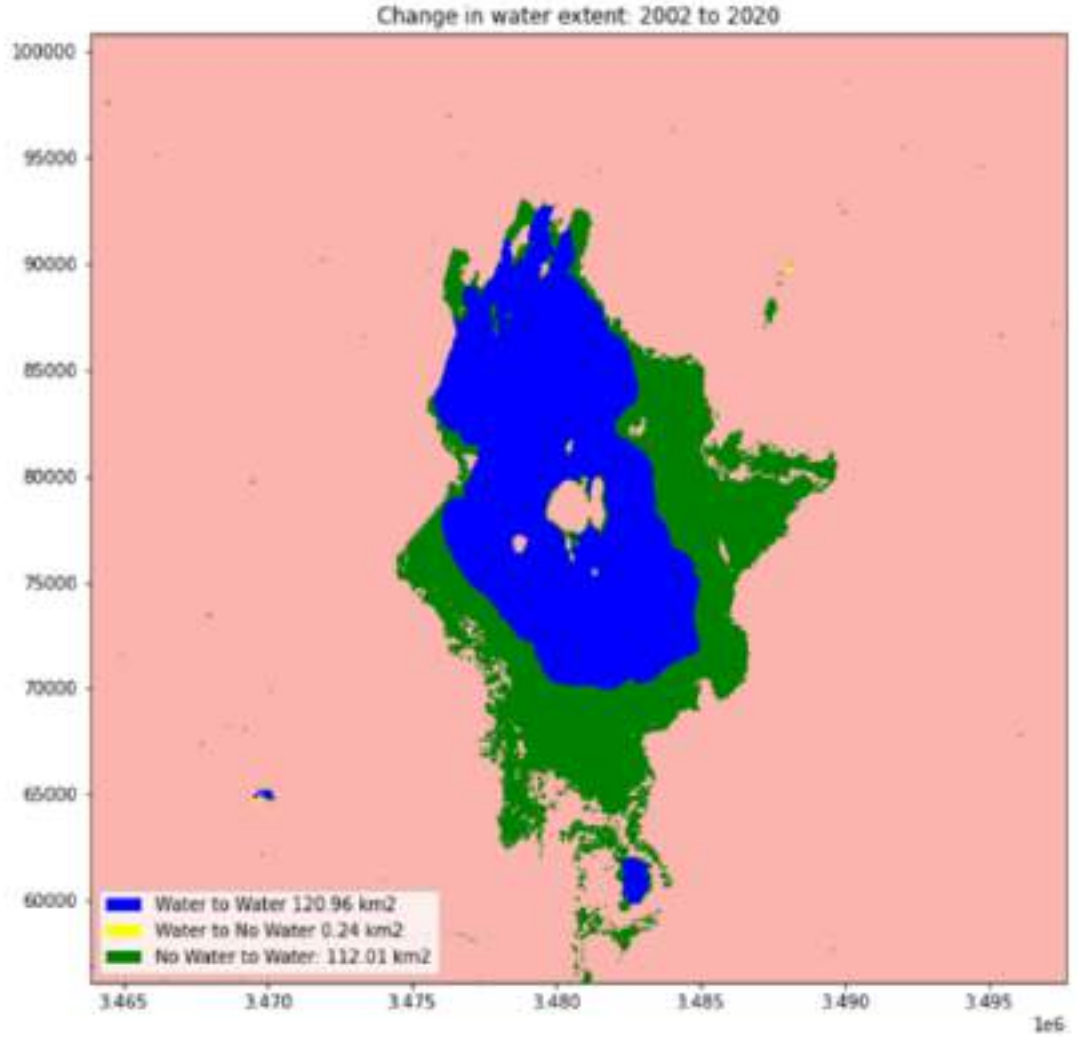


Figure 1: Change analysis of the lake water extent between 2002 and 2020, the lake has expanded by 112.01km2.

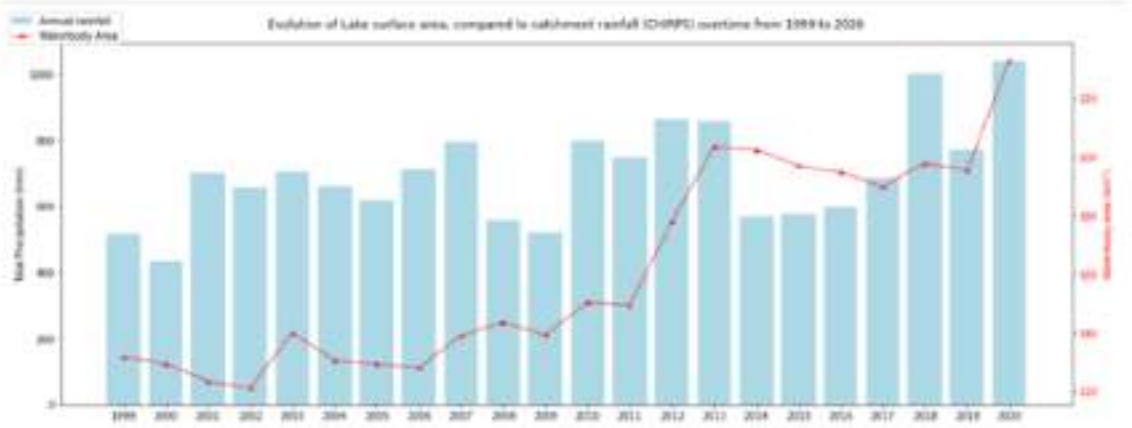


Figure 2: A gradual increase of rainfall is observed during this period, however, to fully understand the cause of the expansion, this analysis should be expanded to cover other rift valley lakes.

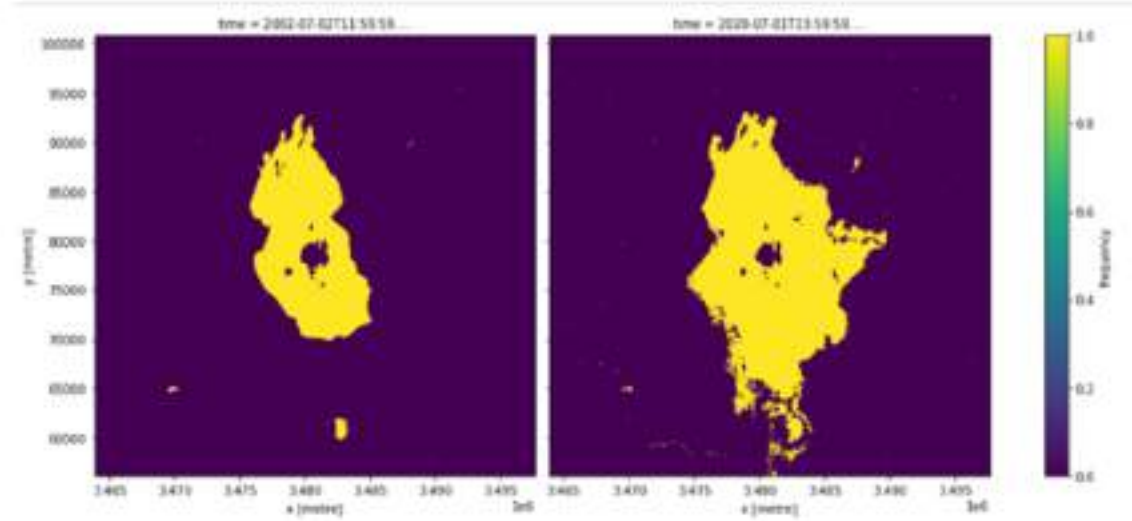
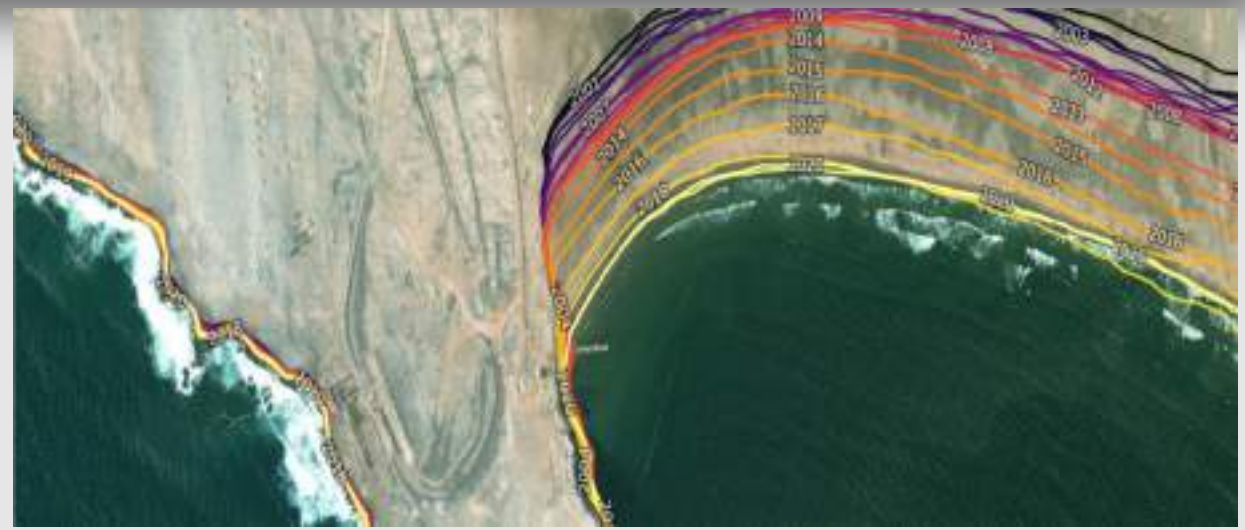


