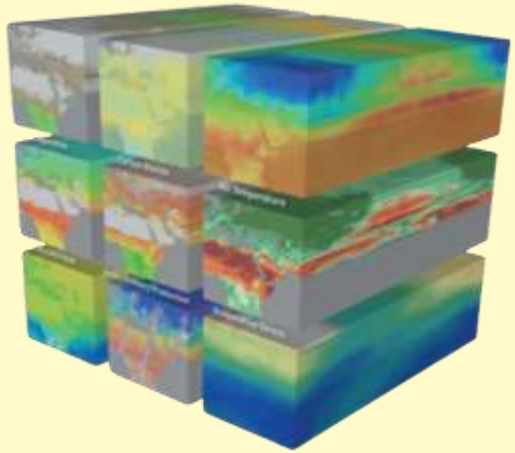
Empowering Uptake Through Enhanced Access to Earth Observation Data Knowledge

Unlocking Innovation Through CF4SFD



Mr. P Sibandze

CSIR ICC

6 June 2024

Image Source: Euro Data Cube Facility service

Outline

- Current state of data access in South Africa
- Proposed framework
- CF4SFD architecture
- Benefits of CF4SFD
- Case Study
- Conclusion

Current State of Data Access

University of Fort Hare
Together in Excellence

1. Existing Policies:

A. **Spatial Data Infrastructure Act, 2003 (Act No. 54 of 2003)**

establishes a framework for developing and managing a spatial data infrastructure in South Africa. It aims to facilitate **capturing, managing, maintaining, integrating, distributing,** and using spatial information.

B. **Promotion of Access to Information Act (PAIA) No. 2 of 2000**

aims to promote transparency, accountability and informed decision-making by ensuring access to relevant information.

C. **Draft National Data and Cloud Policy**

aims to create an enabling environment for data and cloud services to ensure equitable access to data and cloud services.

2. Existing platforms:

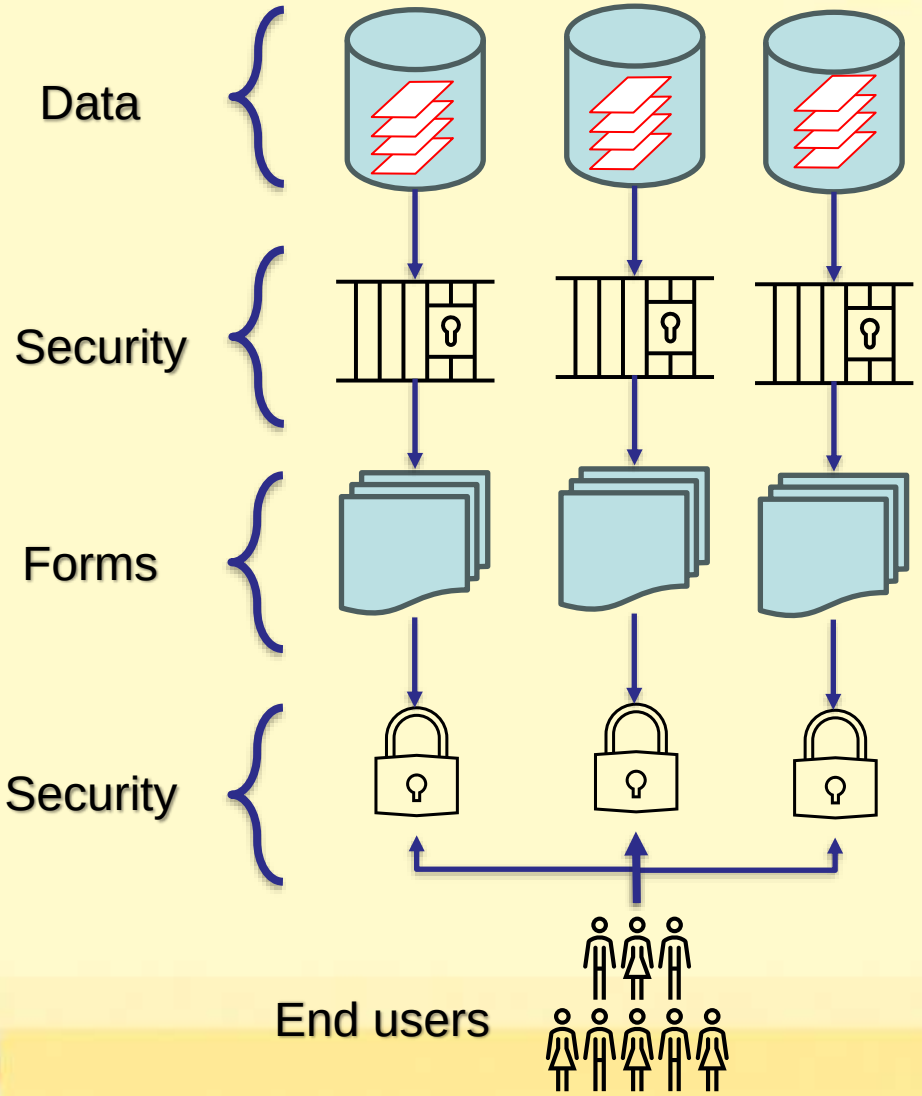
SAEON, ARC, SAWS, STATSA, SANSA, SEAD-SA, SANBI etc.

