

기후변화 대응을 위한 연안공간계획

Step1

Coastal & MSP

Development of Decision Ready Tools to Support
Coastal and Marine Spatial Planning

**Satellite Application Algorithms for
Coastal and Marine Spatial Planning in PICs:
A Case Study in Funafuti, Tuvalu**

Chan-Su Yang



Ministry of Foreign Affairs



PACIFIC ISLANDS FORUM



한국해양과학기술원
KOREA INSTITUTE OF OCEAN SCIENCE & TECHNOLOGY

Step1

Coastal & MSP



The daily lives of Pacific Island countries are always intertwined with the sea.

기후변화 대응을 위한 연안공간계획

Step1

Coastal & MSP

Coastline monitoring

Land use mapping

Wave properties retrieval



Ministry of Foreign Affairs



PACIFIC ISLANDS FORUM



한국해양과학기술원
KIOST
KOREA INSTITUTE OF OCEAN SCIENCE & TECHNOLOGY





Coastal & MSP

Step 1
Development of Decision Ready Tools to Support Coastal and Marine Spatial Planning



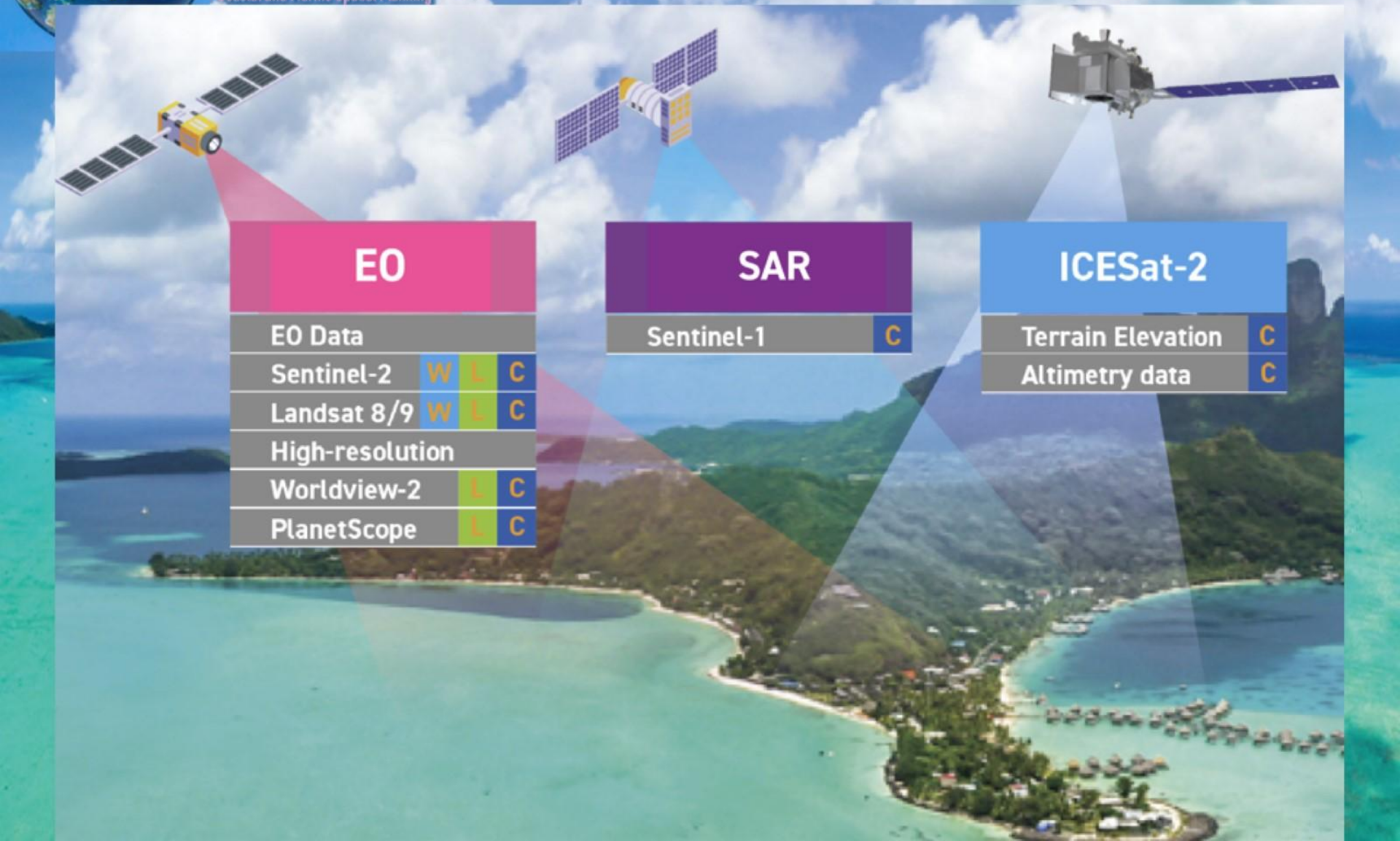
EO			
EO Data			
Sentinel-2	W	L	C
Landsat 8/9	W	L	C
High-resolution			
Worldview-2		L	C
PlanetScope		L	C



SAR	
Sentinel-1	C



ICESat-2	
Terrain Elevation	C
Altimetry data	C





Step1
Coastal & MSP
 Development of Decision Ready Tools to Support
 Coastal and Marine Spatial Planning

Changes in Fualafeke islet from 1897 to 2017 (120 years) are shown.

