

# Data Collection from Mobile Phones Using Open Data Kit (ODKCollect) for field validation of satellite-derived data products

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Noel Jerome B. Borlongan  
Senior Science Research Specialist  
Philippine Space Agency




# Satellite Data

## Importance

- Earth Observation and Monitoring
- Mapping
- Research and Development, Policy-making, and Disaster Risk Reduction Management





## Satellite Data Available in the Philippines:

  
PhilSA


### Satellite Data Sources accessed by PhilSA

**Sovereign**  
Satellites owned, operated, and tasked by the Philippines.

  
Diwata-2


  
NovaSAR\*


**Disaster Charter-Activated**  
Satellite images shared through the International Charter: Space and Major Disasters for rapid response to major disasters.


  
RCM-2\*\*

  
SAOCOM-1A


**Commercial**  
Satellites with paid subscription.


  
\*Komsat-5


  
\*GeoEye-1


  
SPOT-6, 7

**Open**  
Satellite images that are free to use and download.

  
Suomi-NPP


  
Terra and Aqua


  
Sentinel-3


  
Sentinel-5P

**Open (continued)**

  
PRISMA\*\*\*


  
EnMAP\*\*\*


  
Landsat 8, 9

  
Sentinel-2A, 2B


  
Sentinel-1A, 1B


**Open (continued)**

  
Goalen-2

  
Kanopus-V


**Commercial (continued)**


  
\*Komsat-3, 3A


  
TerraSAR-X

  
\*Dove & \*Skysat\*\*

**Commercial (continued)**

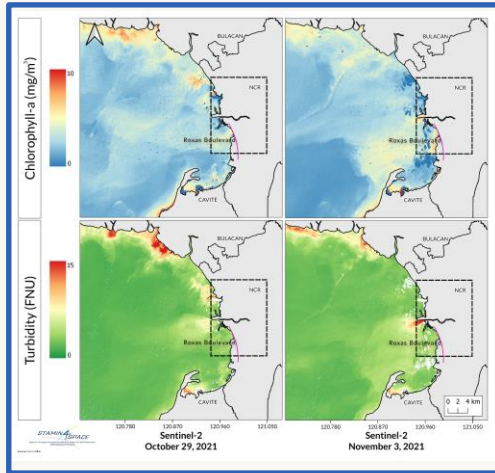
  
\*Worldview-2,3,4

  
\*Pleiades Neo\*\*

  
\*ICEYE\*\*



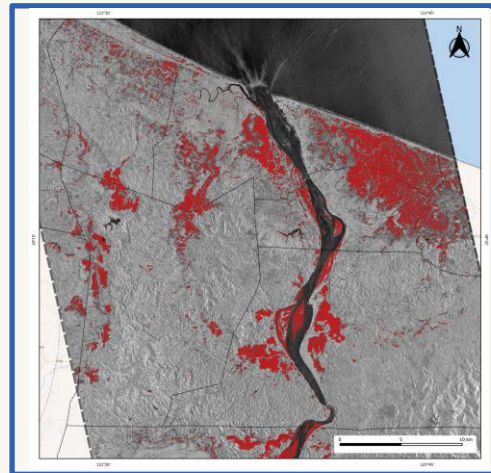
# Applications of Satellite Data



## Assessing Water Quality

### Optical Image

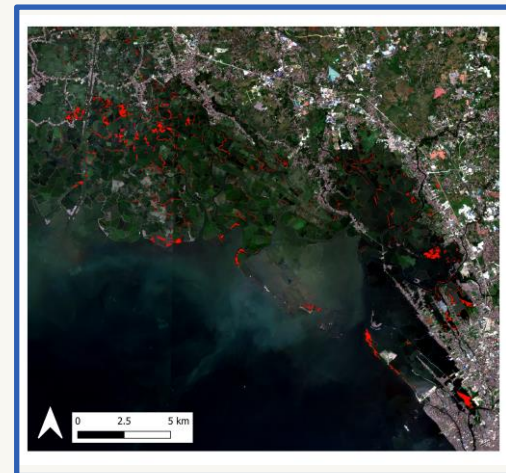
**Satellite:** Sentinel-2  
**Accessed via:** STAMINA4Space  
**Capture dates:** 29 October 2021  
and 03 November 2021  
**Resolution:** 30m  
**Basemap:** PhilGIS, Google Earth



