SIDS

PI-ReSOC

Capacity Building of Remote Sensing Monitoring for Marine Environment and Disasters in Pacific Island Countries

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SOED

SIO

CRESDA

SPREP
Secretariat of the Pacific Regional Environment Programme

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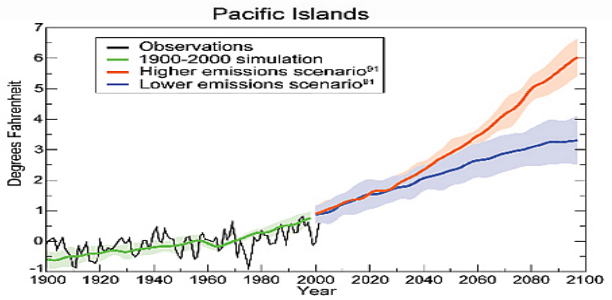
1.1 Challenges faced by SIDS

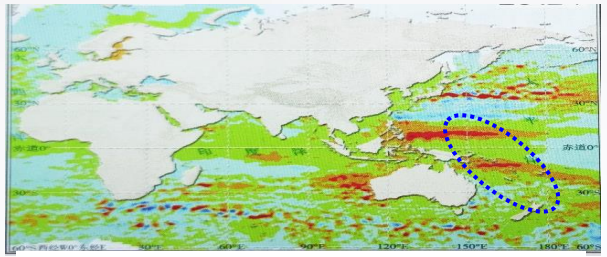
- **Climate Change & Sea-Level Rise**: Highly vulnerable to sea levels rising and severe weather.
- **Food Supply & Water Shortage**: Limited access to locally grown food and fresh water
- **Biodiversity & Natural Resource Loss:** Regression of coastal ecosystem and its service, including coral reefs degradation and fisheries resources depletion.
- **Economic Fragility**: Limited economic diversity, high dependence on tourism and imports

1.2 PICs are vulnerable to climate change

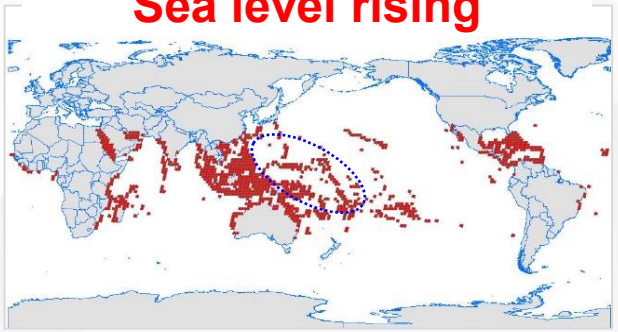
☐ Challenges caused by Large-Scale climate events



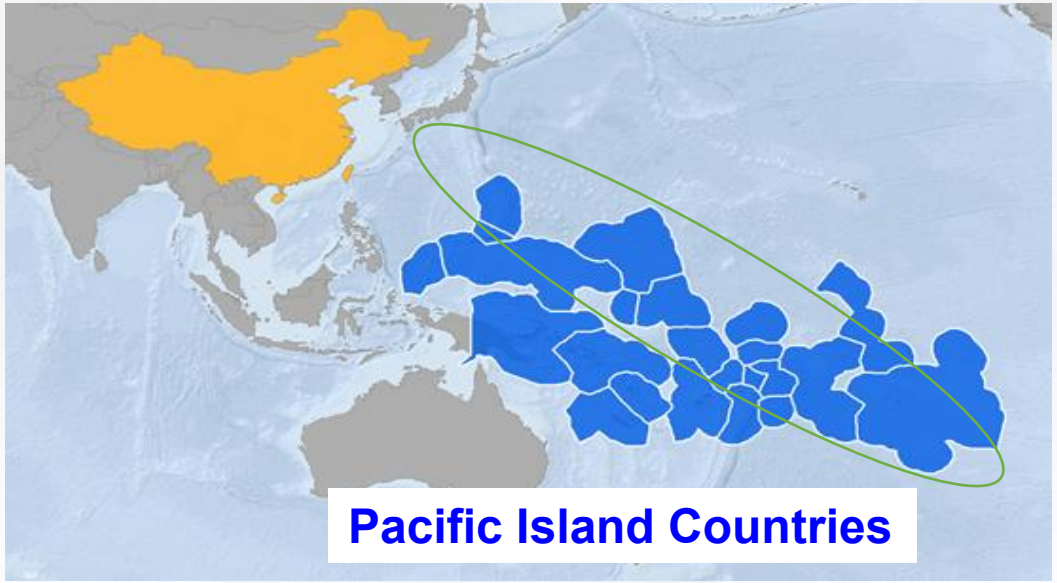
Global warming



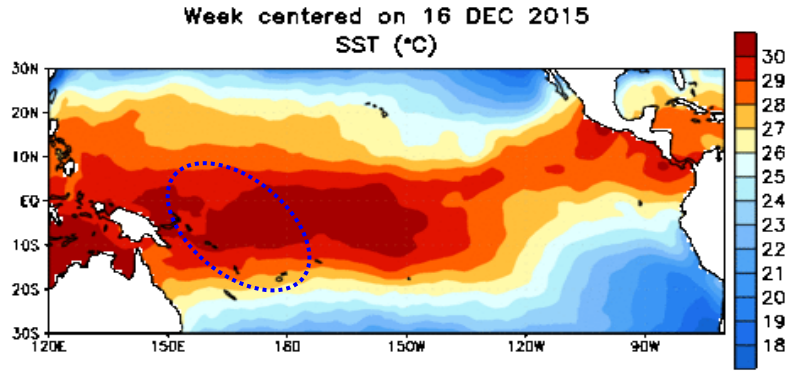
Sea level rising



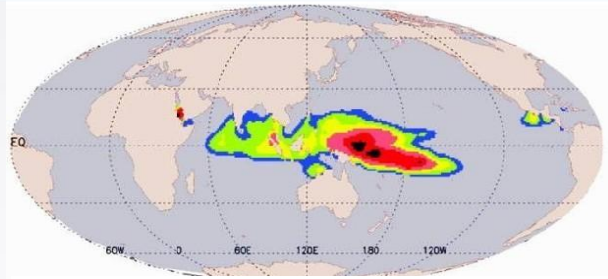
Coral reef Distribution



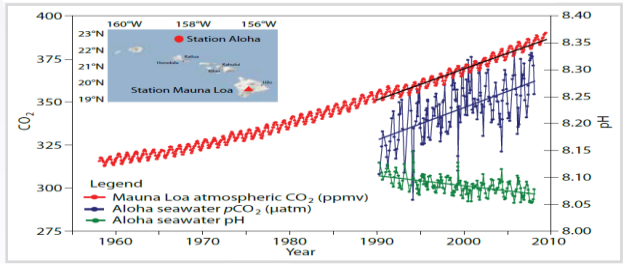
Pacific Island Countries



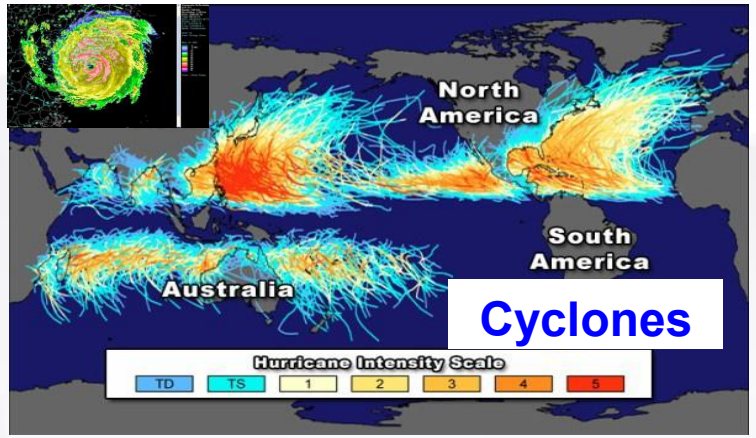
ENSO and Heat Wave



Indo-Pacific warm pool area



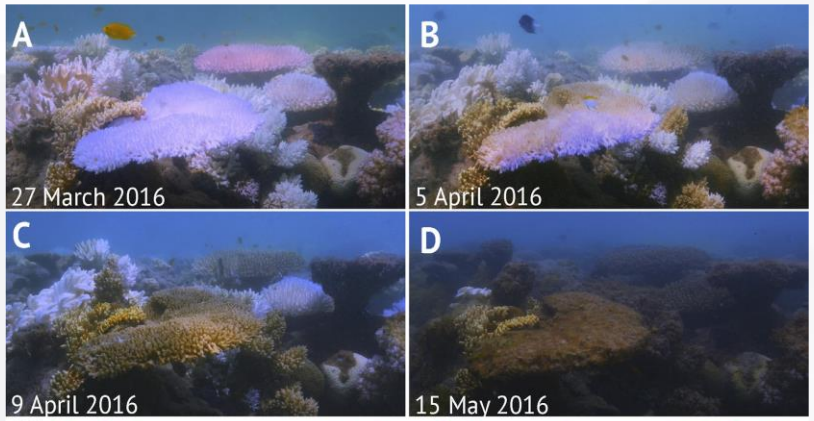
Ocean acidification



Cyclones

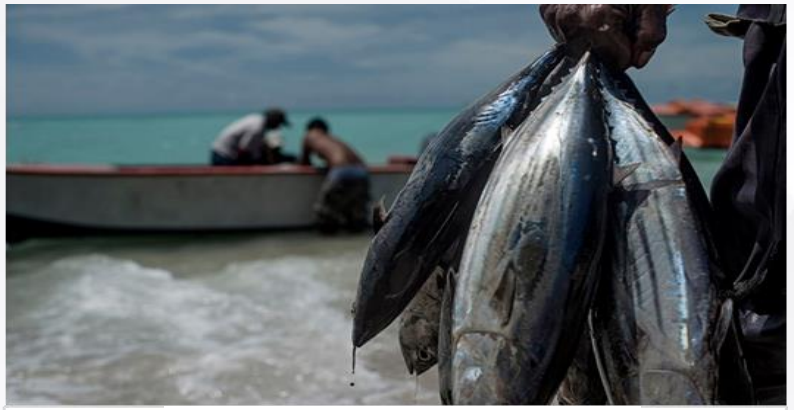
1.3 PICs are vulnerable to multi-stressors forcing

- It resulted in a lot of environmental and ecological issues

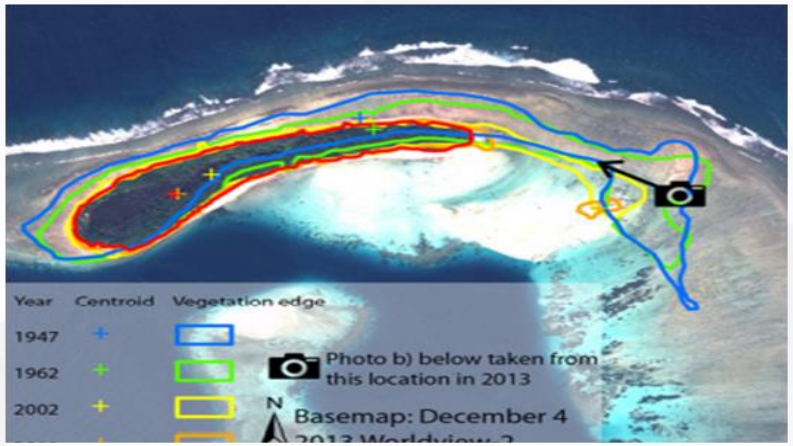


Coral reef bleaching

Deforestation



Over fishing



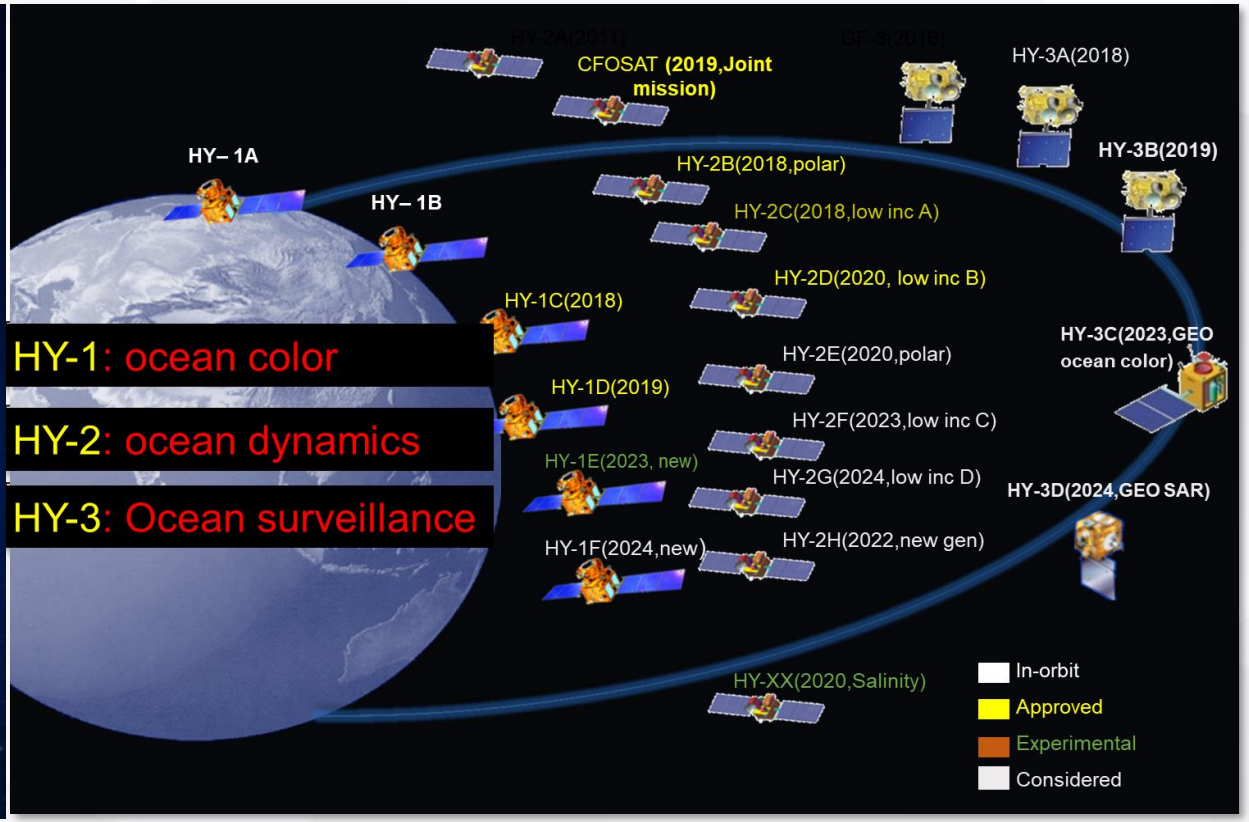
Coastal erosion

Flooding

Coastal destruction

1.4 China's Remote Sensing Capabilities

- China has launched **more than 400 satellites**, including **Gaofen series, Ziyuan series, Ocean series**, and set up one of the largest Earth Observation networks.



