SIDS



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

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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



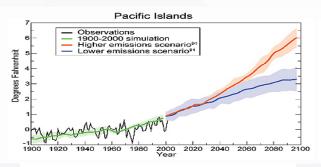




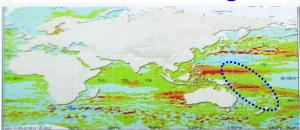
1.2 PICs are vulnerable to climate change

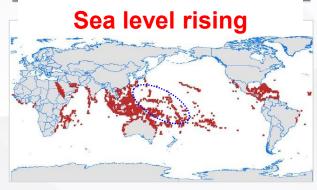


☐ Challenges caused by Large-Scale climate events

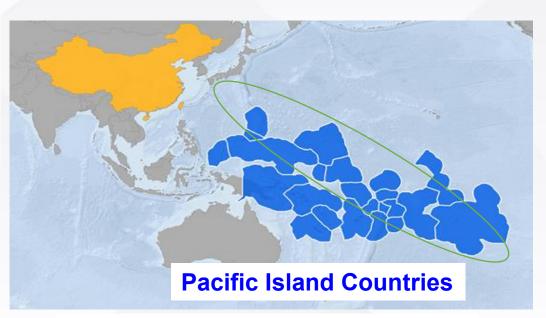


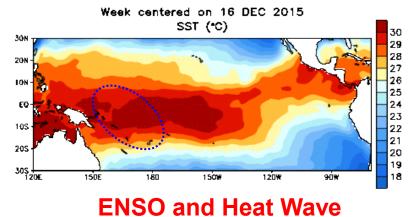
Global warming

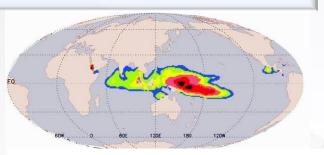




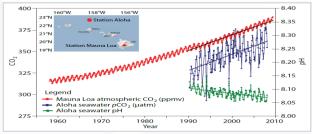
Coral reef Distribution



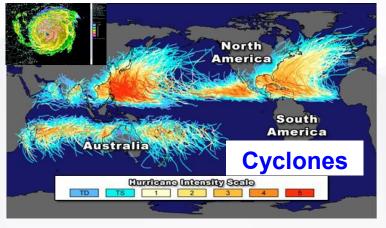




Indo-Pacific warm pool area



Ocean acidification

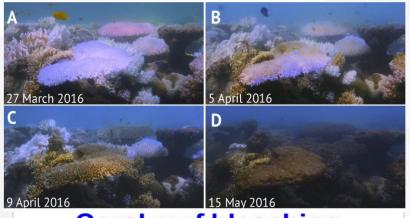




1.3 PICs are vulnerable to multi-stressors forcing



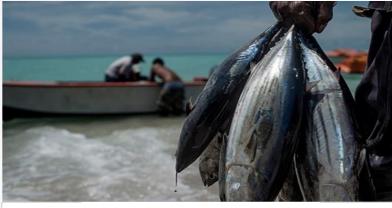
☐ It resulted in a lot of environmental and ecological issues



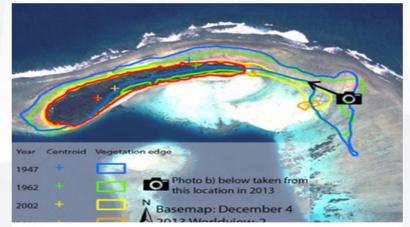
Coral reef bleaching



Deforestation



Over fishing



Coastal erosion



Flooding



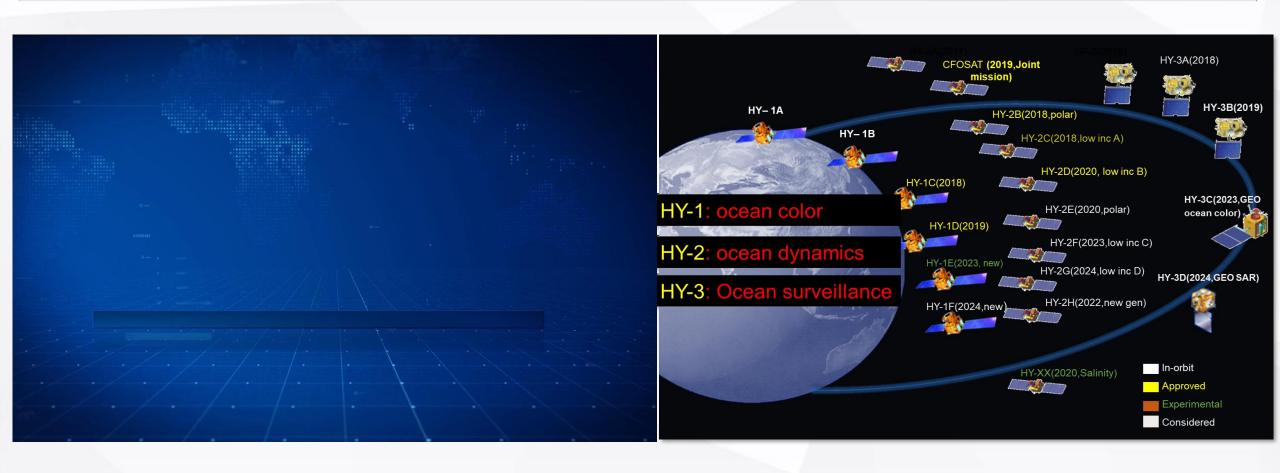
Coastal destruction



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.