## Flood Mapping

### Synthetic Aperture Radar Image

**Satellite:** ICEYE  
**Accessed via:** PhilSA  
**Capture dates:** 01 November 2022  
**Resolution:** 3m  
**Basemap:** OpenStreetMap



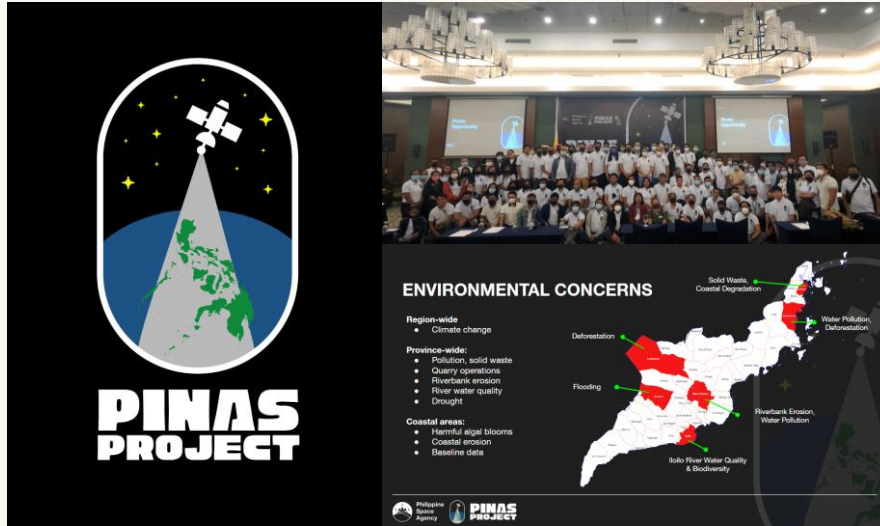
## Mangrove Detection

### Optical Image

**Satellite:** Sentinel-2  
**Accessed via:** Google Earth Engine  
**Capture dates:** 01 October 2021 to 23 October  
2022  
**Resolution:** 10m



# PINAS



PhilSA Integrated Network for Space-Enabled Actions towards Sustainability

## PINAS Network

- The PINAS project envisions a community empowered through space data mobilization wherein the full value chain of space data will be utilized. It envisions to be an active network of institutions and people working together toward sustainability using space data and information.



