

## The Taiwan Marine Environment Monitoring Service (TwMEMS)

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### Abstract

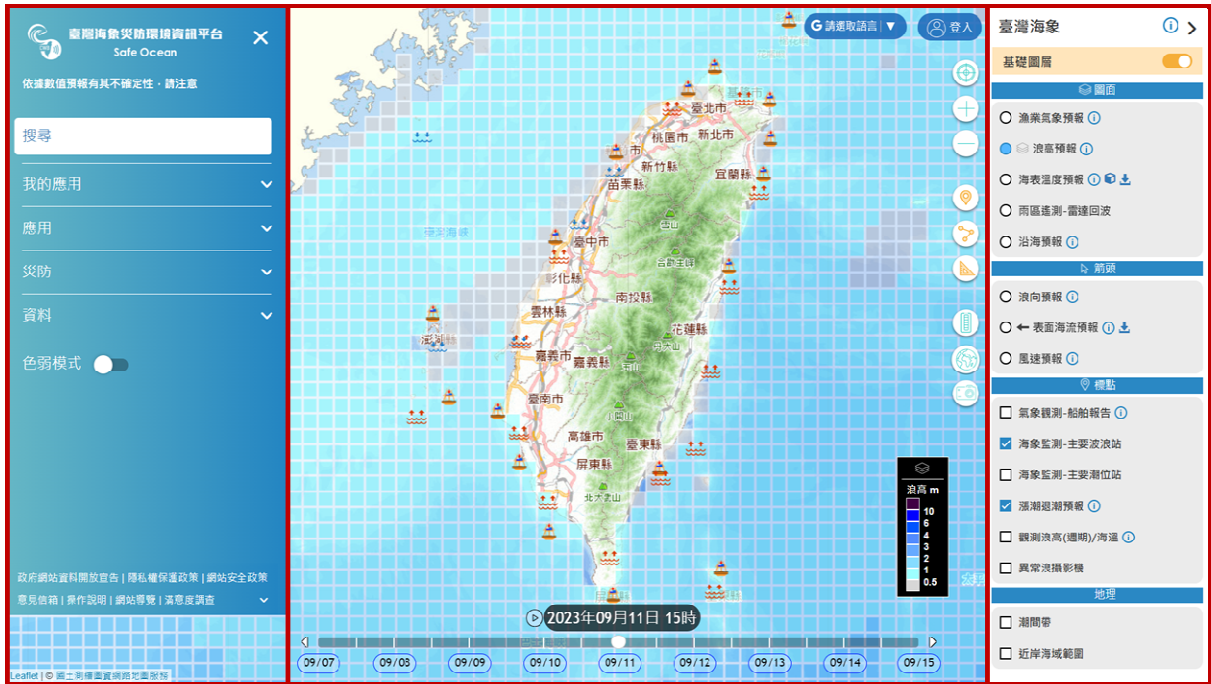
Taiwan is one of the most vulnerable areas in the world and frequently suffers from natural disasters. Sea-related hazards are mainly triggered by monsoons in winter and typhoons (tropical cyclones) in summer, including extreme waves, storm surges, destructive swells, coastal flooding, and SST drop. With the prosperity of various marine activities and industries, the frequency of disasters has also increased, so that government departments must do something to make marine activities safer. Therefore, the motivation of this study is to provide scientific information for government departments responsible for disaster prevention in a short time and relief as a decision reference for warning and response to marine disasters. Furthermore, it also provides diverse reference information for the public and industries.

A service platform (referred to as Taiwan Marine Environment Monitoring Service) was designed to integrate marine environmental parameters, including wind, wave, tide, current and temperature components, from in-situ and remote sensing observations, ship reports and numerical models to support the safety of various marine-related activities in Taiwanese waters. In addition to the direct use of data, several warning subsystems are plugged into the platform for data processing and analysis to provide additional information. For example, people can utilize this platform's convenient tidal information and passenger ship comfort forecasts to provide maritime meteorological references for vessels during navigation. The platform utilizes 130 GIS layers, all linked to the "Northwest Pacific Ocean Meteorological Database", it's a massive data repository. The platform's development technology employs responsive web design (RWD), allowing users to access real-time sea conditions and for the next 5 days weather forecast information service through web browsers, mobile phones, or tablets. This service platform is now in operation and has served more than 10 governmental institutions and numerous members of the public in Taiwan.

