PySARFlow

An open-source python library for SAR data pre-processing and analysis

Presented by:
Omowonuola Akintola
Rabina Twayana
Ethel Ogallo
Beatriz Peres

COPERNICUS MASTER IN DIGITAL EARTH
Université Bretagne Sud ubs
PARIS LODRON UNIVERSITÄT SALZBURG

Agenda

1. Introduction & Motivation
2. Why SAR?
3. PySARFlow Overview
4. Use Case
5. Accessing Package
6. Contact

1. Introduction & Motivation

- Despite the growing usage of SAR data, the processing workflow remains complex and still relies on specialized heavy desktop tools creating huge barriers for students and non-experts.

- There is a growing need for a modular, open-source and user-friendly workflow that can take Level-1 SAR products and guide users through essential steps ideally ending in products that are usable and compatible with geospatial pipelines

- We introduce **PySARFlow**, an open-source Python library designed to streamline SAR data preprocessing and analysis.
  - Built on the esa-snappy library, a wrapper for the SNAP Java engine,
  - PySARFlow provides similar robust functionality available through the SNAP Desktop application
  - offers a Python-based environment for greater accessibility and integration with modern geospatial pipelines.

2. Why SAR??

- All-weather, all-day imaging Unlike optical sensors (like Landsat or Sentinel-2)
- SAR doesn’t rely on sunlight and penetrates clouds, smoke, and darkness.
- Works day or night
- Works in any weather condition
- Crucial for monitoring disasters, flooding, and deforestation in cloudy regions

3. PySARFlow Overview

- PySARFlow organizes SAR processing into modular workflows, supporting both **Ground Range Detected** (GRD) and **Single Look Complex** (SLC) data.

- Each each step in the pipeline mirrors SNAP functionality but is optimized for automation and scalability.

SLC Workflow

1. Load and subset
2. Apply topsar split
3. Apply orbit file
4. (Co-registration) Back geocoding
5. Generate interferogram
6. Debursting
7. Multilooking
8. Goldstein Phase Filtering
9. Snaphu phase unwrapping*

GRD Workflow

1. Load and subset
2. Apply orbit file
3. Thermal noise removal
4. Border noise removal
5. Radiometric Callibration
6. Speckle filtering
7. Terrain Correction

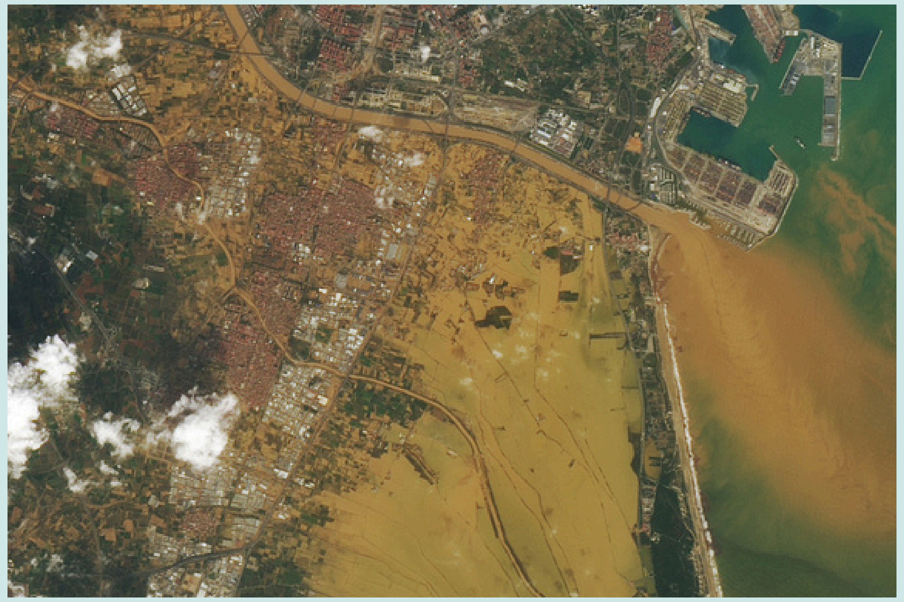
4. Use Case

1. **Flood Mapping using Sentinel-1 GRD**
2. **EarthQuake Mapping Using Sentinel 1 SLC**