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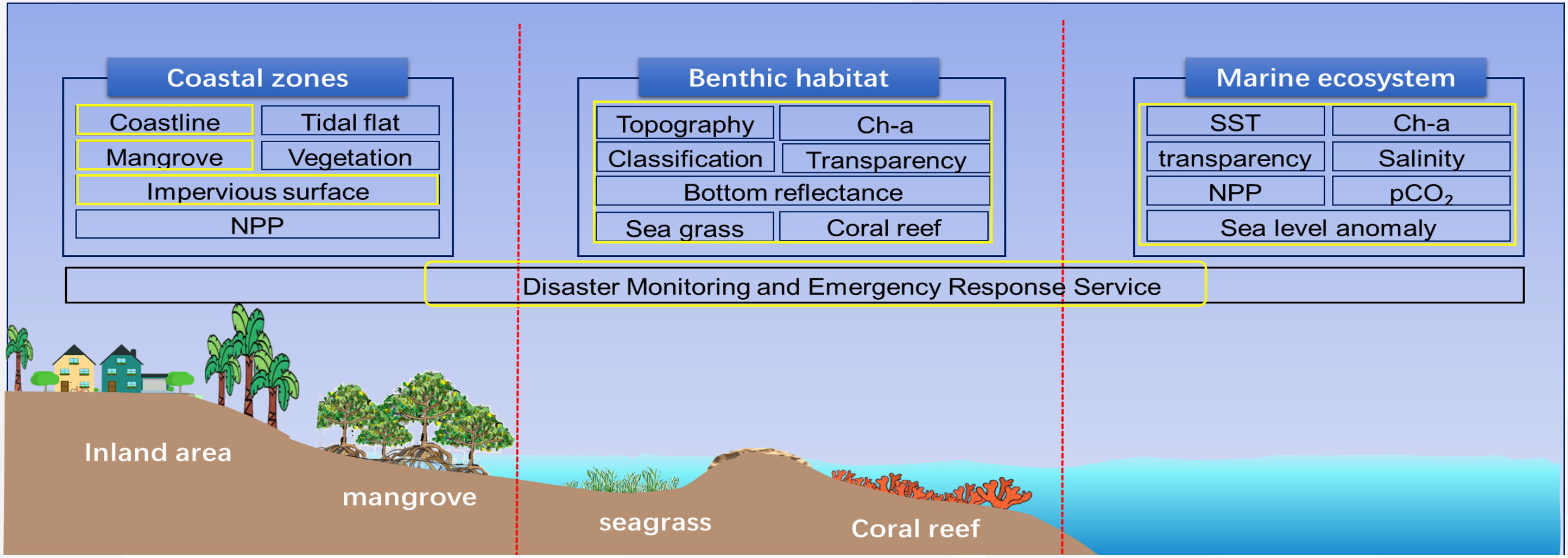
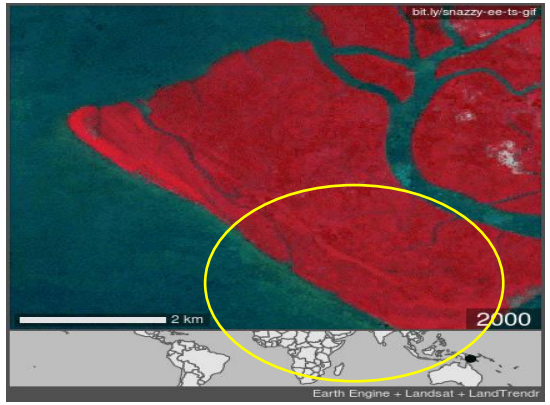
2.1 Monitoring of ecological elements

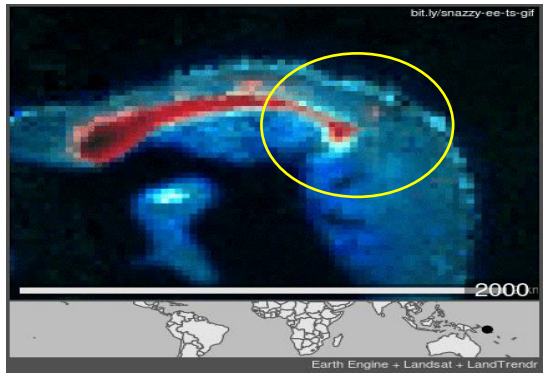
- We have set up more than 20 remote sensing based ecological elements, across coastal zones, benthic habitats, and marine ecosystems.

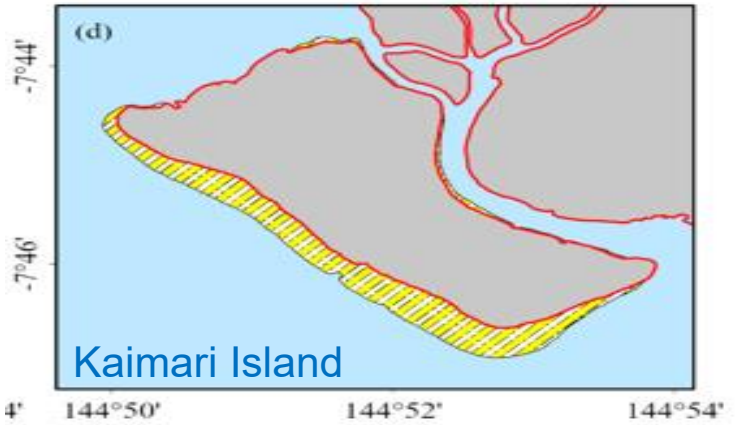


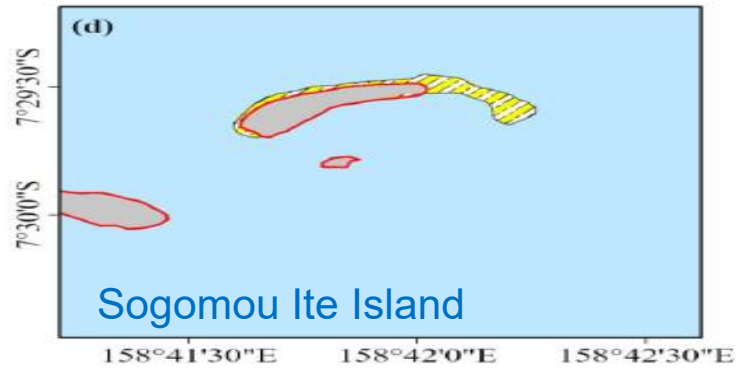
Detection of Coastal Erosion （2000-）

- Identify the eroded coastal areas, revealing the spatial distribution of erosion and degradation. It provides scientific support for coastal management, ensuring the sustainability and resilience of coastal environments and communities.



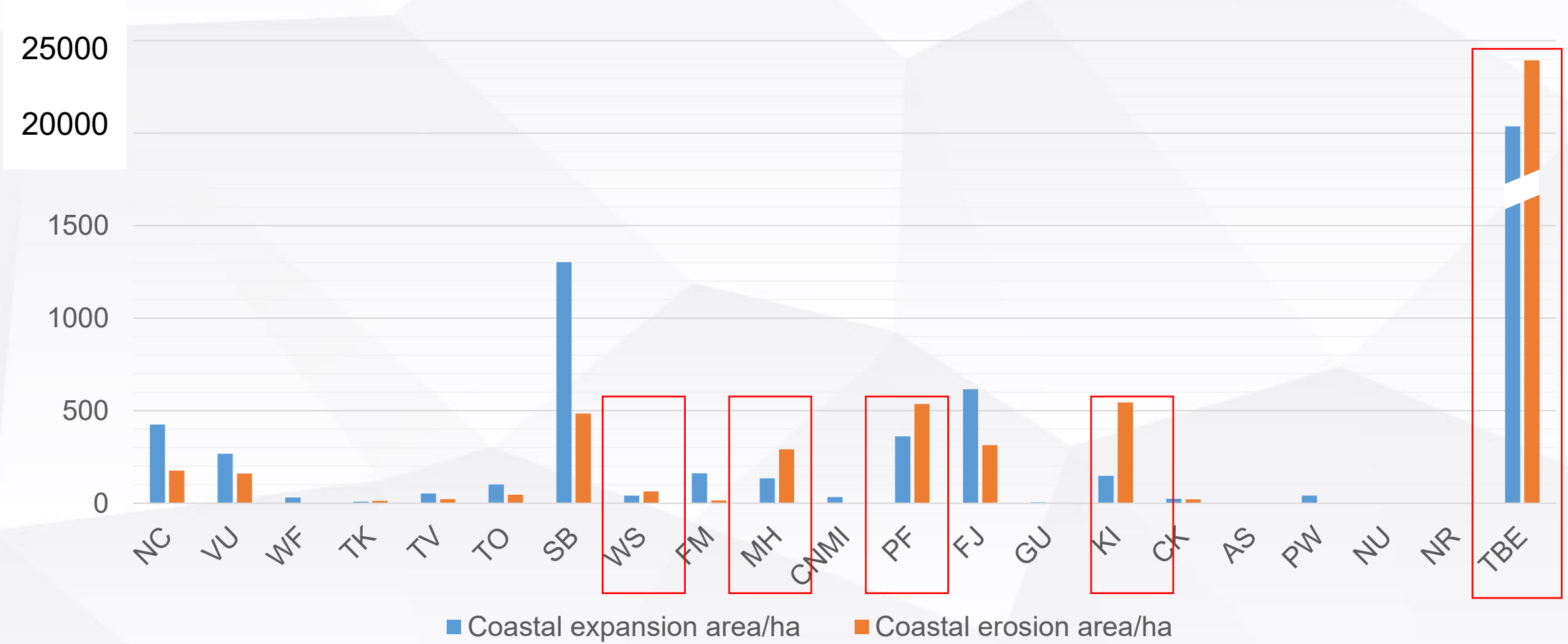






Detection of Coastal Erosion （2000-）

- Samoa, Marshall Islands, French Polynesia, Kiribati, and Papua New Guinea are at the risk of coastal erosion.

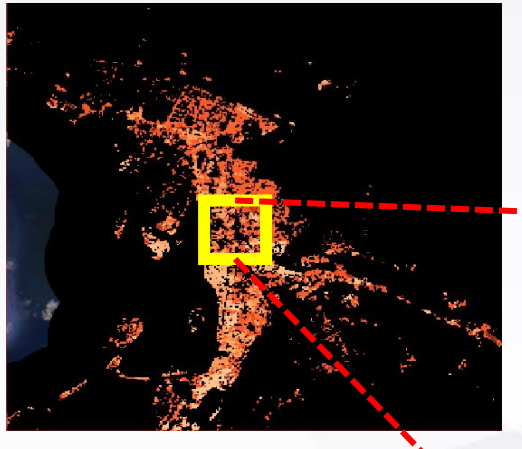


Monitoring of human settlement changes (2000-)

- We used the impervious surface as the indicators of human settlement. The data sources is Landsat from 2000-2020.

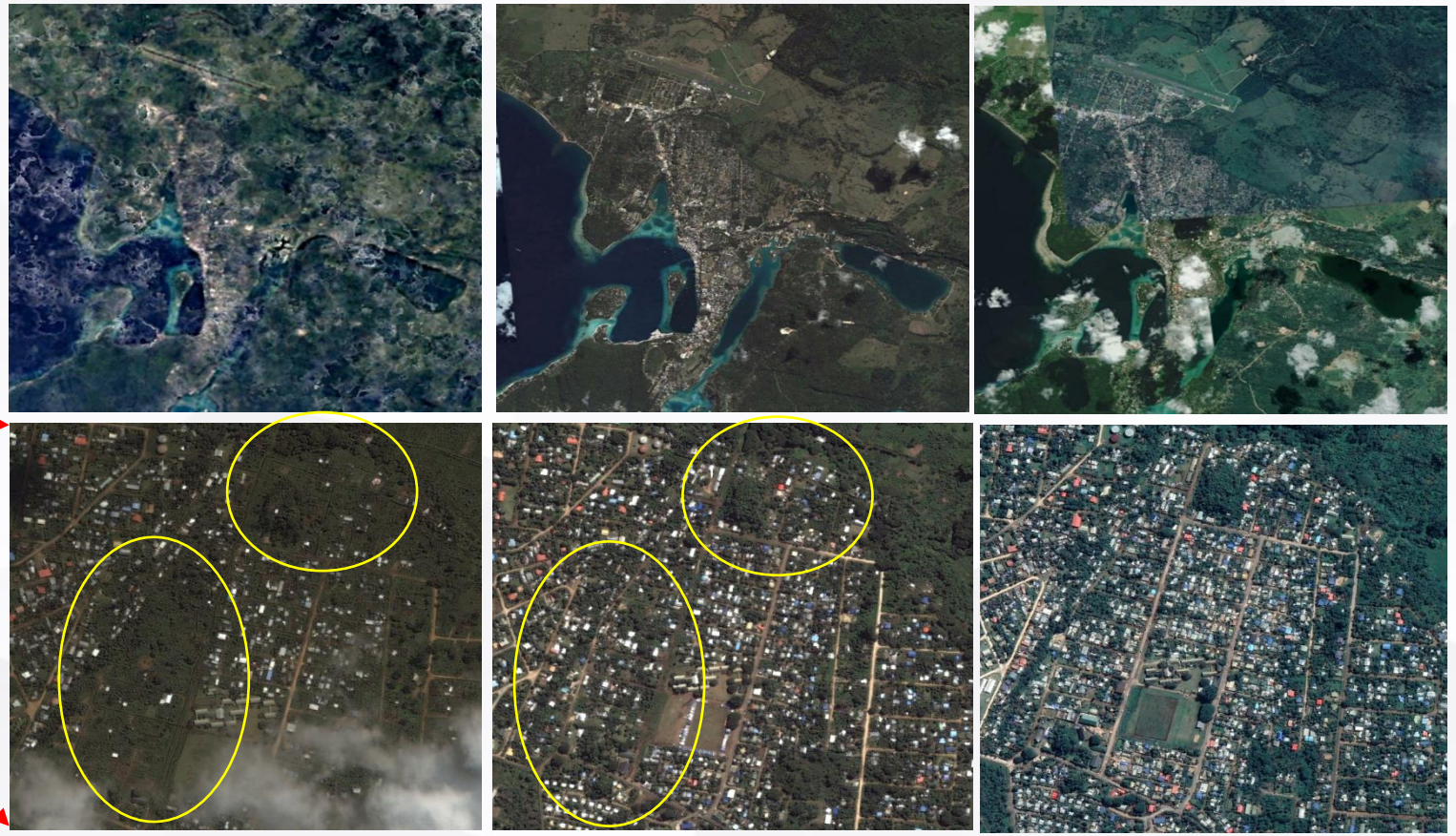
Port-Vila in Vanuatu

Port-Vila



Non-IMP

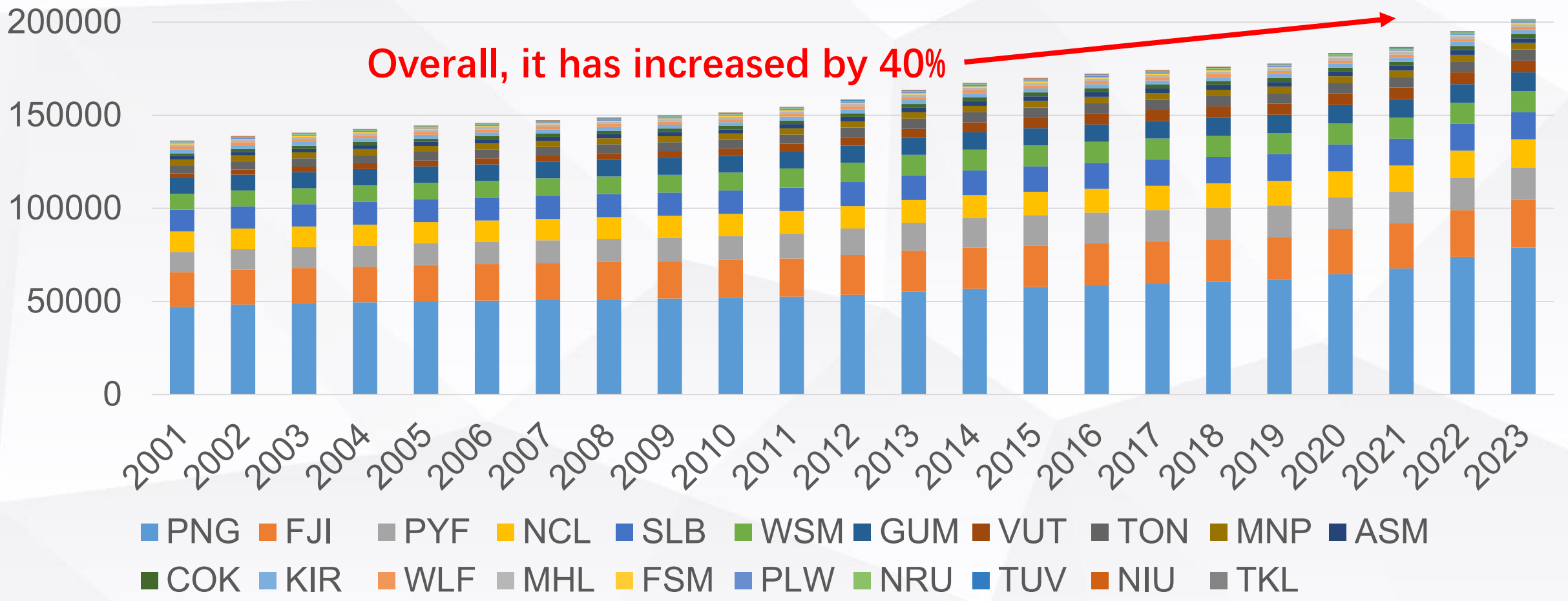
1998 2021



2000 2010 2020

Monitoring of human settlement changes (2000-)

- We used the impervious surface as the indicators of human settlement. It revealed the trend of impervious surface in past 20 years.



