Tainan Hydraulics Laboratory,
National Cheng Kung University, TAIWAN

5 F., 500 Anming Rd., Sec.3, Tainan City, Taiwan. 70955
http://iard.thl.ncku.edu.tw/en/;
http://www.thl.ncku.edu.tw/english/introduction/i_org.2015B.htm

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Outline

Tainan Hydraulics Laboratory (THL) was founded by a joint venture between the National Hydraulic Research Institute, Ministry of Economic Affairs (MOEA) and the Taiwan Provincial College of Engineer (predecessor of National Cheng Kung University (NCKU) in 1950. By 2015, T.H.L had about 150 full time researchers, technical engineers and administrative staffs. The 9 divisions of THL are (1)Division of Field investigation; (2)Division of Physical Modeling; (3)Numerical Modeling and Geographical Information Division; (4)Land-subsidence Prevention and Reclamation Corps; (5)Water Professions Enterprise Information and Incubation Center; (6)Ocean Energy Research Center; (7)Division of International Affairs and Research Development; (8)Division of Human Asset and Administration Management; (9)Division of Project and Knowledge Management.

Missions of THL including:

- Contributing research and investigation efforts to Hydraulics, Coastal and Ocean engineering.
- Establish domestic hydraulic and oceanic database and geographical information system.
- Providing sufficient research data to government department, such as, Water Resources Agency, and Industrial Development Bureau of Ministry of Economic Affairs in Taiwan, and etc..
- Supporting National Cheng Kung University in teaching, research activities and experiment training, in order to achieve a higher research level and to integrate industrial, governmental, academic and research activities.

Research topics including: generation and transformation of wind waves, waves and tidal currents, wave statistics, wave-structure interaction, coastal sediment transport, coastal pollution, and offshore engineering.

THL also participated in major coastal engineering construction projects in Taiwan, such as offshore cage aquaculture study in Pintung County; simulation of tsunami waves; EIA of offshore wind farm along the west coastline in Chang-Hwa county; construction of deep water harbor of Mailau; land reclamation and protection of eroded coastal areas in Yulin county; mitigation of disasters caused by typhoon waves and tsunamis; sustainable development of rich tidal power; wetland rehabilitation and utilizing ocean resources around Taiwan.

Each year, researchers in THL publish research efforts on international journals and international conferences, which are Journal of Fluid Mechanics, ISOPE Journals,

European Journal of Mechanics Fluid, Ocean Engineering, Coastal Engineering, Journal of Coastal Research, and etc. Researchers in THL also participate in international conferences, such as IAHR World Conference of the International Association for Hydro-Environment Engineering and Research, PACON Conference of the Pacific Congress on Marine Science and Technology, the International Offshore and Polar Engineering Conference (ISOPE), and the International Conference on Coastal Engineering (ICCE).

Fig. 1 research facilities of THL (a) Long wave flume, 300m X 5m X 5.2m (b,c) Near Shore Basin (150m X60m)

International Collaboration

With solid research force, THL has established joint research collaborations with leading institutes in the world (Fig. 2). The establishment of international collaborations not only strengthens research capabilities but also creates values for all collaborative partners.