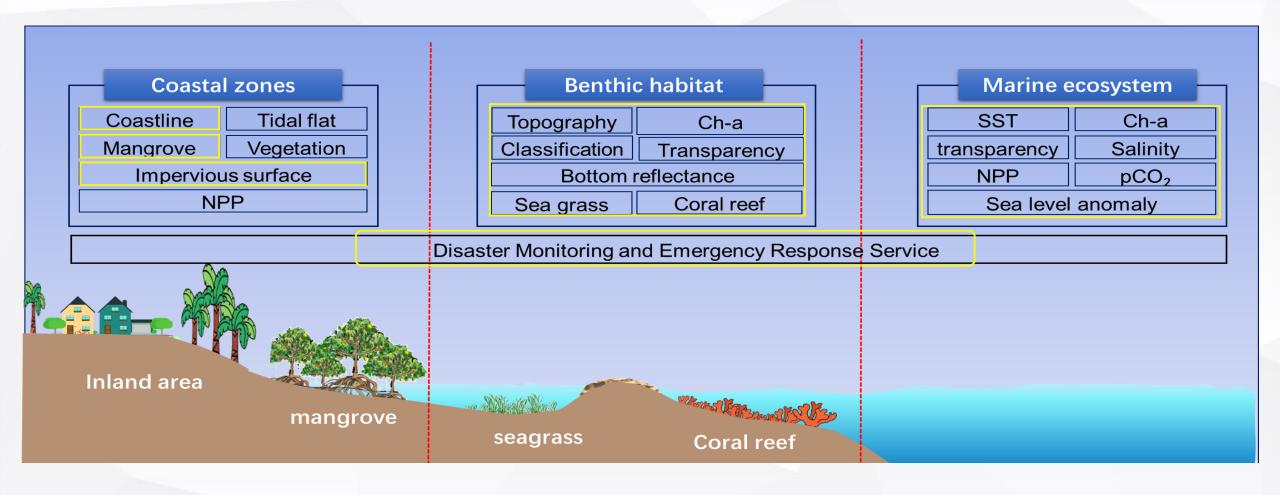




2.1 Monitoring of ecological elements



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



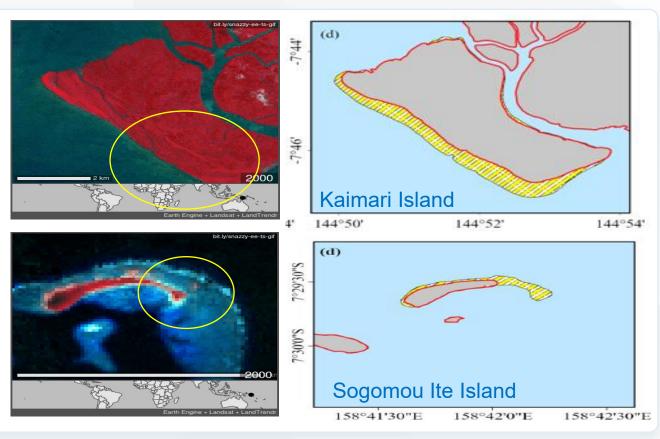


Detection of Coastal Erosion (2000-)



□ 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.



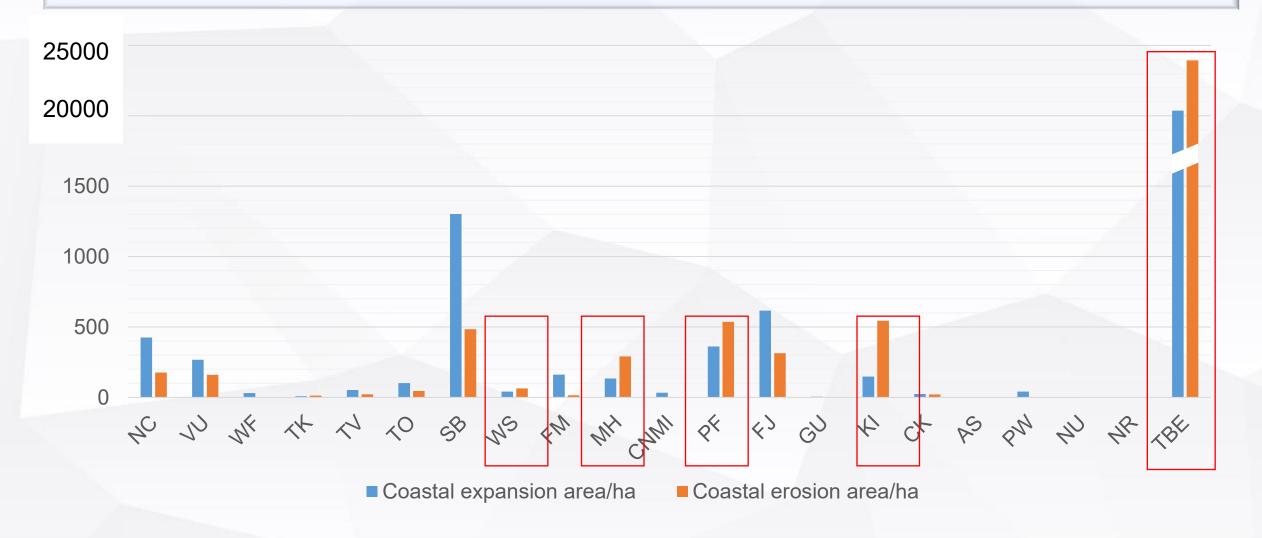




Detection of Coastal Erosion (2000-)



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

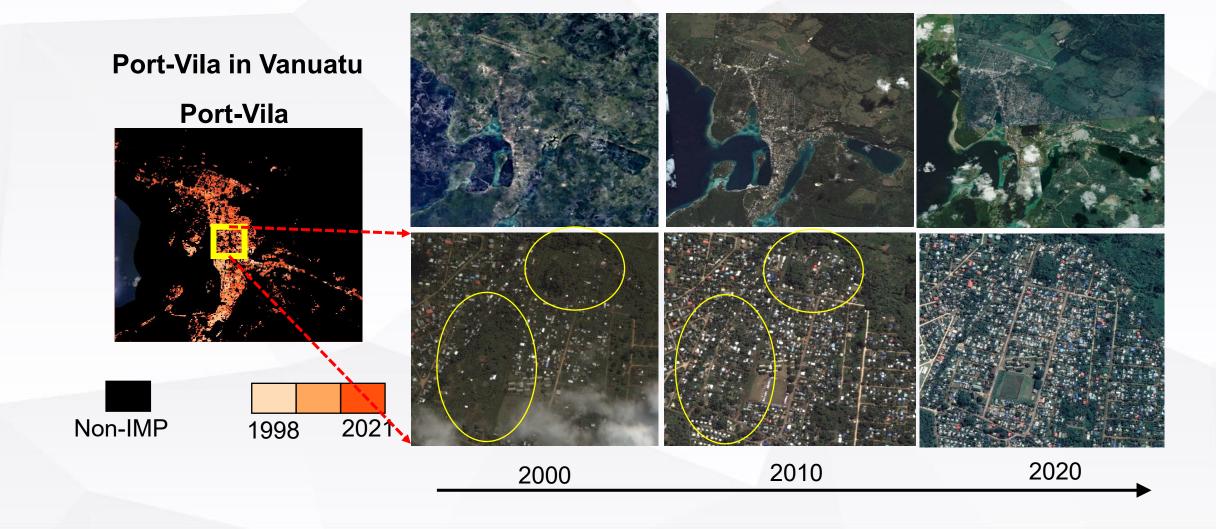




Monitoring of human settlement changes (2000-)