Keywords: marine environment monitoring service, the warning modules

### Reference

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- [2] Shareef, M. M. (2014). Effective use of GIS for visualizing forecasted meteorological and marine data. *Meteorol. Appl.* 21, 340–349. doi: 10.1002/met.1343.



Application products

Ocean maps GIS information

Layer



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<https://ocean.cwa.gov.tw/>

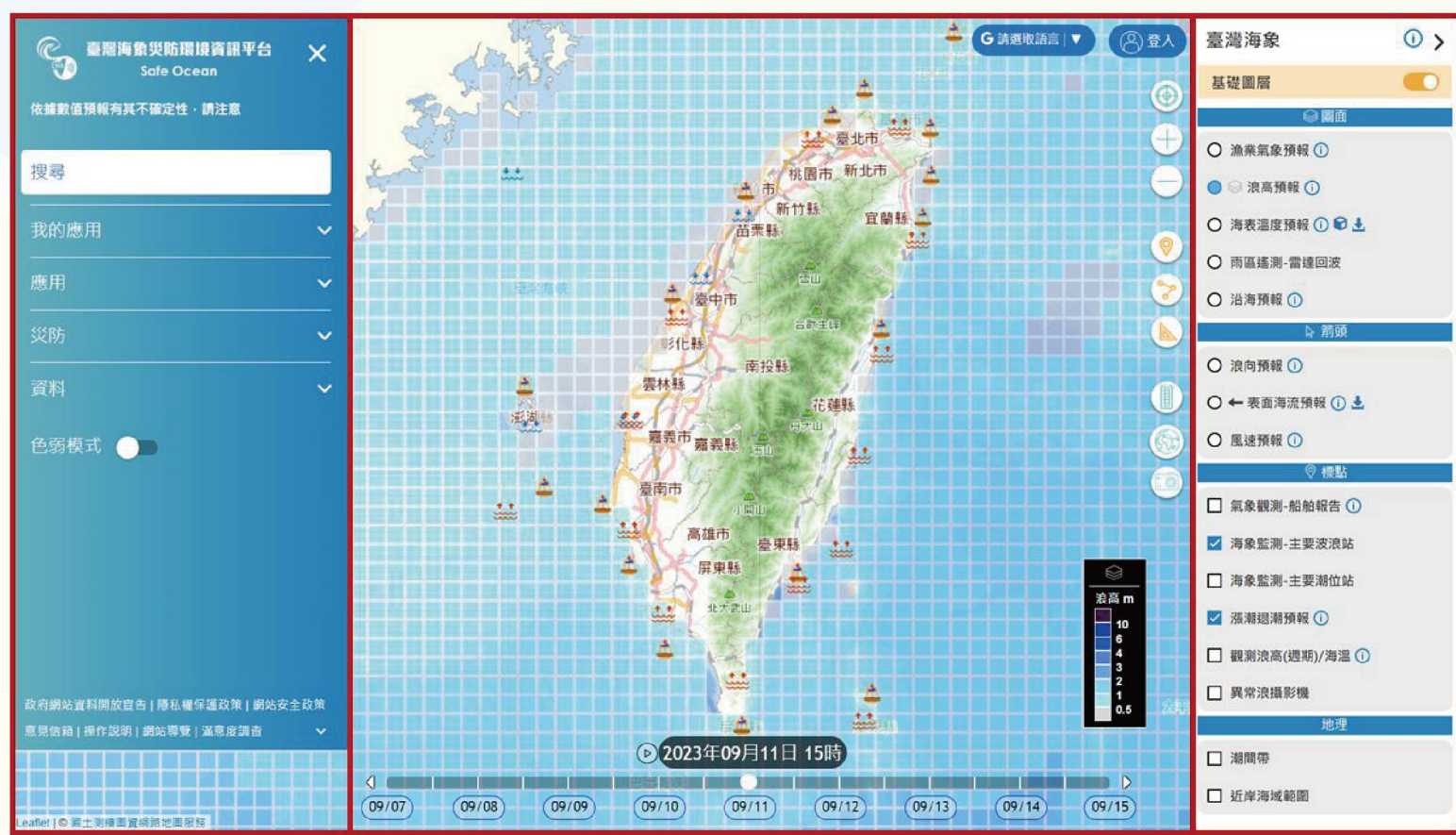
## BACKGROUND

Taiwan is one of the most vulnerable areas in the world and frequently suffers from natural disasters. Sea-related hazards are mainly triggered by monsoons in winter and typhoons (tropical cyclones) in summer, including extreme waves, storm surges, destructive swells, coastal flooding, and SST drop. With the prosperity of various marine activities and industries, the frequency of disasters has also increased, so that government departments must do something to make marine activities safer. Therefore, the motivation of this study is to provide scientific information for government departments responsible for disaster prevention in a short time and relief as a decision reference for warning and response to marine disasters. Furthermore, it also provides diverse reference information for the general public and industries.