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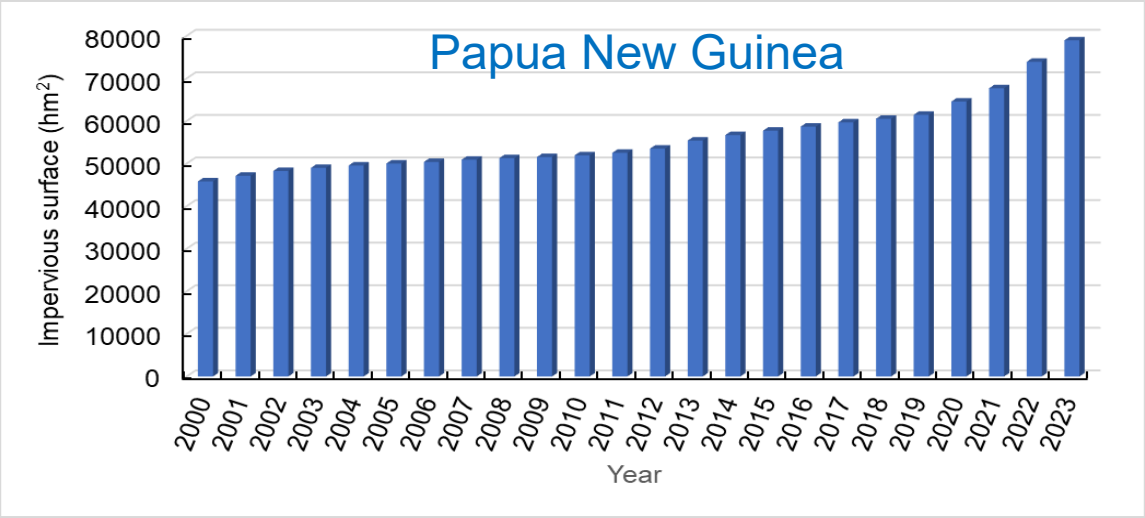
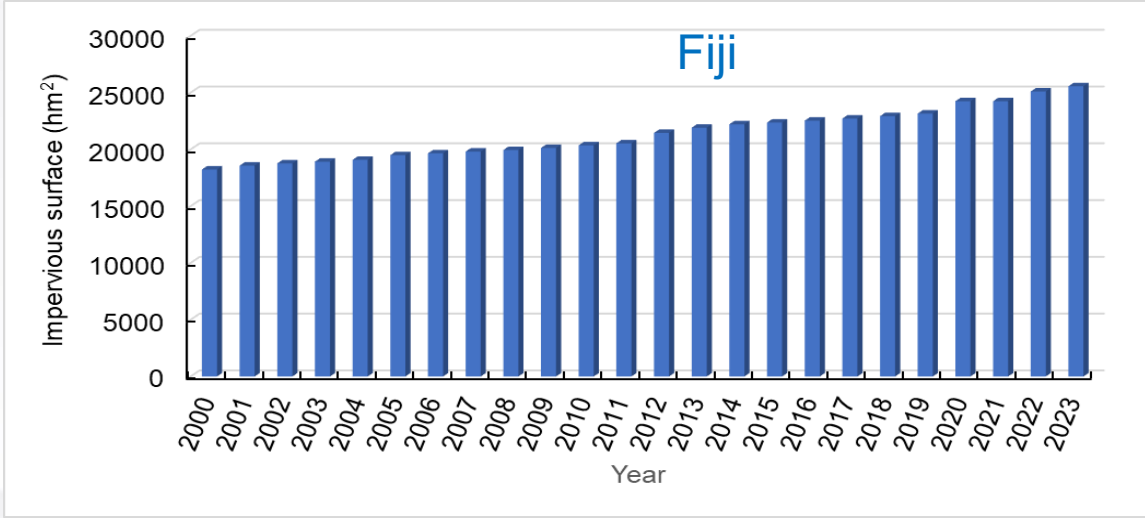
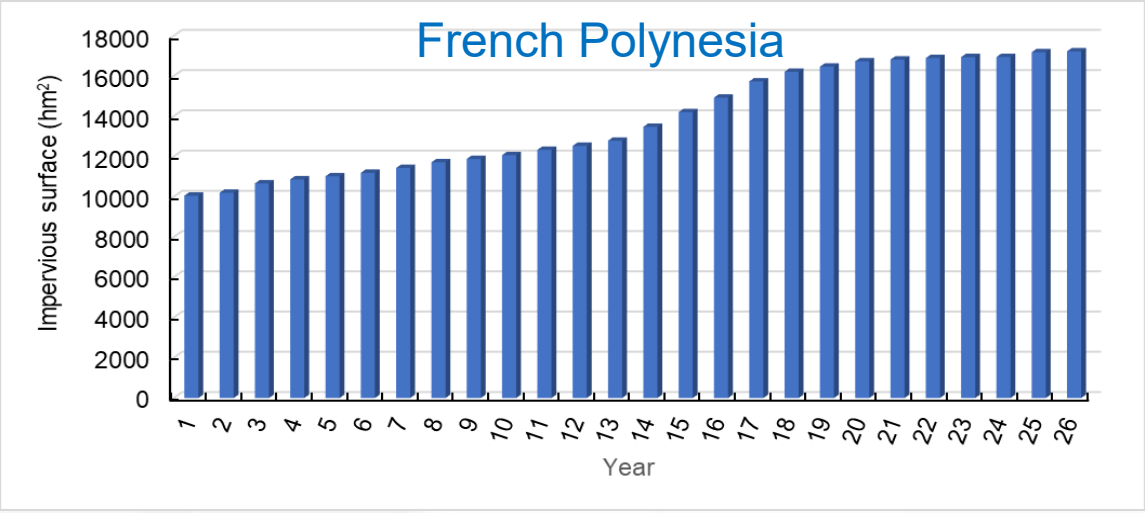
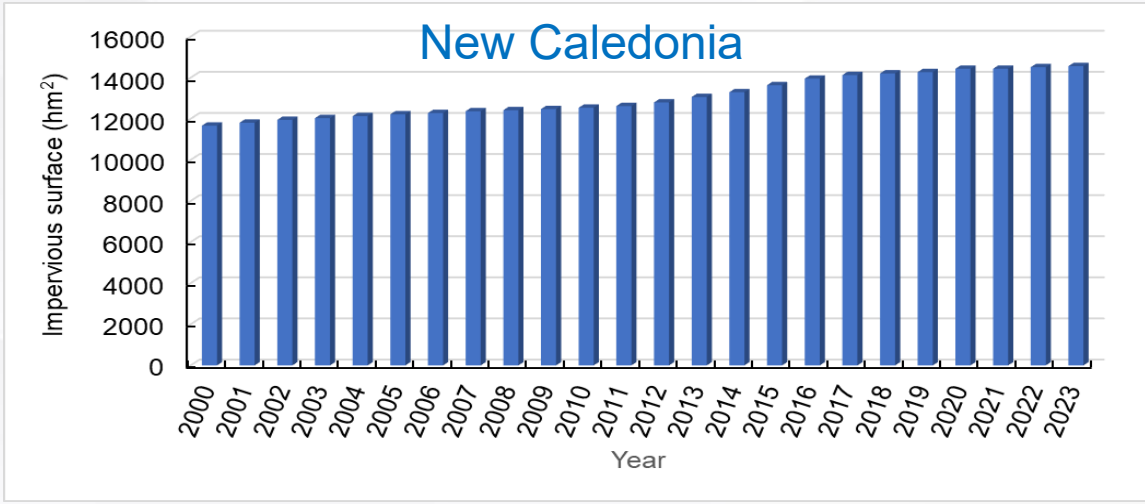


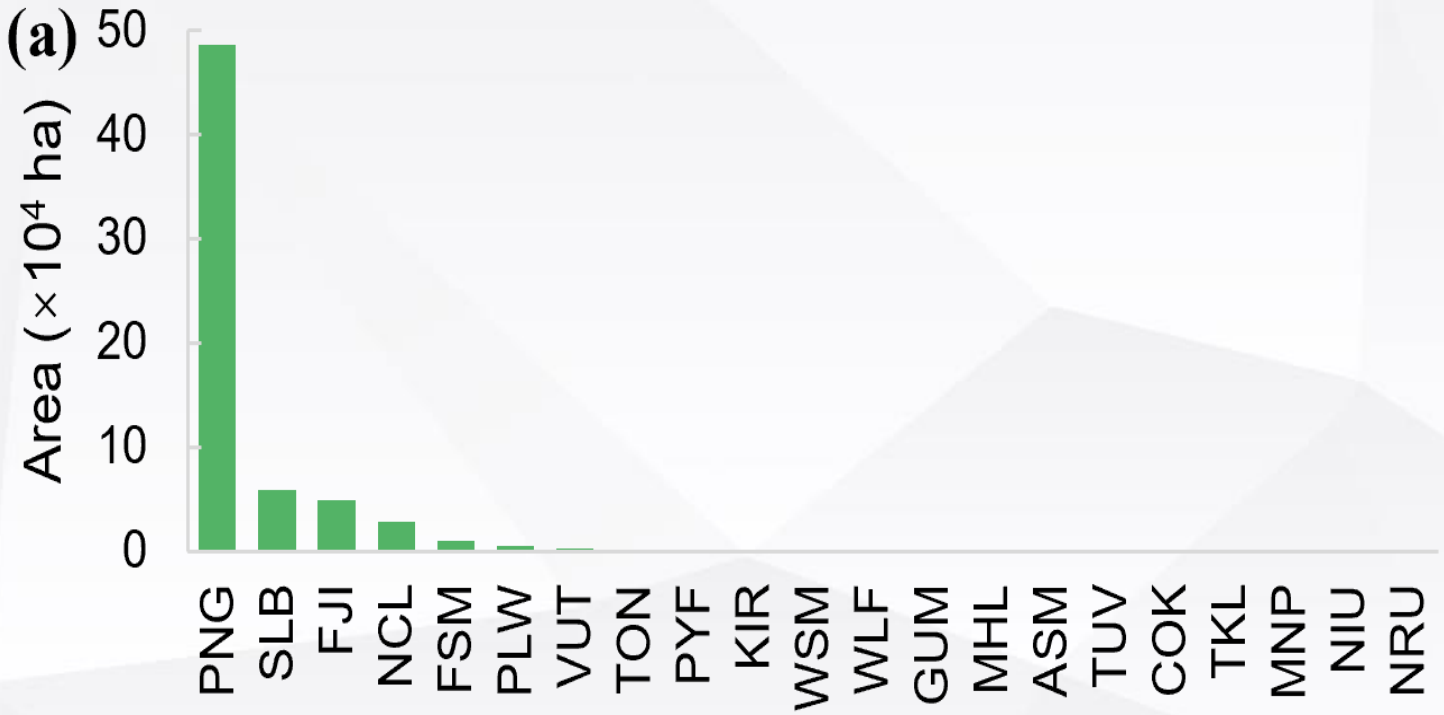


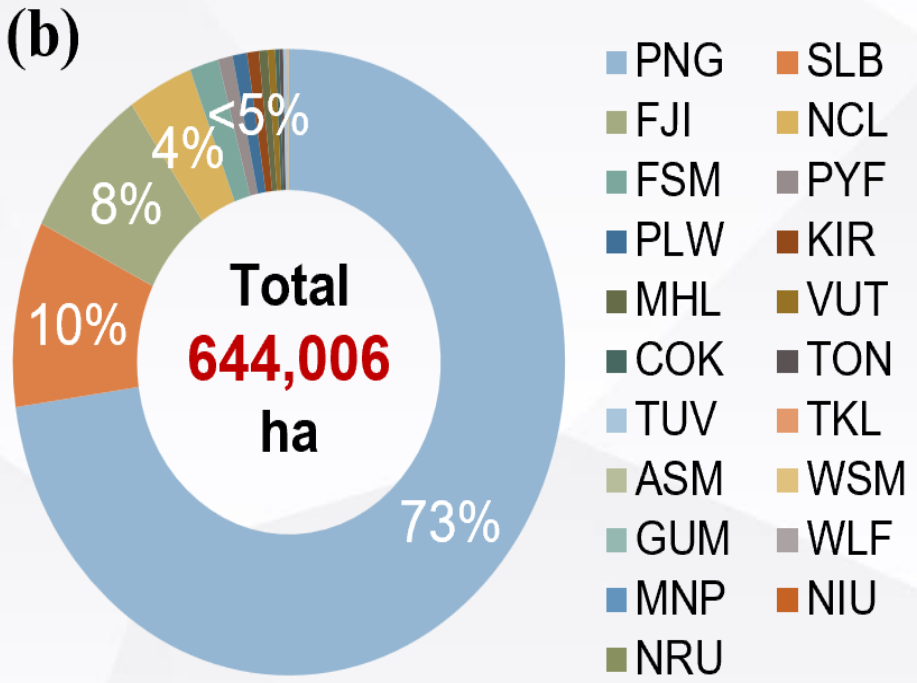




Monitoring of Mangrove dynamics (2000-)

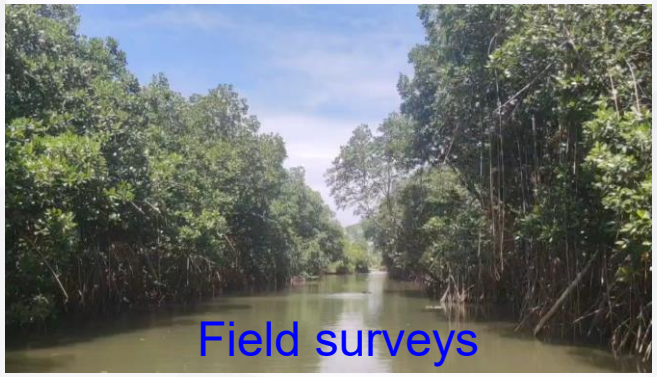
- We develop a special method for mapping mangrove ecosystem in PICs, that integrates an adaptive sampling strategy and a small set of training samples, enabling long-term mangrove monitoring.

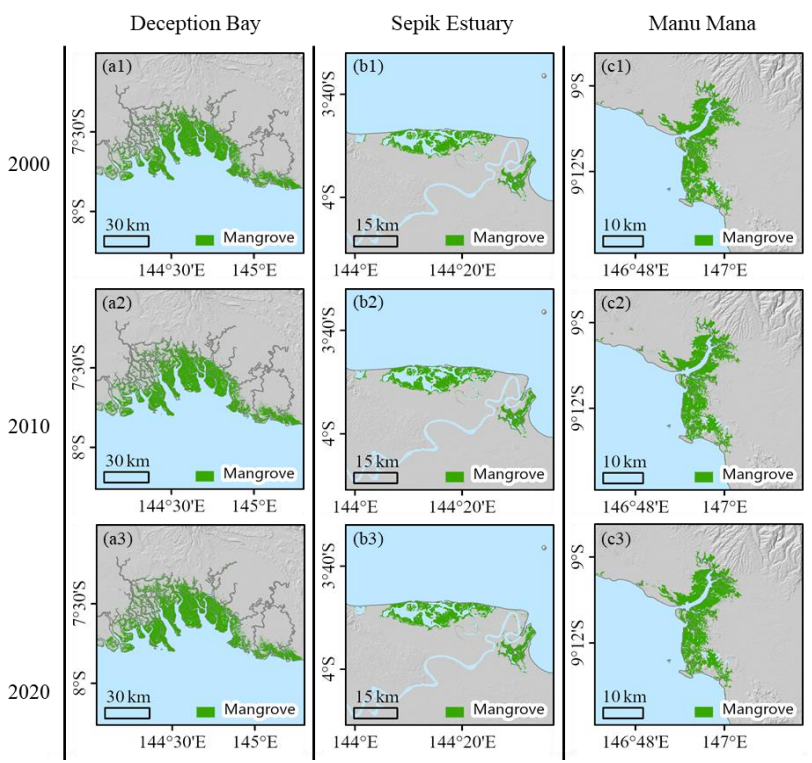




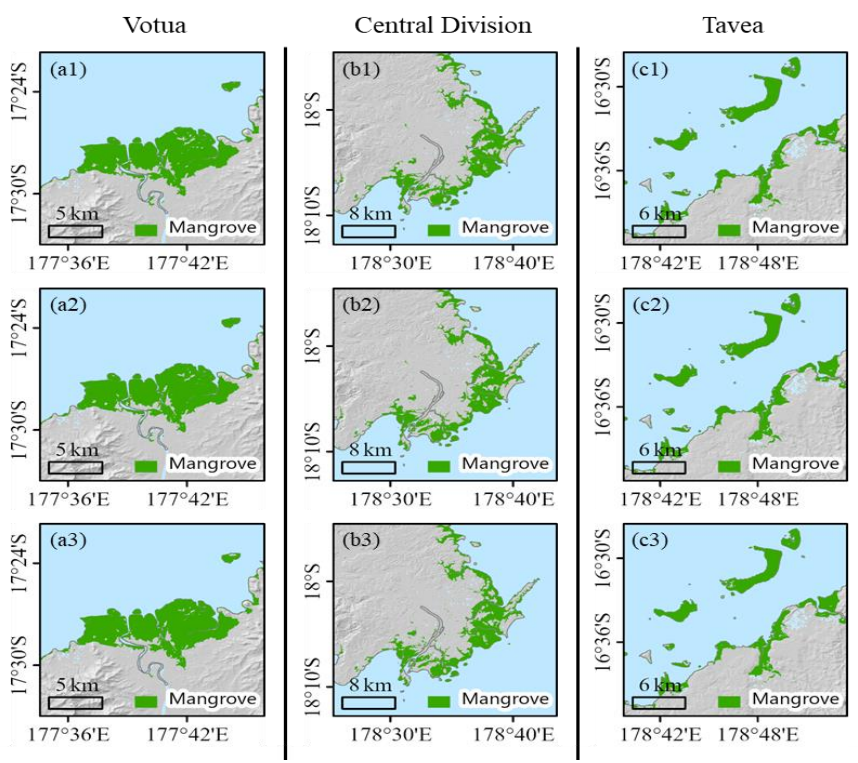
Monitoring of Mangrove dynamics (2000-)

- Some hotspot areas of mangrove concentration have been identified.
- Providing a basis for enhancing restoration and protection of mangroves.