Current State of Data Access

University of Fort Hare
Together in Excellence

3. Challenges:

- Decentralized data sources
- Excessive paperwork (B2B emails)
- Data redundancy (climate data)
- Data inconsistencies
- Data security (different protocols)
- Difficulty in data governance
- Increased data retrieval time



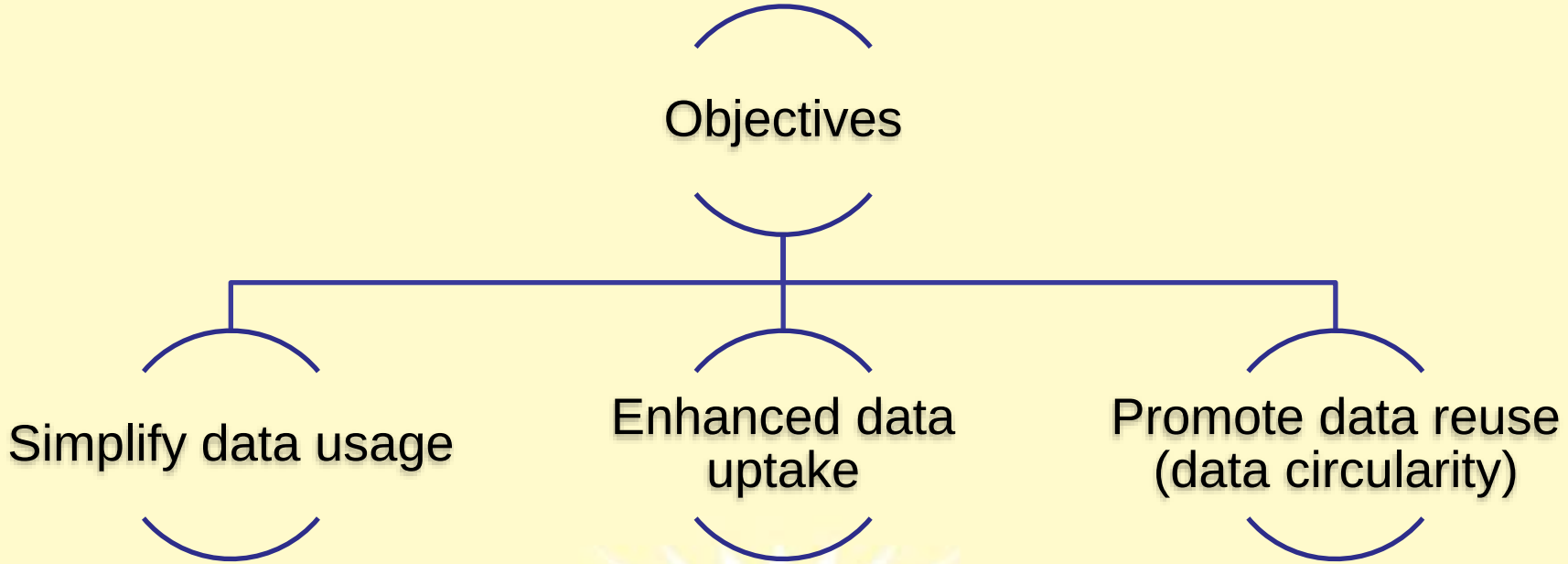
Proposed Framework

University of Fort Hare
Together in Excellence

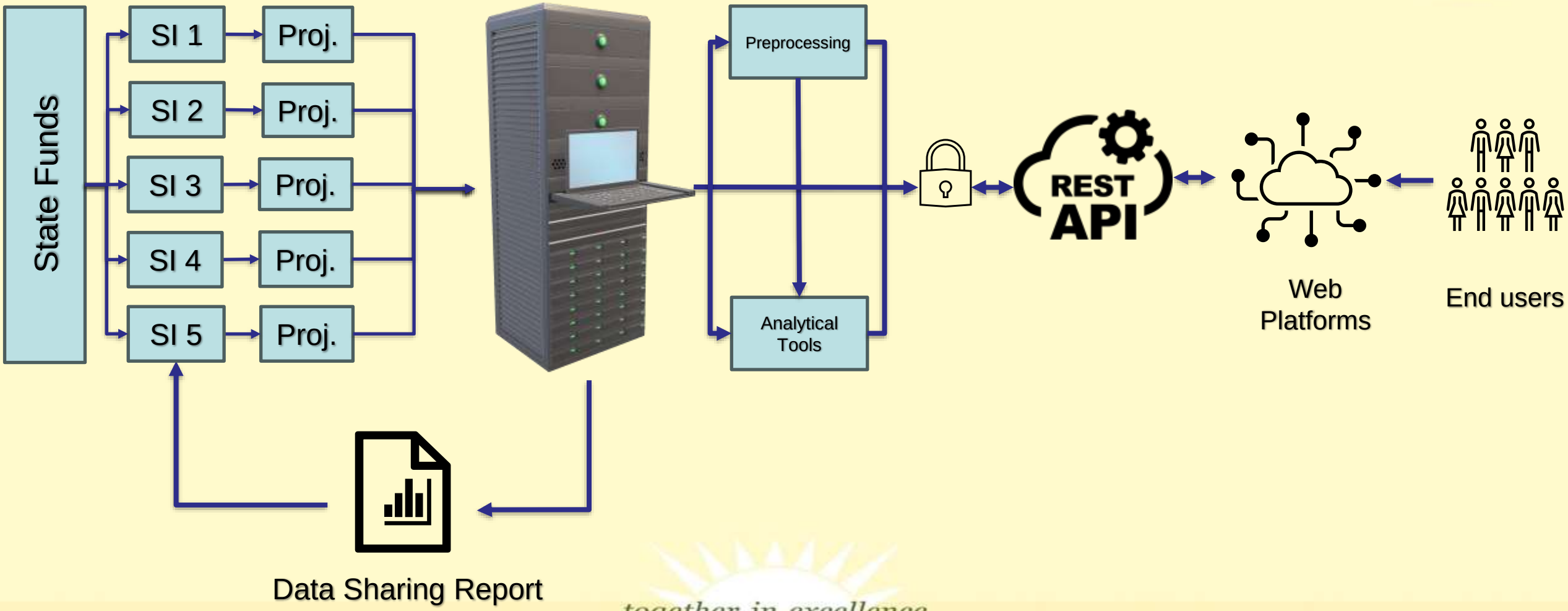
Centralised Framework for State-Funded Data

CF4SFD

"Ensuring unrestricted access to state-funded data."