A platform for marine environment monitoring services including not only self-measured data but also data collected worldwide was established since 2020. In addition to the direct use of data, several warning subsystems are plugged into the platform for data processing and analysis to provide additional information.

## VARIED GIS LAYERS

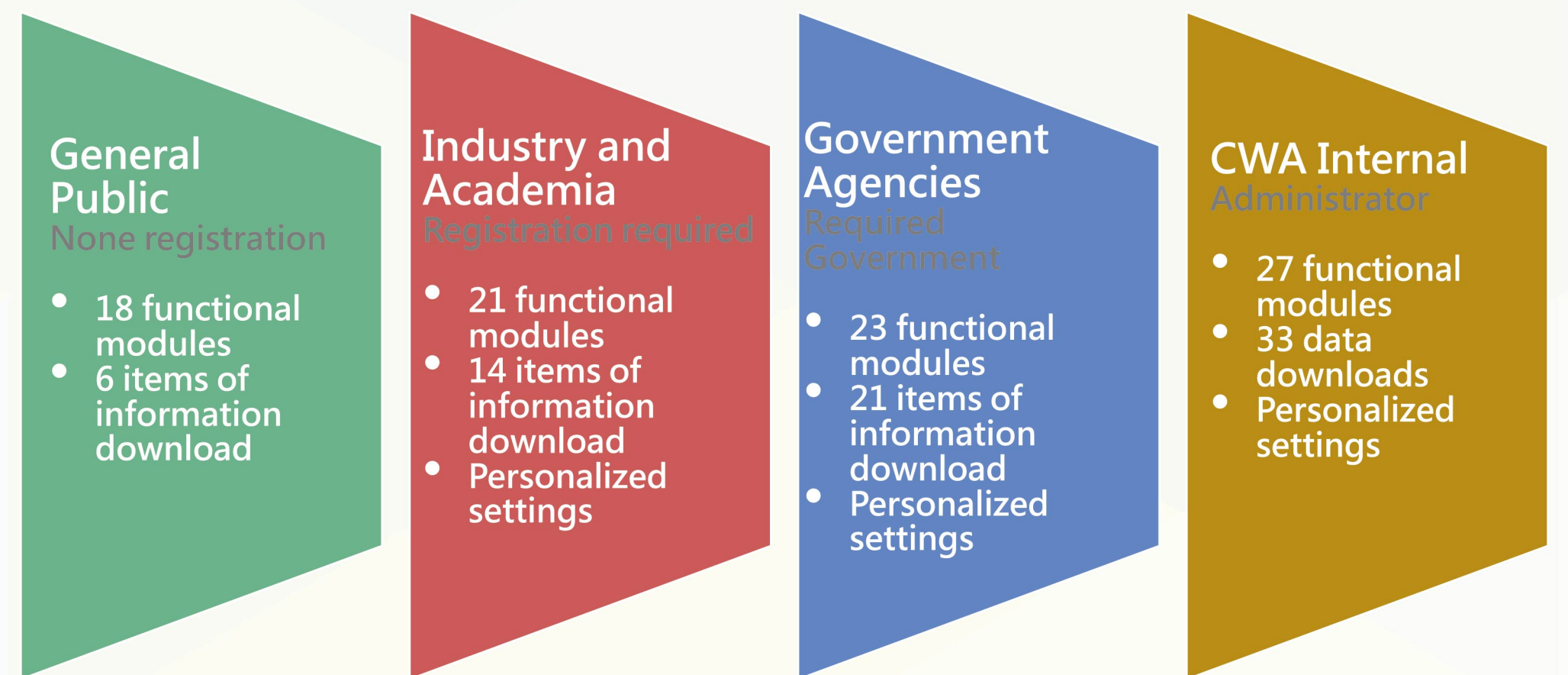
To meet different application needs, we pair various foundational data and value-added application data to present the platform. The platform utilizes 130 GIS layers, all linked to the "Northwest Pacific Ocean Meteorological Database", its a massive data repository. The platform's development technology employs responsive web design (RWD), allowing users to access real-time sea conditions and for the next 5 days weather forecast information service through web browsers, mobile phones, or tablets. User accounts are categorized into four segments: "General Public", "Industry and Academia", "Government Agencies", and "CWA Internal", providing information services tailored to each user group.