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

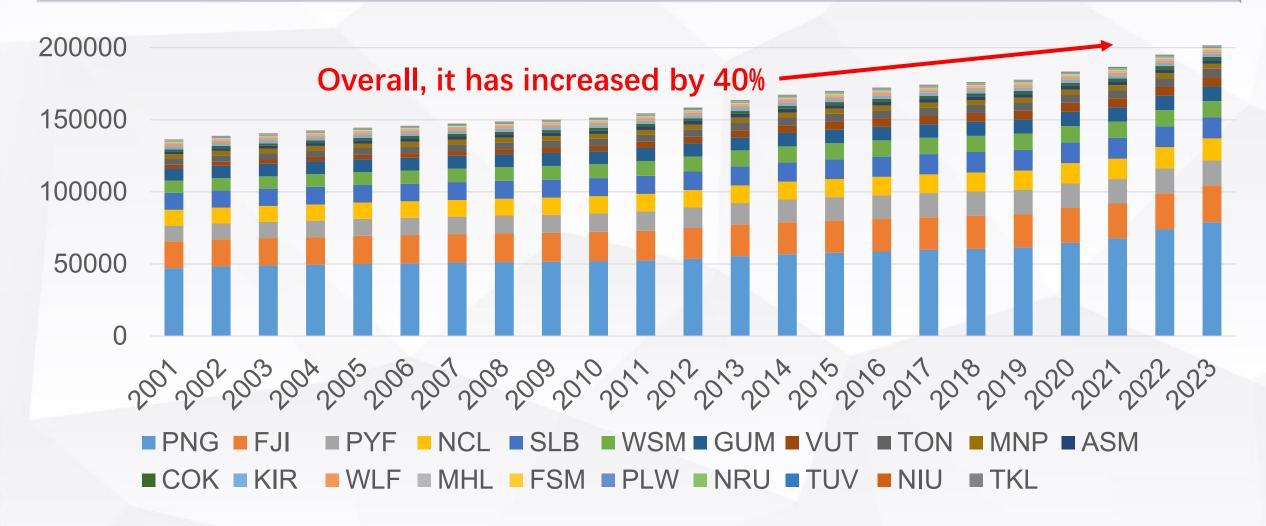




Monitoring of human settlement changes (2000-)



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

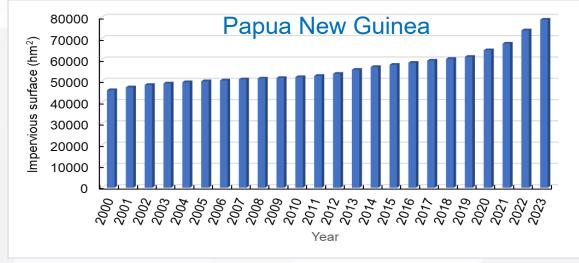


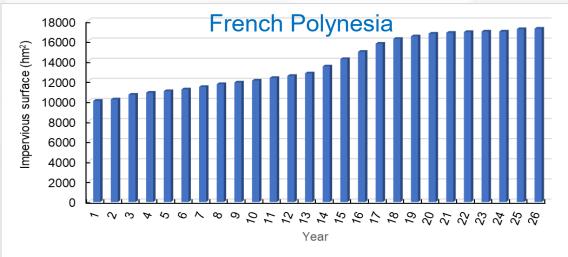


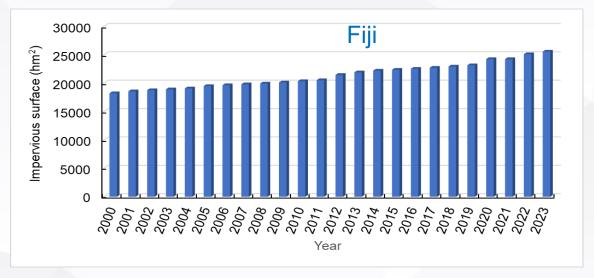
Monitoring of human settlement changes (2000-)

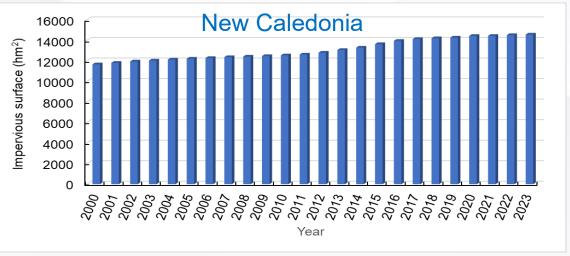


☐ We used the impervious surface as the indicators of human settlement. It revealed the trend of impervious surface in past 20 years.







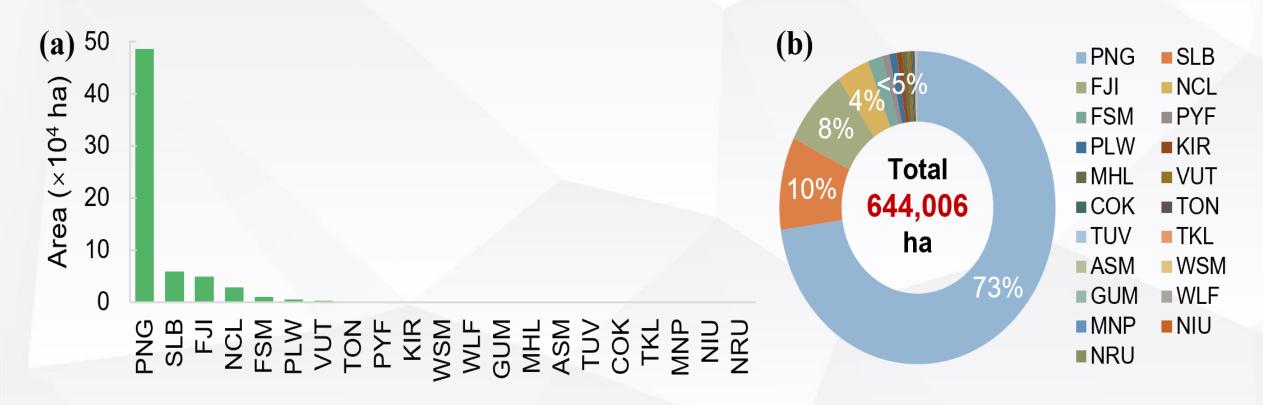




Monitoring of Mangrove dynamics (2000-)



■ 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.