# Mangrove Validation thru Citizen Science

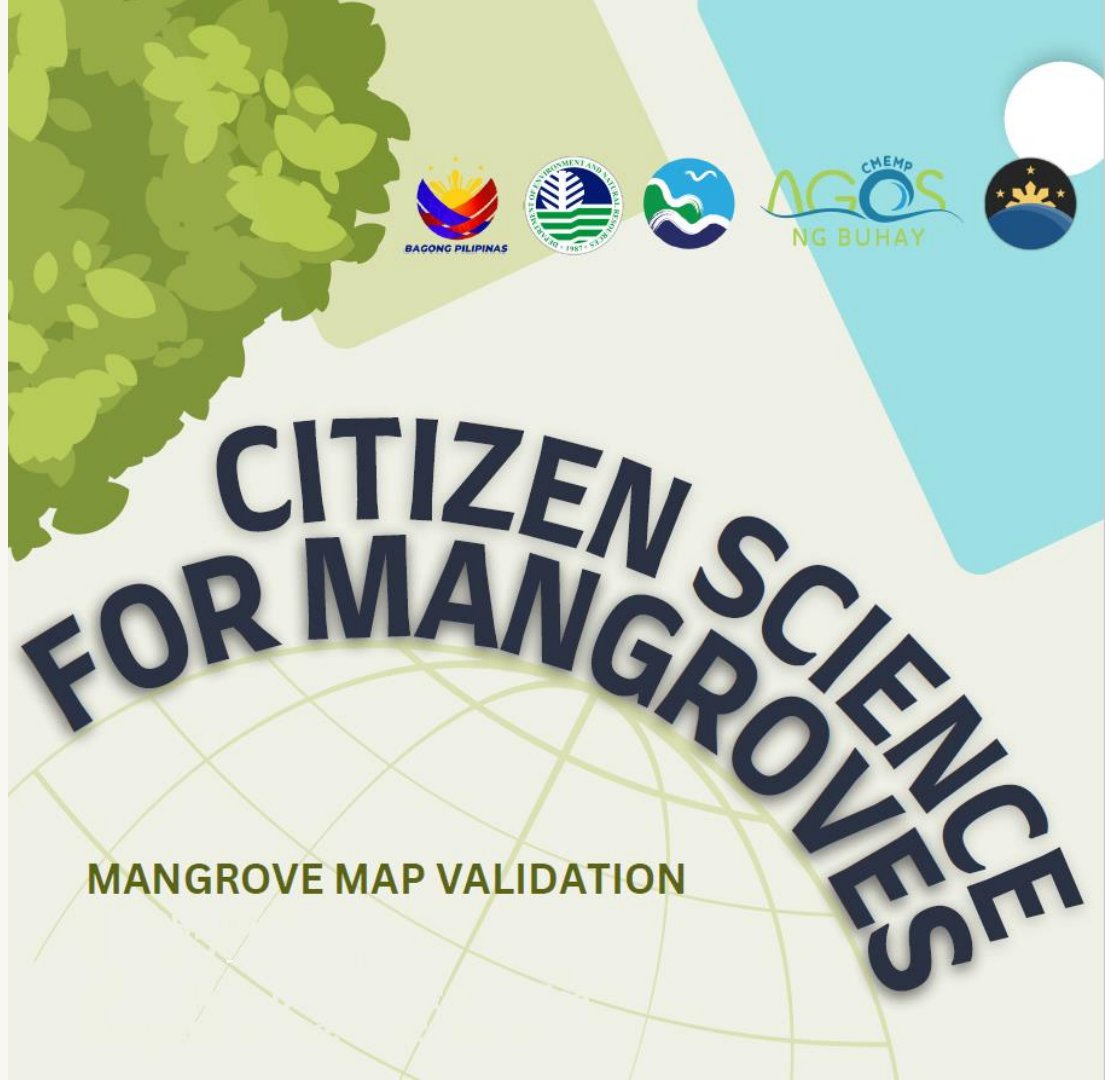
IMG: HILSTAR.COM/GAEA KATREENA CABICO

## HEADLINES

PhilSA, DENR team up to **create mangrove map** using satellite data

f X Instagram YouTube WhatsApp TikTok Instagram /philstarnews

philstar  
GLOBAL



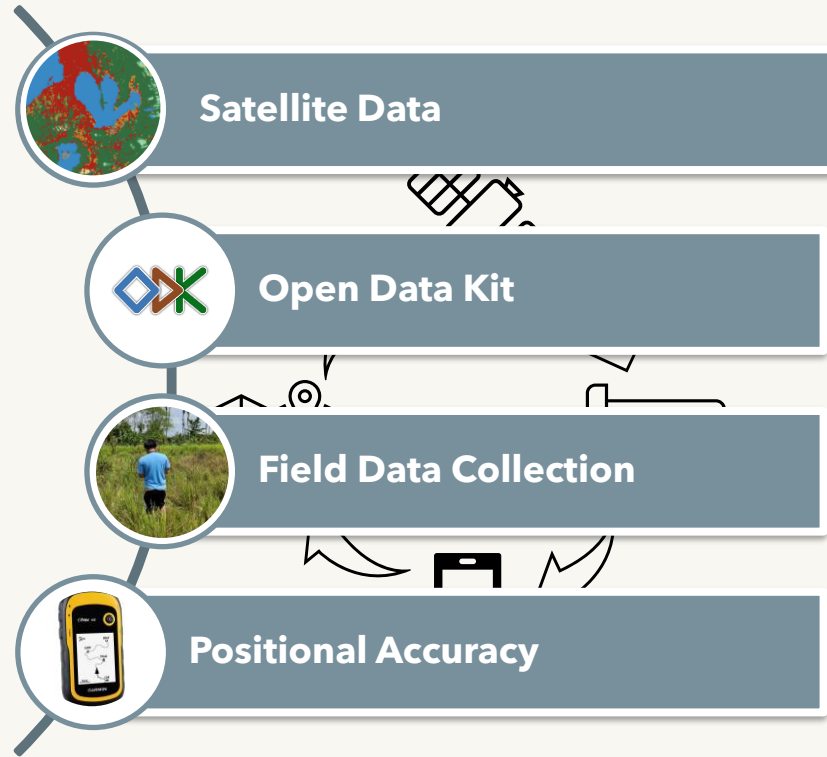
# Data and Methodology

## Problems

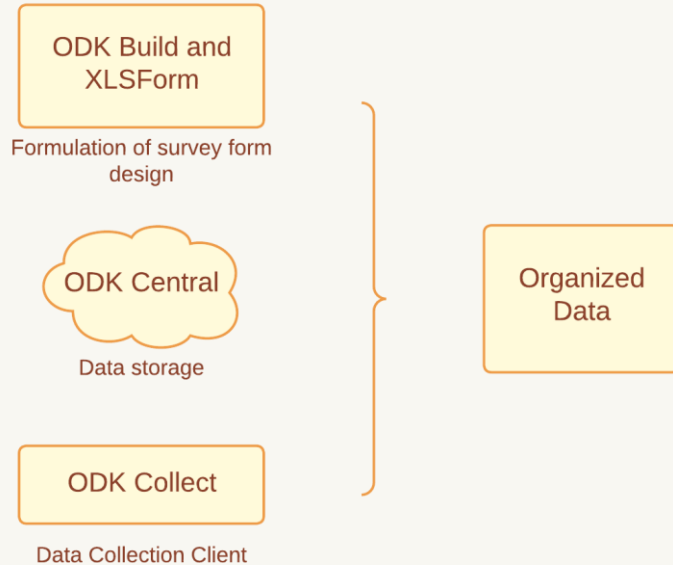
- Calibration and validation of maps
- Efficient field data collection methods

## Objective

- Utilize ODK to develop a method for satellite data validation.
- Investigate the positional accuracies of the mobile phone's built-in location services used by ODK.



# Open Data Kit (ODK)



## Open Data Kit System Architecture

- Platform for open-source tools designed to acquire and manage collected data
- Standard workflow: Create Forms, Manage Users, Collect Data

## Why ODK?

- Digital!
- Supports various Q&A formats for various needs
- Built-in positioning capabilities
- Filling of surveys available even without internet



# Open Data Kit System Architecture

## ODK Build

Land Cover Validation rename | File Edit View Help

Signed in as jatabardillo. Sign out.

**Area Name**  
a\_name  
required

**Land Cover Classification**  
lclass  
required

**Land Use Classification**  
How is the area used?  
luclass  
required

**Location**  
GPS Location of point  
loc  
required

**Photos**  
img  
required

**Remarks**  
rmk

**Properties**

Data Name  
a\_name

Label  
English  
Area Name

Hint  
English

Default Value

Read Only

Required

Required Text  
English

Length  
Minimum  
Maximum

Invalid Text  
English

Advanced

Information: Text  
Collects textual information. Use this for names, long-form responses, and other free text information.

+ Add new Text Numeric Date/Time Time Location Media Barcode Choose One Select Multiple Metadata Group





# Open Data Kit System Architecture

## ODK Central

ODK Central Projects Users System en Jomari

PINAS Workshop [Back to Project Overview](#)

### Land Cover Fieldwork

Overview Versions Submissions Public Access Settings Draft

[Create a new Draft](#)

### Submissions

[New](#) [API access](#) [Analyze via OData...](#)

