Application of Copernicus Data for Analysing Potential Climate Change Effects on the Maritime Boundaries of Pacific Countries

Kishan Kumar
kishank@spc.int

Cristina Izaguirre
cristinai@spc.int

Presentation Outline

INTRODUCTION

WHY USE REMOTE SENSING

APPLICATION

CONCLUSION

FUTURE RESEARCH

Resilient Boundaries for the Blue Pacific

Research project that is looking to understand any potential effects that climate change may have on the maritime zones in the region from the scientific, technical and legal perspectives

Present options to countries, which combines all these 3 areas of work, to maintain their maritime zones

Countries can make informed adaptation decisions

Why use Remote Sensing

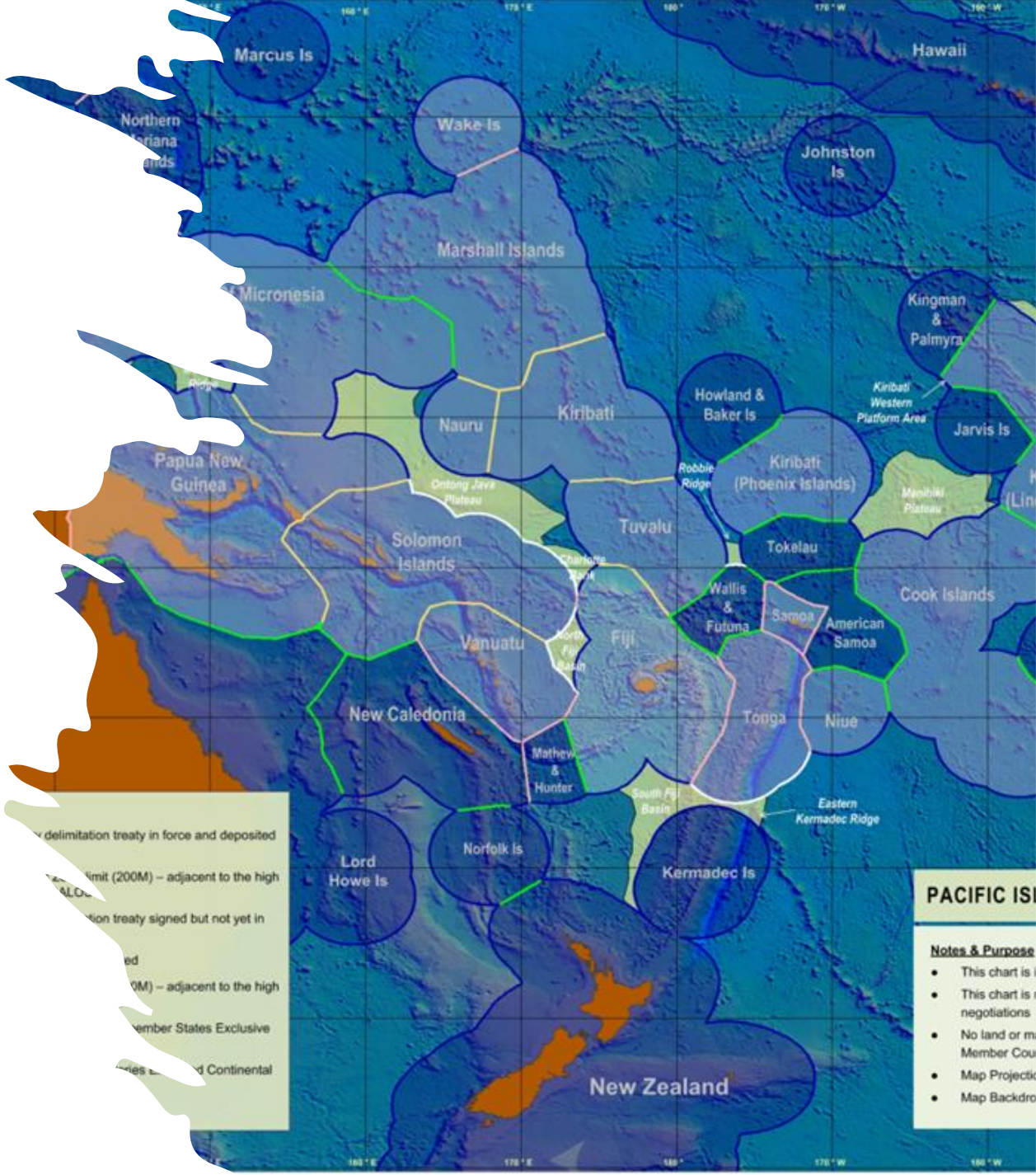
375 areas of interest for 12 countries

Data gaps due to remoteness

Budget friendly

Time constraints

Consistency in analysis



Application

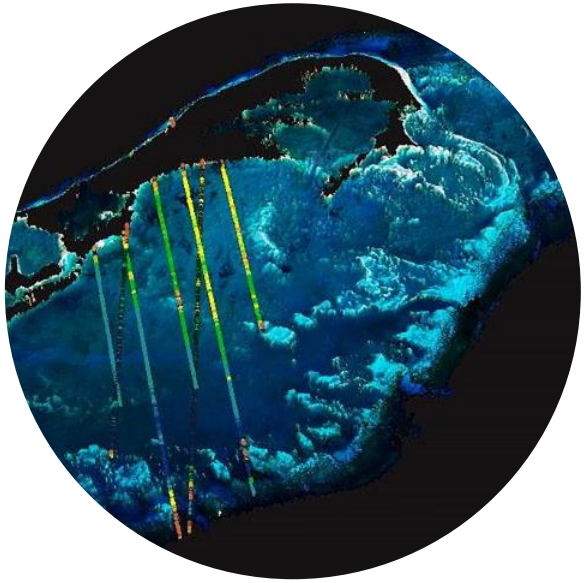
Landcover classification(Holdaway et al., 2021)

Mangrove Classification(Arset 2020)