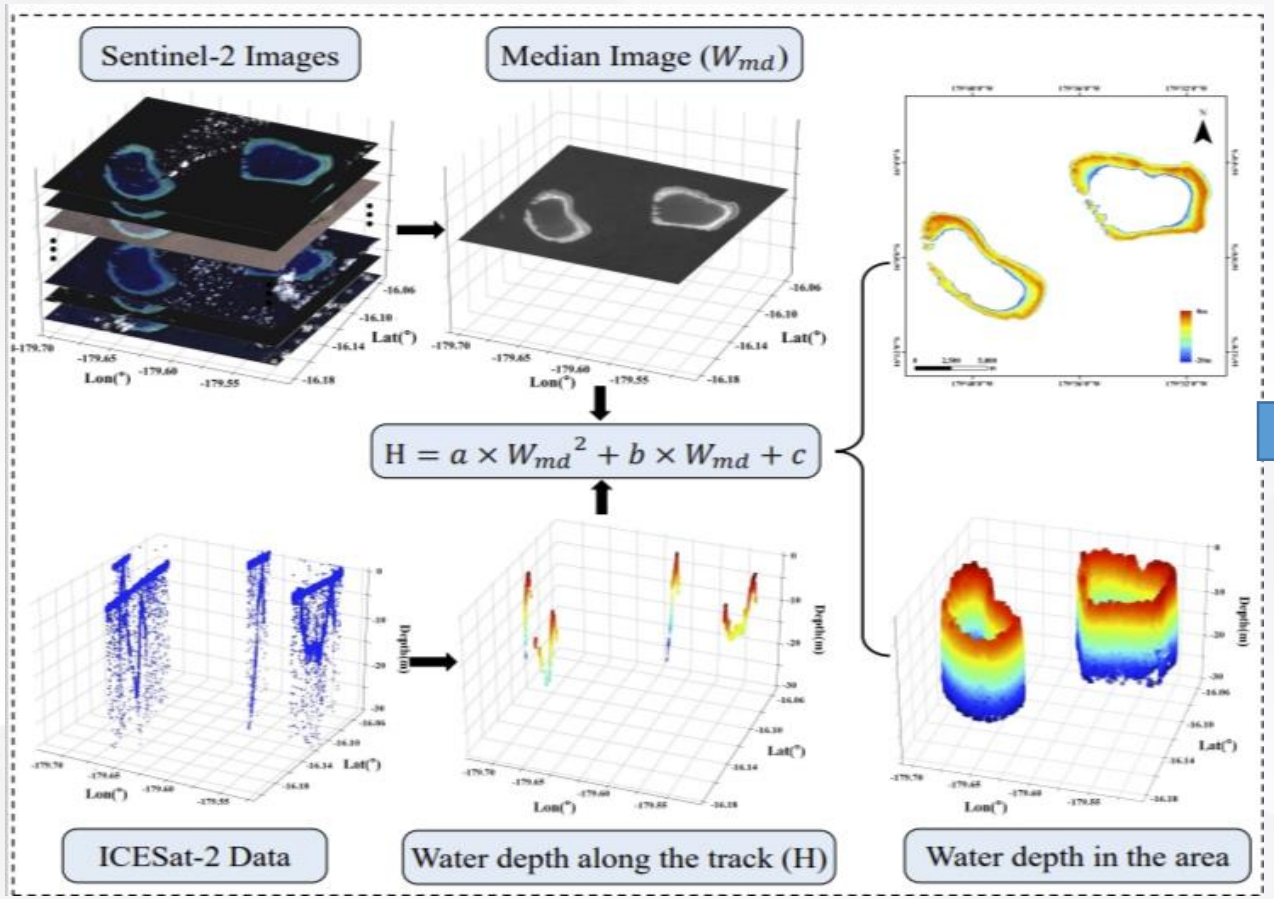
Papua New Guinea

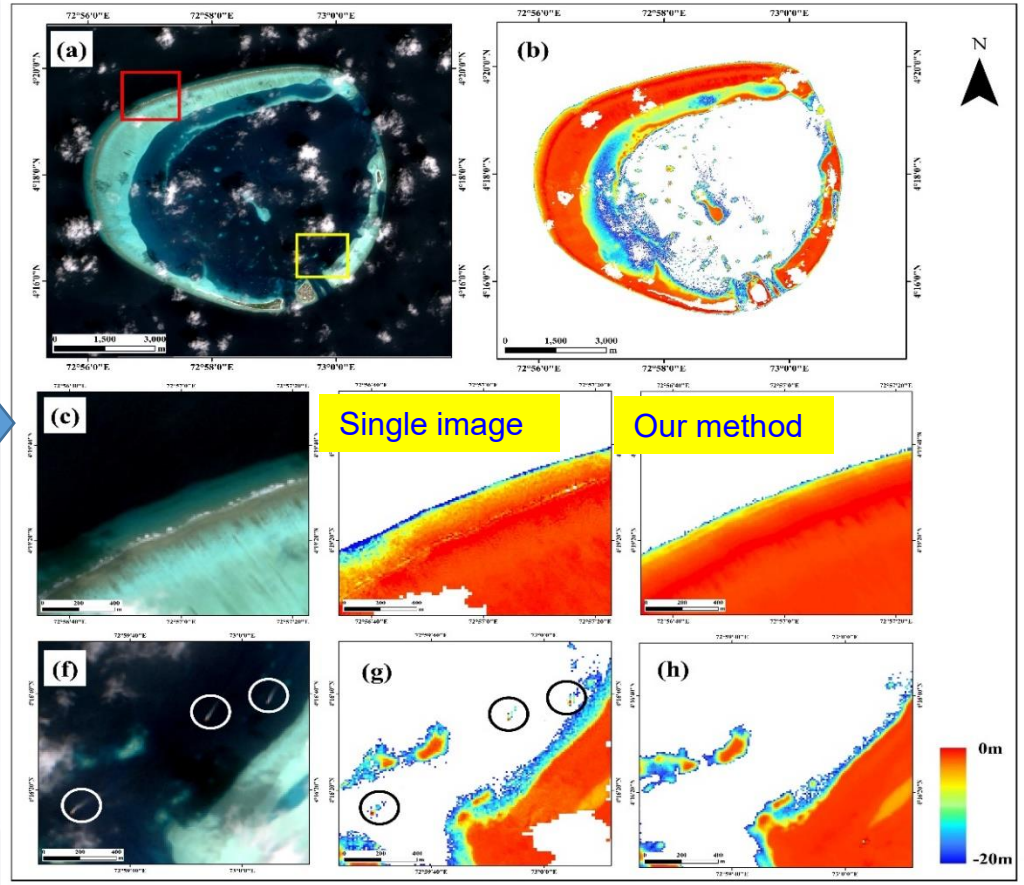


Fiji

Monitoring of Benthic Habitat Mapping

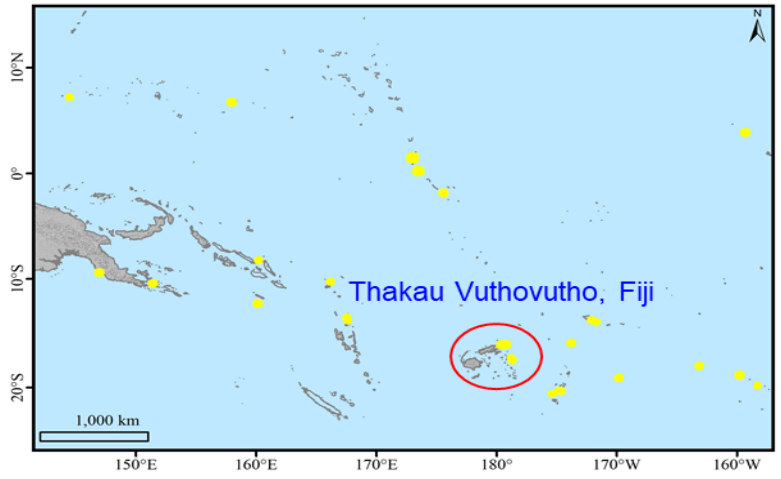
- We developed a new high effective method for benthic habitat mapping based on massive active-passive remote sensing data.

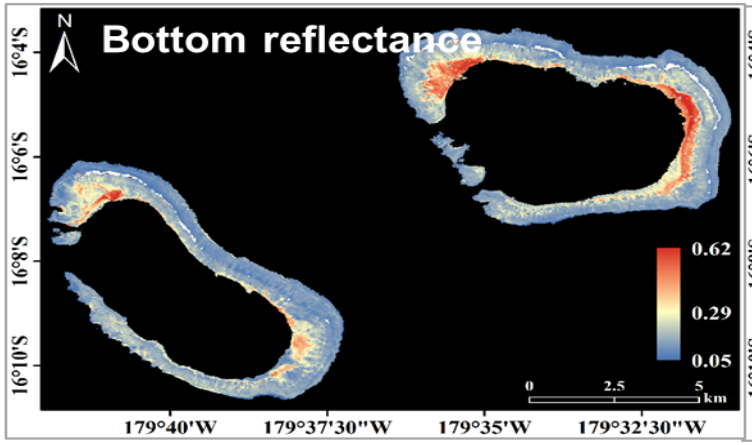


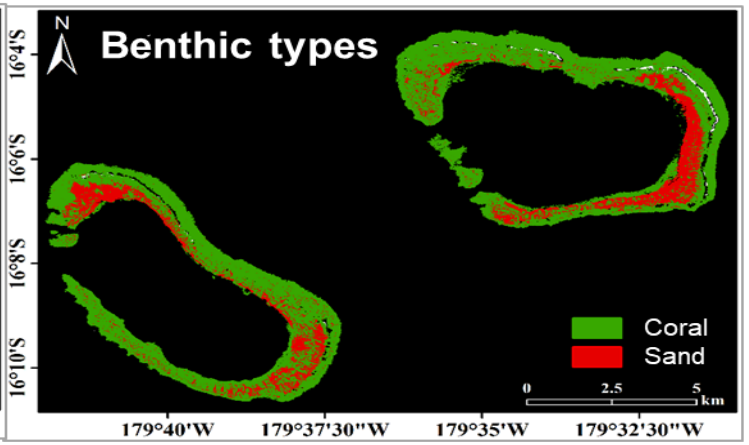


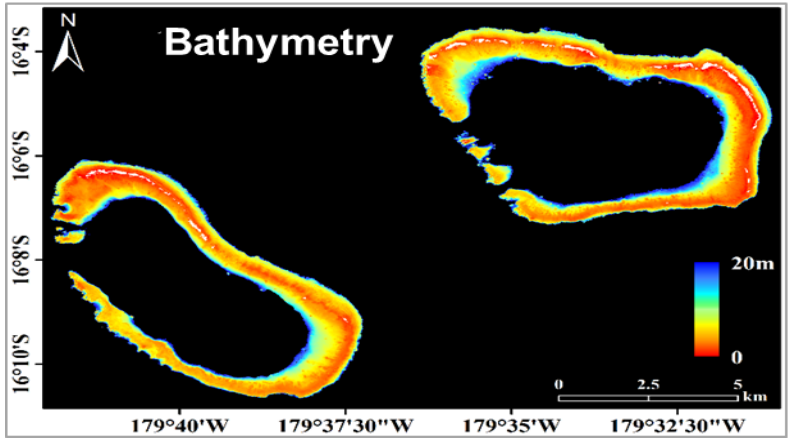
Monitoring of Benthic Habitat Mapping

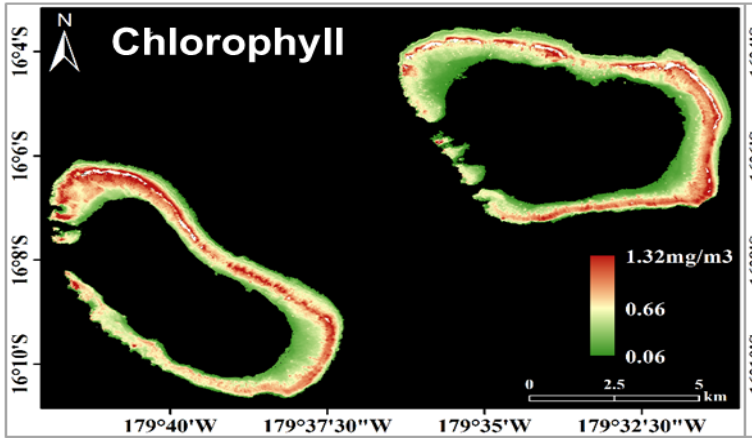
- 5 benthic habitat features were inversed in Pacific Islands Countries, including bottom reflectance, benthic habitat types, bathymetry, chlolophyll, transparency.