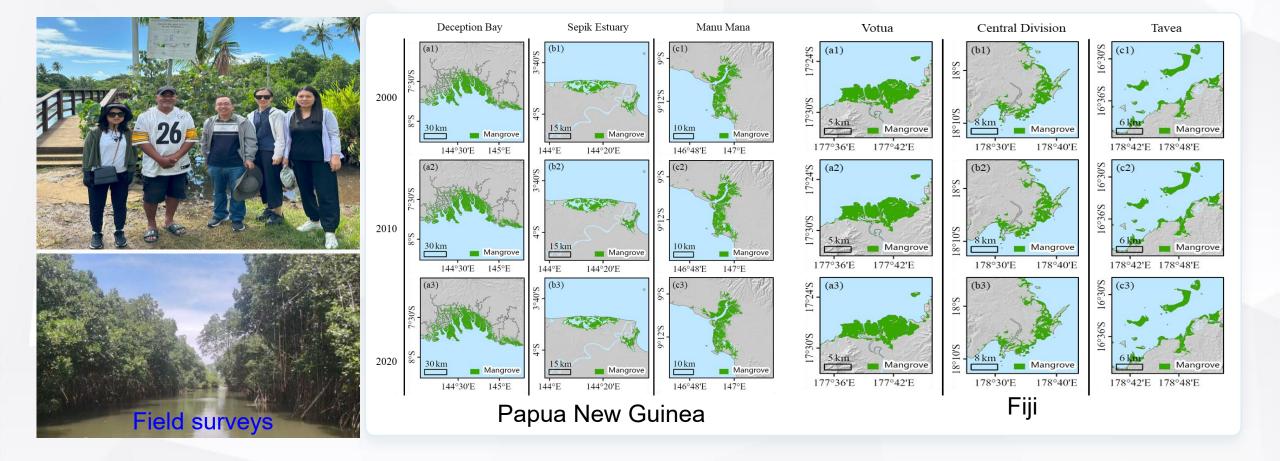




Monitoring of Mangrove dynamics (2000-)