Satellite Derived Bathymetry (Li et al., 2019)(Li et al., 2021)

Landcover Classification Classes

Urban Sand Coral Vegetation



Data Selection

•Images selected for 3 years per analysis

1. Sentinel 2

- Sensor Type: Multispectral optical sensor

- Horizontal Resolution: 10-meter resolution

2. Sentinel 2

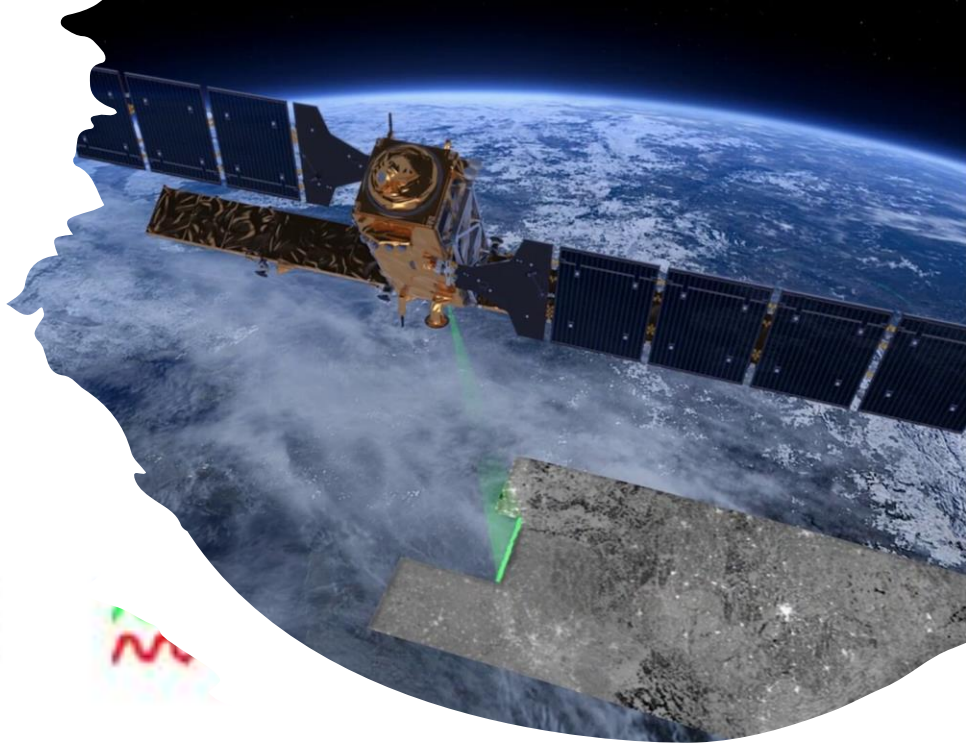
- Sensor Type: Sentinel 1

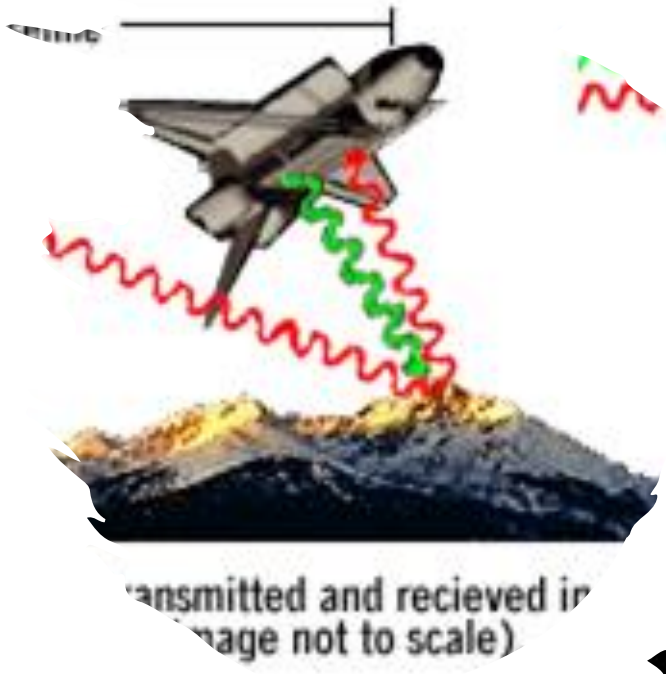
- Horizontal Resolution: 10, 25, 40 meter