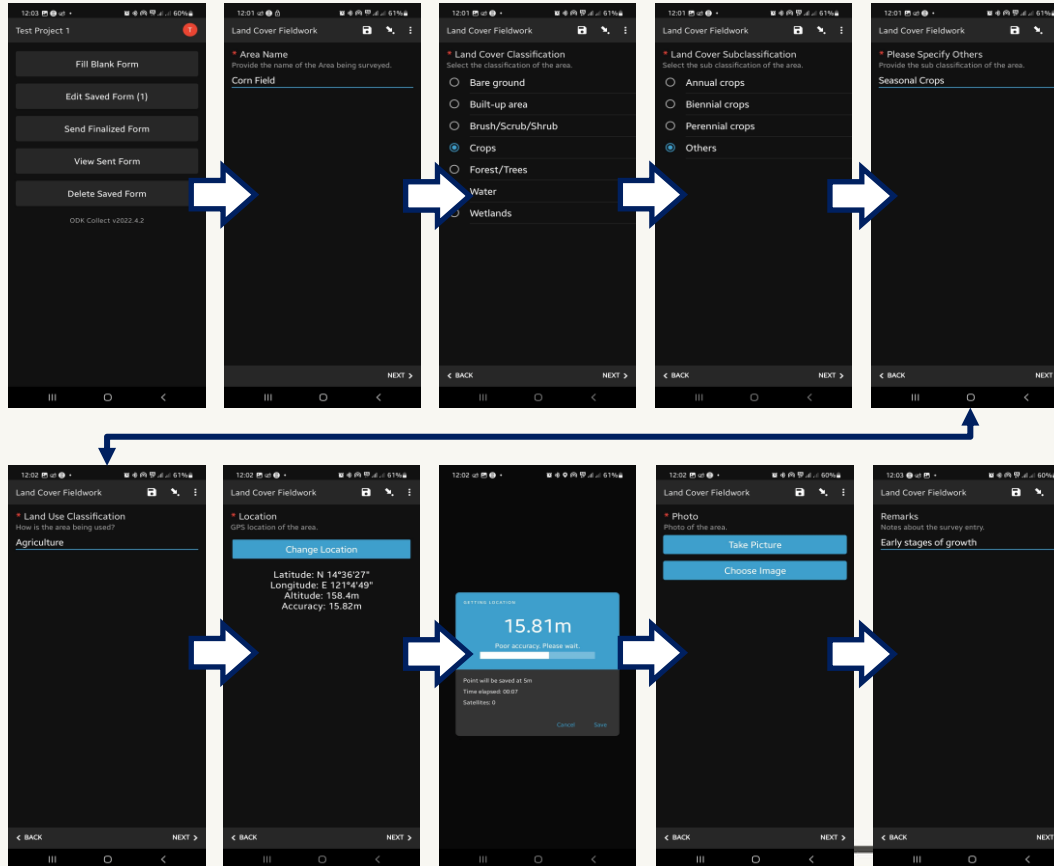
Filter (Anybody) Submitted at (Any State) 10 of 12 Refresh [Download 404 Submissions...](#)

Submitted by	Submitted at	State and actions	area_name	land_cover_classification	land_cover_sub_classification	land_cover_sub_classification_others	land_use_class
404 Workshop Group 1	2022/12/11 17:07	Received	Small Indoor Store	builtup_area	medium_density		
403 Workshop Group 1	2022/11/24 11:28	Received	Infrastructure	builtup_area	medium_density		Building
402 Workshop Group 1	2022/11/24 11:27	Received	Mmsu Cafsd	crops	anual_crops		Rice crop
401 Workshop Group 1	2022/11/24 11:23	Received	Cafdz building	builtup_area	low_density		
400 Workshop Group 1	2022/11/24 11:22	Received	Rice	crops	biennial_crops		
399 Workshop Group 1	2022/11/24 11:21	Received	Crops	crops	anual_crops		Ricefield
398 Workshop Group 1	2022/11/24 11:20	Received	Mmsu lagoon	forest_trees	trees		Trees
397 Workshop Group 1	2022/11/24 11:19	Received	Building in construction	builtup_area	medium_density		
396 Workshop Group 1	2022/11/24 11:19	Received	Water	water	ponds		Pond
395 Workshop Group 1	2022/11/24 11:18	Received	Mmsu Oval	bare_ground			Grass land