Optical	SAR based	ICESat-2
EO Data	Sentinel-1	Terrain Elevation
Sentinel-2		Altimetry data
Landsat B/T		
High-resolution		
WorldView-2		
PlanetScope		

- North-east : Accreted (1897-1943), then eroded (1943-2017).
- South-east: Eroded (1897-1943), then accreted (1943-2017).
- South-west: Eroded (1897-1943), then accreted (1943-2017) ; however, only in 1971, fused with neighbouring Paava and later on separated again.





Step1

Coastal & MSP

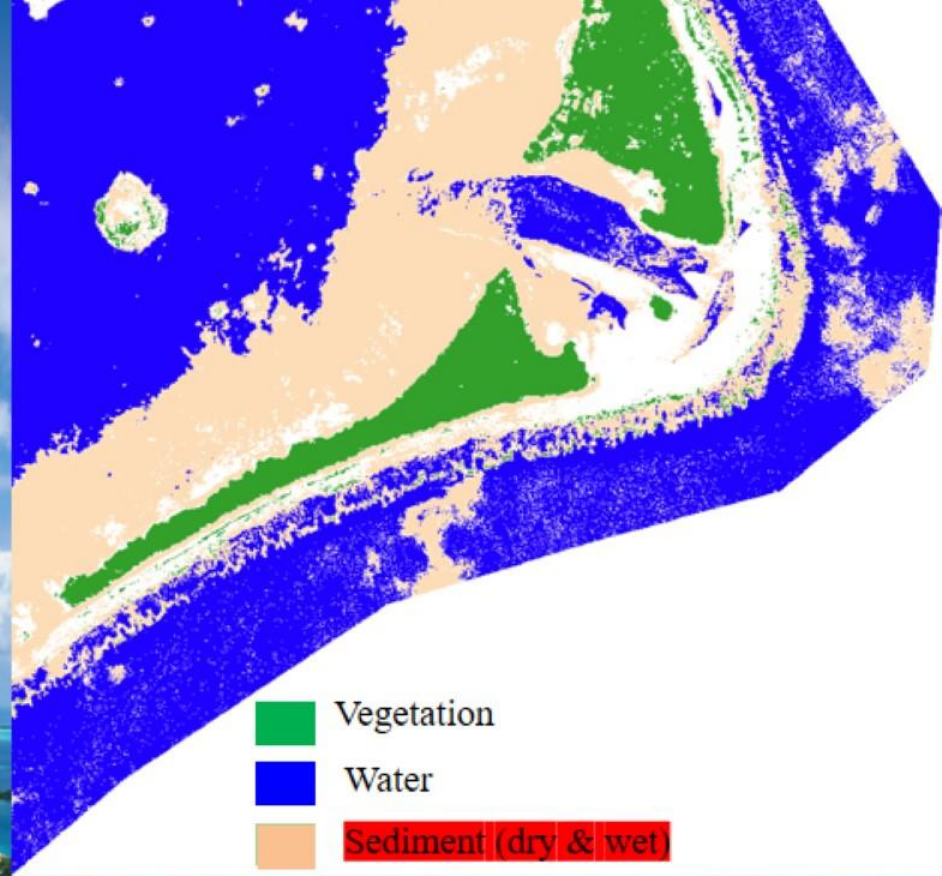
Development of Decision Ready Tools to Support Coastal and Marine Spatial Planning



Optical		
EO Data		
Sentinel-2	W	C
Landsat 8/9	W	C
High-resolution		
Worldview-2	W	C
PlanetScope	W	C

SAR based		
Sentinel-1		C

ICESat-2		
Terrain Elevation		C
Altimetry data		C



- Vegetation
- Water
- Sediment (dry & wet)



Coastline monitoring : Change in Fualafeke coastline

and use mapping : Funafuti



Step1

Coastal & MSP

Development of Decision Ready Tools to Support Coastal and Marine Spatial Planning



Optical		
EO Data		
Sentinel-2	W	C
Landsat 8/T	W	C
High-resolution		
WorldView-2	C	
PlanetScope	C	

SAR based		
Sentinel-1	C	

ICESat-2		
Terrain Elevation	C	
Altimetry data	C	



Coastline monitoring : Change in Fualafeke coastline



and use mapping : Funafuti



Wave properties retrieval : wavelength, wave direction



Step1
Coastal & MSP
 Development of Decision Ready Tools to Support Coastal and Marine Spatial Planning



Optical		
EO Data		
Sentinel-2	W	C
Landsat 8/9	W	C
High-resolution		
Worldview-2	W	C
PlanetScope	W	C

SAR based		
Sentinel-1		C

ICESat-2		
Terrain Elevation		C
Altimetry data		C



Ministry of Foreign Affairs



PACIFIC ISLANDS FORUM

ROK-PIF cooperation fund 2021-2023

Period : February 2021~December 2023



Pacific Community
 Communauté du Pacifique

Algorithm development for tools **Application of Digital Management Tools**

1. Coastline monitoring
2. Land use mapping
3. Wave properties retrieval

Supporting Coastal & Marine Spatial Planning



Coastline monitoring : Change in Fualafeki coastline



and use mapping : Funafuti



Wave properties retrieval : wavelength, wave direction

Towards Livable Islands in the Pacific Island Countries



Step 1
Coastal & MSP
 Development of Decision Ready Tools to Support
 Coastal and Marine Spatial Planning