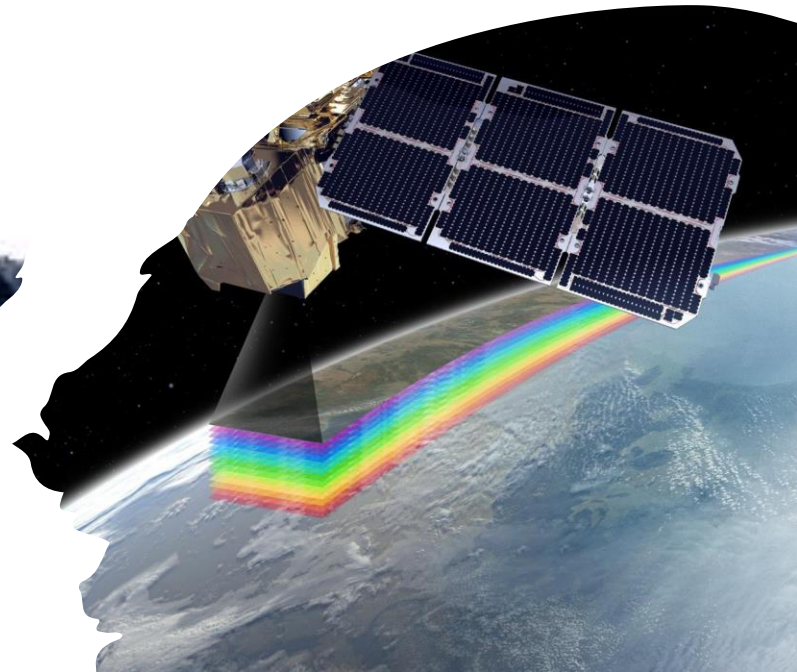
3. Shuttle Radar Topography Mission

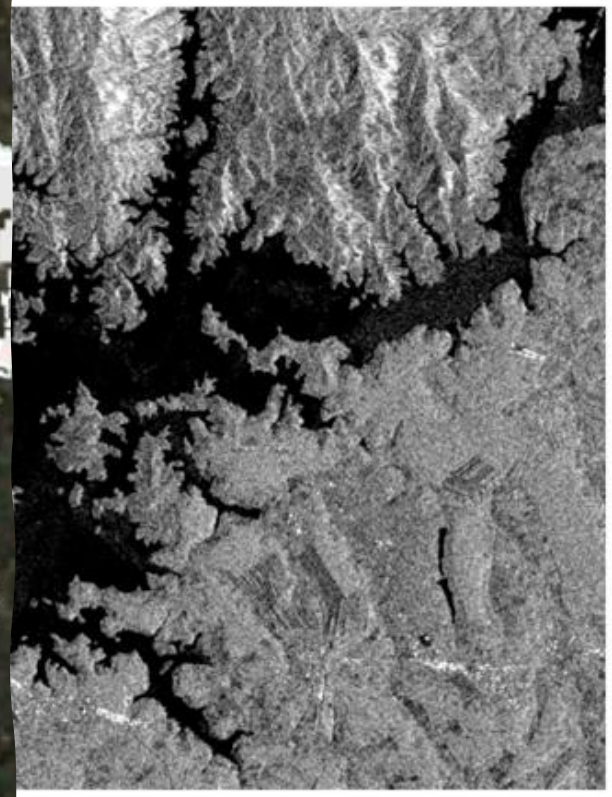
- Sensor Type: Synthetic Aperture Radar

- Horizontal Resolution: 30 meter

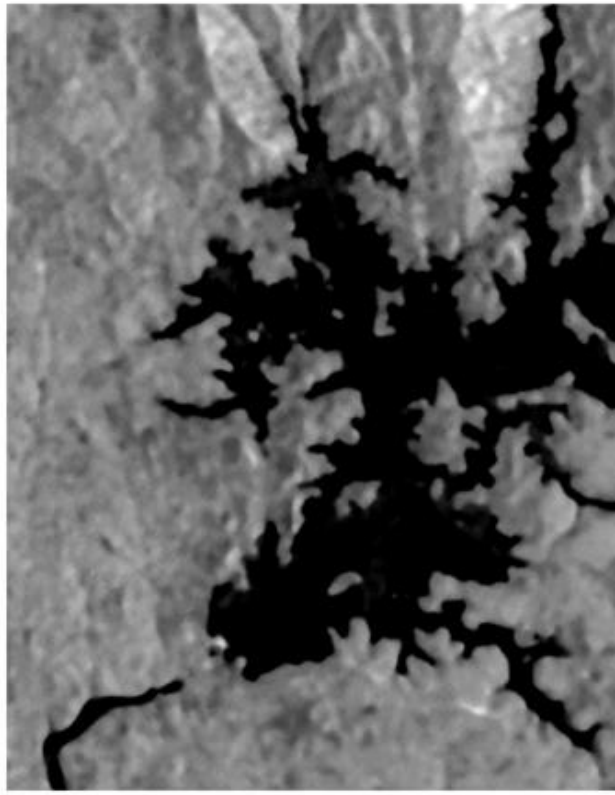








Original



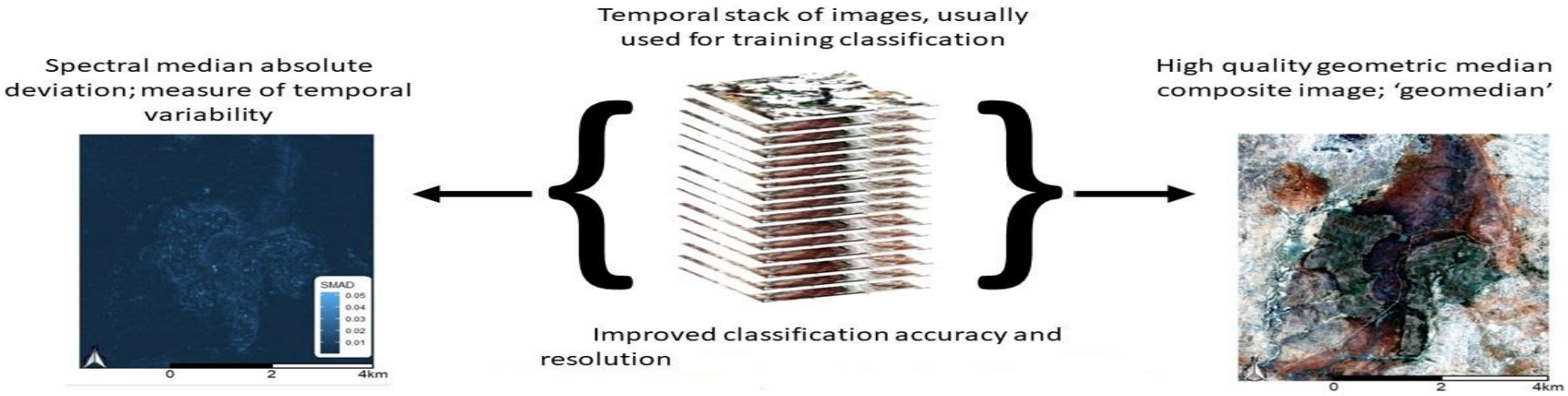
Smoothed

Pre-processing

- Cloud masking
- Speckle filter
- Elevation filter

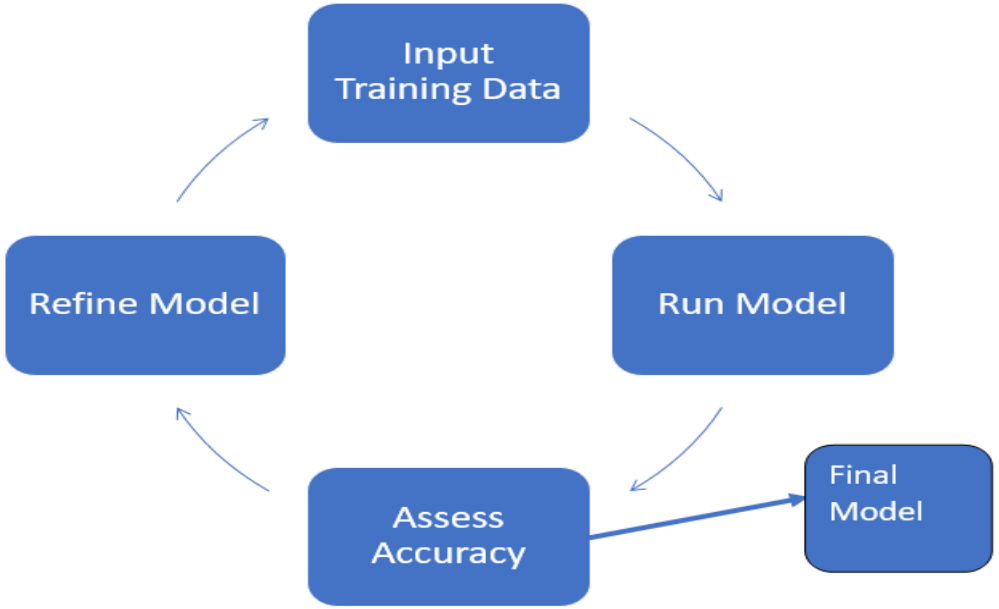
Data Transformation

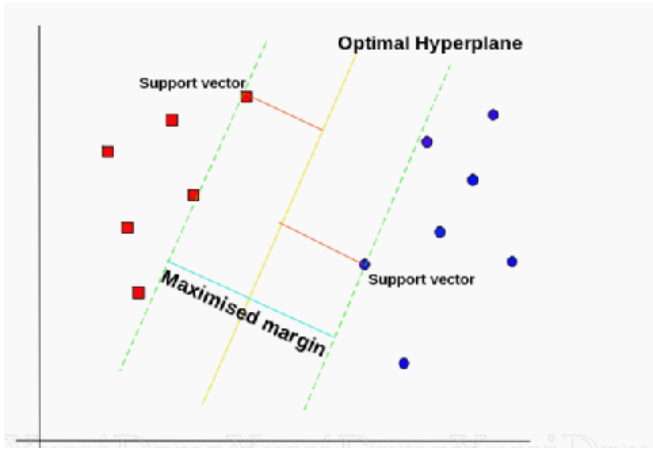