Figure 3: Plotted water classified pixel for the two dates where we have the minimum and maximum surface water extent.

Use case 4-Coastal Erosion & Blue Economy

Coasts serve as major socio-economic hubs for 38 African countries:

- ❑ Africa's coastal areas host half of the 15 African megacities which are fast expanding due to rural-urban migration and population growth
- ❑ The African blue economy is expected to be worth $405 billion and employ more than 57 million people by 2030
- ❑ Coastal communities and the blue economy are vulnerable to the impacts of climate change



- ❑ Scenarios
- ❑ Mangroves
- ❑ Infrastructure
- ❑ Agriculture

Useful links for more information

Malawi Hazards and Vulnerability Mapping

https://apps.rcmrd.org/disaster/malawi-hazards-and-vulnerability-mapping-project

Digital Earth Africa

https://www.digitalearthafrica.org/

AfriGEO
Earth Observations for Africa

Digital Earth AFRICA

REGIONAL CENTRE FOR MAPPING OF RESOURCES FOR DEVELOPMENT

Partners


Digital Earth
AFRICA


Afri
GEO
Earth Observations
for Africa


NASA


UN
DP


European Union


United Nations
Economic Commission
for Africa


IUCN


AFRICAN UNION


german
cooperation
giz


AUDA-NEPAD
AFRICAN UNION DEVELOPMENT AGENCY


esri


Food and Agriculture Organization
of the United Nations


CIFOR


ALPC


CNRU
RWANDA
National Commission
for UNESCO


NELGA
Network of Excellence
on Land Governance in Africa


TAHMO


USAID
FROM THE AMERICAN PEOPLE

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Jorge Luis Vazquez Aguirre, WMO

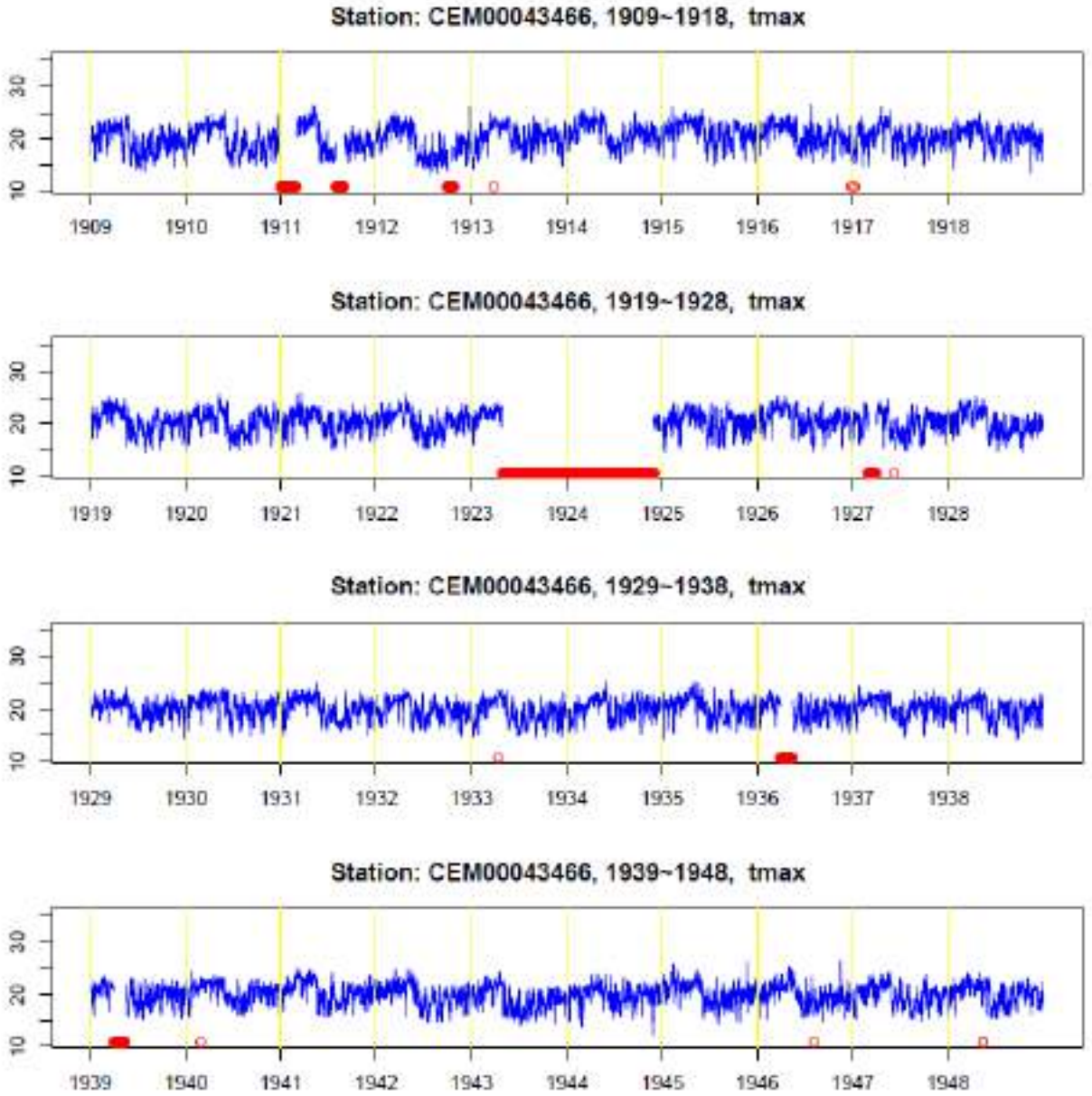
Jorge Vazquez is a Deputy Project Officer (short-term) at the Climate Services Branch, Services Department of the World Meteorological Organization. His background is in atmospheric science (B.Sc., M.Sc.) and climatology. He has been collaborating with WMO for more than a decade as part of Expert Teams in Technical Commissions including ET on Climate Change Detection and Indices, Sector-specific Climate Indices and Climate Information for Decision-making.