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

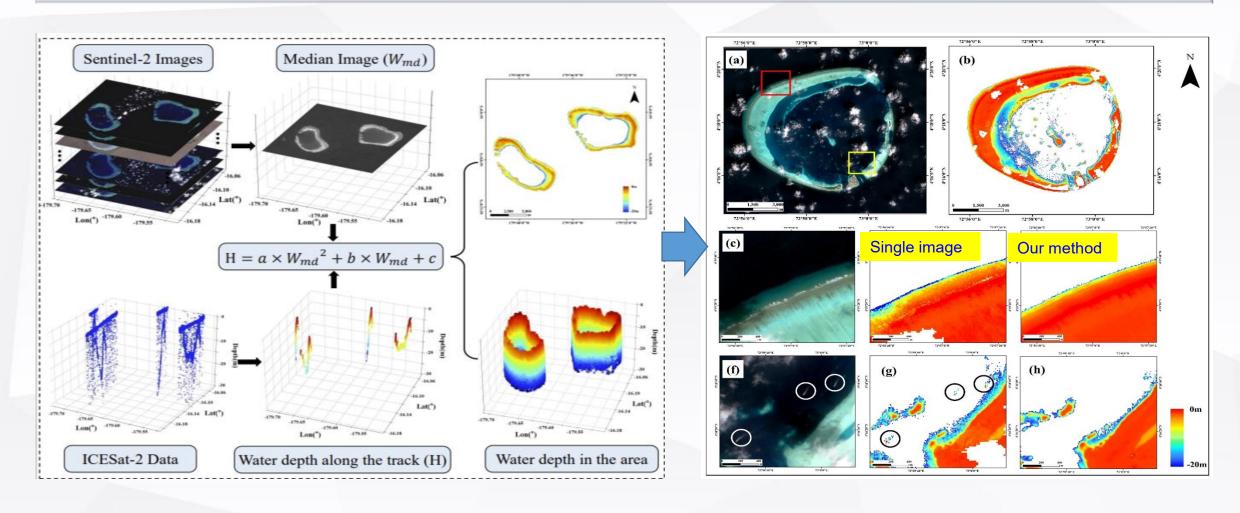




Monitoring of Benthic Habitat Mapping



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

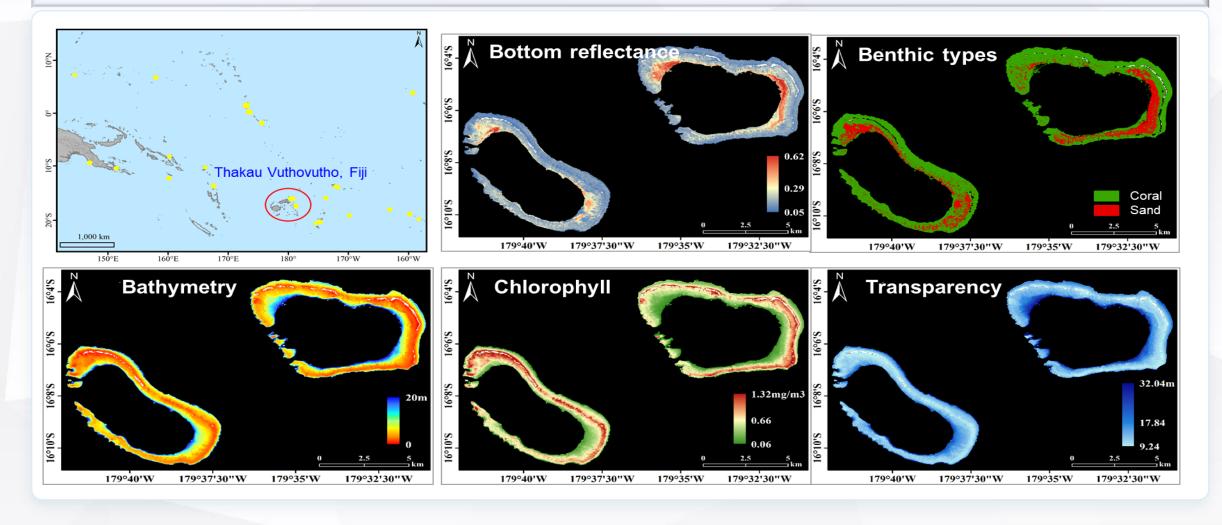




Monitoring of Benthic Habitat Mapping



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





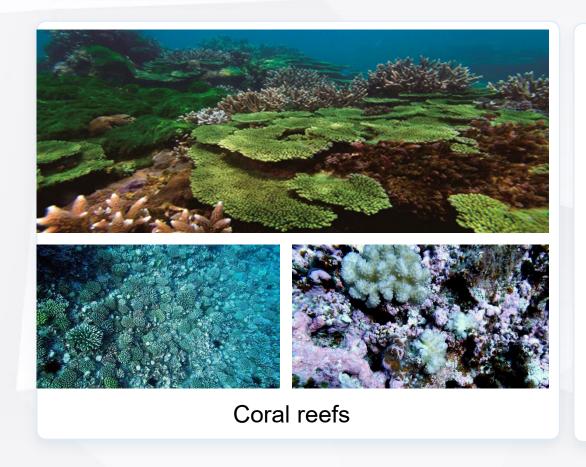
Monitoring of Benthic Habitat Mapping



2015.07-2017.02

2019.12-2020.11

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



173°24'E 173°28'E 173°32'E 173°36'E 173°24'E 173°28'E

Kuria- Aranuka Atoll in **Kiribati**

2014.11-2015.07

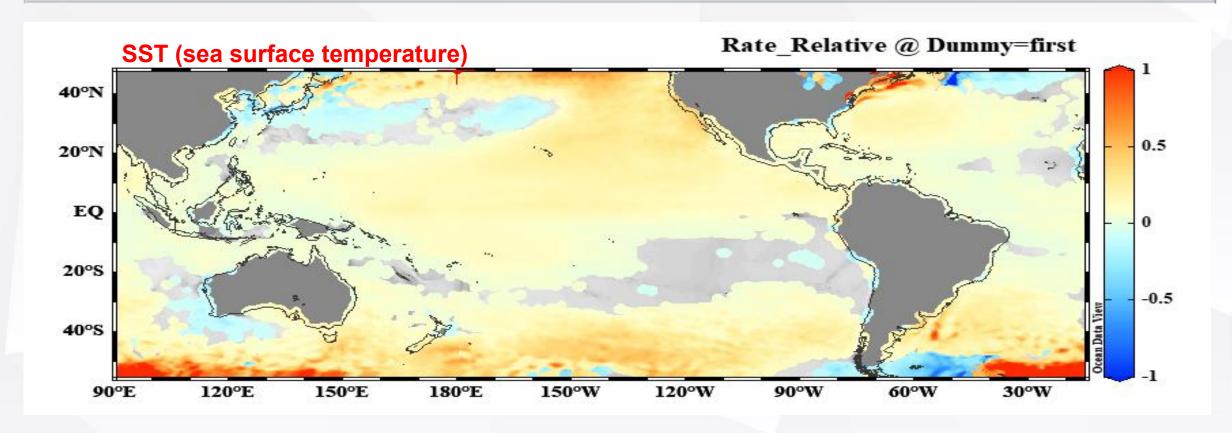
2017.02-2019.12



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).

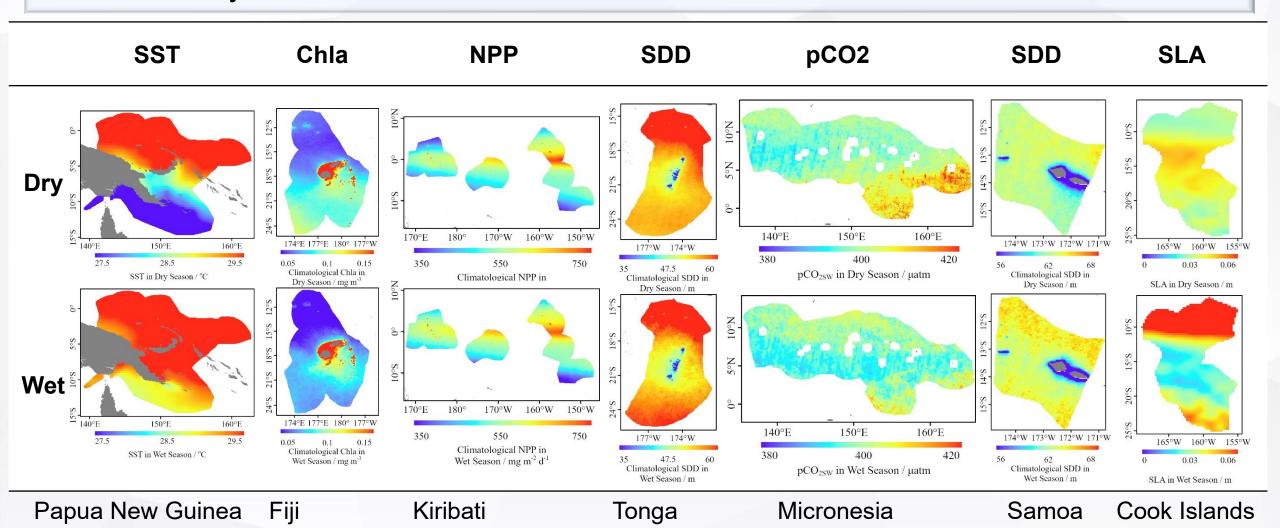




Monitoring of marine environment (1998-)