- Mean reduction
- Normalised Difference Spectral Vector computation

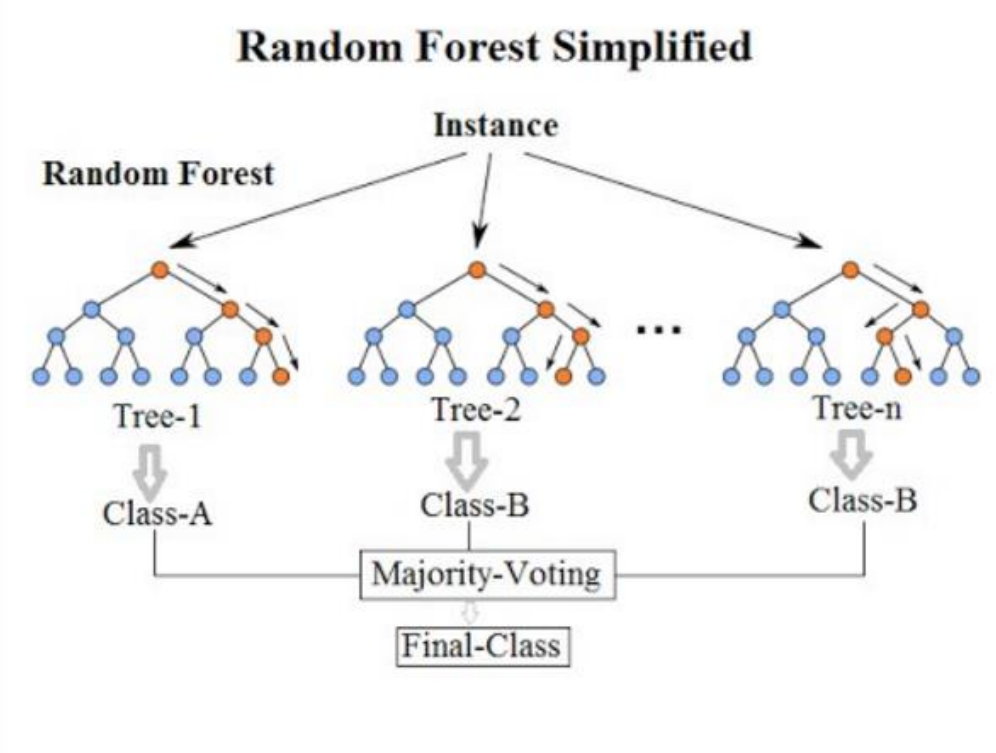


Data Mining

- Support Vector Machine classifier
- Random forest classifier

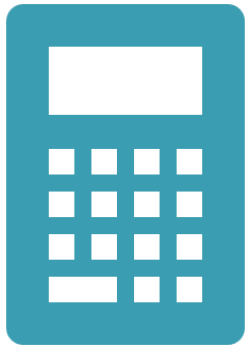






Post Processing

Post classification filtering

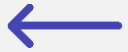


Mean area calculation

Why Fusion of Optical and Synthetic Aperture Radar

Spectral confusion between sand and urban class for Sentinel 2 only classification