Integrating climate information from remote sensing and other sources into adaptation project proposals

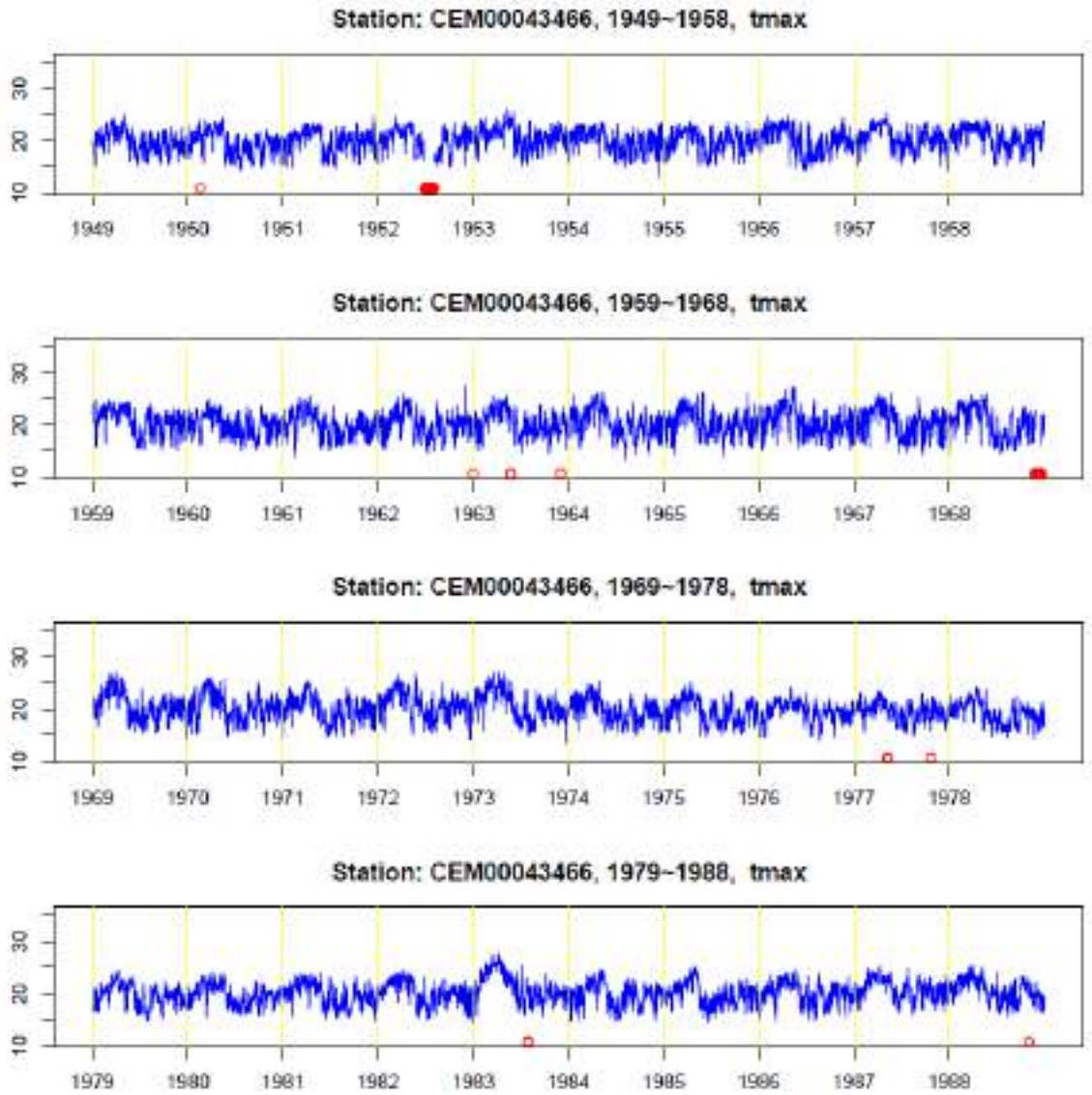
Jorge Luis Vazquez Aguirre

WMO

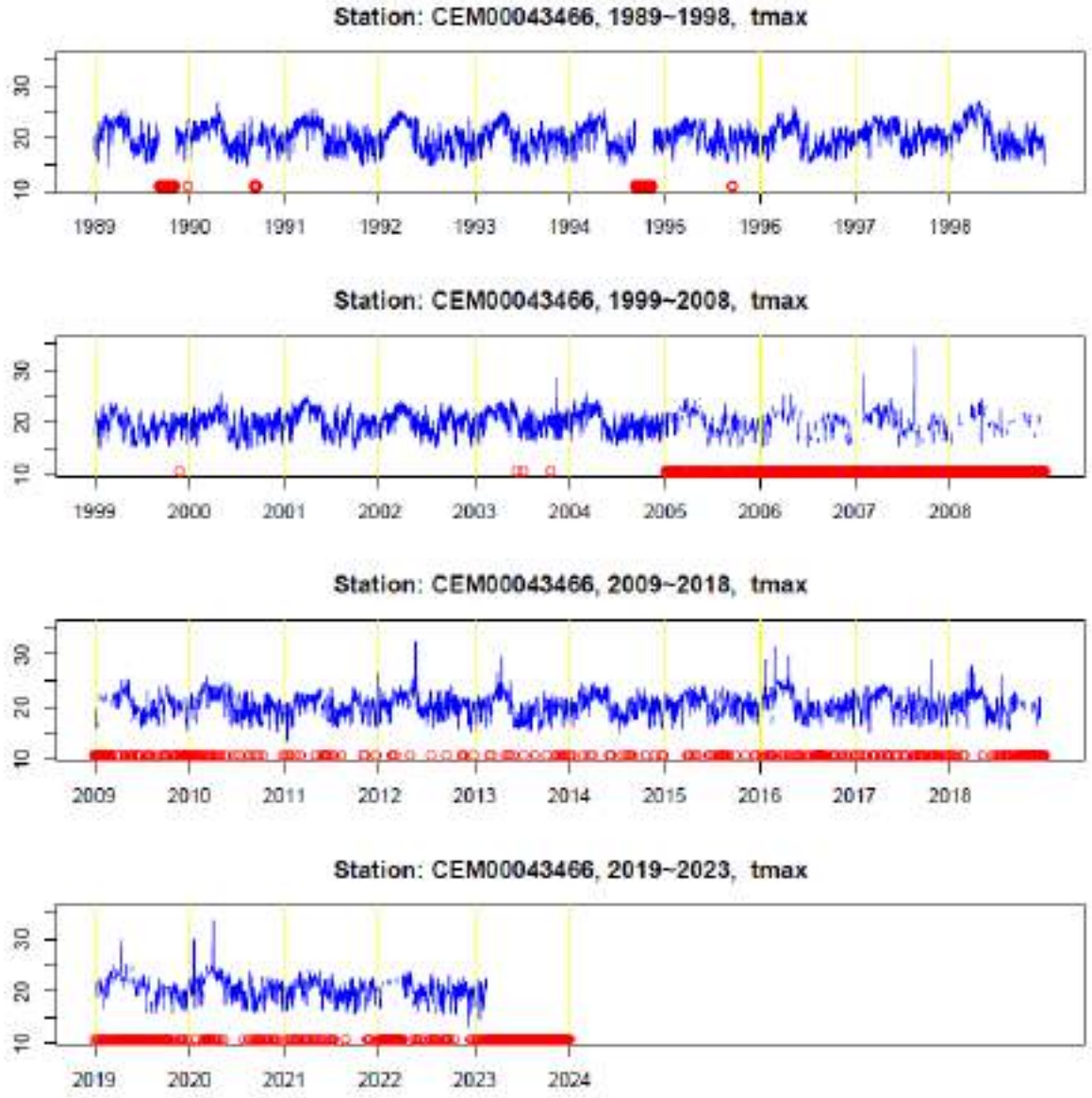
Instrumental climate records



Instrumental climate records



Instrumental climate records



Climpact (UNSW)