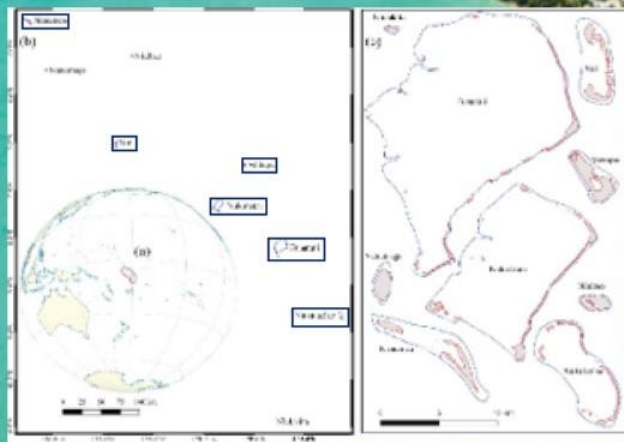
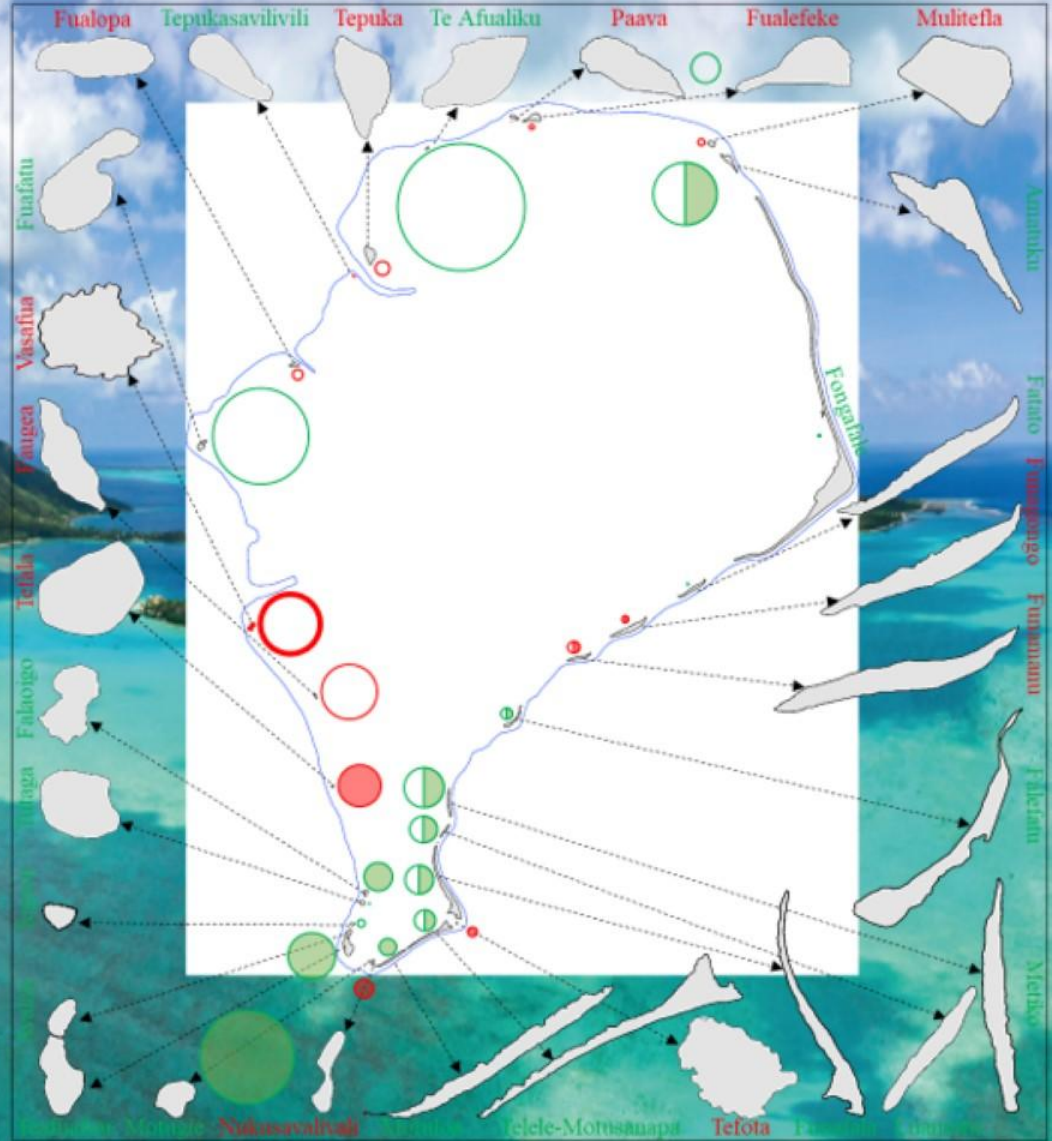
<https://doi.org/10.7780/kjrs.2023.39.1.2>

Coastline change trend

- █ Eroded
- █ Accreted
- █ Accreted, then eroded
- █ Eroded, then accreted

Islet size change

Increase	Decrease
○ 150%	○
○ 100%	○
○ 50%	○
○ 10%	○



Towards Livable Islands in the Pacific Island Countries



Step1
Coastal & MSP
 Development of Decision Ready Tools to Support Coastal and Marine Spatial Planning