☐ 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

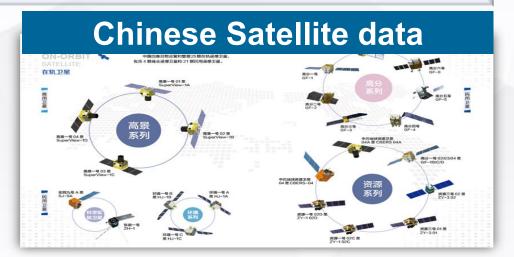














Monitoring service





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

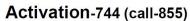


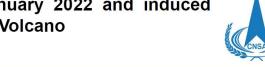
Case 1: Tonga volcanic eruption



■ 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 and induced tsunami, Hunga Tonga-hunga Ha'apai Volcano







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



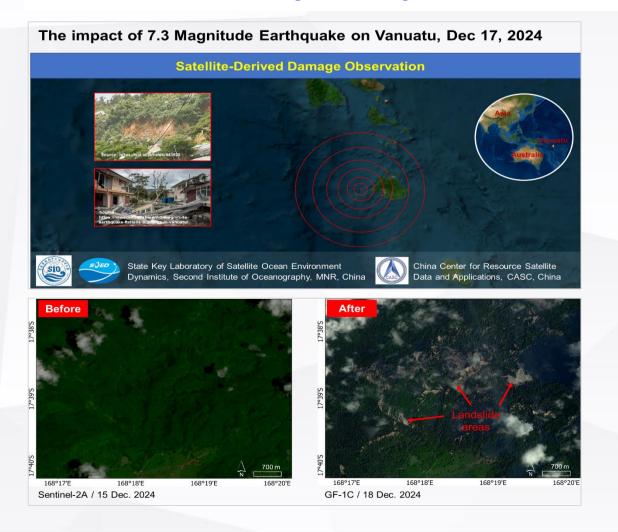
China Center for Resource Satellite Data and Applications, CASC, China

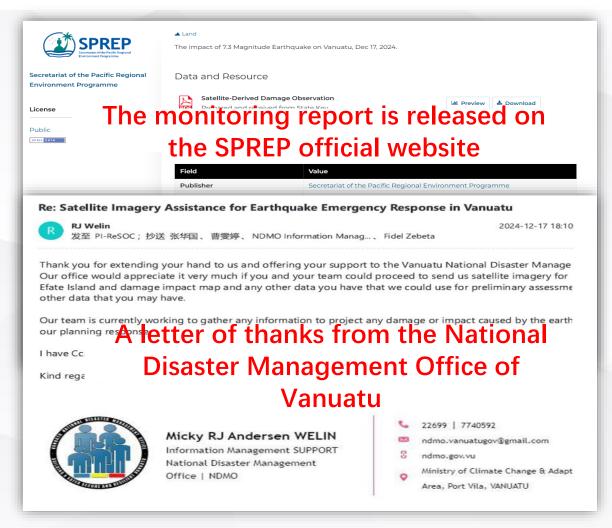
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Case 2: Vanuatu earthquake



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





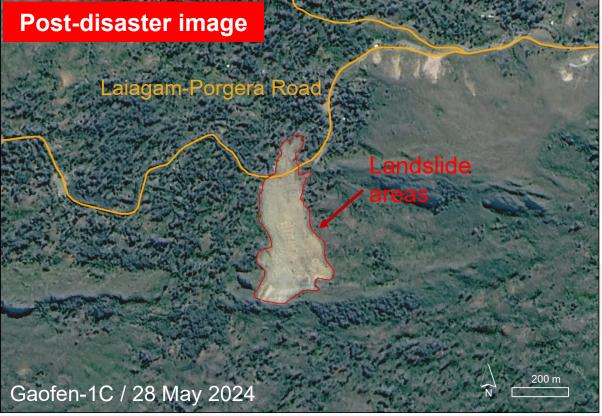


Case 3: Landslide in Papua New Guinea



- ☐ 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 hm².
- 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.





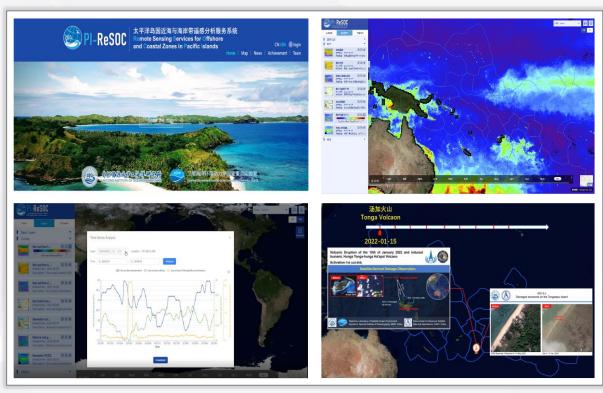


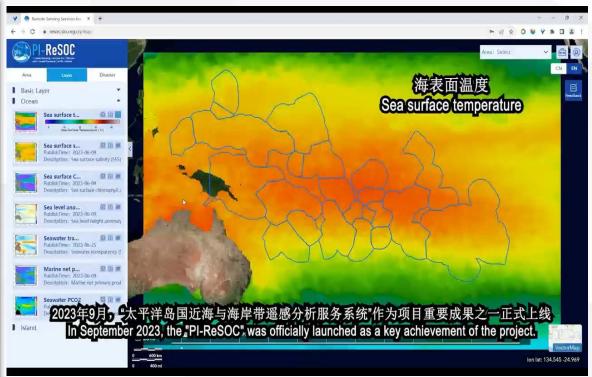
2.3 Launched an online system called PI-ReSOC