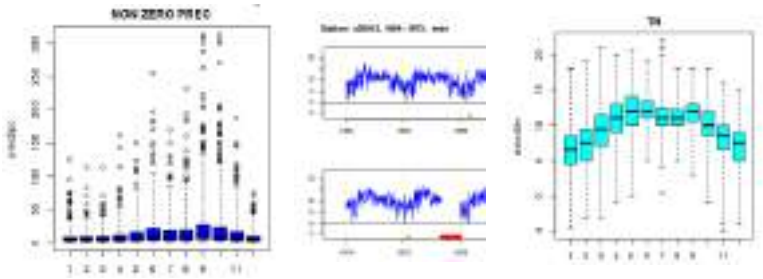
https://www.climpact-sci.org

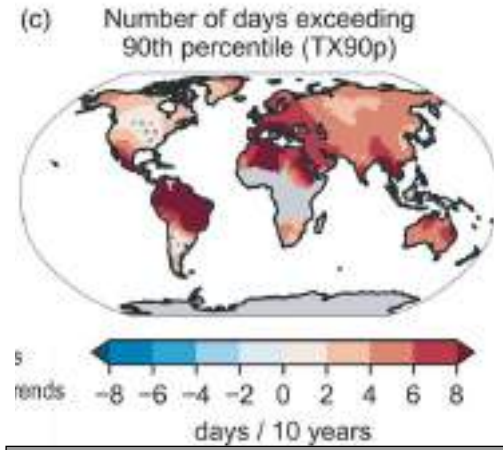
27 ETCCDI indices + 45 ET-SCI indices

From daily precipitation, max temp, min temp.

Climpact is based on RClimdex PCIC software

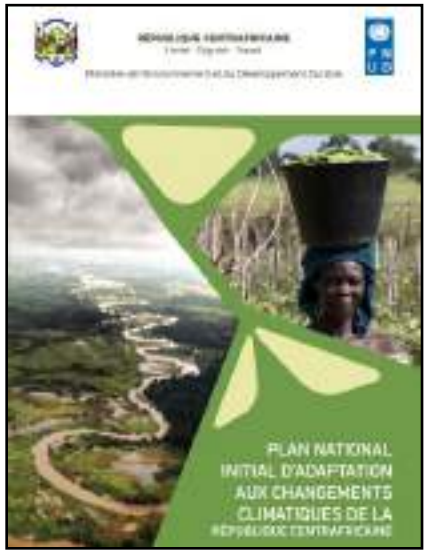
Climpact calculates indices using your own data





IPCC AR6. Fig. 11.9 Trends 1960-2018

Climpact indices included in National Adaptation Plans GCF project proposals



Quality Control of climate data:

- Plots of each index over time
- Files storing indices data
- Trend and threshold calculation
- Diagnostic file and plot to identify outliers and common errors in timeseries
- Correlations with sector data

GREEN CLIMATE FUND

UNSW SYDNEY

Climpact (UNSW)

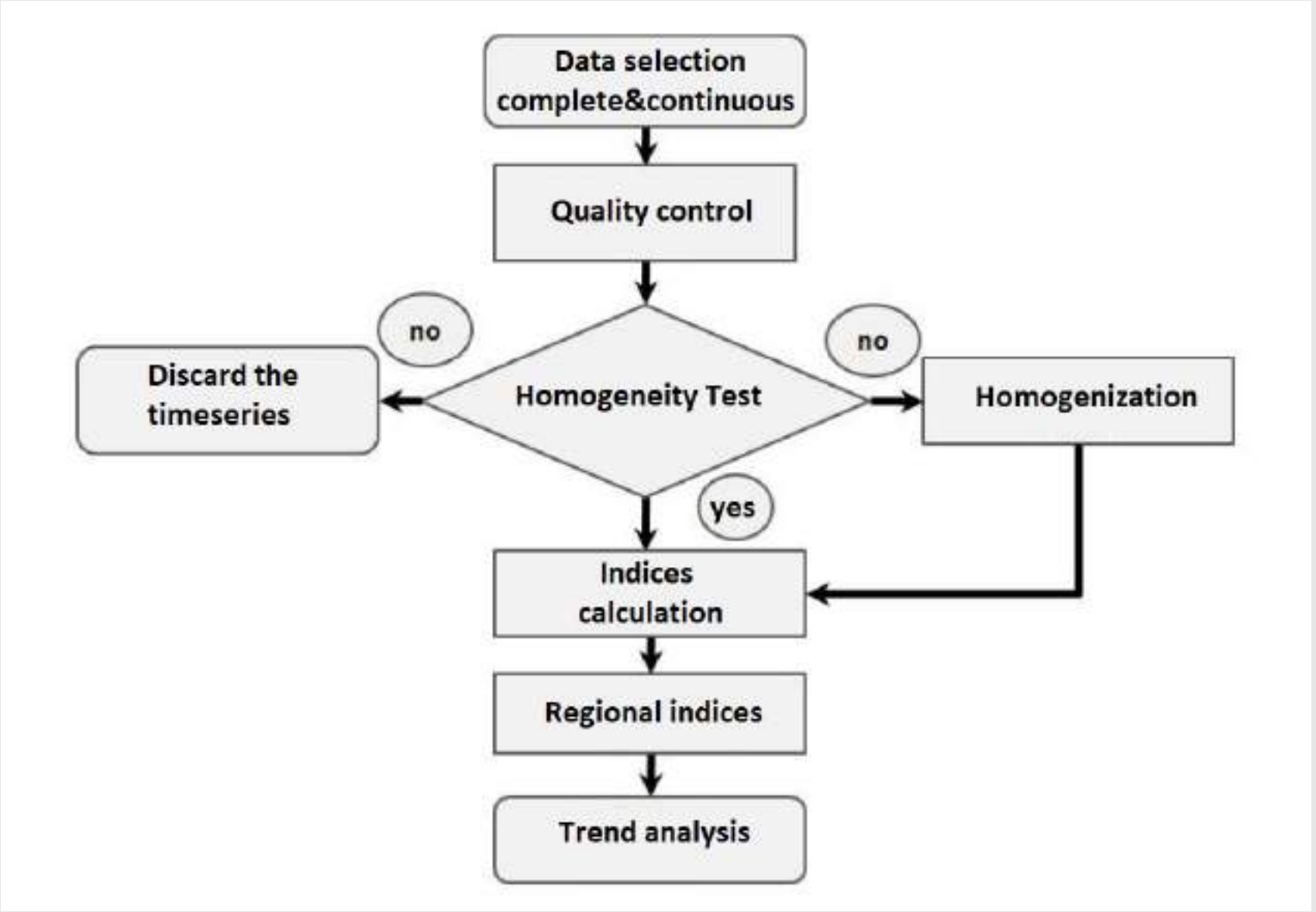
https://www.climpact-sci.org

Climpact users by country (markers) and Climpact-related ET-SCI workshops (yellow boxes) and WMO/GCF workshops (green boxes)