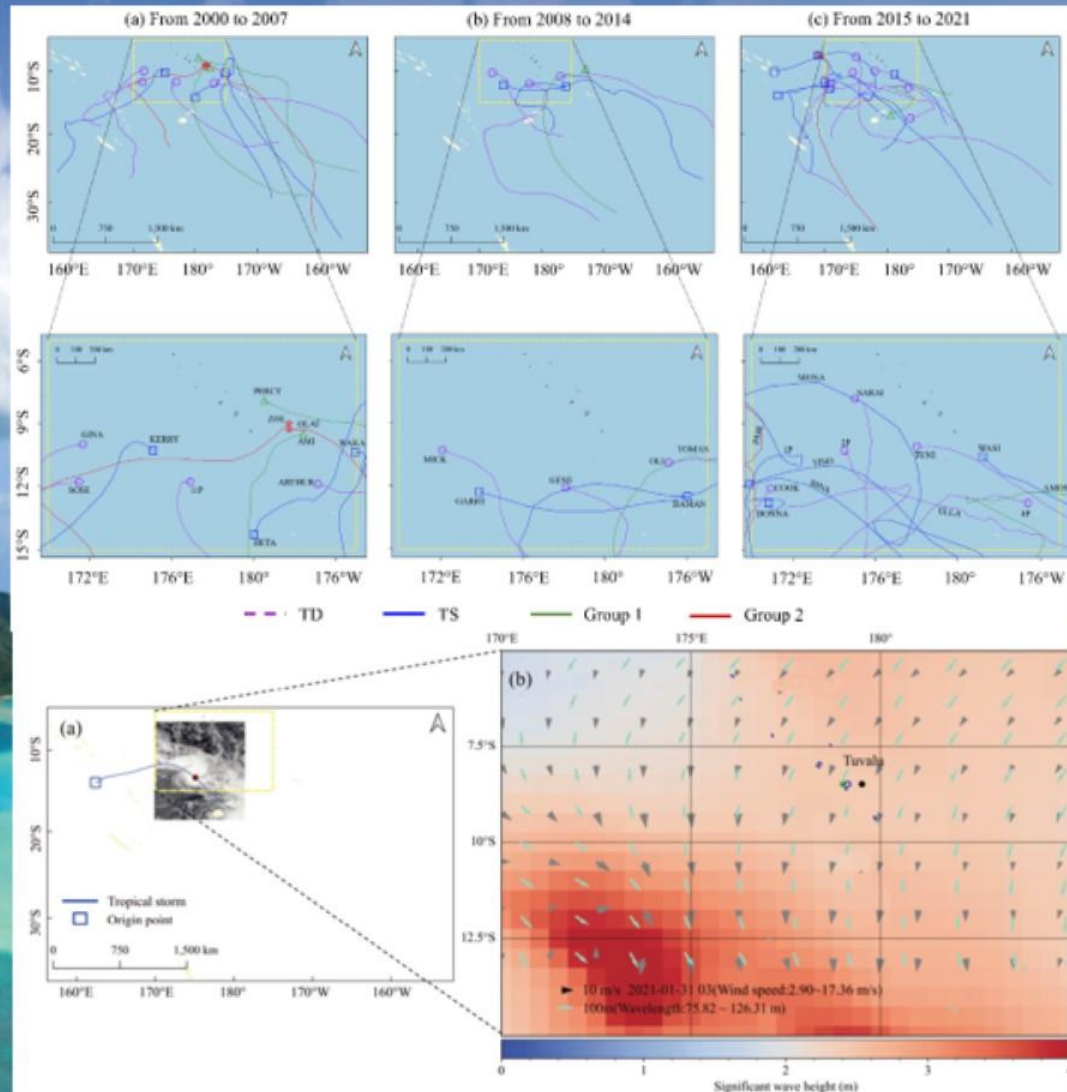
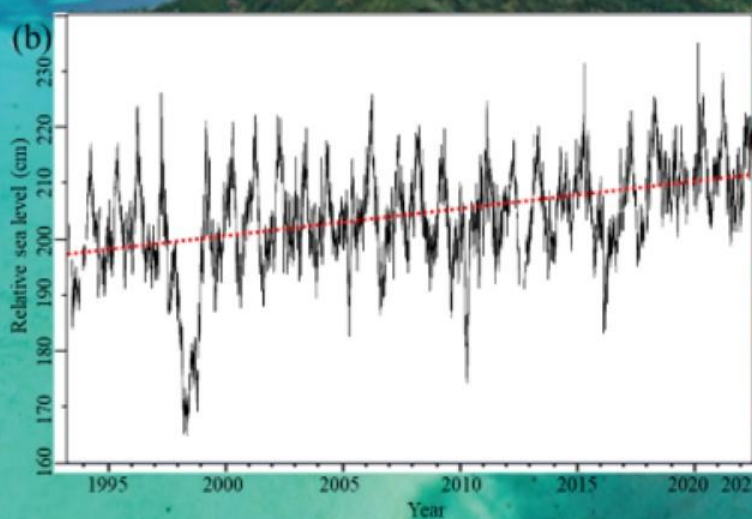
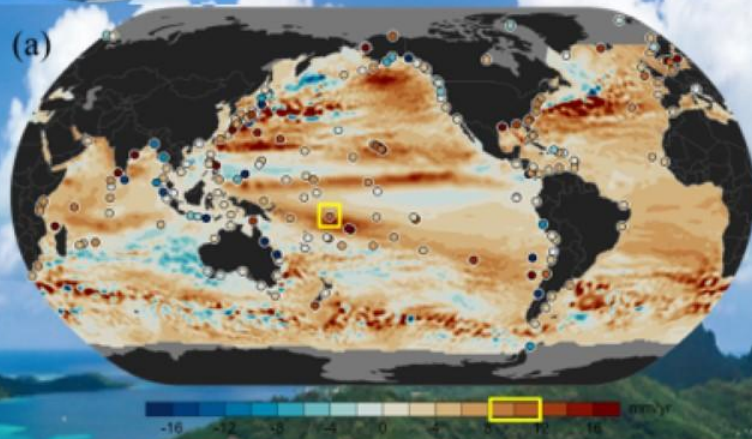