CF4SFD Architecture



Benefits of CF4SFD

University of Fort Hare
Together in Excellence

CS4SD

- Single access point for geospatial and non-geospatial data, including in situ data.
- Promotes innovation, research and technological advancements (HRDEM, climate data)
- Drives economic growth (support industries)
- Improved data quality and consistency
- Enhanced data security
- Cost-effective
- Facilitated compliance and governance
- Better resource allocation

Case Study

Copernicus Climate Data Store (CDS)

Product type

- Climate indices (3)
- Climate projections (40)
- In-situ observations (15)
- Reanalysis (48)
- Satellite observations (42)
- Seasonal forecasts (12)

Variable domain

- Atmosphere (composition) (5)
- Atmosphere (surface) (46)
- Atmosphere (upper air) (38)
- Land (biosphere) (23)
- Land (cryosphere) (6)
- Land (hydrology) (29)
- Ocean (biochemistry) (1)
- Ocean (physics) (19)

Sector

- Agriculture (8)
- Biodiversity (5)
- Coastal regions (8)
- Disaster risk reduction (4)
- Energy (4)
- Health (8)
- Infrastructure (2)
- Tourism (4)
- Transport (1)
- Water management (10)

Spatial coverage

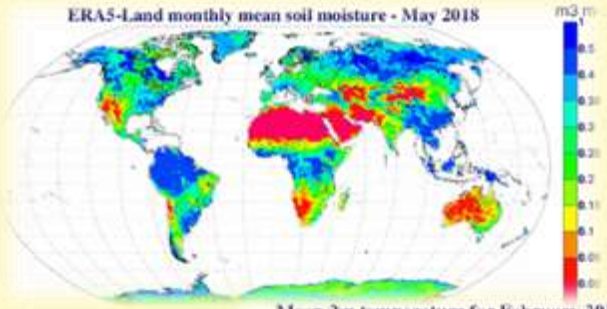
- Europe (59)
- Global (97)

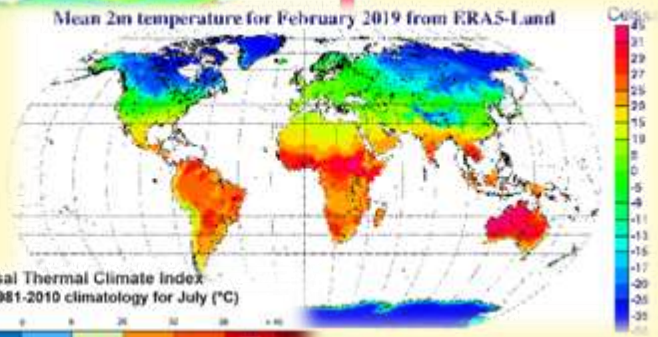
Provider

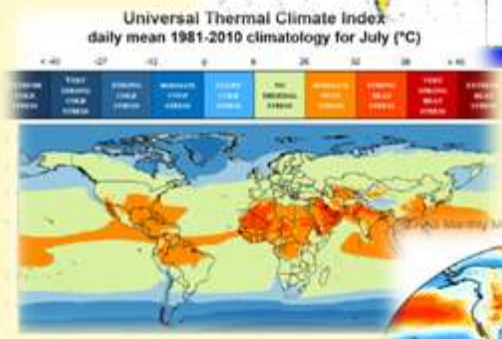
- Copernicus C3S (76)
- Copernicus CEMS (13)
- ESA CCI (4)
- EUMETSAT SAF (6)