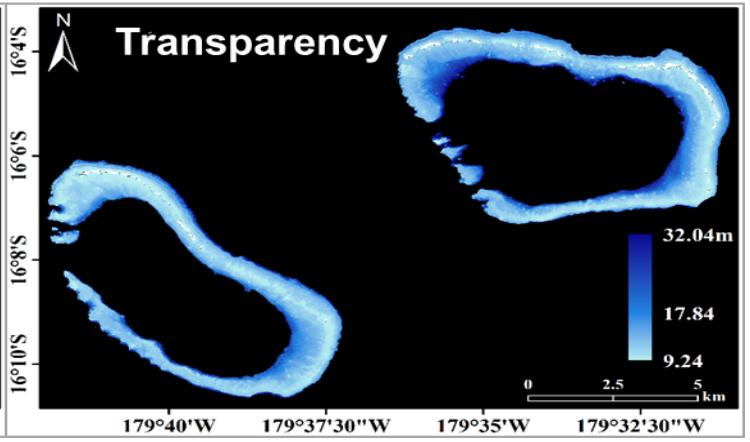






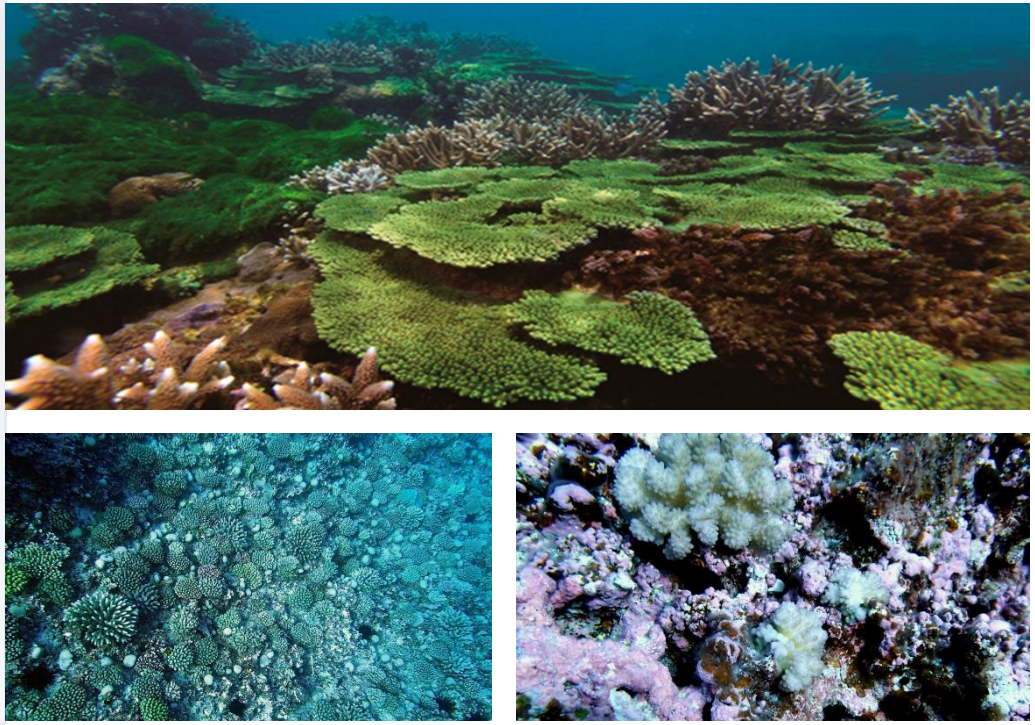




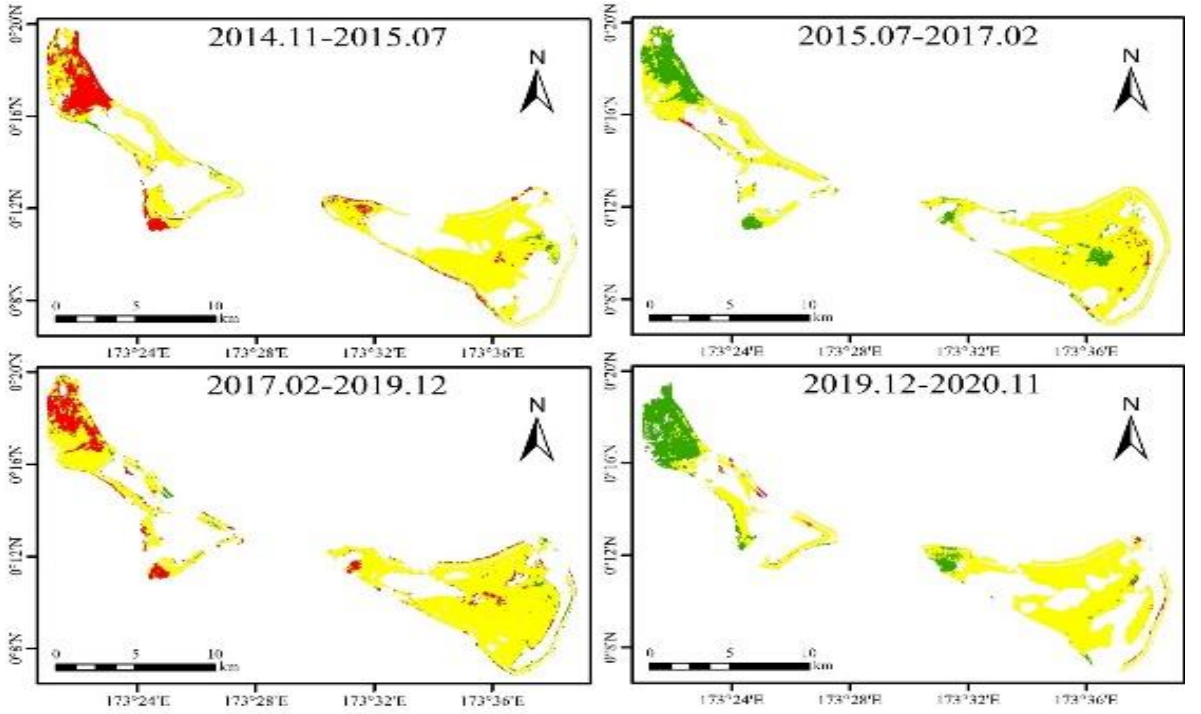


Monitoring of Benthic Habitat Mapping

- Identify the spatial-temporal pattern of coral reef bleaching and its recovery using the time series of remote sensing images.



Coral reefs

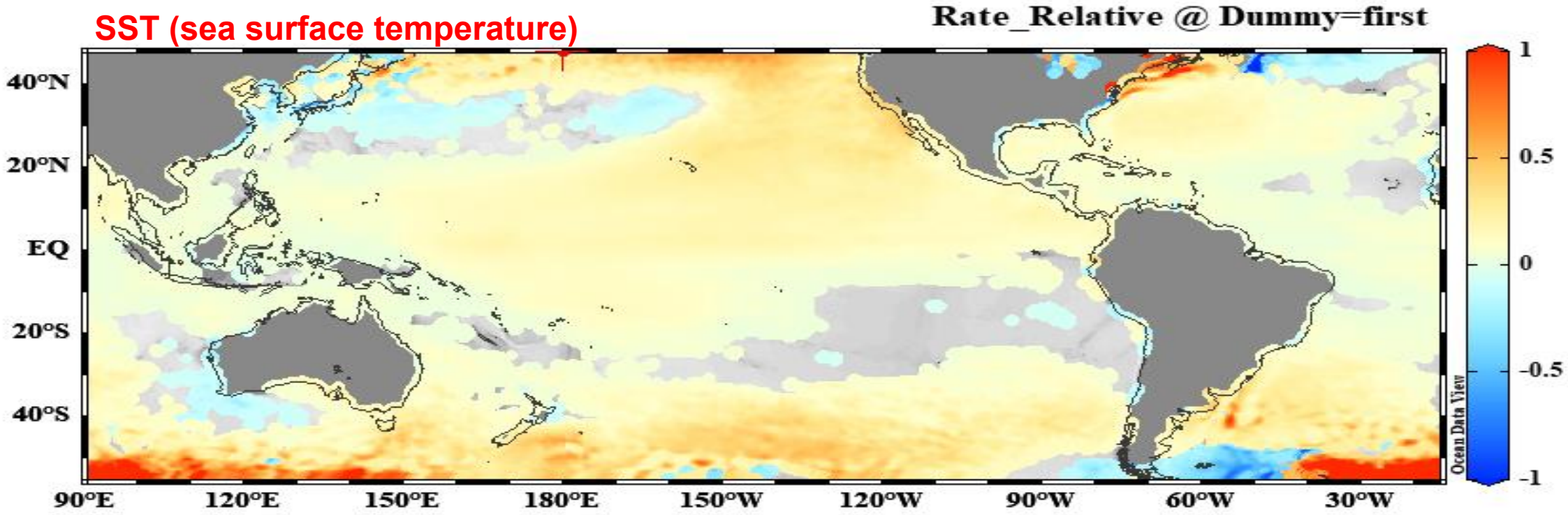


Kuria- Aranuka Atoll in **Kiribati**

Monitoring of marine environment （1998-）

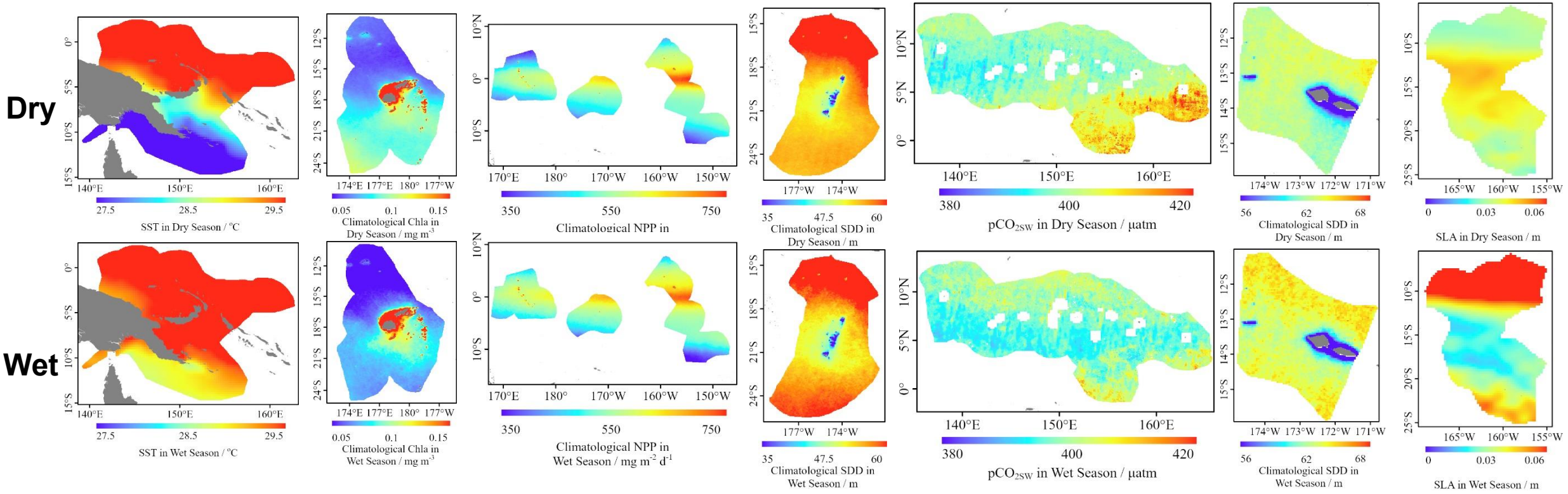
- We produced long-term monitoring datasets of marine environment, including SST (1998-2023), Chla (1998-2023), NPP (1998-2023), SLA (1993-2023), SSS (2010-2023), SDD (1998-2023), pCO2 (1998-2023).

SST (sea surface temperature)



Monitoring of marine environment （1998-）

- We also found the characteristics of marine ecological environment elements between dry and wet seasons for different PICs.



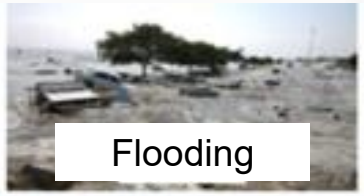
2.2 Disaster Monitoring

- Provides emergency monitoring reports for disasters using Chinese satellites.
- Supports **disaster fast response** and **post-disaster recovery** initiatives.

Disasters


Landslide

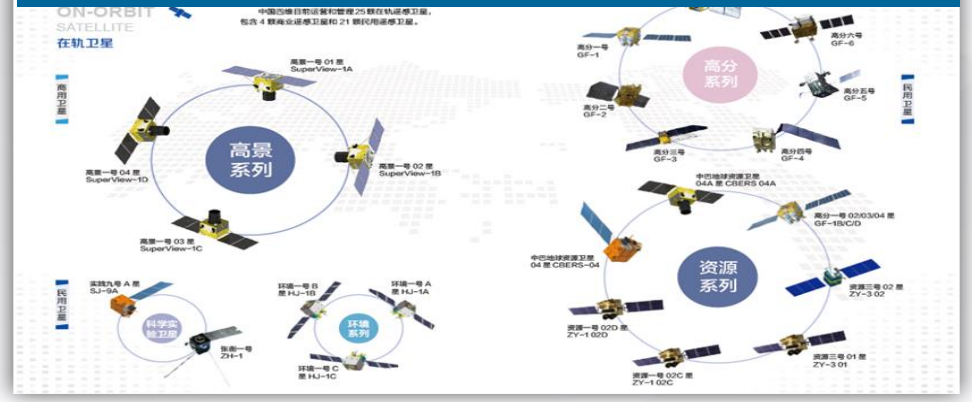

Earthquake


Flooding


Oil spilling

volcanic eruption

Chinese Satellite data



Monitoring service

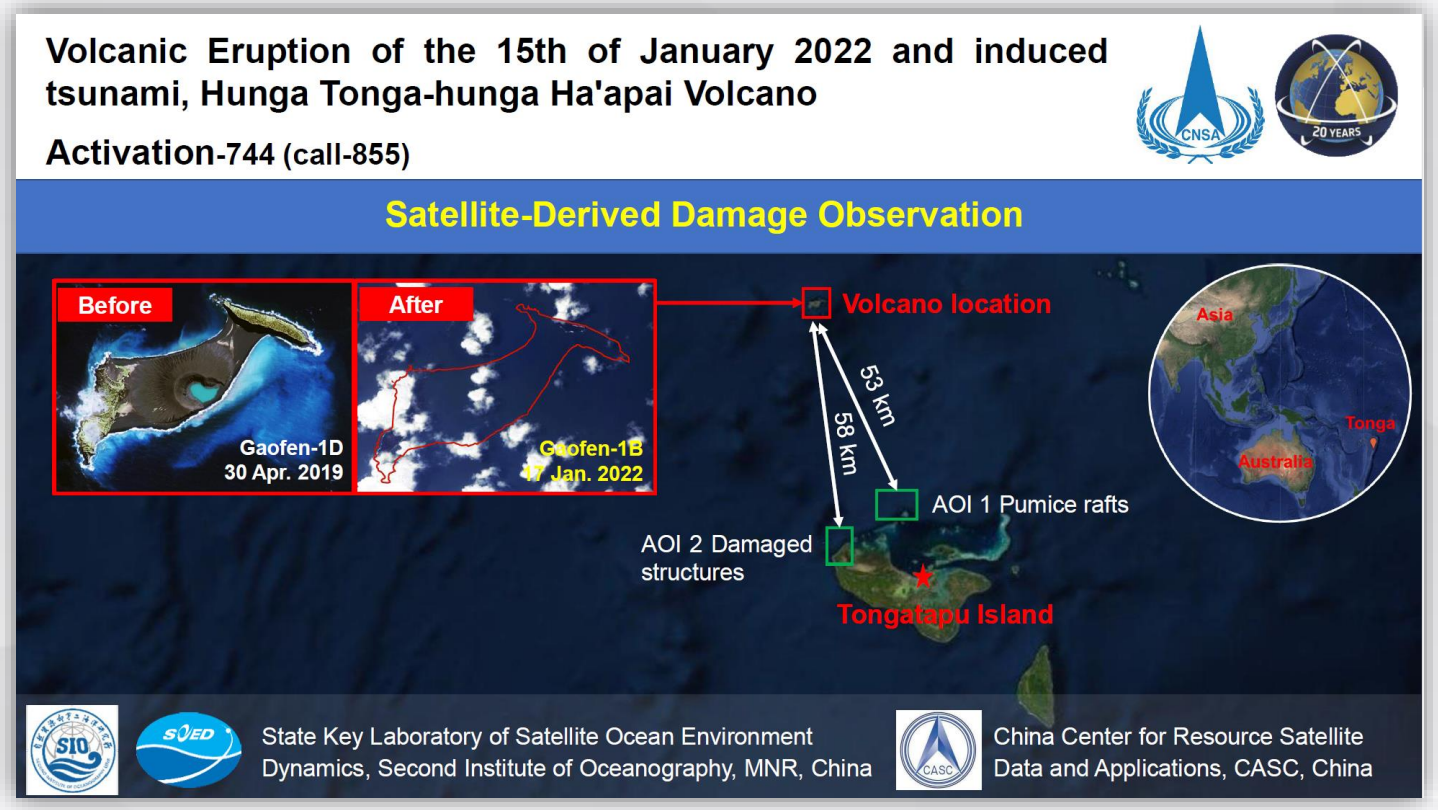
2.2 Disaster Monitoring

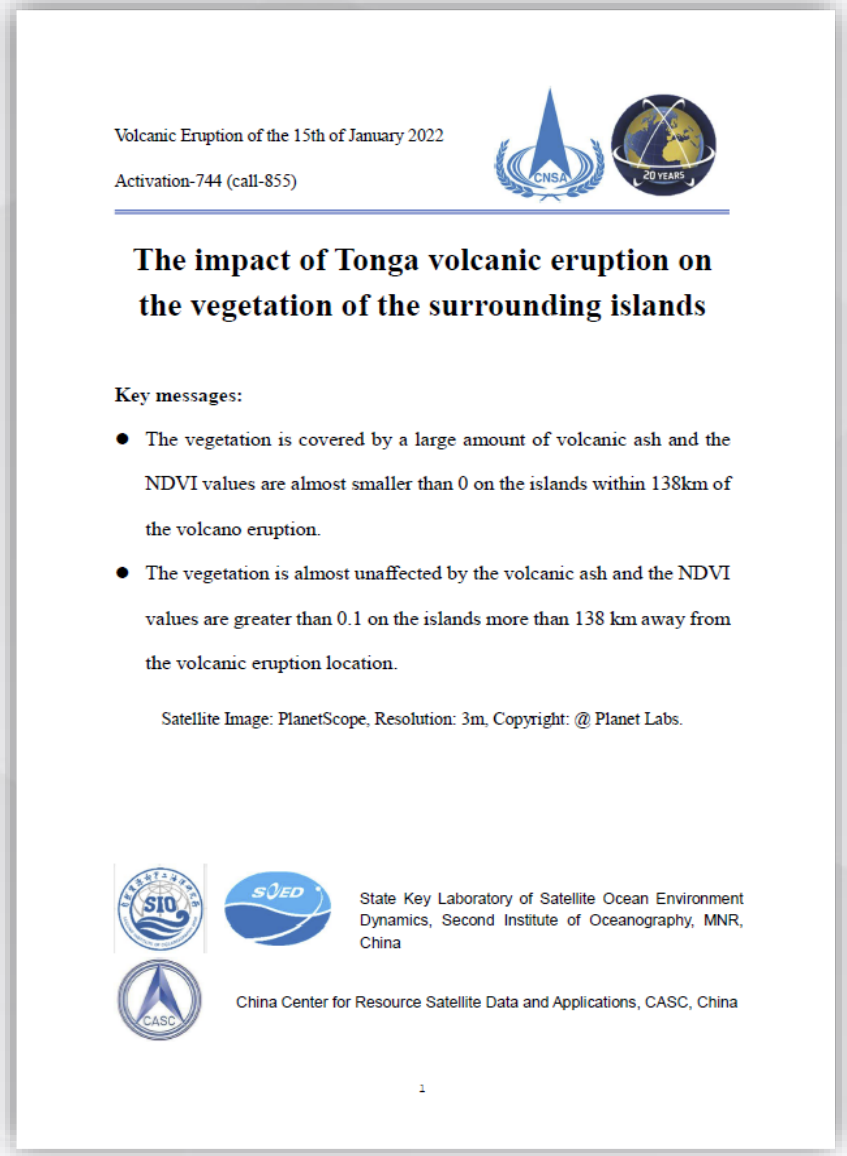
☐ Since 2022, a total of 14 events and 15 reports, using China's satellite images.