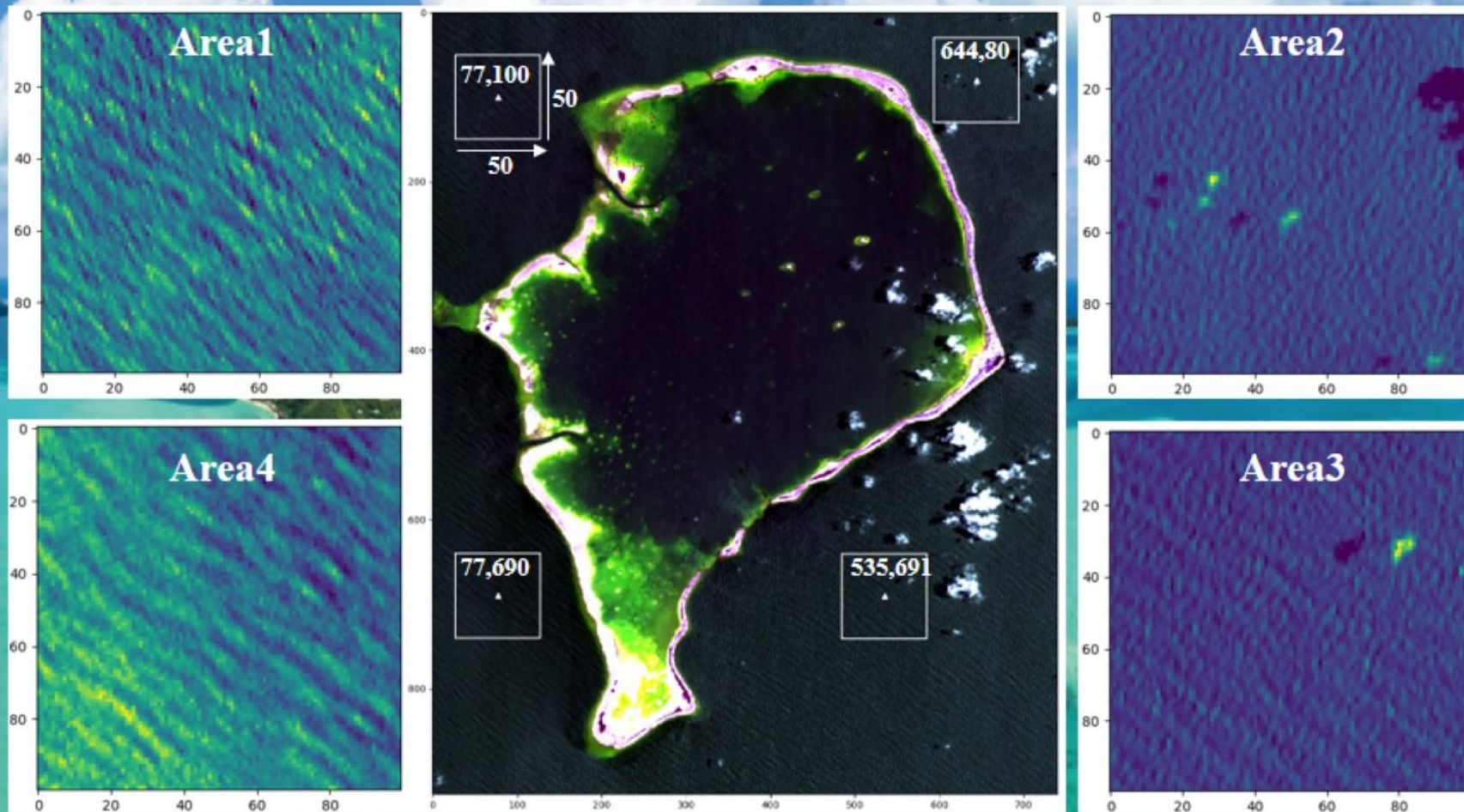
Fig. 10. Wind and wave distribution map. (a) True color MODIS (RGB channels: bands 1, 4, and 3) image of cyclone Bina on January 31, 2021. (b) Wind and wave conditions within the specified region (yellow dashed box) during the occurrence period (maroon dot) of cyclone Bina. Green and black dot indicates the first (8.5°S, 179°E) and second (8.5°S, 179.5°E) locations, respectively. Blue polygons indicate the islets of Tuvalu.

Towards Livable Islands in the Pacific Island Countries



Step1
Coastal & MSP
Development of Decision Ready Tools to Support
Coastal and Marine Spatial Planning