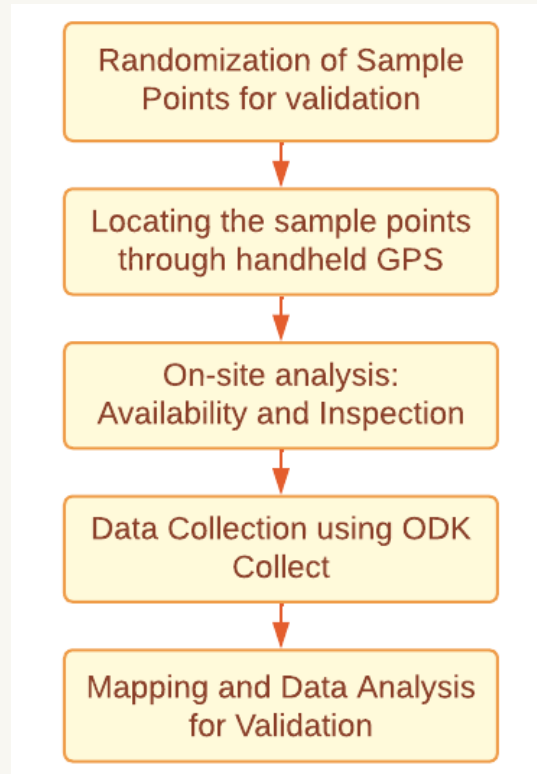


# Open Data Kit System Architecture

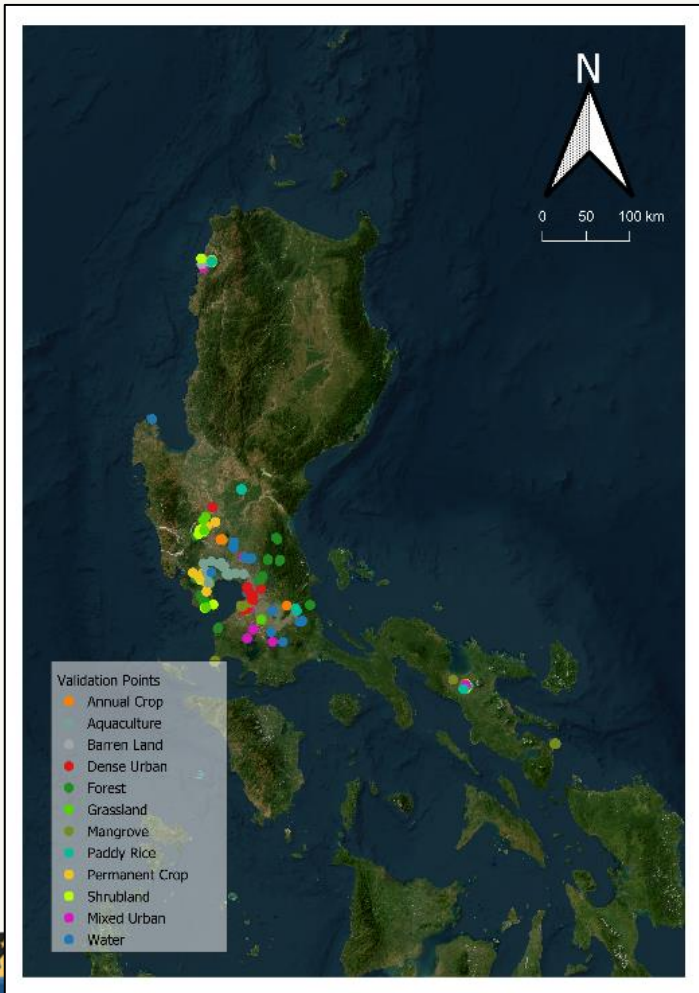
## ODK Collect



# Map validation workflow using ODK



# Results



Land cover class	F1-score	Recall	Precision
Annual crop	88.0	76.9	83.3
Aquaculture	88.2	88.2	88.2
Barren land	71.4	80.0	64.5
Dense Urban	96.2	100.0	92.6
Forest	86.4	82.6	90.5
Grassland	69.8	88.2	57.7
Mangrove	96.6	93.3	100.0
Paddy Rice	87.5	97.2	79.5
Permanent Crop	71.8	66.7	77.8
Shrubland	66.7	59.5	75.9
Mixed Urban	85.1	74.1	100.0
Water	90.9	88.2	93.8