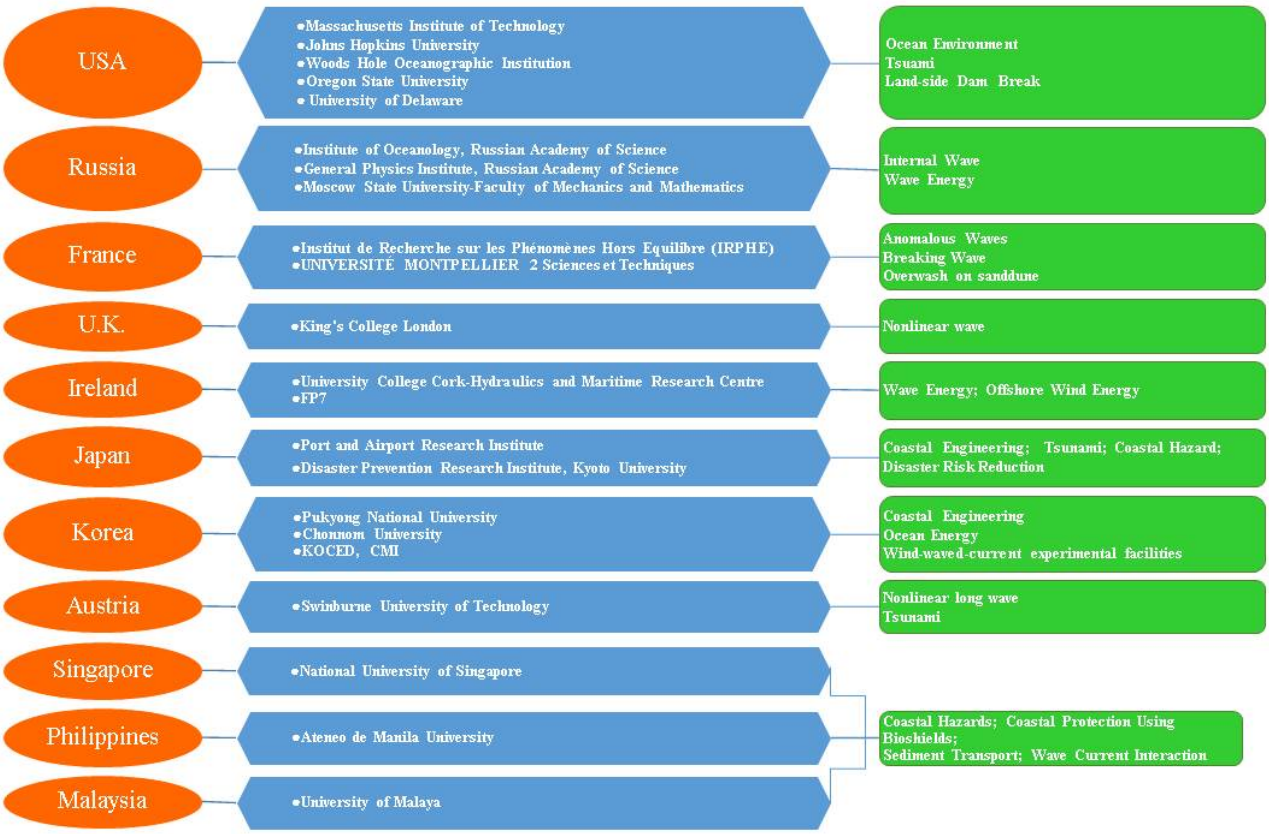

Fig. 2 THL has established joint research collaborations with leading institutes in the world

Research and Achievement

Situated in the highly potential typhoon impact region of West pacific, the coastal area of Taiwan suffers frequent disaster caused by typhoons (3~4 events in a year). Starting from 1976, the Water Resources Agency of Ministry of Economic Affairs published the " Proposal for Construction and Renovation of Sea Dikes in Taiwan". Since then, sea dikes are built in Taiwan to protect the livelihood, safety and property of the people living along the coastal area.

The main function of the seawall is to defend coastal and estuarine areas from storm surge and wave impact. By the end of 2012, a total of 524 Kilometers of sea dikes were built to protect the coastal areas in Taiwan, Penghu, Kinmen and Matsu. Which means approximately 44% of Taiwan coastline covers by seawalls. This is 95.6% of the total sea dikes length of 548 Kilometers planned by Water Resources Agency in 1976. In the "Sustainable Coastal Development Program" approved by Executive Yuan of Taiwan in 2007, which points out that the sustainable development in coastal area should not reduce the proportion of natural shoreline. The program also suggests the maintenance and management of existing sea dikes should integrate with wave dissipation function, ecology conservation and environment friendly, in addition to strengthen the safety of dikes.

Tainan Hydraulics Laboratory makes efforts in research and development of coastal engineering during past 60 years. The research results are applied to the development and protection of the coastal zone along Taiwan accompany with the aforementioned coast management policy released by Taiwanese government. For example, a series of application research were conducted during past several years to evaluate the performance of the seawalls along the southwest Taiwan for coastal zone protection. Based on the research results, some suggestions about the improvement of coastal zone environment were proposed. On the other hand, coastal erosion along Liaolo Bay which is a semi-circular beach and locates at the south coast of Kinmen Island was observed during past years. Field and numerical experiments were conducted to discuss the hydrodynamics inside the bay. CMS-WAVE and CMS-FLOW models were setup and validated according to the collected field data. Then, the models were applied to simulate the hydrodynamics inside the study site during typhoon events. Longshore current pattern along the semi-circular beach is sensitive to the incident wave. For wave approaching from east direction, the most affected region inside the bay by the wave locates on the west of the beach. However, widespread impact on the whole beach was found when the wave incident from south direction. Wave (1~2 m) travels from E~ESE direction at the bay mouth usually occurs in winter and induces to consistently westward longshore current along the beach with speed 0.2~0.4 m/s. High wave approached from SE~S direction during the studied typhoon events which induced to strong transiently and complex current patterns inside the bay beach with maximum speed up to more than 1.0 m/s (Fig. 3). A rip circulation cell constantly found near the outcrop, which enhanced the strength of the rip circulation. Besides, rip circulation cells occasionally found at some spots along the beach respectively which depends on the incident wave energy and direction. Based on the study on hydrodynamic and sediment transport inside the bay beach, a coastal protection project was proposed to the airport authority.