Wave Properties



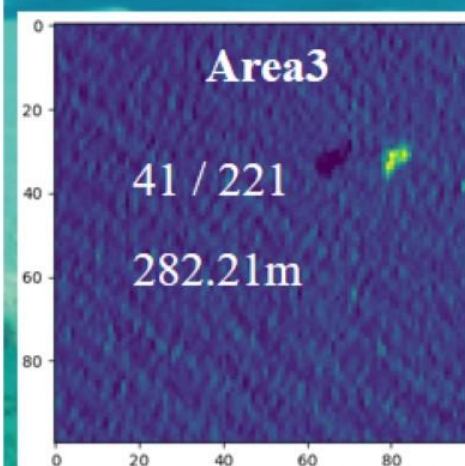
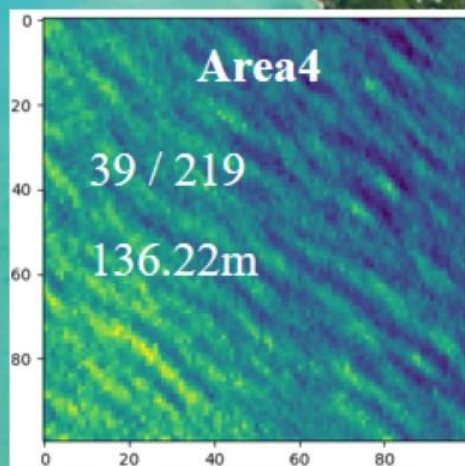
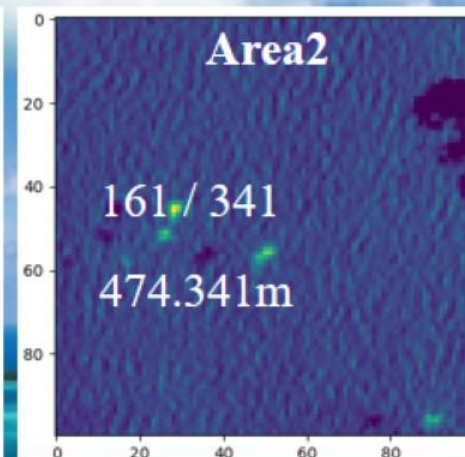
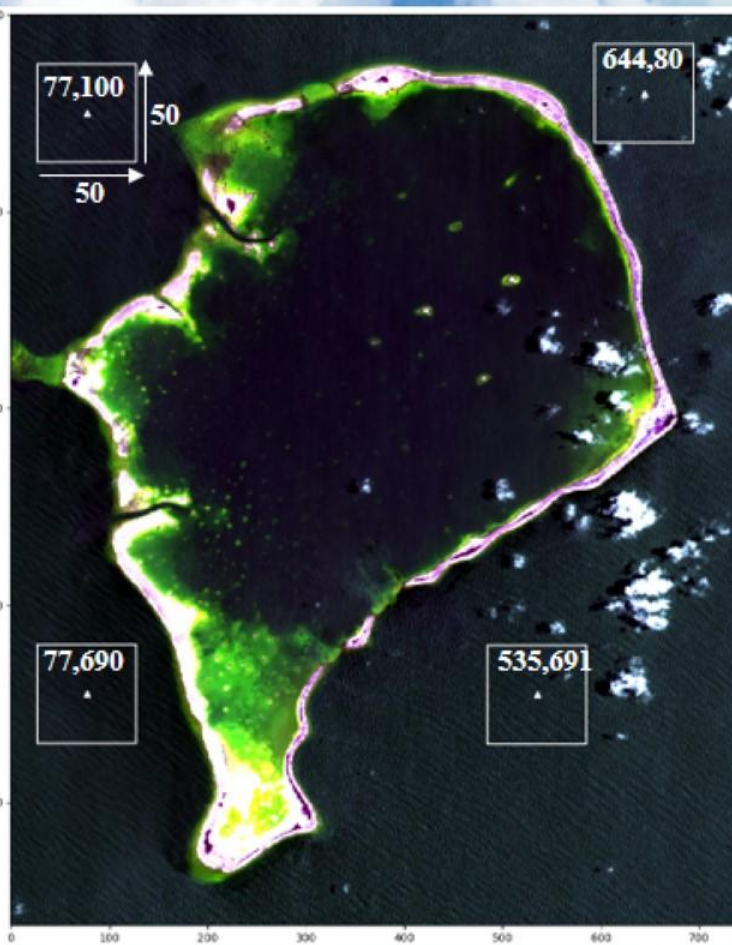
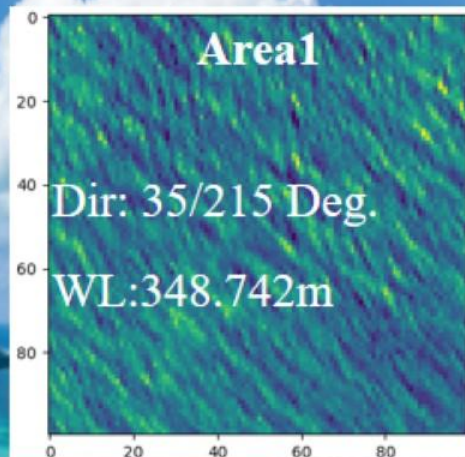
Satellite Image (Landsat-8_20161010)

Towards Livable Islands in the Pacific Island Countries



Step1
Coastal & MSP
Development of Decision Ready Tools to Support
Coastal and Marine Spatial Planning