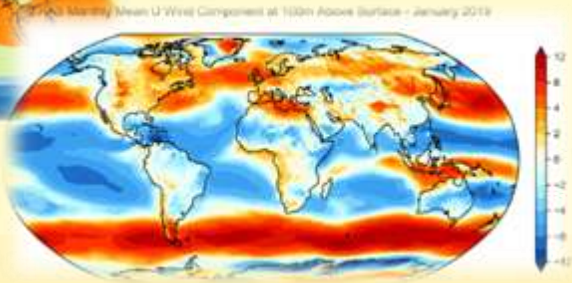
Temporal coverage

- Future (57)
- Past (145)
- Present (56)









Case Study

Copernicus Climate Data Store

University of Fort Hare
Together in Excellence

Toolbox Editor

Applications | Data | Documentation

Search for app or example

your workspace

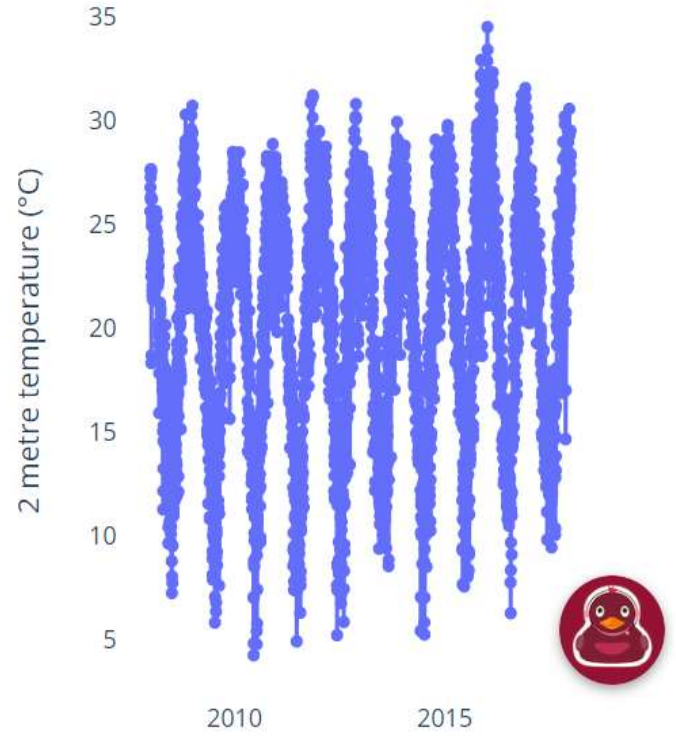
- Temp_v2_1940-1960
- Temp_1991-2023
- Temp_1961-1990
- Temp_1940-1960
- Soil_moisture_1961-1990
- Soil_moisture_1991-2023
- Soil_moisture_1940-1960
- 03 Extract time series and plot graph-1
- Evo_2_1991-2023
- Evo_2_1961-1990
- Evo_2_1940-1960
- Runoff_1961-1990
- Runoff_1991-2023
- Runoff_1940-1960
- Evapo-1991-2023
- Evapo_1961-1990