GREEN CLIMATE FUND

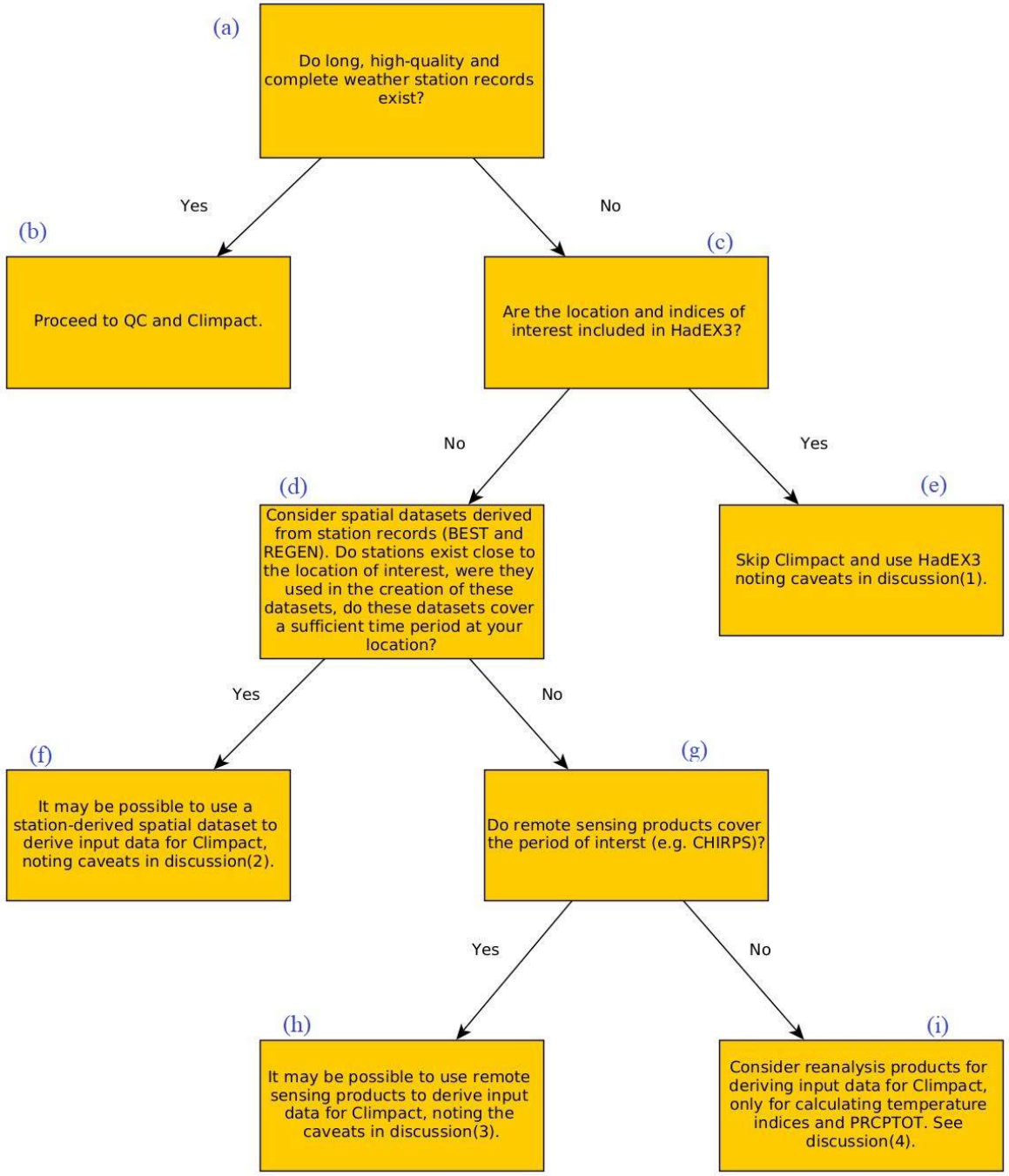
UNSW SYDNEY

Climate indices from instrumental data

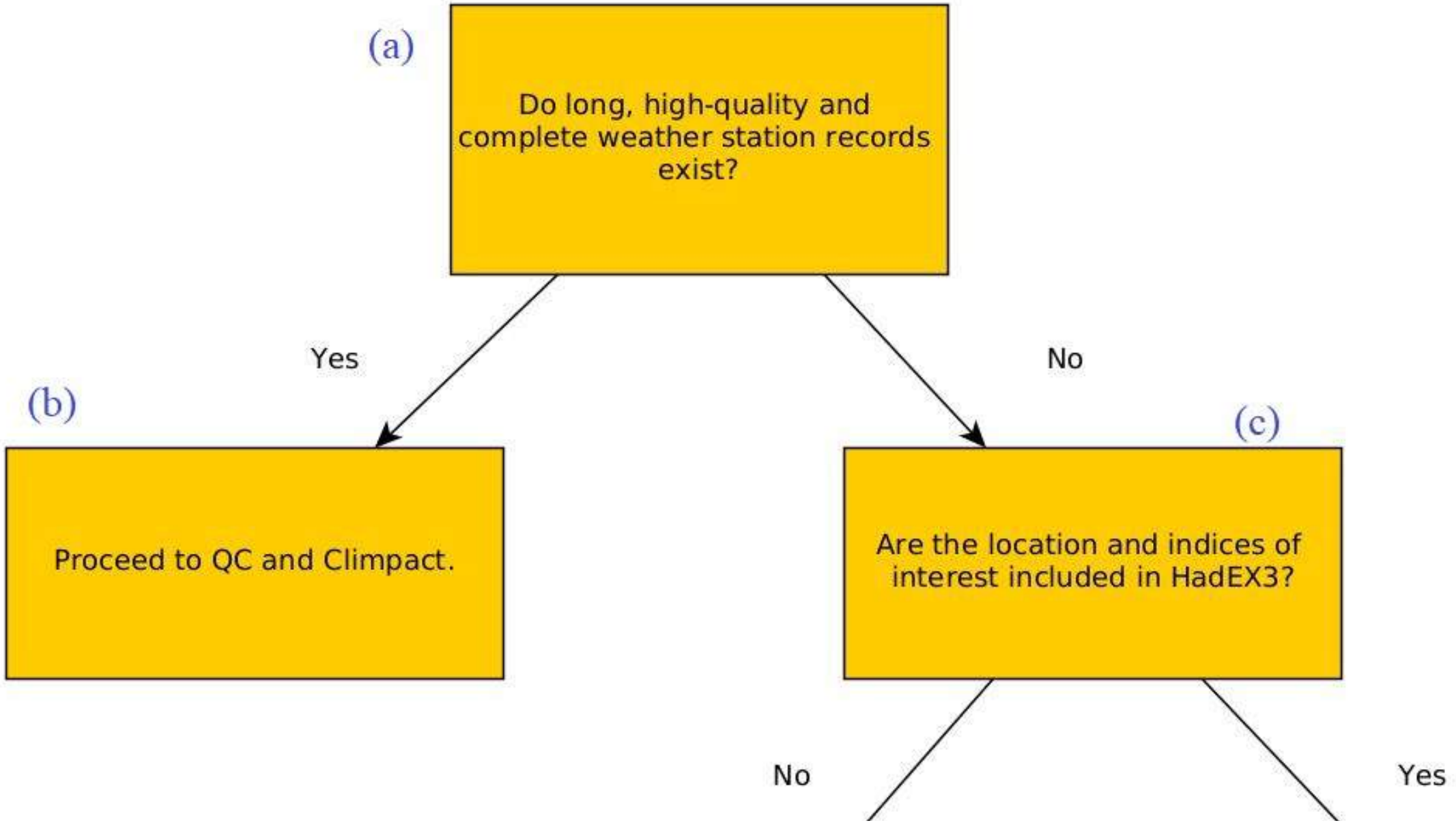


Herold et al. 2022. Pers. Comm.