Wave Properties



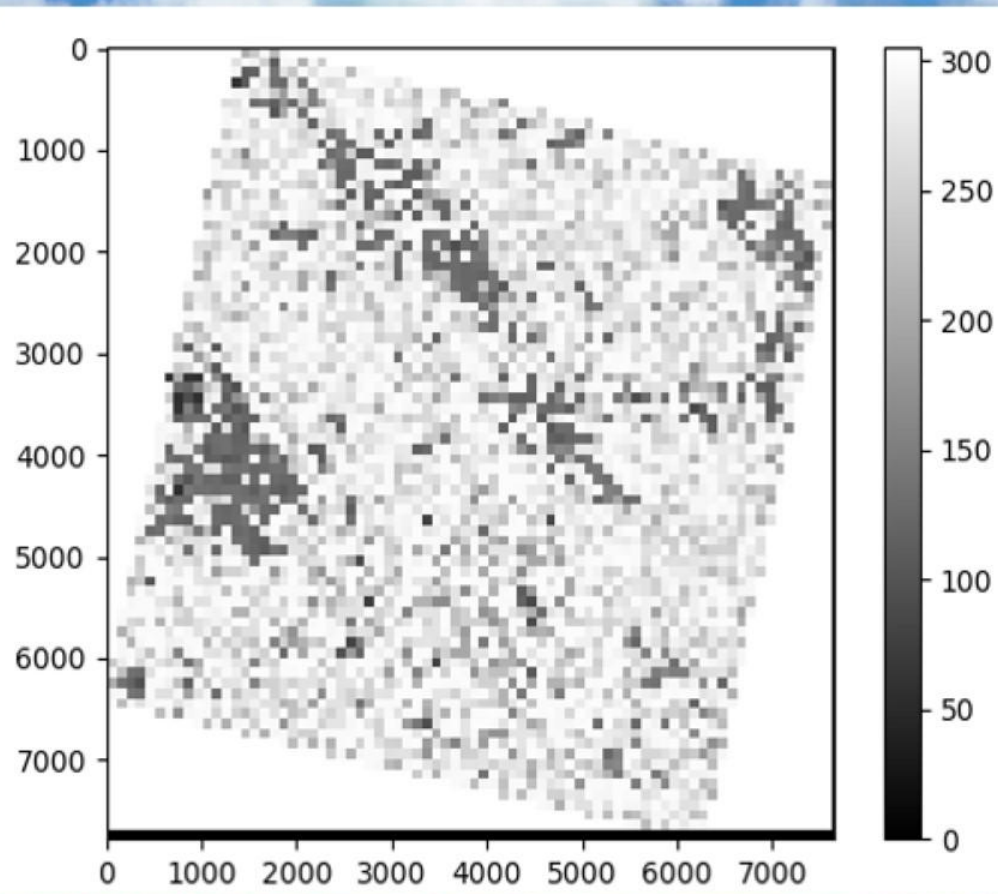
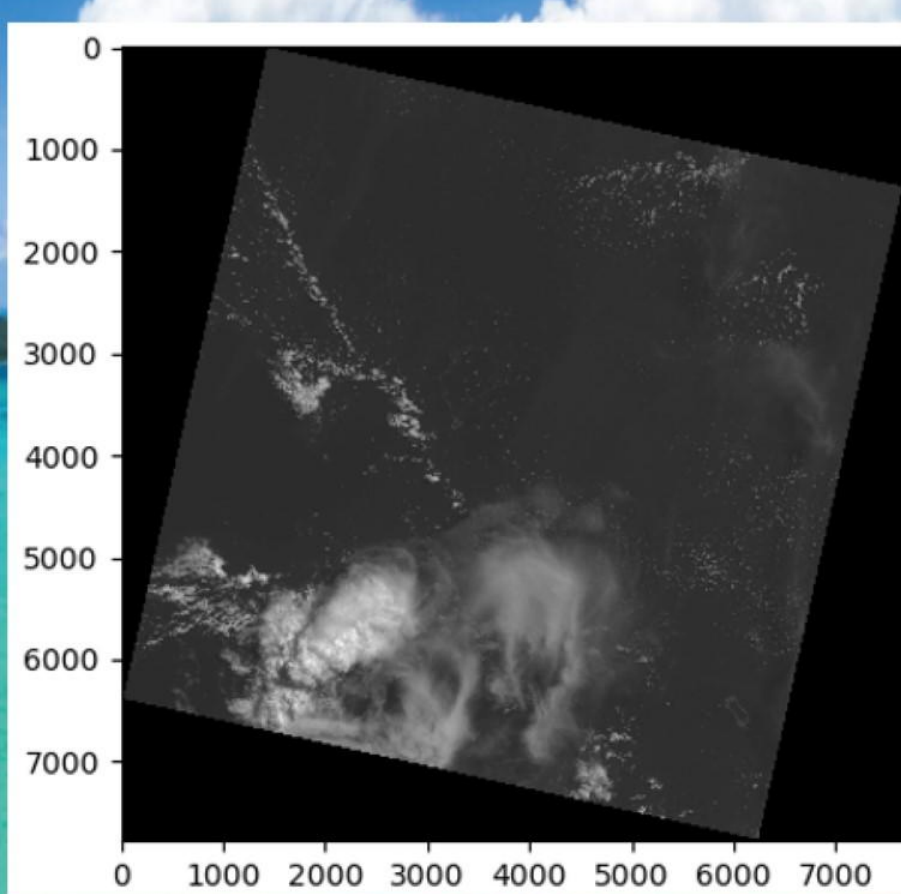
Satellite Image (Landsat-8_20161010)

Towards Livable Islands in the Pacific Island Countries



Step 1
Coastal & MSP
Development of Decision Ready Tools to Support
Coastal and Marine Spatial Planning

Wave Properties



Towards Livable Islands in the Pacific Island Countries

Step1

Coastal & MSP
Development of Decision Ready Tools to Support
Coastal and Marine Spatial Planning