03 Extract time series and pl... | Console | Your queue | Runtime profile

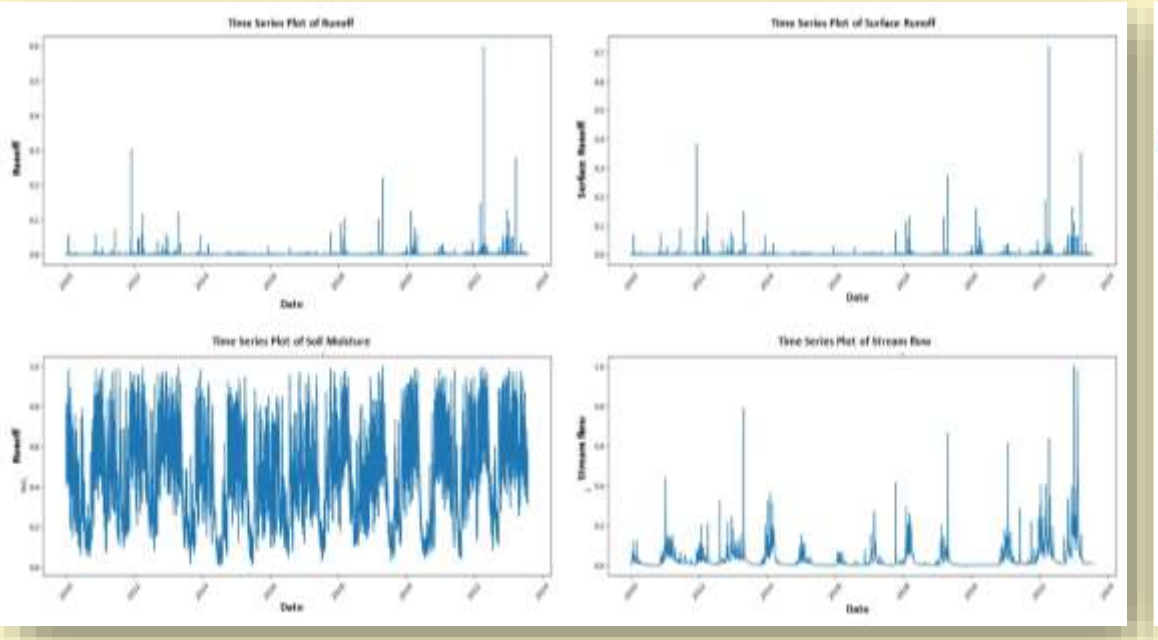
Layout | Copy | Run

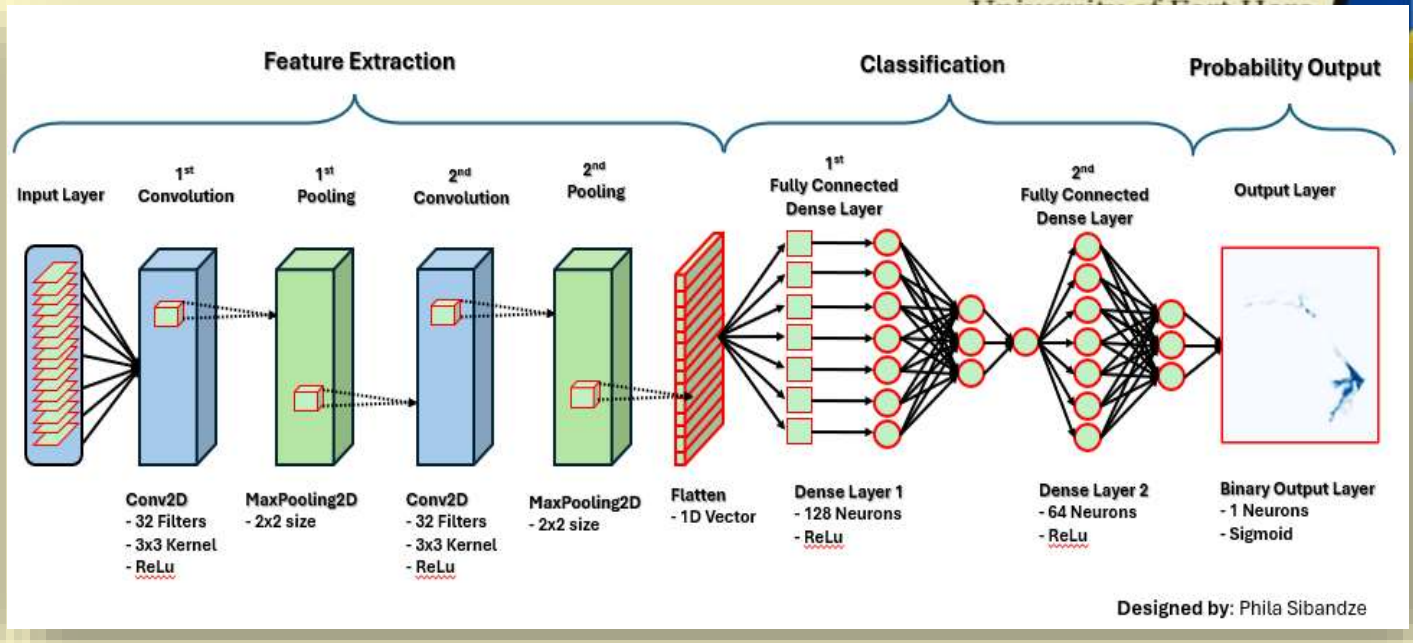
```
1  import cdstoolbox as ct
2
3  layout = {
4      'input_ncols': 3,
5  }
6
7  variables = {
8      'Near-Surface Air Temperature': '2m_temperature',
9      'Eastward Near-Surface Wind': '10m_u_component_of_wind',
10     'Northward Near-Surface Wind': '10m_v_component_of_wind',
11     'Sea Level Pressure': 'mean_sea_level_pressure',
12     'Sea Surface Temperature': 'sea_surface_temperature',
13 }
14
15
16 @ct.application(title='Extract a time series and plot graph',
   layout=layout)
17 @ct.input.dropdown('var', label='Variable',
   values=variables.keys(), description='Sample variables')
18 @ct.input.text('lon', label='Longitude', type=float,
   default=75., description='Decimal degrees')
19 @ct.input.text('lat', label='Latitude', type=float, default=43.,
   description='Decimal degrees')
20 @ct.output.livefigure()
```