NO.	Disaster	Disaster area	Occurred time	Response time	Satellite images	report
1	Volcanic eruption	Tonga	2022.Jan.15	2022.Jan.15	84	Yes
2	typhoon	Vanuatu	2022.May 19	2022.May 19	23	Yes
3	earthquake	Papua New Guinea	2022.Sep.11	2022.Sep.11	20	Yes
4		Solomon Islands	2022.Nov.22	2022.Nov.22	4	No
5		Vanuatu	2023.Jan.8	2023.Jan.9	5	No
6	typhoon	Solomon Islands / Vanuatu	2023.Feb.27	2023.Feb.27	23	Yes
7		Vanuatu	2023.Mar.2	2023.Mar.2	13	Yes
8	earthquake	New Caledonia	2023.May 19	2023.May 19	34	No
9	typhoon	Northern Mariana Islands	2023.May 23	2023.May 23	121	No
10		Vanuatu	2023.Oct.23	2023. Oct.23	46	No
11		Fiji	2023.Nov.13	2023.Nov.13	24	Yes
12	earthquake	Papua New Guinea	2024.Mar.24	2024.Mar.24	72	Yes
13	landslide	Papua New Guinea	2024.May.24	2024.May.26	29	Yes
14	sunken ship	Samoa	2024.Oct.5	2024.Oct.6	5	Yes

Case 1: Tonga volcanic eruption

- We have generated 3 post-event assessment reports using high-resolution satellites including Gaofen, HJ, and Jilin for the Tonga volcanic eruption, Jan15,2022




Volcanic Eruption of the 15th of January 2022

Activation-744 (call-855)

The impact of Tonga volcanic eruption on the vegetation of the surrounding islands

Key messages:

- The vegetation is covered by a large amount of volcanic ash and the NDVI values are almost smaller than 0 on the islands within 138km of the volcano eruption.
- The vegetation is almost unaffected by the volcanic ash and the NDVI values are greater than 0.1 on the islands more than 138 km away from the volcanic eruption location.

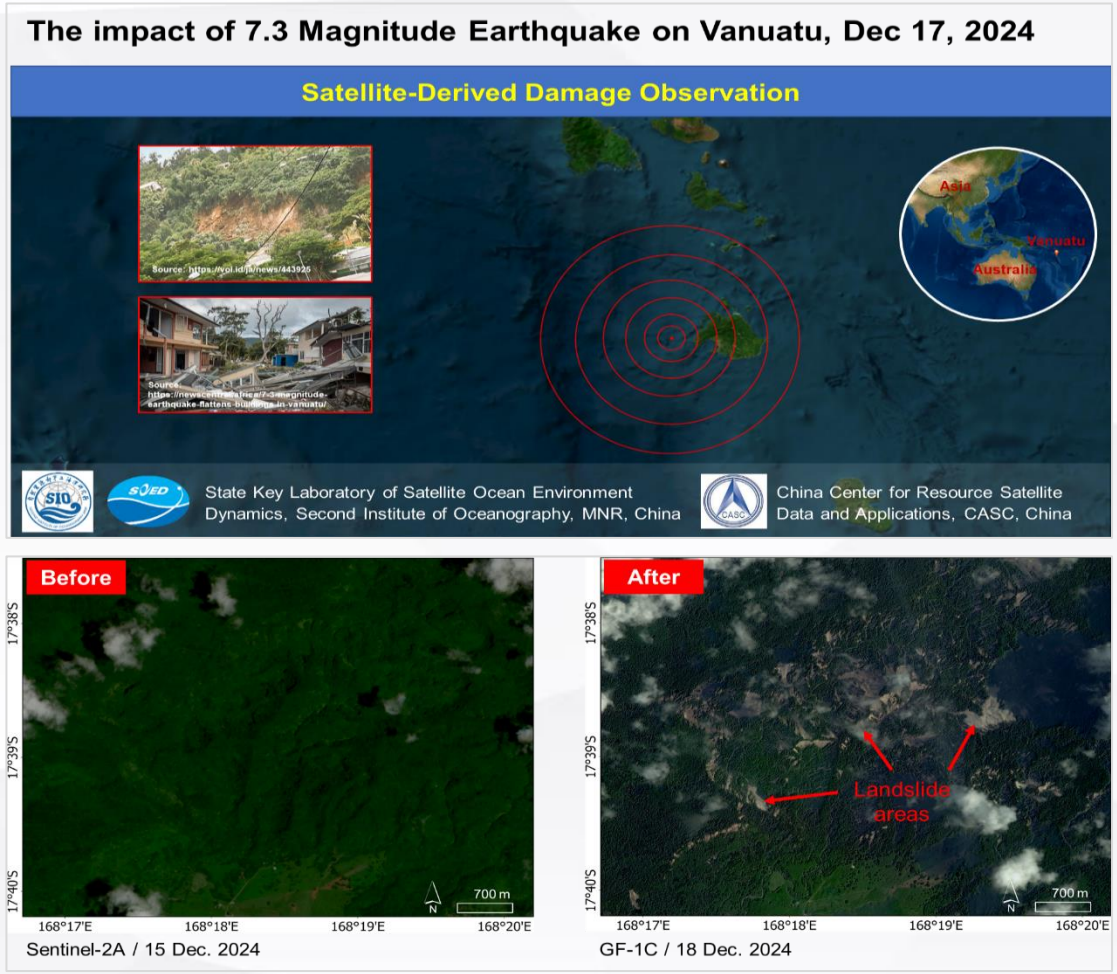
Satellite Image: PlanetScope, Resolution: 3m, Copyright: @ Planet Labs.

State Key Laboratory of Satellite Ocean Environment Dynamics, Second Institute of Oceanography, MNR, China

China Center for Resource Satellite Data and Applications, CASC, China

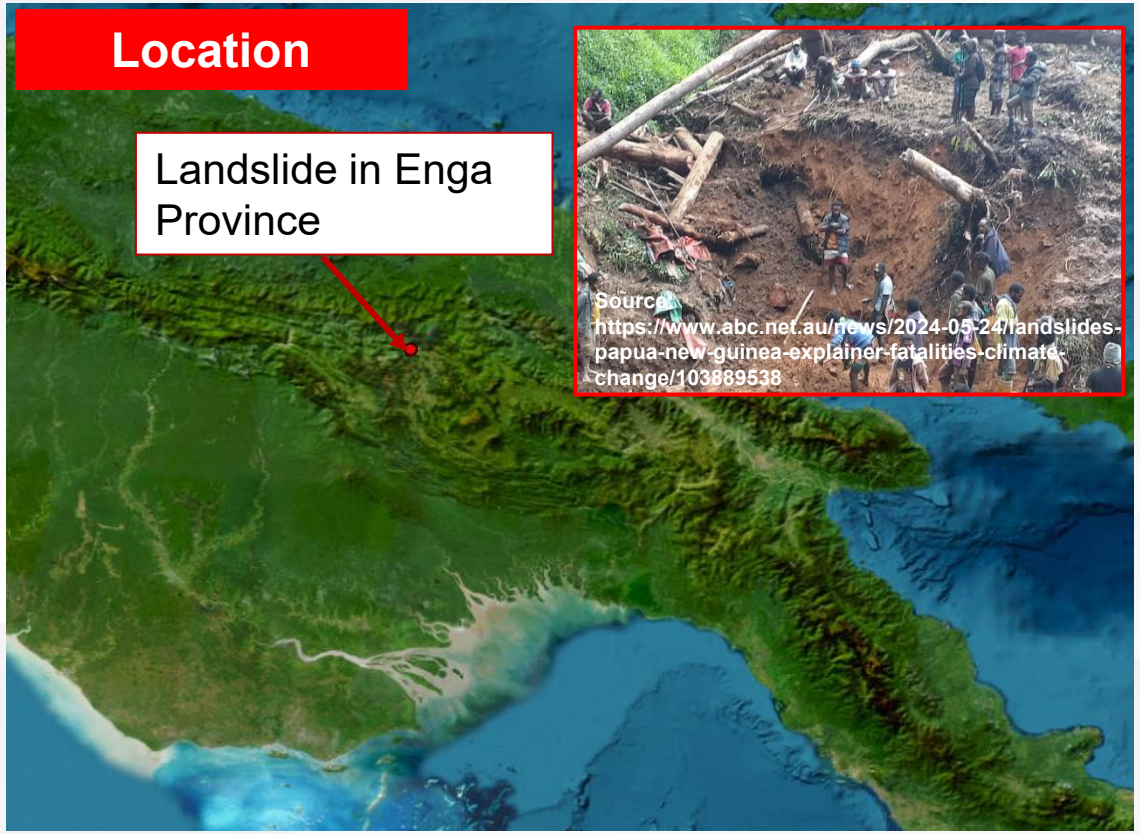
Case 2 : Vanuatu earthquake

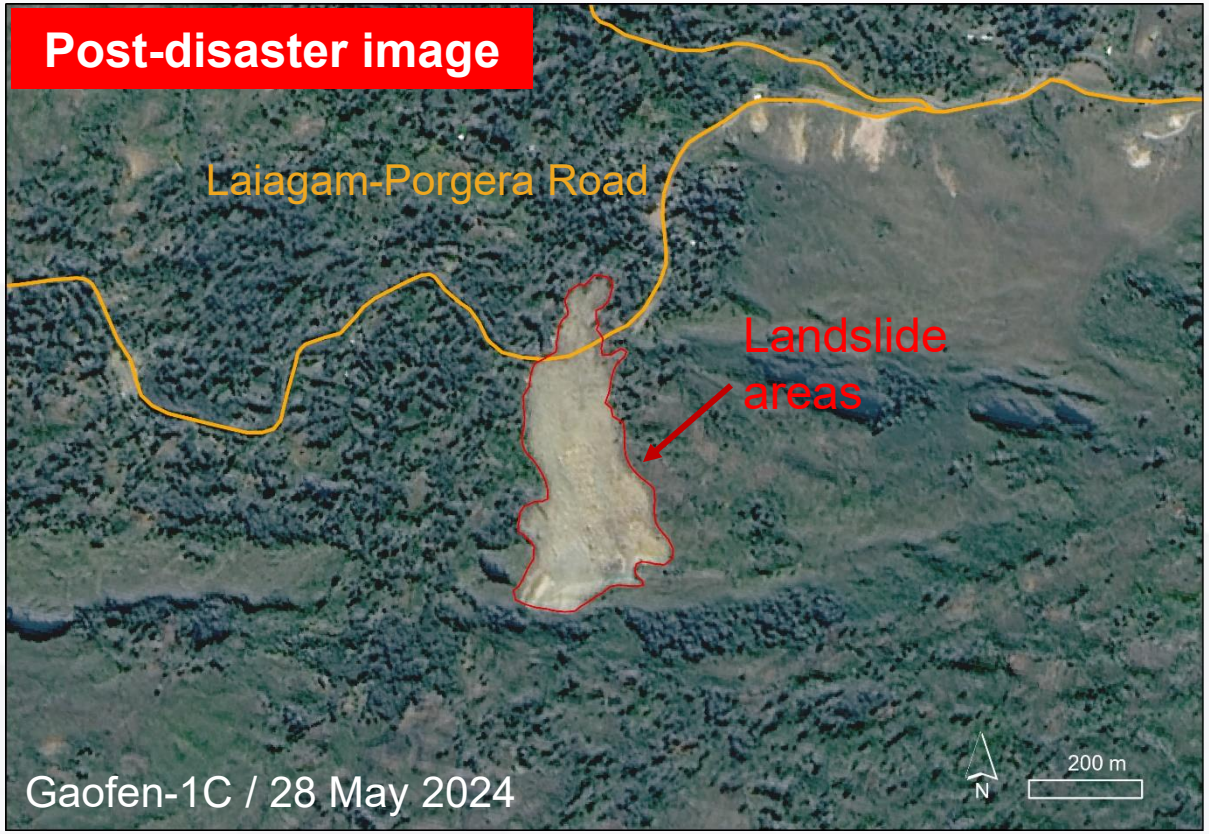
- Vanuatu earthquake, monitoring detected large-scale landslides and identified 16 cases of building damage, Dec.17, 2024.



Case 3 : Landslide in Papua New Guinea

- A event of Landslide in Enga Province, Papua New Guinea, May 24, 2024
- The maximum length of the landslide area is about 600m and the area coverage is about 9.05 hm^2.
- We have sent the monitoring reports to Disaster Charter and user agency, and received positive feedbacks that they are useful for the post-disaster recovery.