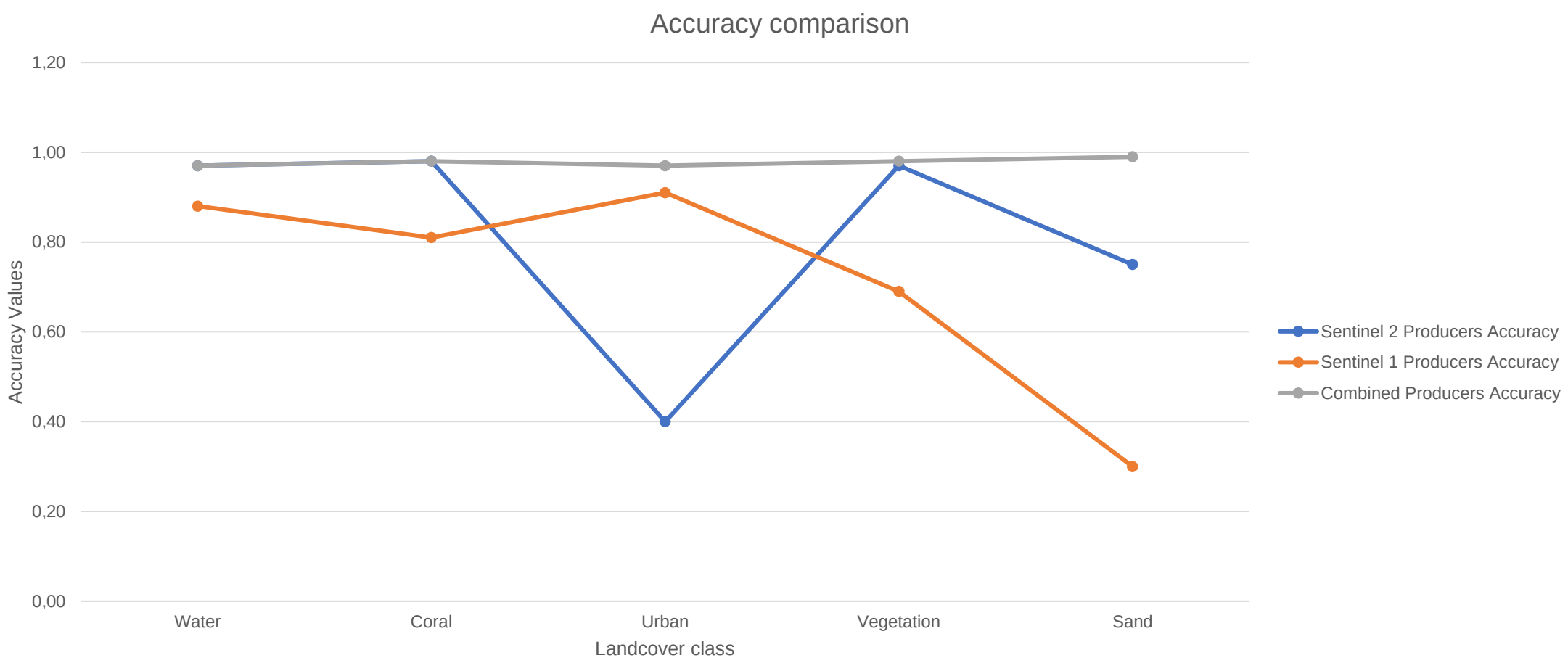
Sentinel 1 adds roughness variable

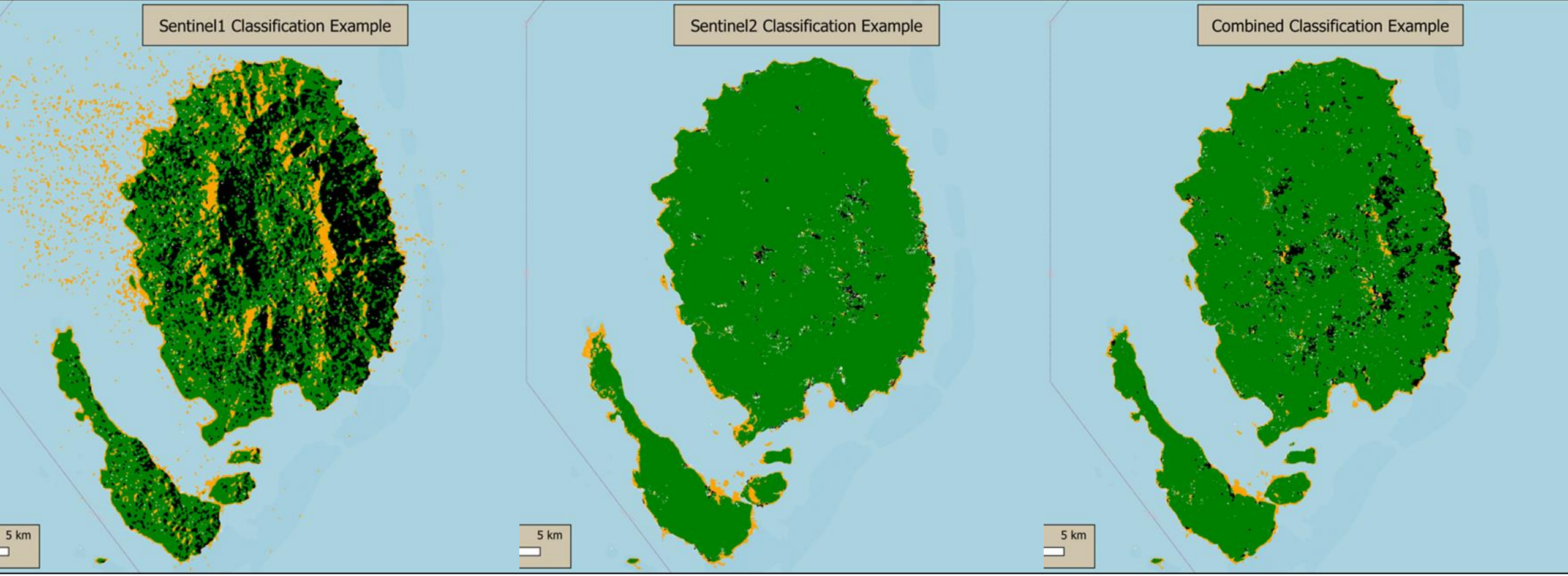


Fusion decreases misclassification

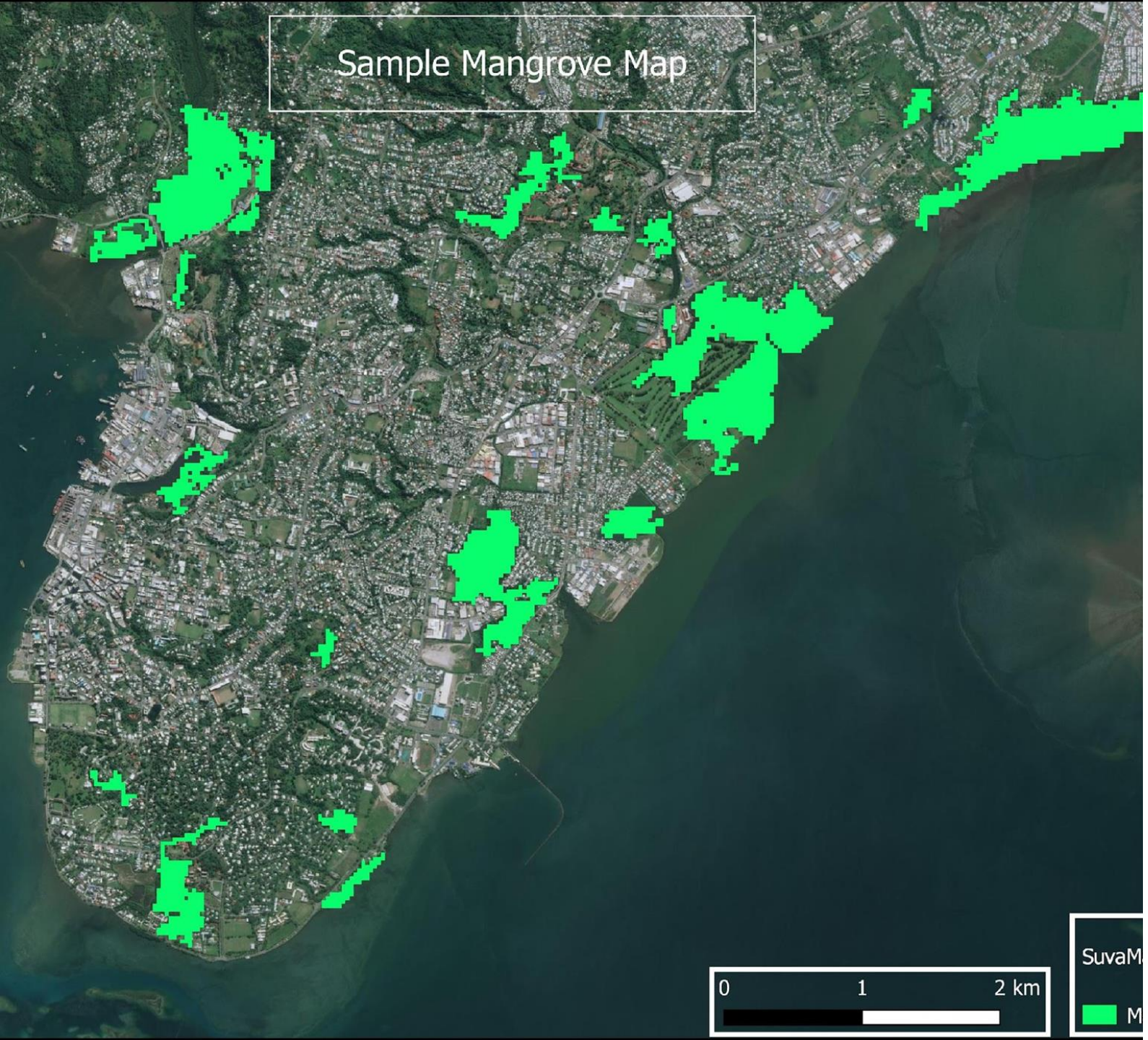
Improves overall model and class accuracy

Comparison


Accuracy comparison
1,20
1,00
0,80
0,60
0,40
0,20
0,00
Accuracy Values
Water
Coral
Urban
Vegetation
Sand
Landcover class
Sentinel 2 Producers Accuracy
Sentinel 1 Producers Accuracy
Combined Producers Accuracy