01 **Flood Mapping**

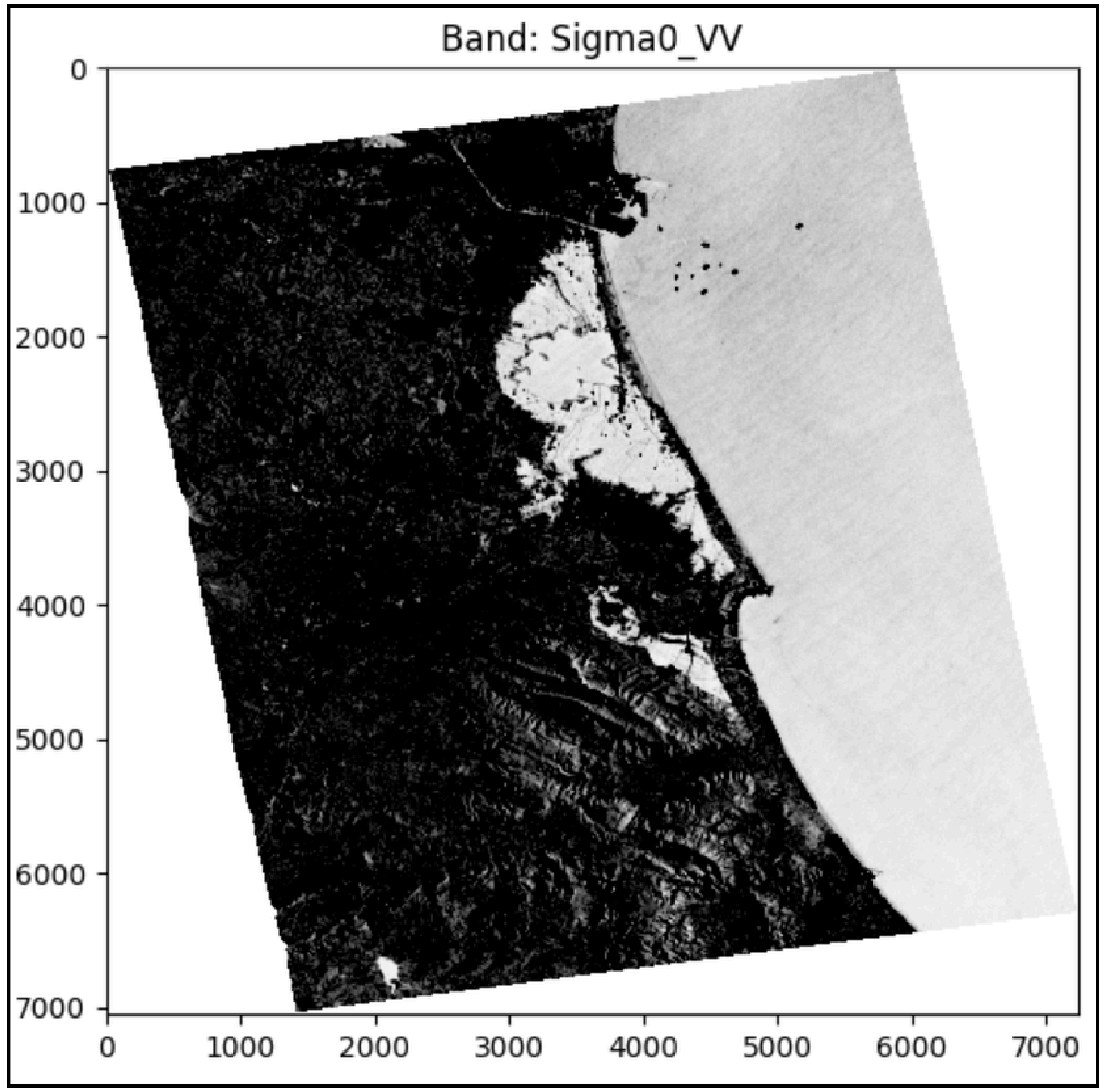
Area of Interest

- Valencia Spain

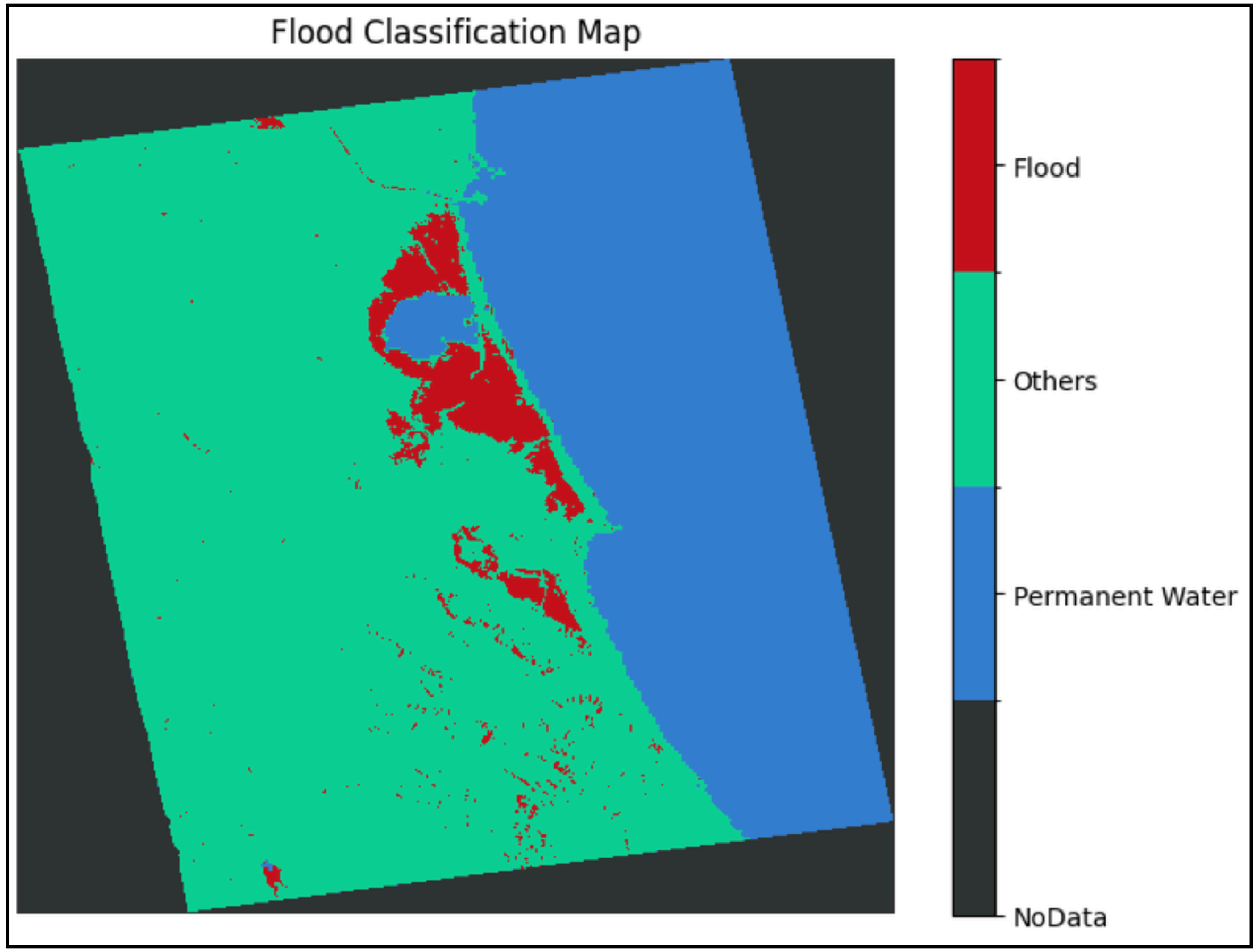


Data Source

- ASF (Alaska Satellite Facility) search portal with the following parameters: GRD-HD, ascending orbit, instrument IW, and VV+VH polarizations