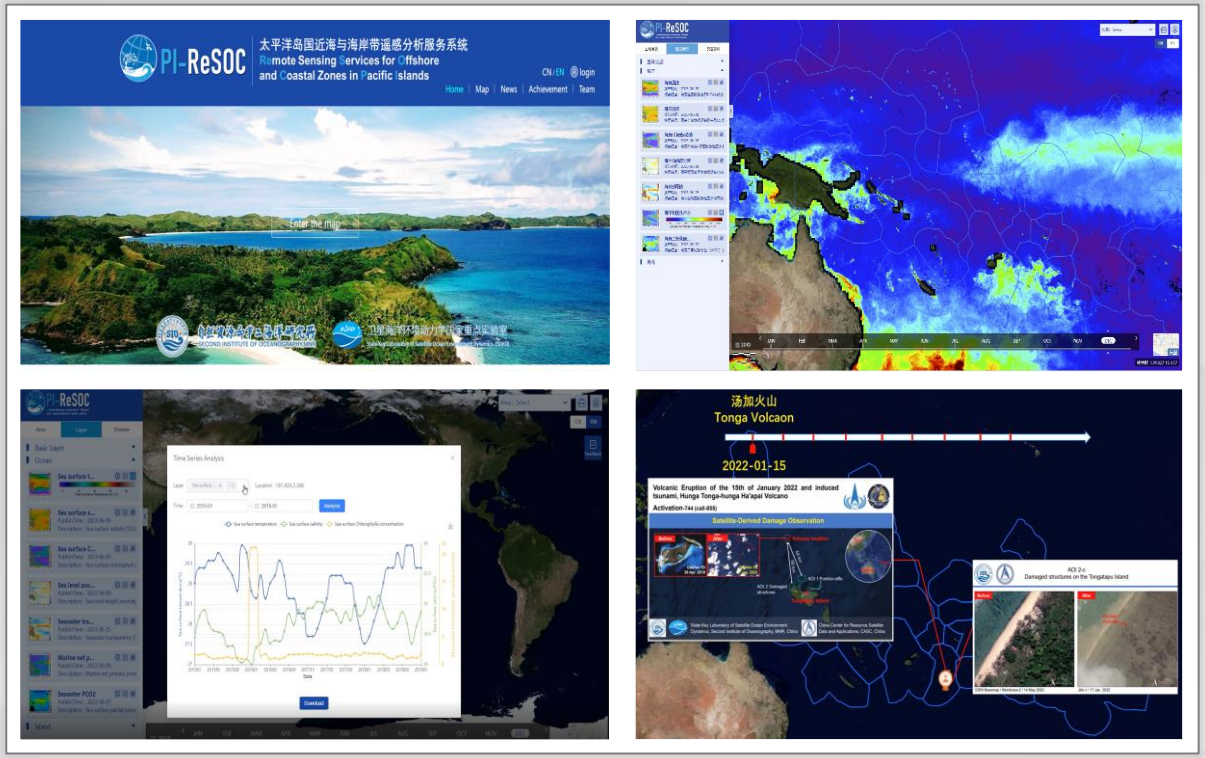
2.3 Launched an online system called PI-ReSOC

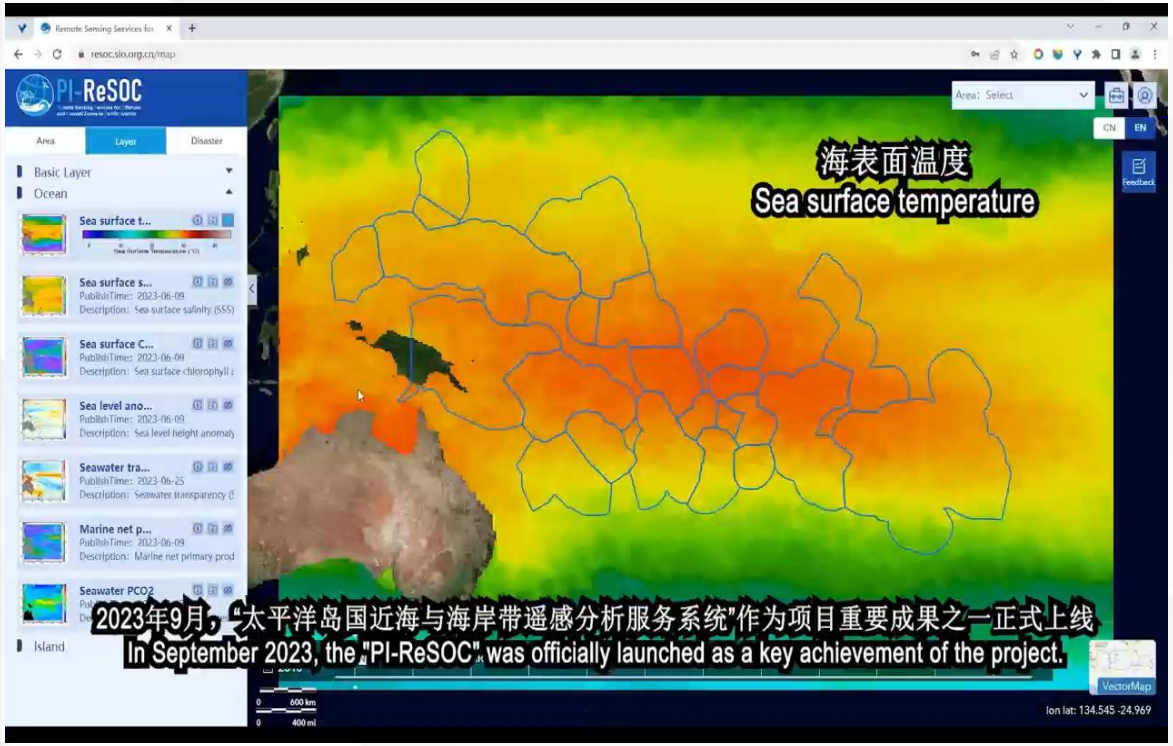
PI-ReSOC

太平洋岛国近海与海岸带遥感分析服务系统

Remote Sensing Services for Offshores and Coastal Zones in Pacific Islands

Launched online in 2023

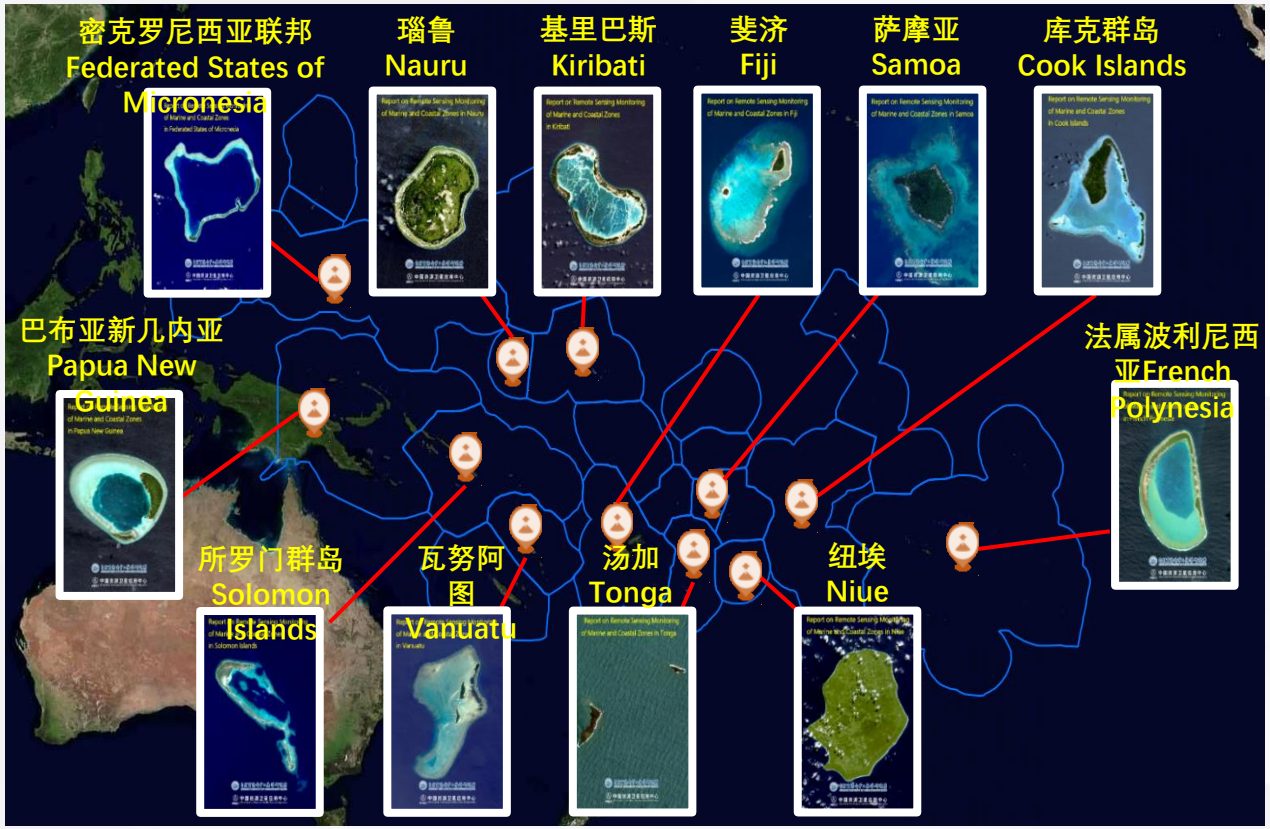


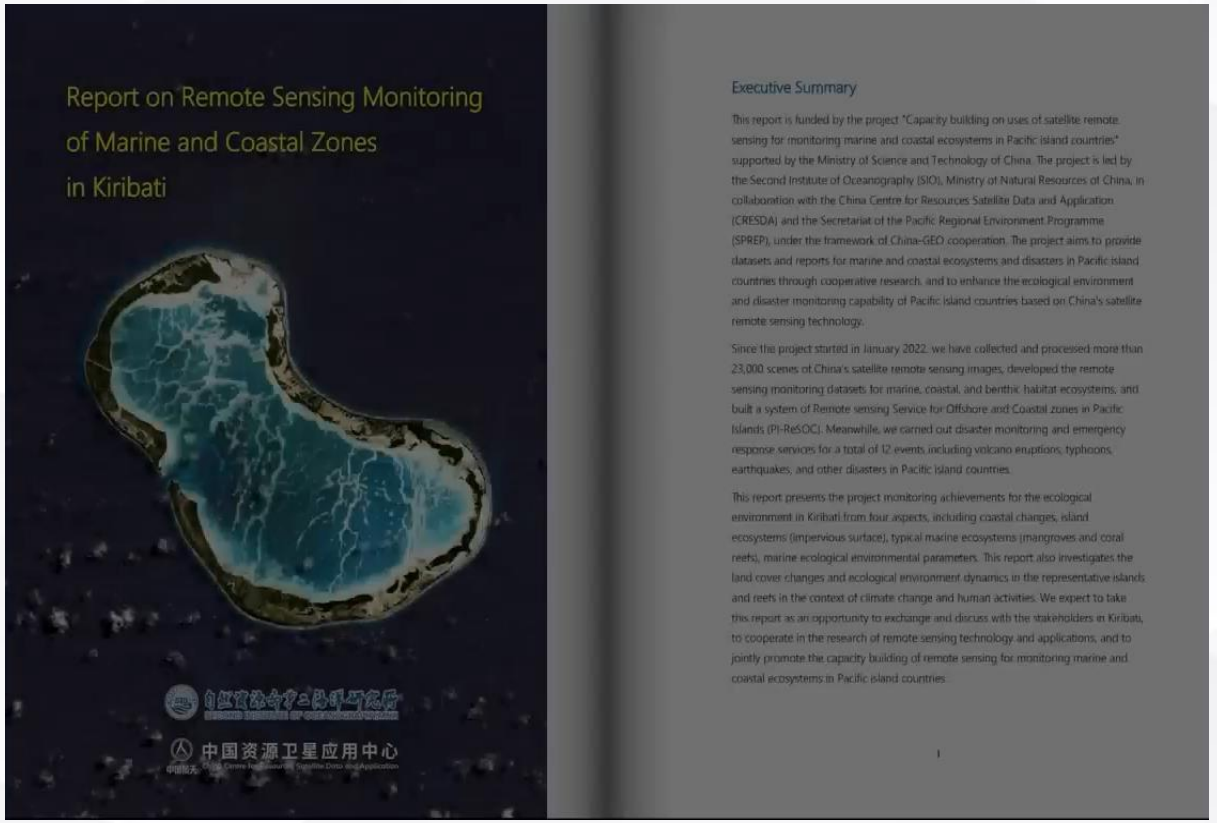


https://resoc.sio.org.cn

2.4 National remote sensing monitoring reports

- We developed national remote sensing monitoring reports for the 12 states, which include the analyses on islands, coasts, oceans and disasters.

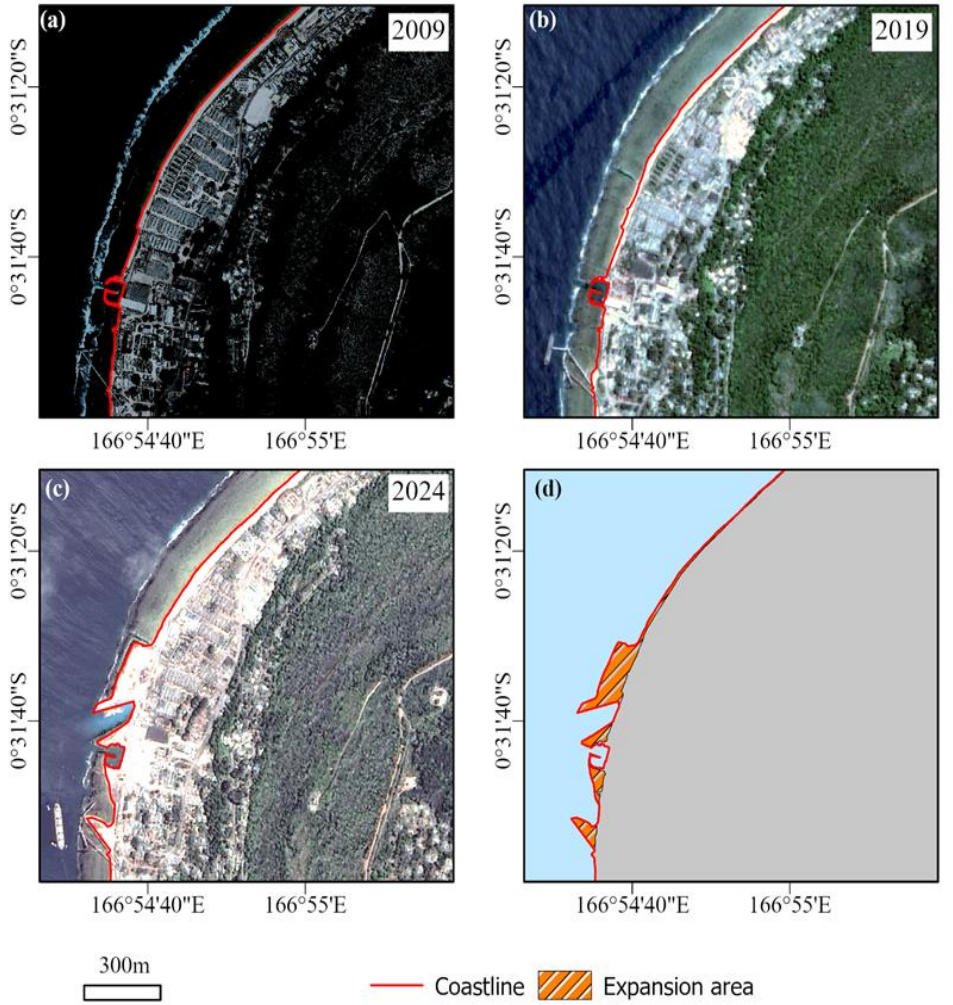




2.4 National remote sensing monitoring reports

- All reports were submitted to the representatives of each country.

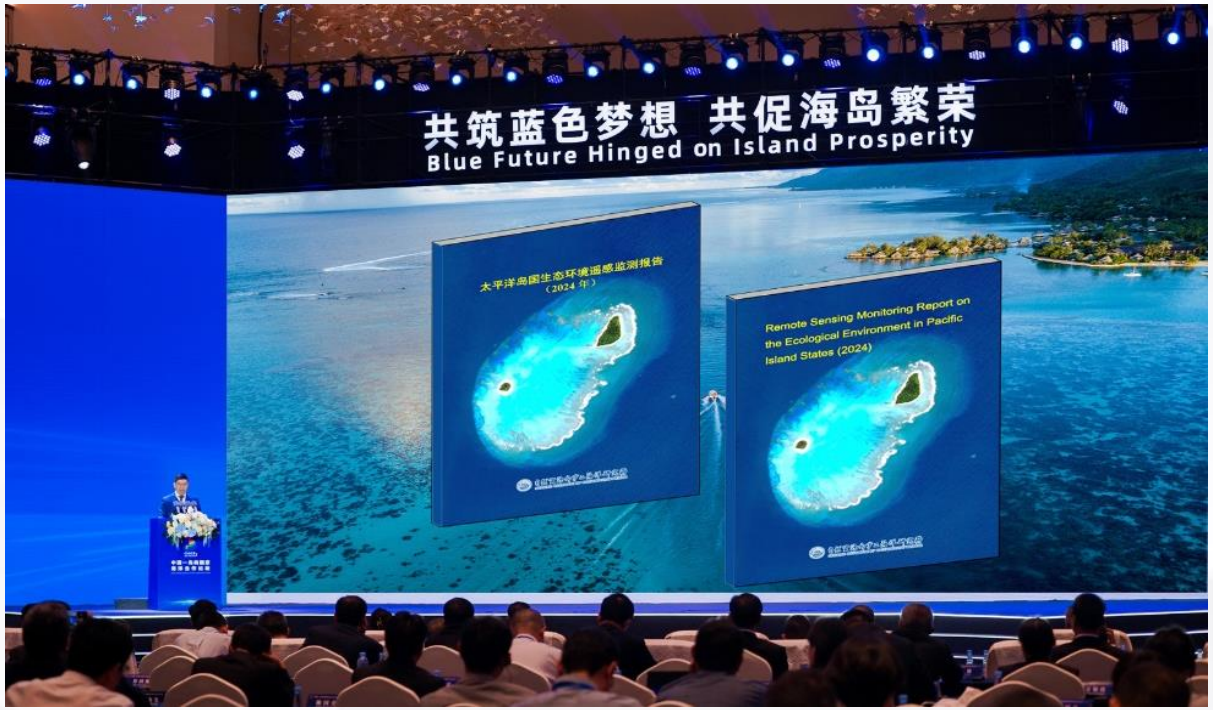
Ambassador Lv Jin Presents the Nauru Satellite Remote Sensing Monitoring National Report to President of Nauru, May 14th, 2025



2.5 Remote Sensing Monitoring Report （2024）

- We releases Remote Sensing Monitoring Report on the Ecological Environment in Pacific Island States (2024) at “the China-Island Countries Ocean Cooperation Forum” attracted approximately 180 participants, including foreign guests from 18 island countries.