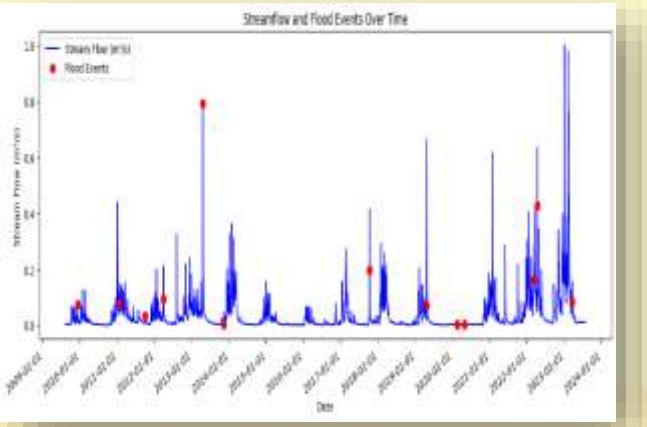
Extract a time series and plot graph

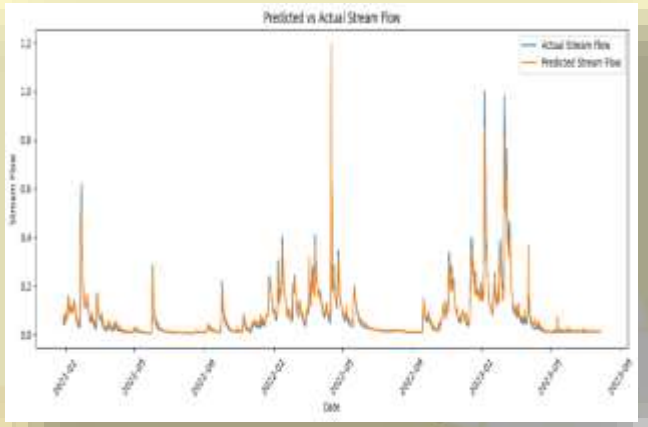


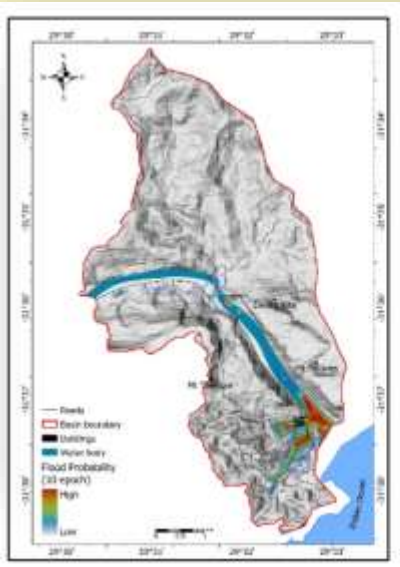
Case Study

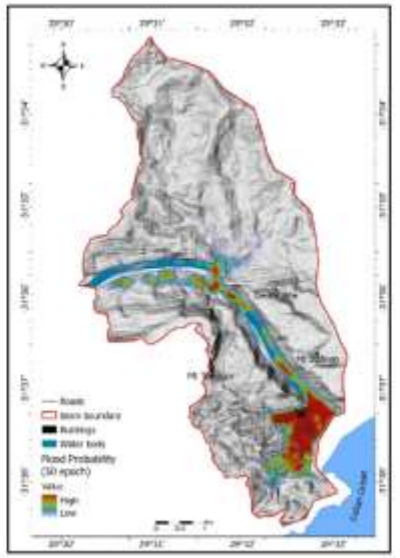

Time Series Plot of Runoff
Time Series Plot of Surface Runoff
Time Series Plot of Soil Moisture
Time Series Plot of Stream flow
Date

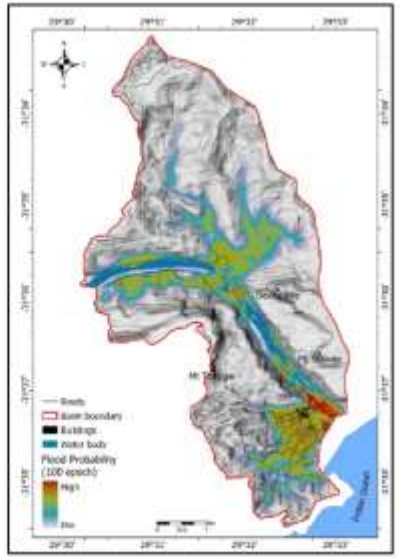

Feature Extraction
Classification
Probability Output
Input Layer
1st Convolution
1st Pooling
2nd Convolution
2nd Pooling
1st Fully Connected Dense Layer
2nd Fully Connected Dense Layer
Output Layer
Conv2D - 32 Filters - 3x3 Kernel - ReLu
MaxPooling2D - 2x2 size
Conv2D - 32 Filters - 3x3 Kernel - ReLu
MaxPooling2D - 2x2 size
Flatten - 1D Vector
Dense Layer 1 - 128 Neurons - ReLu
Dense Layer 2 - 64 Neurons - ReLu
Binary Output Layer - 1 Neurons - Sigmoid
Designed by: Phila Sibandze


Streamflow and Flood Events Over Time
Stream Flow (m^3/s)
Flood Events
Date


Predicted vs Actual Stream Flow
Actual Stream Flow
Predicted Stream Flow
Stream Flow
Date


Rivers
Basin boundary
Buildings
Water body
Flood Probability
(10 epoch)
High
Low


Rivers
Basin boundary
Buildings
Water body
Flood Probability
(50 epoch)
High
Low


Rivers
Basin boundary
Buildings
Water body
Flood Probability
(100 epoch)
High

Conclusion

University of Fort Hare
Together in Excellence

Why is it crucial to ensure unrestricted access to state-funded data?

- Start a dialogue around CF4SFD which could lead:
  - Recommendation to changes to policies or formulation of new policies.
  - Support the implementation of the centralized framework
  - Participating in its development and usage
- Simplify data access
- Increase in data usage
- Promote data reuse (data circularity)
- Promote innovation
- Support and stimulate the industry, including the private sector.

NEOSS
NATIONAL EARTH OBSERVATION AND SPACE SECRETARIAT

University of Fort Hare
Together in Excellence

together in excellence