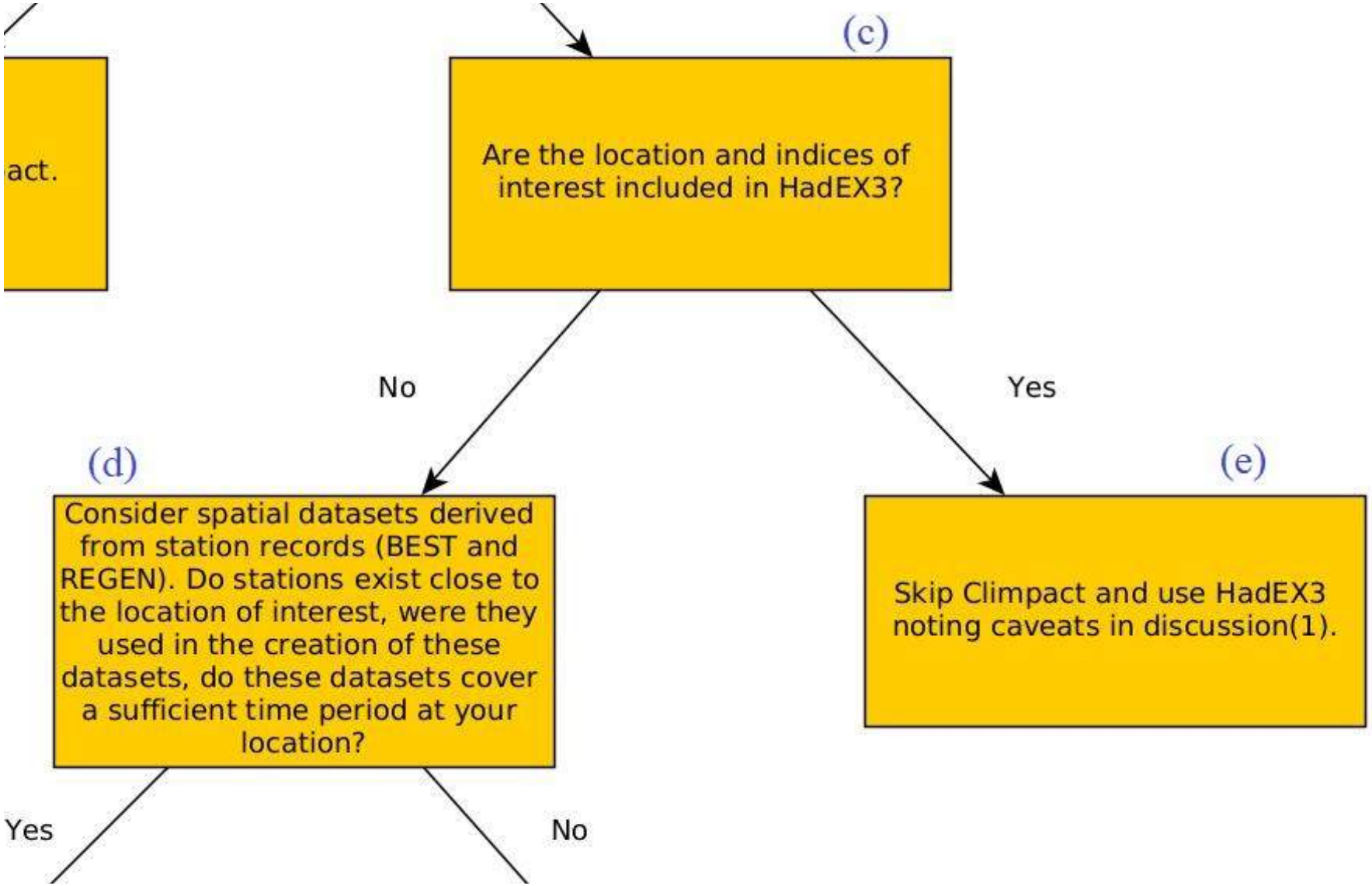
Climate indices when no good observed instrumental data (station level) exist



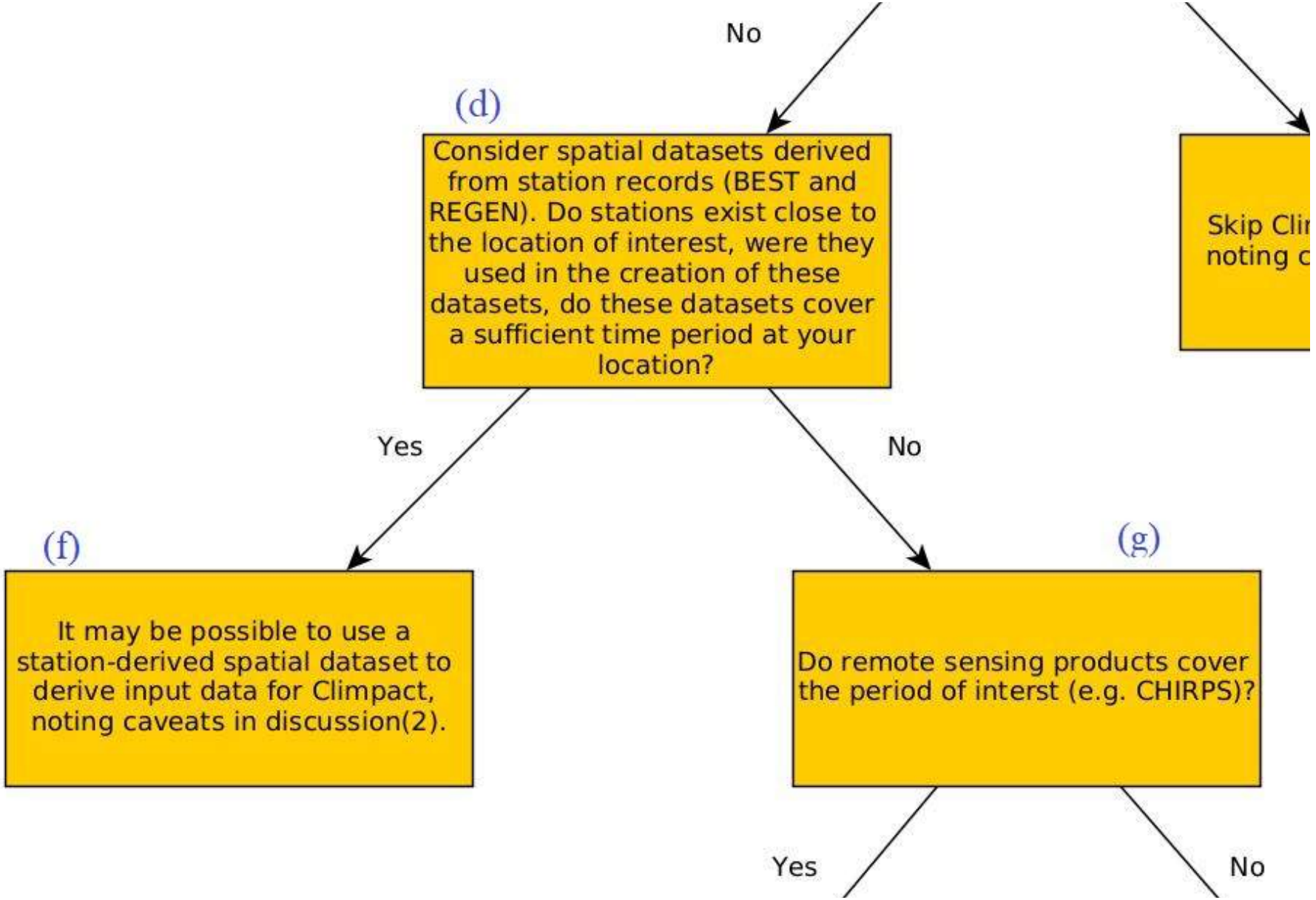
(1)


(a)
Do long, high-quality and complete weather station records exist?
Yes
No
(b)
Proceed to QC and Climpact.
(c)
Are the location and indices of interest included in HadEX3?
No
Yes