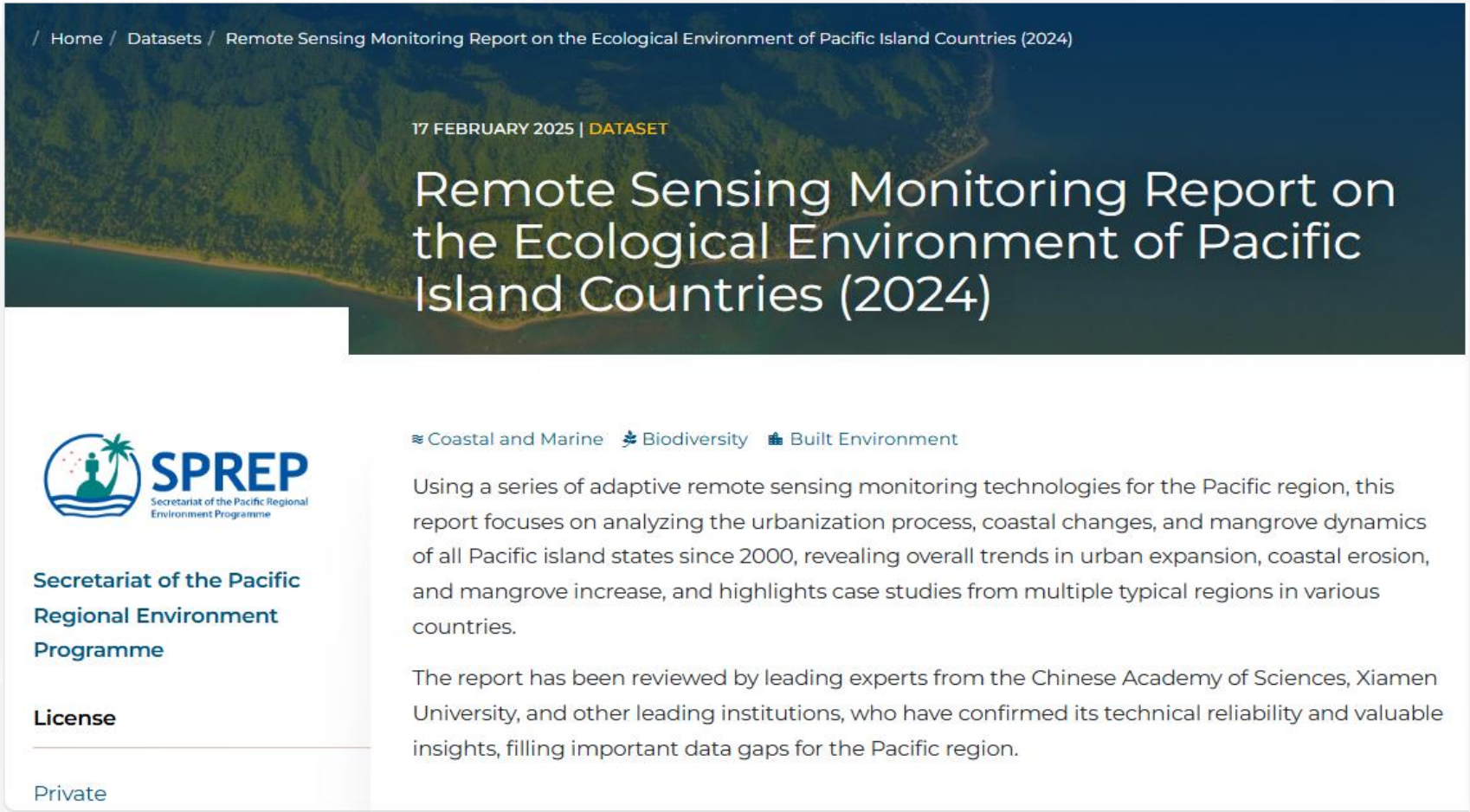
“China-Island Countries Ocean Cooperation Forum”
Pingtan, Fujian Province, Nov.5th， 2024

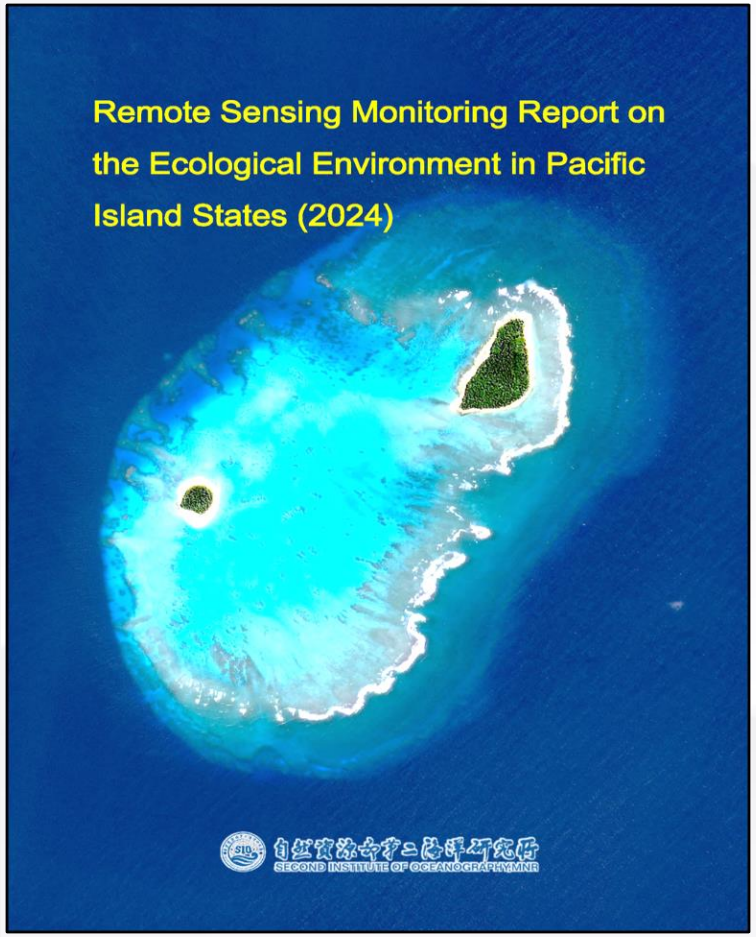


Deputy Director General Chen Jianfang

2.5 Remote Sensing Monitoring Report (2024)

- The report has been highly appraised by SPREP and has been officially released on the SPREP official website.

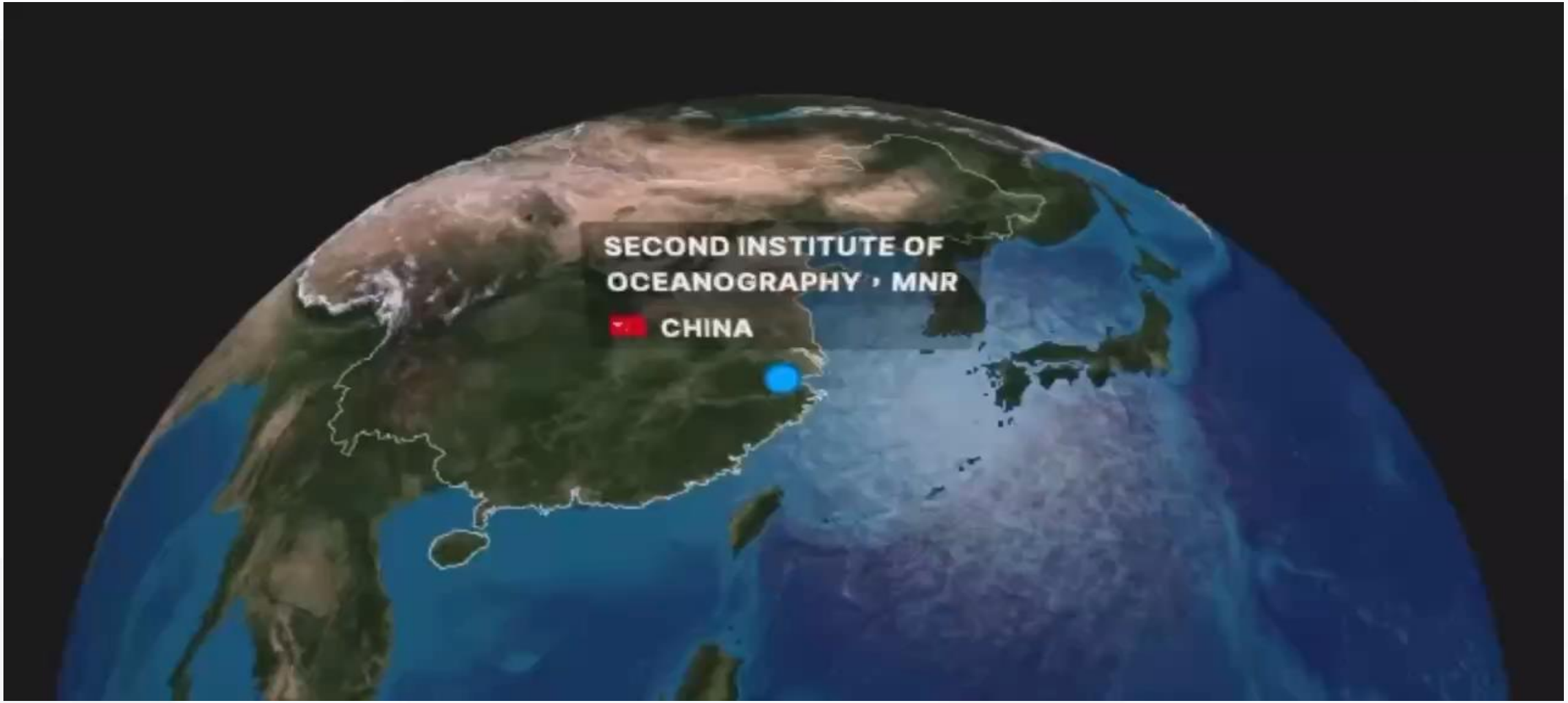




CONTENTS

3.1 Communications

- Since 2023, our team has visited four Pacific island countries, namely Fiji, Samoa, Tonga and Vanuatu.



3.1 Communication

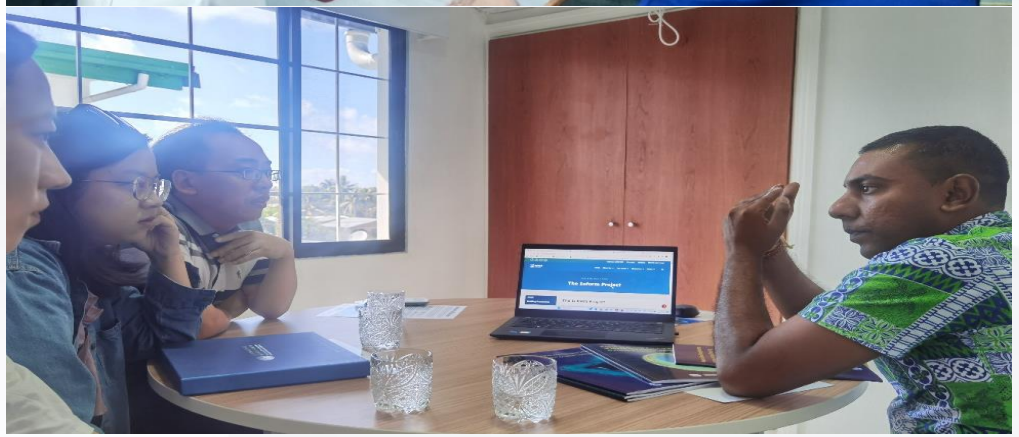
- We visited SPREP headquarters (Samoa), took part in the workshop on climate and marine ecological protection.

SPREP headquarters

Attending the 30th anniversary event of SPREP

3.1 Communication

- We visited SPREP headquarters (Samoa), took part in the workshop on climate change and marine ecological protection.



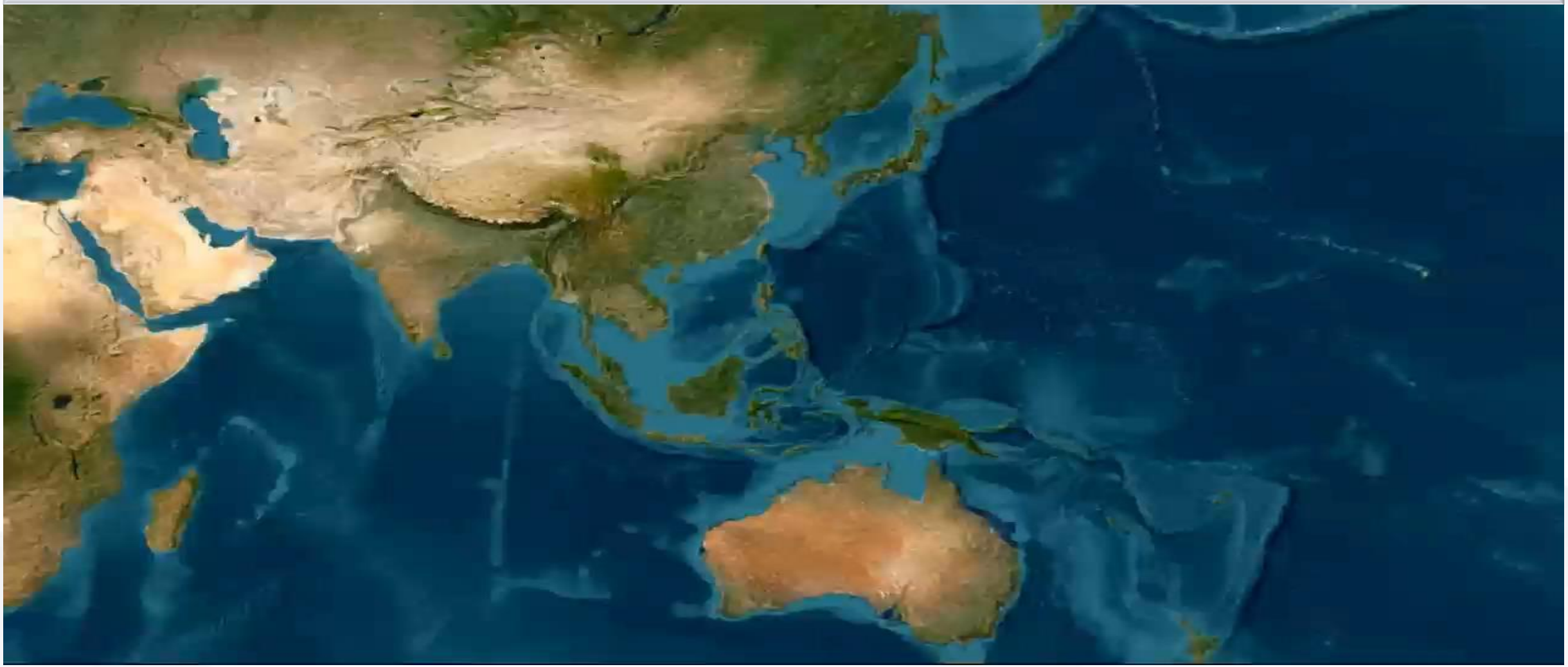
3.2 Training Courses for SIDS

- We presented the achievement through 9 international training and seminars, more than 250 trainees from over 20 SIDS, including Fiji, Samoa, Tonga, Cook Islands, Kiribati, Papua New Guinea, Seychelles, Maldives, and Zanzibar, etc.
- Received positive feedbacks and build stronger connections with SIDS.

3.2 Training Courses for SIDS

3.2 Training Courses for SIDS

- **Training- SIDS 2024** was held in Hangzhou, with **26 trainees from 15 small island developing states** in the world, June 1st to 15th, 2024.



3.2 Training Courses for SIDS

- **Training- SIDS 2024** was held in Hangzhou, with **26 trainees from 15 small island developing states** in the world, June 1st to 15th, 2024.

3.2 Training Courses for SIDS

- Training- SIDS 2025 was held in Hangzhou, with 22 trainees from 10 small island developing states in the world, June 15st to 29th, 2025.


Thank you!
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zhanghg@sio.org.cn