a



b

a. Terrain Corrected SAR Pre-processed VV Band

b. Flood Classification Map with 4 Classes

9999: NoData
0: Permanent Water
1: Others
2: Flood

02 Earthquake Mapping

Area of Interest

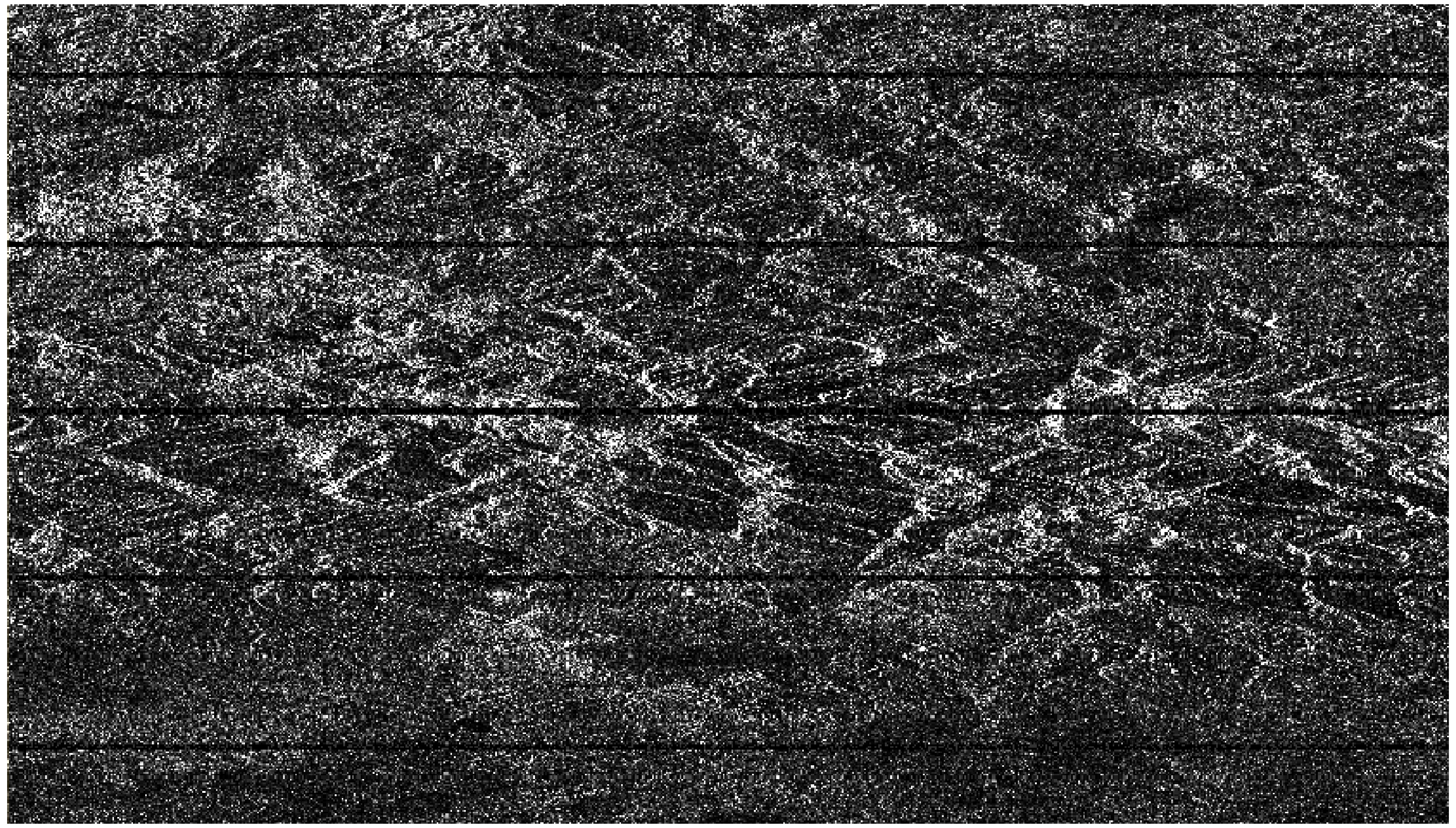
-Morocco

Data Source

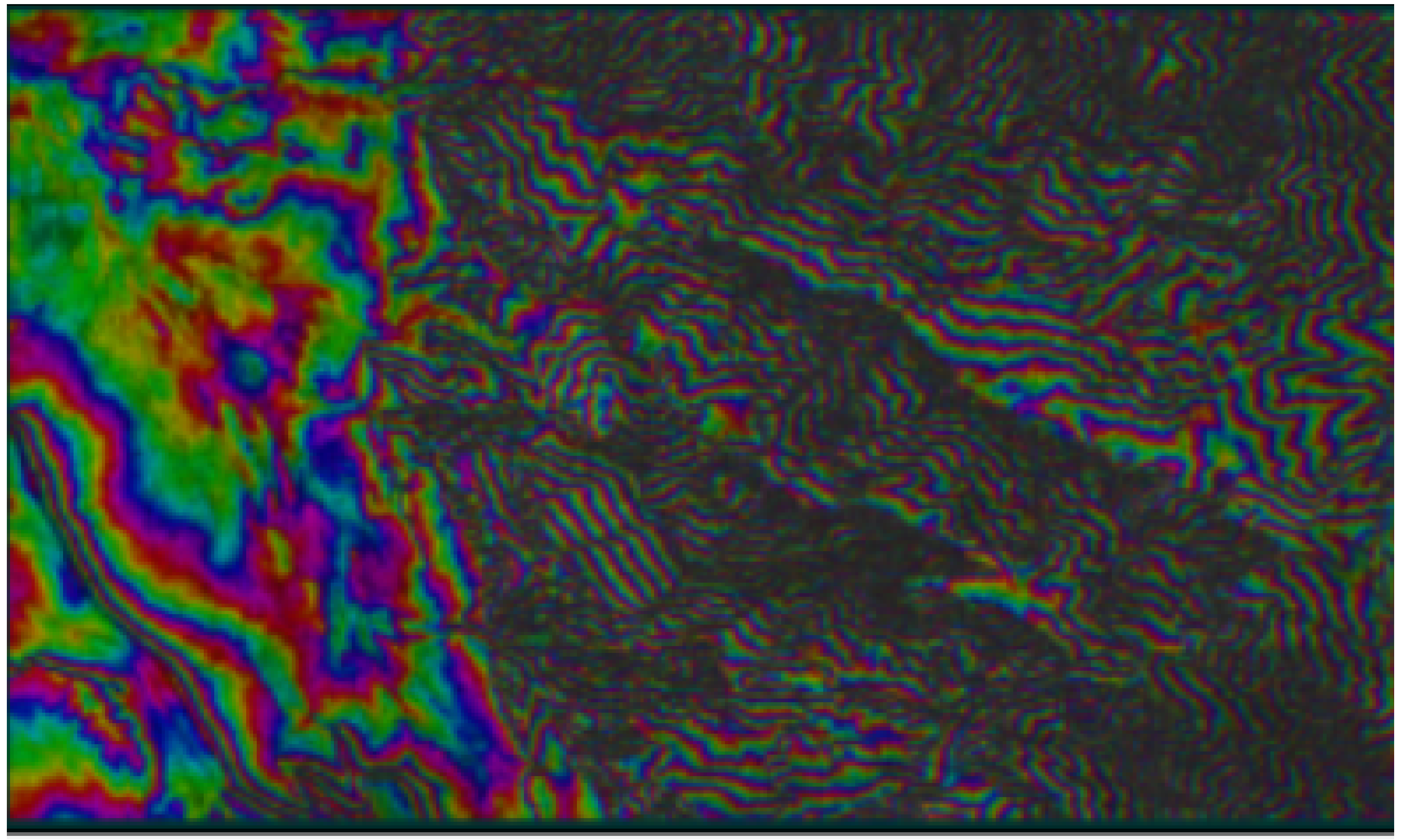
- ASF search portal with the following parameters: SLC

Documentation

Example Workflow



a. Raw SAR SLC before processing



b. Generated Interferogram

Fringes show surface motion

4. Accessing Package

PyPI

https://pypi.org/project/pysarflow/

Documentation

https://rabinatwayana.github.io/pysarflow/

Contributions are most welcome!!!

https://github.com/rabinatwayana/pysarflow

1 **Pre-requisite**

Before installing PySARFlow, ensure the ESA SNAP Desktop application is installed and properly configured. *Please refer to the official documentation for detailed instructions.*

2 **Installation**

```
pip install pysarflow
```

```
# Importing functions from package--
from pysarflow import read_grd_product, subset_AOI, apply_orbit_file, thermal_
    radiometric_calibration, speckle_filter,terrain_correction, plotBand,expor
    maskPermanentWater,generateFloodMask, preprocess_grd_product
```

```
# import functions from the package

from pysarflow import read_slc_product, burst_for_geometry, topsar_split, appl
save_product, interferogram, topsar_deburst, plot, multilooking, goldstein_pha
snaphu_unwrapping, snaphu_import
```

Our Team

Rabina Twayana

Omowonuola Akintola

Ethel Ogallo

Beatriz Peres

Correspondent:
rabinatwayana123@gmail.com

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