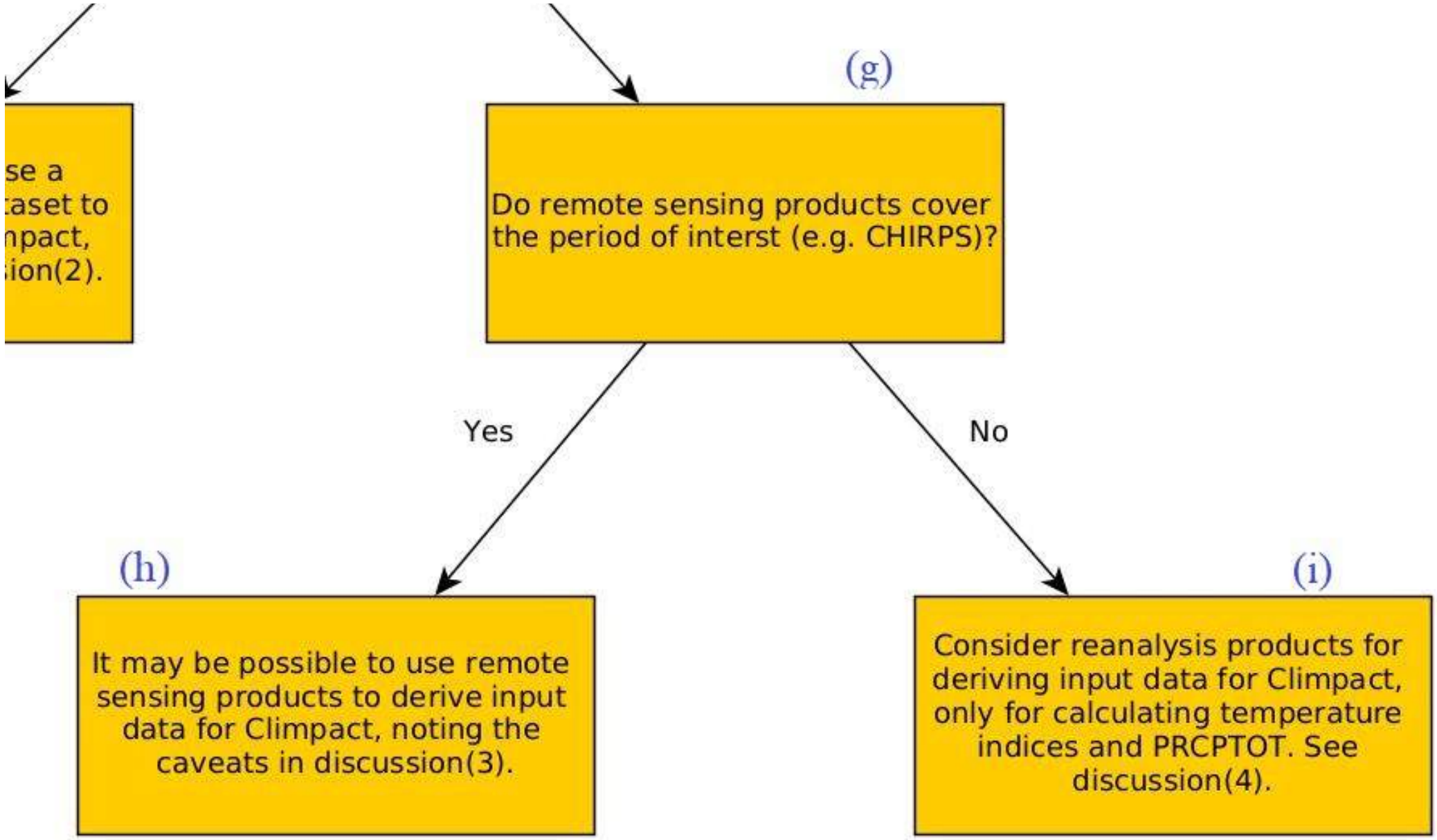
(2)


act.
(c)
Are the location and indices of interest included in HadEX3?
No
Yes
(d)
(e)
Consider spatial datasets derived from station records (BEST and REGEN). Do stations exist close to the location of interest, were they used in the creation of these datasets, do these datasets cover a sufficient time period at your location?
Skip Climpact and use HadEX3 noting caveats in discussion(1).
Yes
No

(3)


No
(d)
Consider spatial datasets derived from station records (BEST and REGEN). Do stations exist close to the location of interest, were they used in the creation of these datasets, do these datasets cover a sufficient time period at your location?
Skip Cli
noting c
Yes
No
(f)
It may be possible to use a station-derived spatial dataset to derive input data for Climpact, noting caveats in discussion(2).
(g)
Do remote sensing products cover the period of interst (e.g. CHIRPS)?
Yes
No

(4)


se a
taset to
npact,
ion(2).
(g)
Do remote sensing products cover the period of interst (e.g. CHIRPS)?
Yes
No
(h)
It may be possible to use remote sensing products to derive input data for Climpact, noting the caveats in discussion(3).
(i)
Consider reanalysis products for deriving input data for Climpact, only for calculating temperature indices and PRCPTOT. See discussion(4).

Climdex (UNSW)

https://www.climdex.org

Climdex plots can be easily cited They have been included in the IPCC reports and many other publications

27 ETCCDI indices (calculated with Climpact)

From station data, or gridded observational data

Summing up climate extremes

27 different indices describe changes in heat, cold, rainfall and drought over time—the hottest day each year, for example, or the amount of rainfall in the rainiest 5 day stretch each year.

Learn more

For any dataset

The Climdex indices are already available for a number of global climate datasets: we host several right here, and more are available from our partners. Find a dataset that suits your needs.

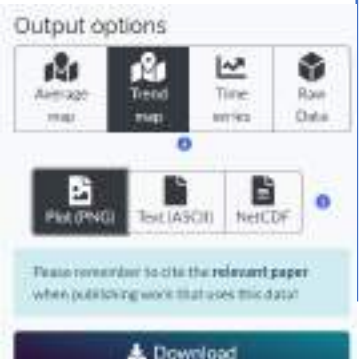
Browse datasets

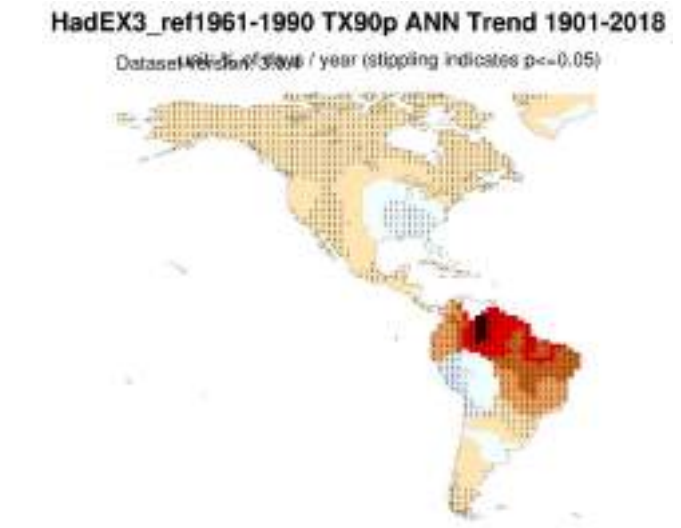
Plots and data, ready to go...

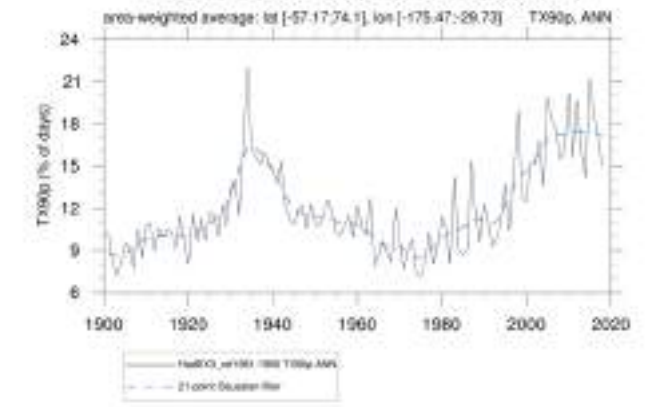
We provide trend maps, average maps, time series plots and raw data of the indices for our hosted datasets right here. Choose the dataset, the index, the timespan and the location.