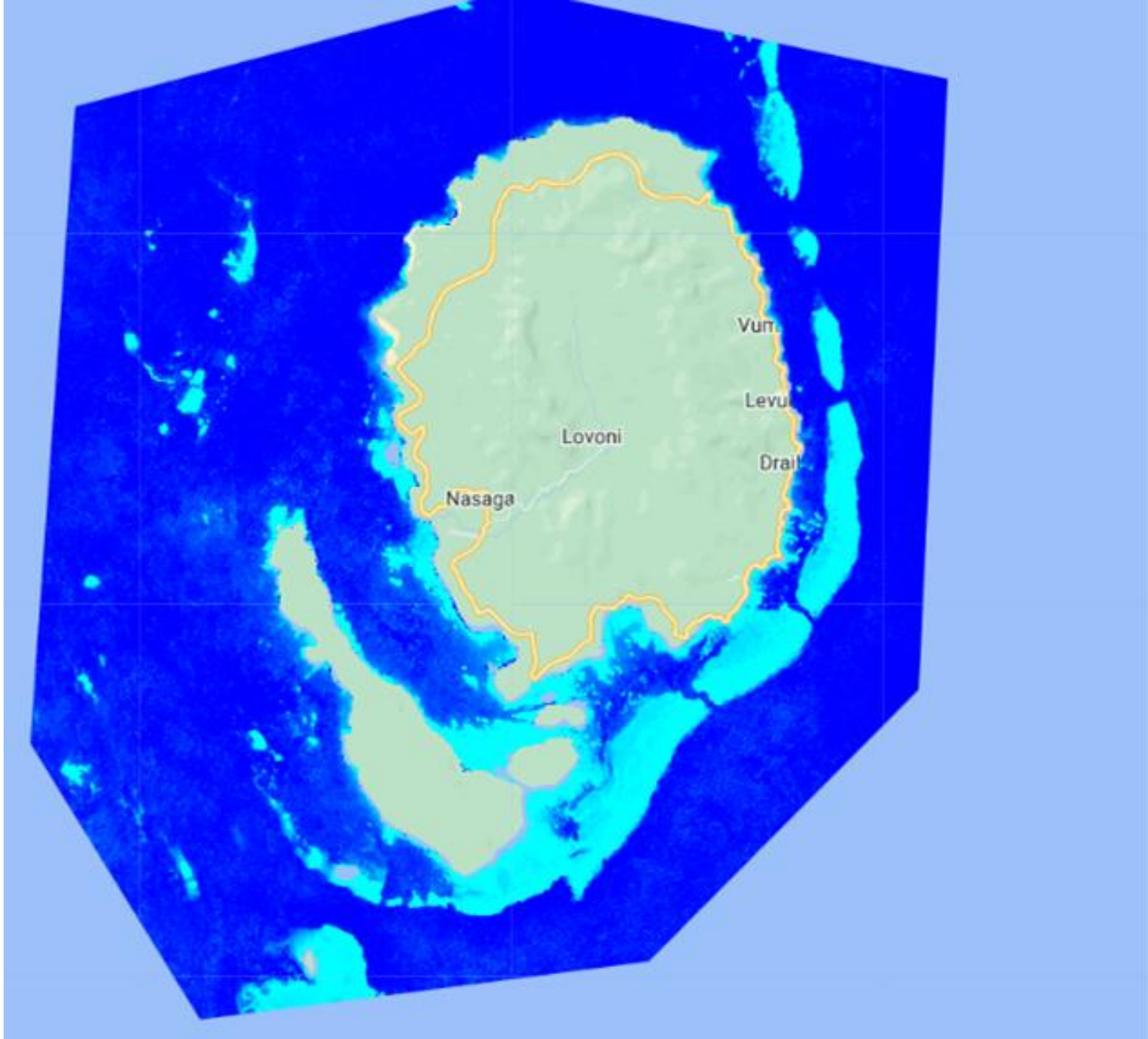
Comparison Maps



Sample Mangrove Classification

Satellite Derived Bathymetry

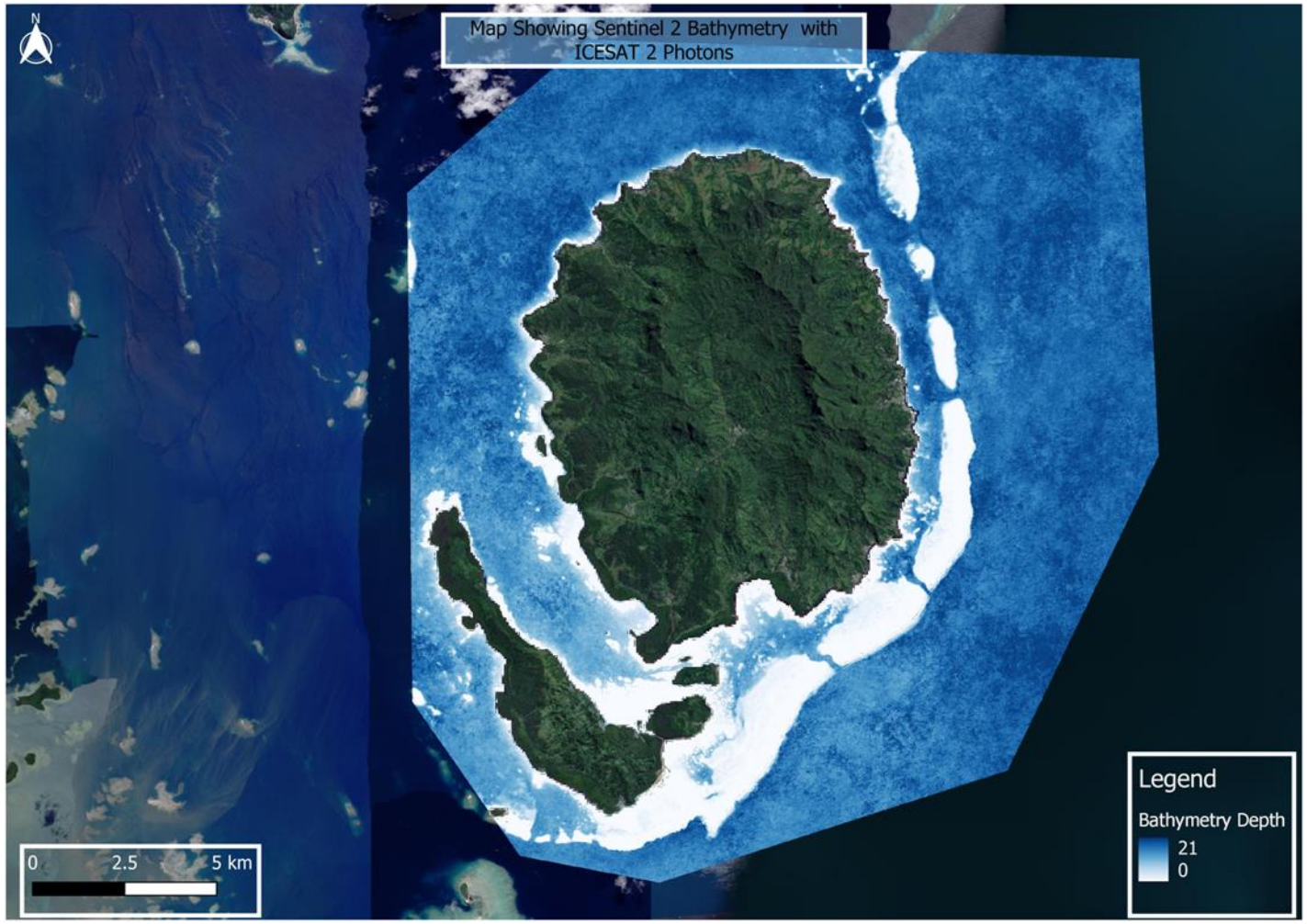
- Allen coral atlas bathymetry methodology
- Based on Sentinel 2
- Data gap is filled by Landsat and Planet
- 10 meter horizontal resolution