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It integrates and provides basic marine geography maps, including GIS layer menus for wind, waves, currents, sea temperature, tides, weather, etc., as well as additional tabular information such as a moving timeline, click-to-select any point forecast, and sea route planning.

comprehensive forecast	wind speed	high wave	long wave	surface velocity	sea surface temperature																										
P 1 (110.889E 22.786N)																															
forecast	09-11 17H	09-11 20H	09-11 23H	09-12 02H	09-12 05H	09-12 08H	09-12 11H	09-12 14H	09-12 17H	09-12 20H	09-12 23H	09-13 02H	09-13 05H	09-13 08H	09-13 11H	09-13 14H	09-13 17H	09-13 20H	09-13 23H	09-14 02H	09-14 05H	09-14 08H	09-14 11H	09-14 14H	09-14 17H	09-14 20H	09-14 23H	09-15 02H	09-15 05H		
wind direction	↘	↘	↘	↘	↘	↘	↘	↘	↘	↘	↘	↘	↘	↘	↘	↘	↘	↘	↘	↘	↘	↘	↘	↘	↘	↘	↘	↘	↘	↘	
Wind speed (level)	3	2	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	
Wave height (m)	0.6	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	
Wave direction	↗	↗	↗	↗	↗	↗	↗	↗	↗	↗	↗	↗	↗	↗	↗	↗	↗	↗	↗	↗	↗	↗	↗	↗	↗	↗	↗	↗	↗	↗	
Periods	6.2	6.3	6.4	6.4	6.4	6.5	6.6	6.5	6.5	6.5	6.6	6.7	6.7	6.7	6.7	6.7	6.7	6.7	6.7	6.7	6.7	6.7	6.7	6.7	6.7	6.7	6.7	6.7	6.7	6.7	6.7
Long wave height (m)	0.6	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7
Long wave period (s)	6.5	6.8	6.9	6.9	6.8	6.8	6.9	7.1	7.1	7.1	7.1	7.1	7.1	7.1	7.1	7.2	7.3	7.2	7.1	7	6.9	6.8	6.8	6.6	6.5	6.4	6.4	6.4	6.4	6.4	6.5
Surface flow velocity (knot)	0.1	0.2	0.2	0.2	0.2	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4
Surface flow direction	↗	↗	↗	↗	↗	↗	↗	↗	↗	↗	↗	↗	↗	↗	↗	↗	↗	↗	↗	↗	↗	↗	↗	↗	↗	↗	↗	↗	↗	↗	↗

## MULTIFACETED INFORMATION SERVICES

In response to SDGs issues related to addressing climate change and its impacts, people can utilize this platform's convenient tidal information and passenger ship comfort forecasts to provide maritime meteorological references for vessels during navigation. This not only enhances maritime safety but also aligns with sustainable actions to reduce carbon emissions for a better future.