Access data

Name	Description	Resolution	Years	Reference	Access
HadEX3	HadEX3 is a gridded analysis using approximately 7,000 stations for temperature and 17,000 stations for precipitation to cover the period 1901-2018. Two versions of HadEX3 are available, one using a reference period of 1961-1990 and another using a reference period of 1981-2010 (this latter dataset only contains indices dependent on the reference period, i.e. it only contains percentile-based indices). Robert Dunn maintains a blog about the the HadEX3 dataset here and the United Kingdom Met Office homepage for the HadEX3 dataset can be found here.	1.875°×1.25°	1901-2018	Dunn et al. 2020	Get data





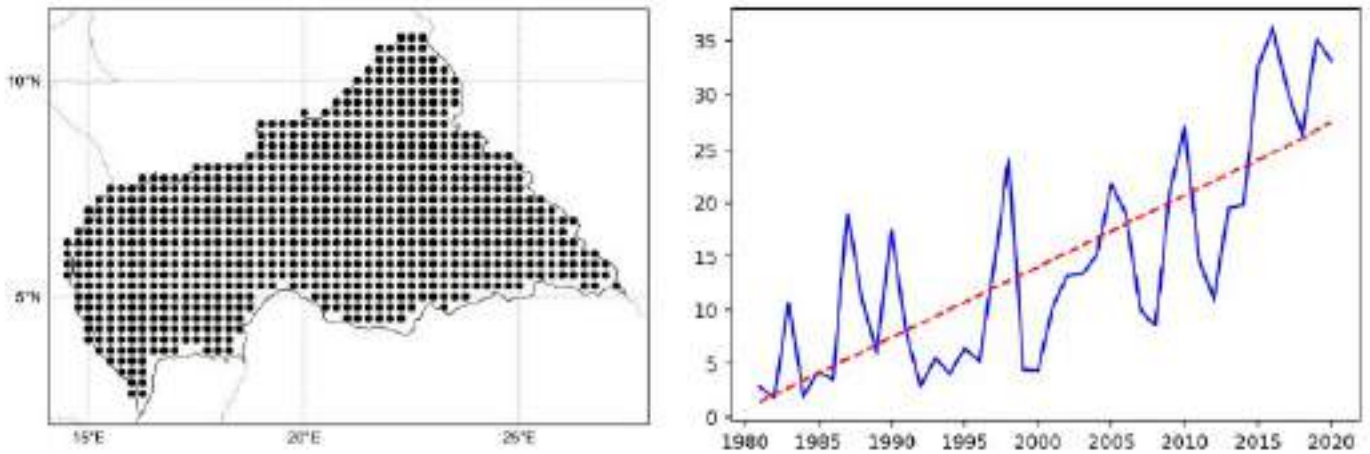


UNSW SYDNEY

Example: Climate change indices for CAR from *ERA5 reanalysis*

ETCCDI indices (temperature) calculated from ERA reanalysis (proxy)

Central African Republic
A regional time series covering all country



Left: Individual locations of 812 ERA5-reanalysis temperature timeseries withing the Central African Republic
Right: CAR regional timeseries of the (Tn90p) warm nights index (average of 812 individual timeseries): annual percentage of days when minimum temperature is greater than the 90th percentile

Challenges for using this type of information for DRR:

Translation of climatic patterns into impacts

Plans to prevent and prepare for impacts as part of DRR

Translate global/regional projections into national/local impacts

Long-term adaptation goals vs short/medium term actions

A. Kumar (per. comm)

Climate Information Platform (SMHI)

https://climateinformation.org

Example: Gaborone, BWA (-24.66 / 25.92)

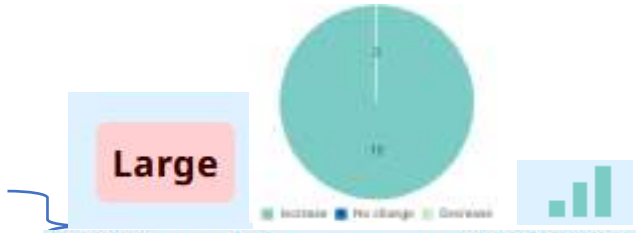
+4◦C

Temperature (annual mean)

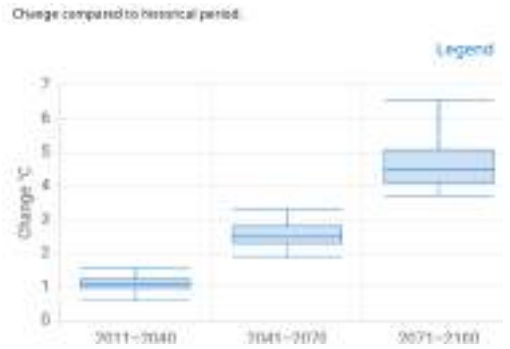
Large
Change is more than 2 °C

Medium
Change is 1.5-2 °C

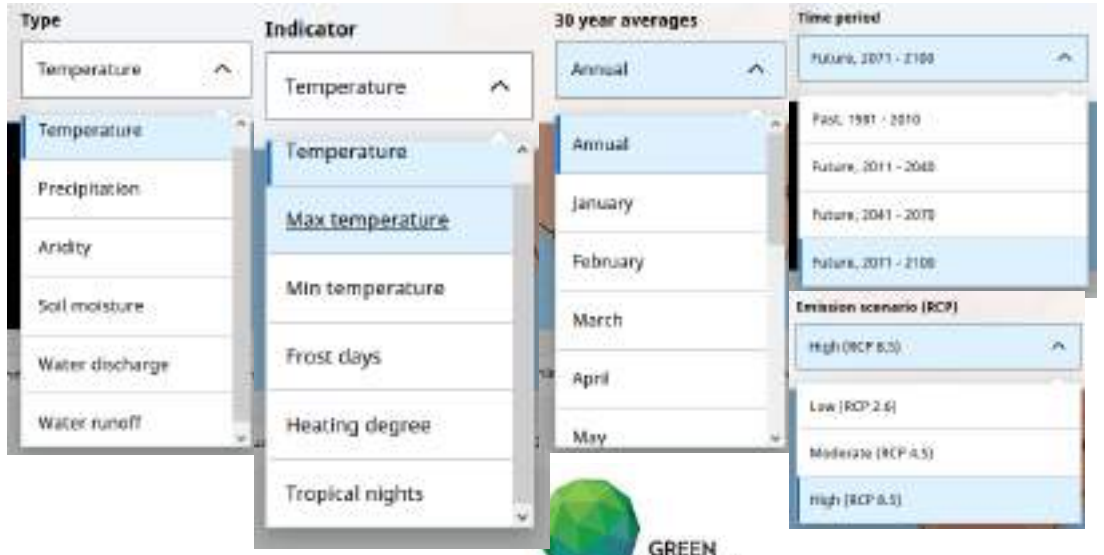
Small
Change is less than 1.5 °C

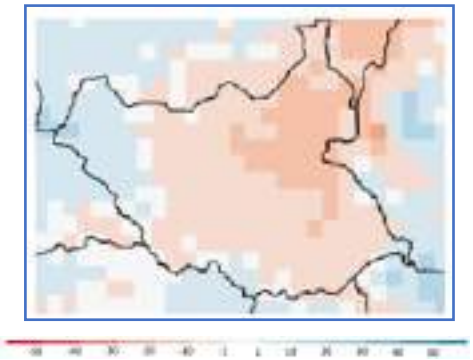


MANY models agree on INCREASE



Future change in top indicators





Annual Precipitation. RCP 8.5
2041 – 2070
% change vs 1981-2010

GREEN CLIMATE FUND

SMHI

Demos

CLIMATE INFORMATION

Site-specific report

Get an instant climate change overview for any location world-wide.

Data Access Platform

Download pre-calculated climate indicators and explore interactive maps and graphs.

Climpact

Calculate climate indicators using your own weather and climate data.

GREEN CLIMATE FUND

WORLD METEOROLOGICAL ORGANIZATION

WCRP World Climate Research Programme

SMHI