DRT Components

Data Sources

EO Data



Sentinel-2



Landsat 8/9



PlanetScope

High-resolution
Data



WorldView-2

SAR Data



Sentinel-1

**Coastline Extraction
Algorithm**

3 CE modules

60%

**Coastline Change
Detection Algorithm**

CCD module

100%

Wave Properties Retrieval

Wave module

80%

**Land Use Mapping &
Change Detection Algorithm**

3 LUMCD modules

60%

Towards Livable Islands in the Pacific Island Countries

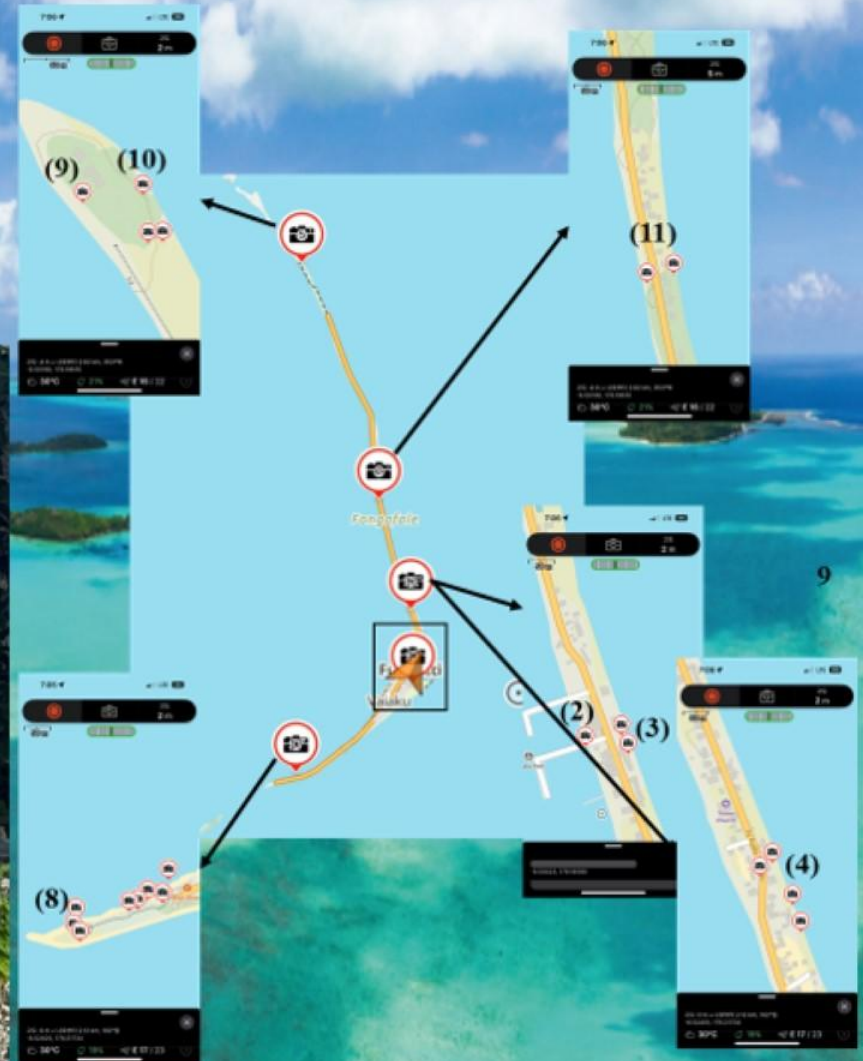
Step1

Coastal & MSP

Development of Decision Ready Tools to Support Coastal and Marine Spatial Planning



Future Works



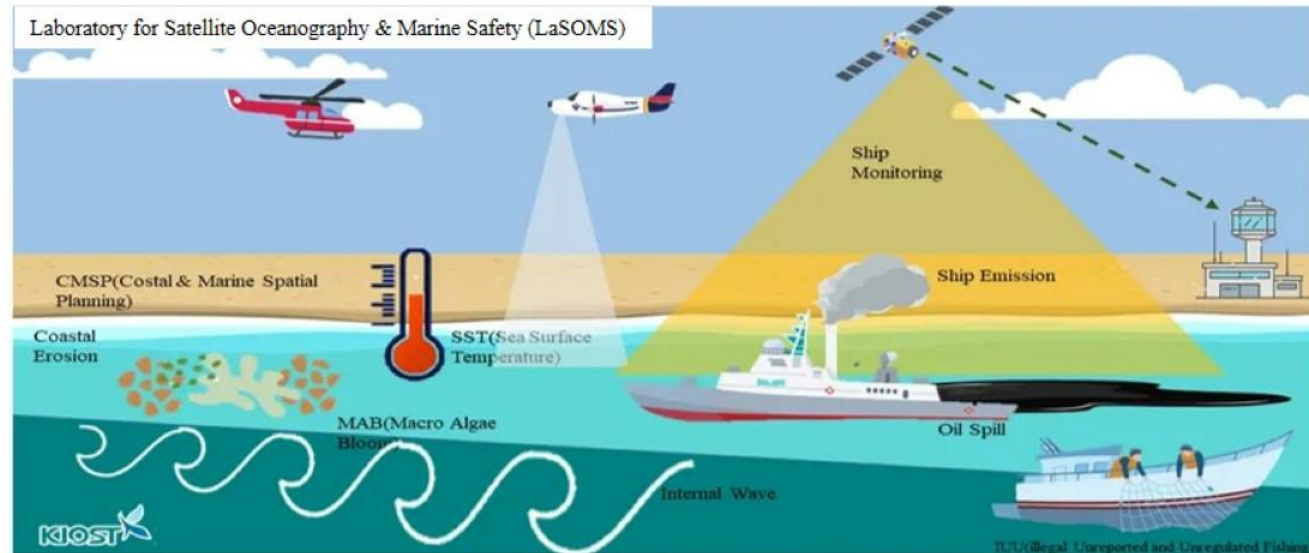
감사합니다



Come join the Laboratory for Satellite Oceanography & Maritime Safety (LaSOMS)

We are looking for students
(Master's/PhD) to start
Spring and Fall 2024 & 2025

Contact: Dr. Chan-Su Yang
(yangcs@kiost.ac.kr)



Application belongs to:

- 1) University of Science & Technology (UST), Republic of Korea Link: <https://www.ust.ac.kr/eng/>
- 2) Ocean Science and Technology School, Korea Maritime & Ocean University, Republic of Korea Link: <https://www.kmou.ac.kr/english/main.do>

** Tuition fee, living and other expenses will be covered by scholarship