Bathymetry Extraction Workflow

- 1. Sentinel 2 bathymetry sampling using transect buffer.
- 2. Extraction of bathymetry from ACA website
- 3. Bathymetry sampling using transect
- 4. Mergence of the two sets of bathymetry points
- 5. Interpolation
- 6. Final sampling using transect

Sample Bathymetry Map

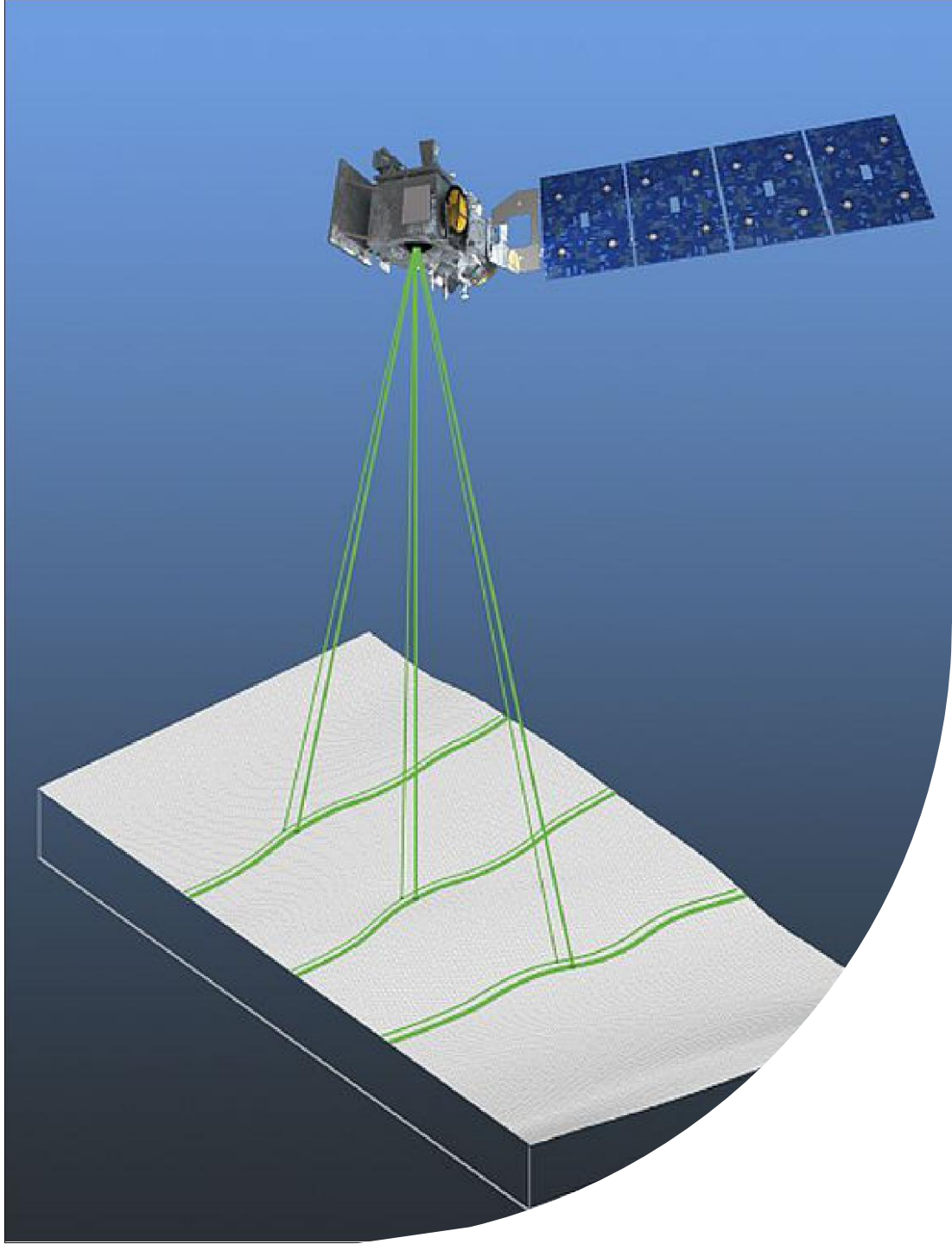


Conclusion

- Cloud remote sensing is optimal for big data projects
- Remote sensing is cost efficient
- Remote Sensing particularly the use of machine learning enables faster results
- Machine learning in remote sensing enables consistent results
- Fusion of SAR and optical data is suitable for land cover classification
- There's potential to use fusion to improve SDB
- Innovation is very important when it comes to remote sensing

Research to Improve Bathymetry using Ice, Cloud and land Elevation Satellite

- Satellite lidar
- Vertical accuracy better than 10cm
- Potential to use fusion to improve vertical accuracy of bathymetry
- Potential to fill the no data regions using ICESAT 2



Sample Map

Sentinel 2 bathymetry and the available ATL03 ICESAT2 Photons