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





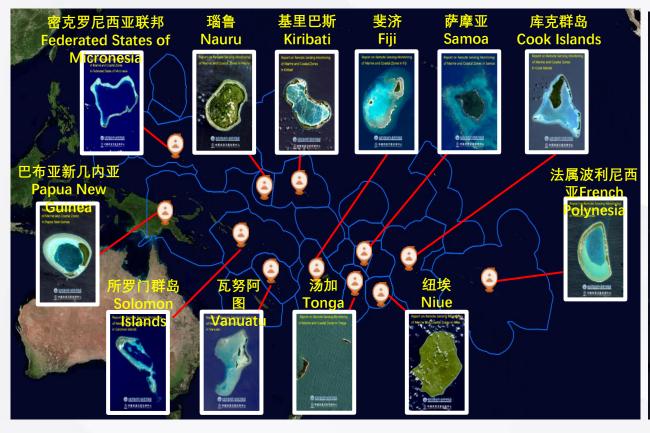
https://resoc.sio.org.cn

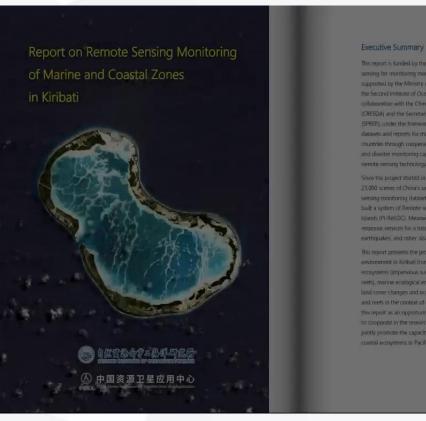


2.4 National remote sensing monitoring reports



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





his report is funded by the project. "Capacity building on uses of satellite remote, entiting for monitoring marine and coastal ecosystems in Pacific Island countries" apported by the Ministry of Science and Technology of China. The project is led by the Second Institute of Oceanography (SIO), Ministry of Natural Resources of China, in plabboardion with the China Centre for Resources Satellife Data and Application (RESDA) and the Secretariat of the Pacific Regional Environment Programme SPRED), under the Inamework of China-GEO cooperation. The project aims to provide laterats and reports for marine and coastal ecosystems and disasters in Pacific Island countries through cooperative research, and to enhance the ecological environment and disaster monitoring capability of Pacific Island countries based on China's satelliteemote sensing technology.

nice the project started in almousy 2002, we have collected and processed more than 3,000 scenes of thinks satellite more sensing images, developed the remote ensing monitoring distates for marine, coastal, and benthic habitat ecosystems, and uit a system of Remote sensing Service for Offshore and Coastal zones in Pacific lands (PF-ReSOC). Meanwhille we carried out disaster monitoring and emergency sponse services for a total of UZ events, including volcano eruptions, typhopos, arthquakes, and other disasters in Pacific Island countries.

more report gracems one project incomposing antivovement on the ecological elementarisms in finitial from found appets, including coastal changes, sland ecceystems (impervious surface), typical madine ecosystems (impervious surface), typical madine ecosystems (impervious and coral creets), marine ecological elementarisms and parameters. This report also investigates the land cover changes and ecological environment dynamics in the representative islands and creet is the context of climate change and human activities. We expect to take this report as an opportunity to exchange emit discuss with the stakeholders in Kiribat, to cooperate in the research of remote seming technology and applications, and to jointly promote the capacity building of remote sensing for monitoring marine and cooxial ecosystems in Pacific eland countries:



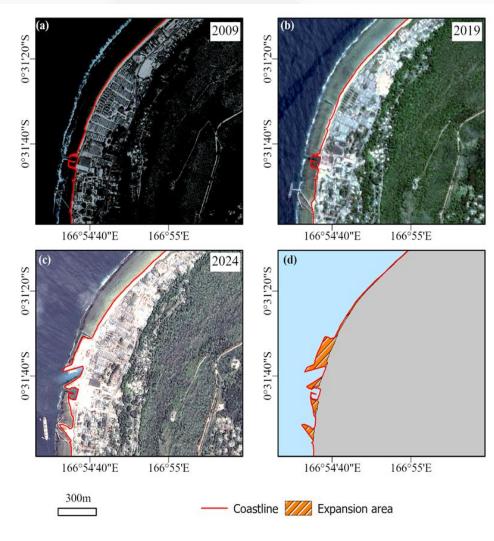
2.4 National remote sensing monitoring reports



☐ 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.







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.

/ Home / Datasets / Remote Sensing Monitoring Report on the Ecological Environment of Pacific Island Countries (2024)

17 FEBRUARY 2025 | DATASET

Remote Sensing Monitoring Report on the Ecological Environment of Pacific Island Countries (2024)



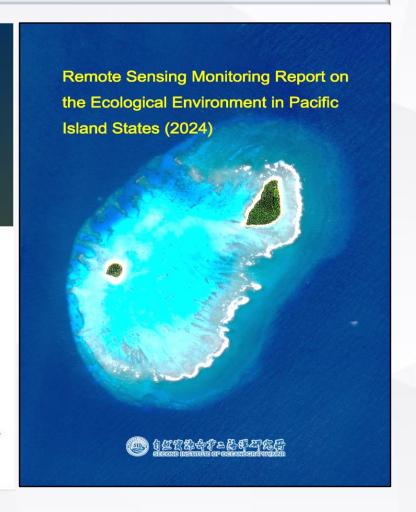
Secretariat of the Pacific Regional Environment Programme

License

Private

Using a series of adaptive remote sensing monitoring technologies for the Pacific region, this report focuses on analyzing the urbanization process, coastal changes, and mangrove dynamics of all Pacific island states since 2000, revealing overall trends in urban expansion, coastal erosion, and mangrove increase, and highlights case studies from multiple typical regions in various countries.

The report has been reviewed by leading experts from the Chinese Academy of Sciences, Xiamen University, and other leading institutions, who have confirmed its technical reliability and valuable insights, filling important data gaps for the Pacific region.