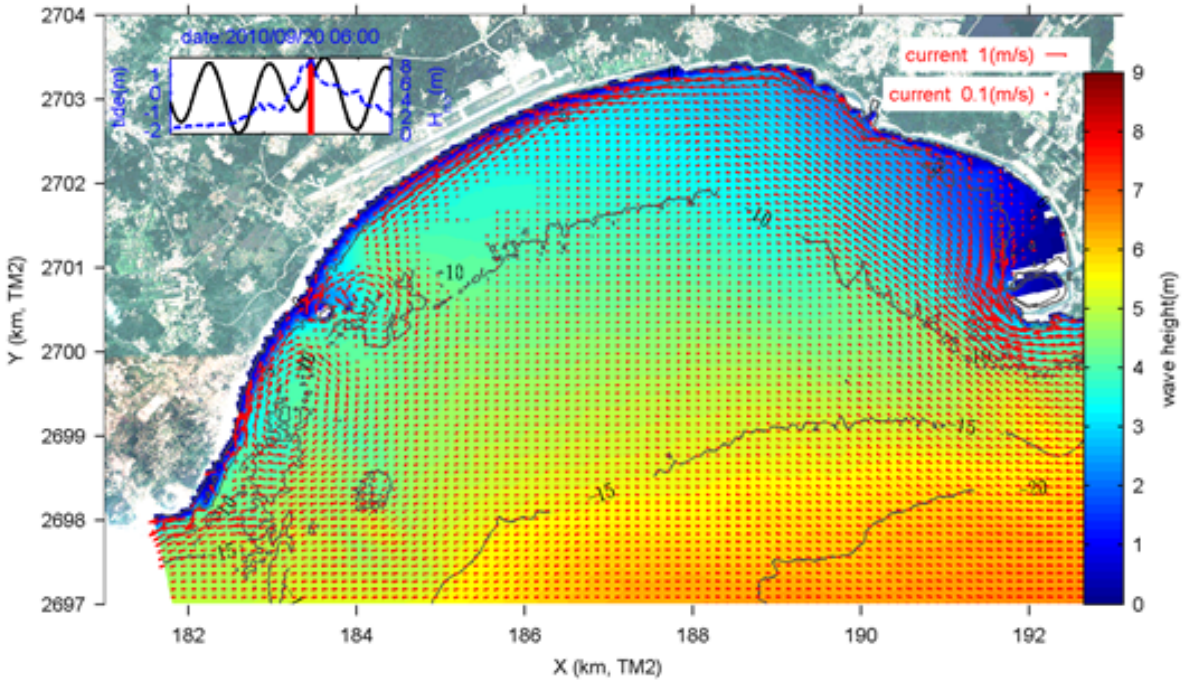

Fig. 3 snapshot of spatial wave heights and currents at a time (6:00 Sep., 20, 2010) during Typhoon Fanabi (wind speed and direction: 14m/s, 140°, wave height and direction: 9.12m, 112°).

Future Challenges

1. Sea Level rise around Taiwan under the impact of global warming.
2. Increasing number and strength of typhoons threatening Taiwan
3. Coastal erosion caused by natural and anthropogenic factors.
4. Severe Land subsidence caused by excessive pumping of groundwater in coastal areas for fish farming.

Disaster Management Policy

In order to rehabilitate the coast, the coastal environment improvement in the future should focus on “soft, environment and ecology friendly engineering” which will strengthen the disaster prevention function of sea dikes, and at the same time satisfies the needs for water zone utilization, recreation and ecology rehabilitation.

On the other hand, non-engineering measure should also include to reduce losses of lives and properties caused by storm surge and extreme typhoon events. For example, limit the land utilization in the coastal area and set up a buffer zone, etc. However, face the future challenges, a new disaster management policy is necessary to accomplish the disaster risk reduction and resilience.