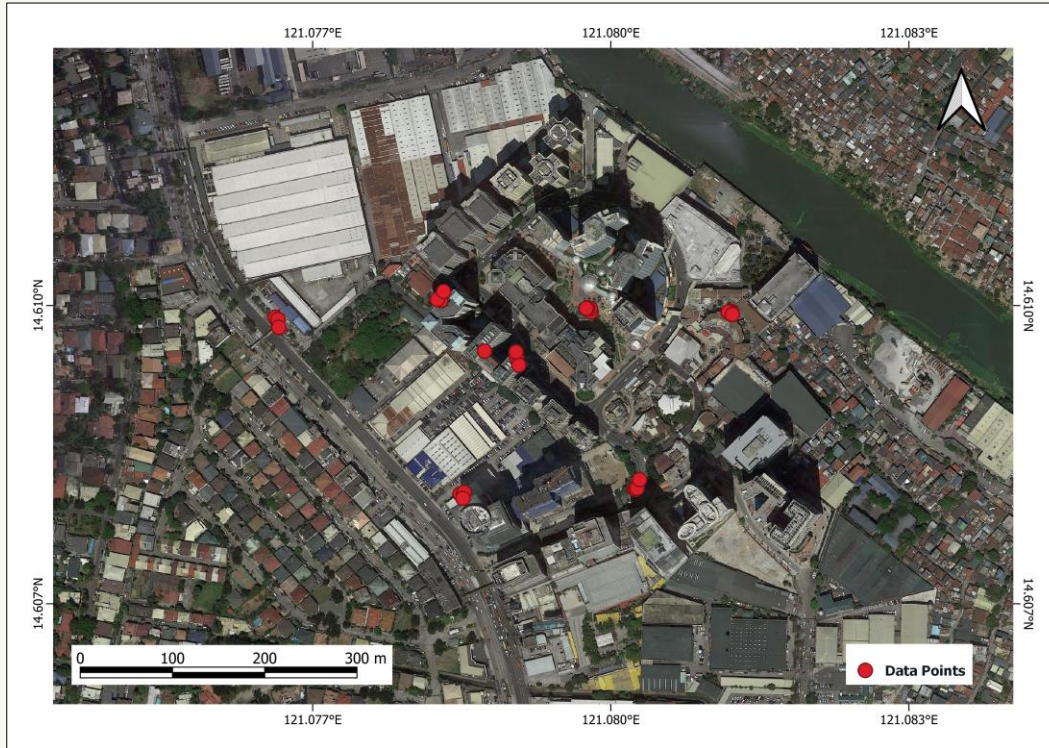
# Results



## Positional Accuracies in Rural Areas

- Average accuracy attained from the field is 4.422m

# Results

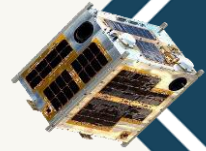


## Positional Accuracies in Urban Areas

- Overall average accuracy attained from the field is 5.433m

Site	Accuracy (m)			
	Xiaomi Poco F3	Xiaomi Blackshark 5 Pro	Samsung Galaxy A52s 5G	Samsung Galaxy Note 7 Fan Edition
1	6.337	6.323	6.277	12.085
2	5.187	4.845	3.863	6.724
3	3.9	3.881	3.9	6.941
4	3.9	4.693	6.474	5.454
5	4.222	3.9	3.9	6.174
6	3.959	4.721	3.881	8.151
7	4.545	6.635	4.099	7.142
<b>Mean</b>	<b>4.579</b>	<b>4.999</b>	<b>4.628</b>	<b>7.524</b>

# Visualization



A robust platform designed to revolutionize space data access for institutions and citizens.

PhilSA's initiative to improve public access and resource-sharing in space-related endeavors (Section 8, RA 11363)

The screenshot displays the PhilSA web application interface. The top left features the PhilSA logo and a search bar. Below the search bar are buttons for 'Explore map data' and 'Upload'. The main area shows a map of the Philippines with labels for Manila, Quezon City, Cebu City, and Davao City. The sidebar on the left contains a 'Your workbench is empty' message and 'Helpful hints'. The top right has navigation and utility buttons like 'About', 'Related Maps', 'Map Settings', 'Help', 'Story', and 'Share / Print'. The bottom right shows a 'Compare' button and a 'No map data enabled' message. The bottom of the interface includes the Cesium logo and technical details like coordinates and elevation.



# Conclusion

## *Limitations and Recommendations*

ODK is a great tool for collecting and managing field validation data.

- Versatile, provides wide range of survey inputs, easy to manage & organize data.
- Open-source, robust, rapid.
- Provides enough accuracy for most open-source earth observation data such as Sentinel-2 & Landsat Imagery for validation.

For this study, both environments achieved sufficient accuracy to be able to validate medium resolution satellite data.

### **Limitations**

- ODKCollect app is for Android mobile phones only as of now.
- Positional accuracy dependent on built-in GPS capability of mobile device.
- Photos captured without orientation or landmarks might be misleading due to location offset.

### **Recommendations**

- Use of low-cost GNSS/commercial GNSS devices to complement data collection.
- Integration to online platforms such as the Space Data Dashboard for visualization and improved public access
- Application in disaster management (DRR)





# Contact the Philippine Space Agency



<https://www.facebook.com/PhilSpaceAgency>



<https://twitter.com/philspaceagency>



<https://www.instagram.com/philspaceagency/>



<https://www.linkedin.com/company/philspaceagency/>



<https://philsa.gov.ph/>



[info@philsa.gov.ph](mailto:info@philsa.gov.ph)



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