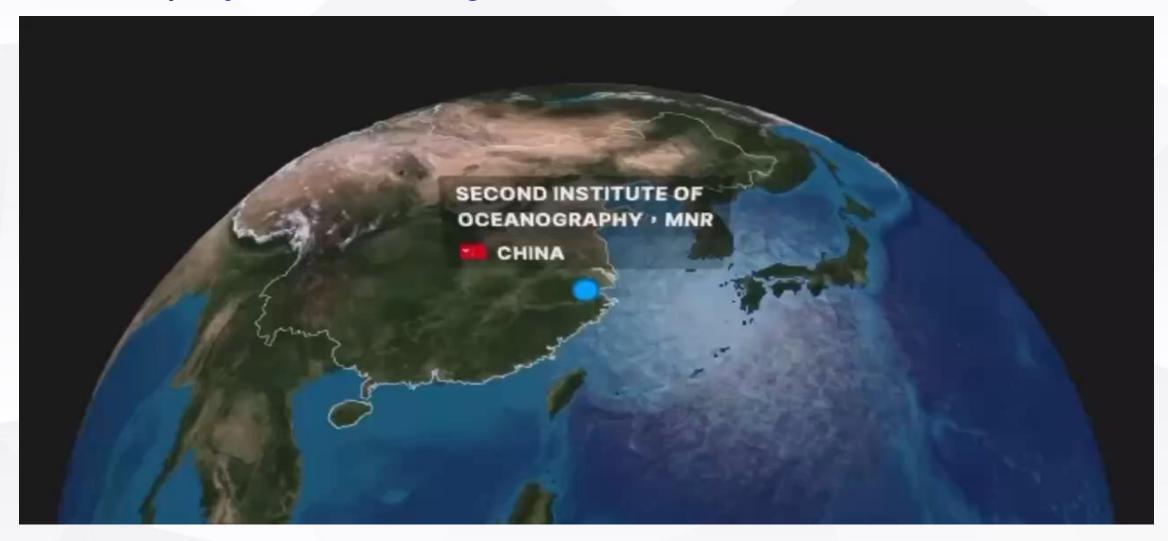




3.1 Communications



□ 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.







- ☐ 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.











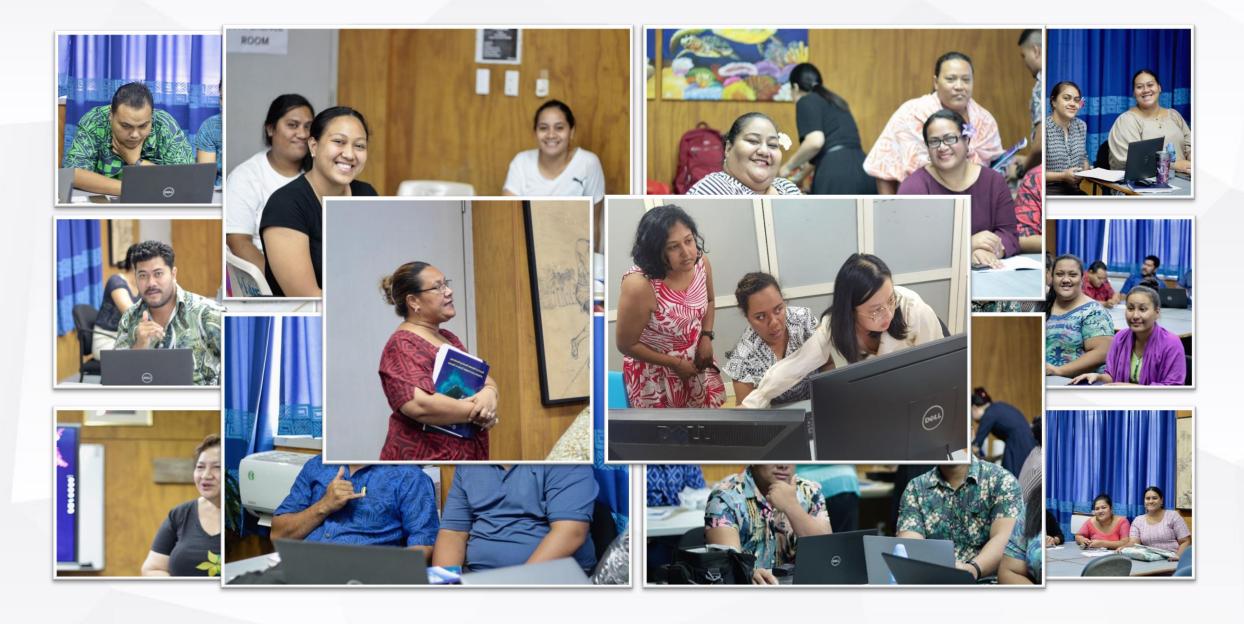








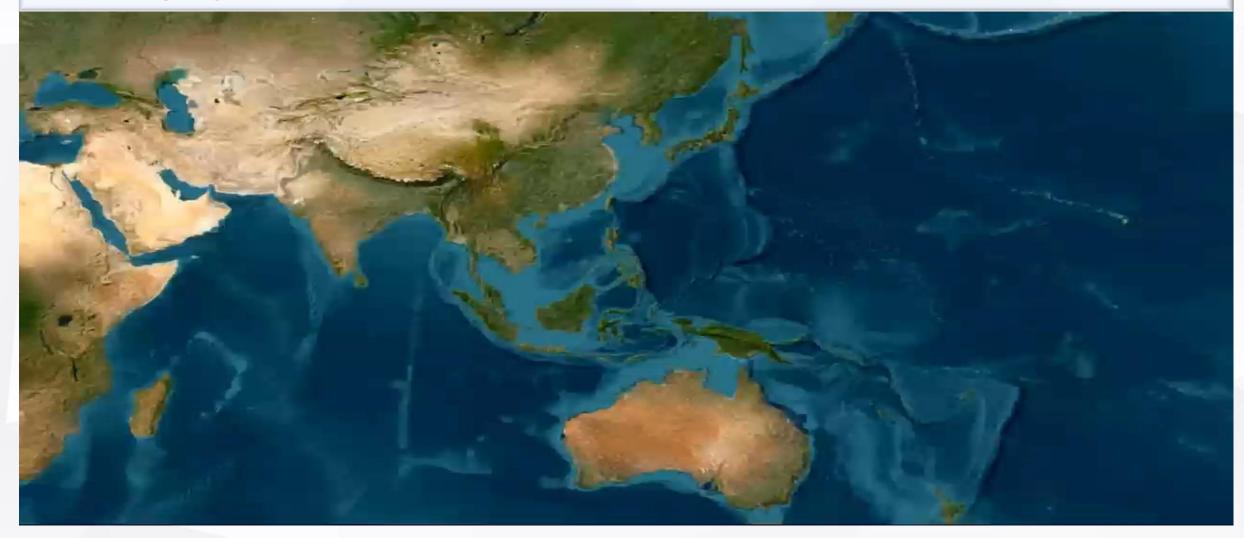








□ Training- SIDS 2024 was held in Hangzhou, with 26 trainees from 15 small island developing states in the world, June 1st to 15th, 2024.







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

















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



