Outline of Selected Project

Host institution 1	Tohoku University
Host institution 2	Japan Agency for Marine-Earth Science and Technology (JAMSTEC)
Center name	Advanced Institute for Marine Ecosystem Change (WPI-AIMEC)
Head of host institution 1	Hideo Ohno
Head of host institution 2	Hiroyuki Yamato
Prospective Center director	Toshio Suga

＜Project Summary＞

The mission of the WPI-AIMEC is to unravel the primary question, "What are the response and adaptation mechanisms of marine ecosystems to Earth-Human system dynamics? " In particular, we will focus on the Northwest Pacific Ocean, where Japan is located, and aim to deepen our understanding of connectivity, stability, and adaptability that are indispensable for the sustainability of marine ecosystems, and to realize predictions of changes in marine ecosystems that are useful for human society through an approach that integrates marine physics, ecology, mathematics, and data science. Geophysical observations, eDNA analysis, and laboratory experiments will be conducted while focusing on "regime shifts" in which the marine ecosystem undergoes rapid structural changes over a wide area. Based on these data and findings, we will make full use of AI and machine learning to promote integrated analysis of big data on ocean physics and ecosystems, and build an ocean ecosystem change model that can be applied from the Northwest Pacific Ocean to the entire globe. By doing so, the center aims to create "Ocean-Ecosystem Change Systematics (OECS)" as a new academic field.

The WPI-AIMEC will establish an interlaboratory system that strongly links the basic academic strengths and higher education functions of Tohoku University with the oceanographic research and computing platform functions of the Japan Agency for Marine-Earth Science and Technology (JAMSTEC) to conduct cutting-edge interdisciplinary research on the elucidation of the response and adaptation mechanisms of marine ecosystems and their change prediction. Furthermore, the WPI-AIMEC will establish a global collaboration and partnership with the University of Hawai'i as a satellite institution, and promote the development of world-class human resources and international brain circulation through international higher education. In addition, the WPI-AIMEC will enhance its public relations, outreach, and DX functions to continuously and effectively disseminate information to the general public and co-create scientific knowledge with domestic and international stakeholders, including UN agencies and policy makers, in order to contribute to "planetary stewardship" for the restoration and recovery of the oceans and ecosystems.

<Remarks>

1. The project aims to advance the science of response and adaptation mechanisms of marine ecosystems to environmental and anthropogenic pressures by bringing together an interdisciplinary team of ocean physics scientists, marine biologists, climate scientists, data experts and modelers. This is a fundamental and highly socially relevant theme that deserves commendation.
2. The project combines Tohoku University's strength in basic academic research and education with JAMSTEC's strength in missions-based research in advanced observation and modelling.
3. Tohoku University and JAMSTEC are jointly committed to establish WPI-AIMEC as an institution with unified governance and a new building at Tohoku University as the main site to achieve an "under-one-roof" environment.

Tohoku University・Japan Agency for Marine-Earth Science and Technology Advanced Institute for Marine Ecosystem Change (WPI-AIMEC)

Director Toshio Suga

Mission: Elucidate and project the response and adaptation mechanisms of marine ecosystems to Earth system dynamics

WPI-AIMEC will expound on the response and adaptation mechanisms of marine ecosystems to Earth system dynamics and will facilitate systematic forecasting of marine ecosystem change through fusional approaches that integrate marine physics, ecology, and mathematical information science. Consequently, a new academic field "Ocean-Ecosystem Change Systematics (OECS)" will be established.

※ Earth system changes: The complex and interactive changes in the Earth's atmosphere, oceans, ecosystems, and other elements.

Missions

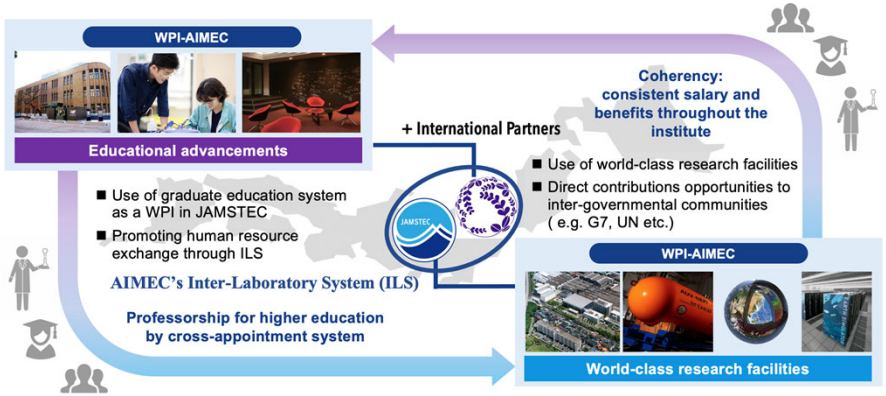
Global warming has caused rapid environmental changes in the ocean, which covers about 70% of Earth's surface. The mission of this center is to achieve the following goals by focusing on marine ecosystems:

- We will deepen our understanding of the connectivity, stability, and adaptability of factors vital to the maintenance of marine ecosystems through interdisciplinary approaches to establish advanced Earth system models that integrate marine ecosystem change.
- This will lead to the creation of a new academic field, "Ocean-Ecosystem Change Systematics (OECS)", which will contribute to "Planetary Stewardship" for the restoration and recovery of the marine environment and ecosystems.

※ Planetary stewardship: Codes of conduct and principles for responsible management and protection of the Earth.

Features

As an alliance-type WPI center, Tohoku University's basic academic and higher education functions and JAMSTEC's oceanographic research and computational platform functions will be strongly linked to promote cutting-edge interdisciplinary research that contributes to the elucidation and projection of marine ecosystem change and fosters the establishment of human resource competencies globally.



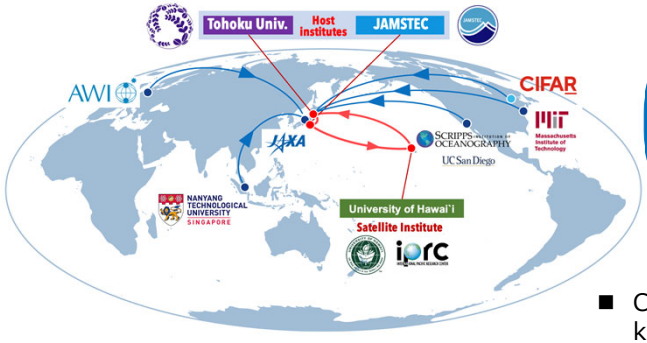
Research

We will designate the Northwest Pacific Ocean as a priority area and conduct interdisciplinary research related to:

1. Clarification of the interactions between climate, ocean, and ecosystems
2. Elucidation of environmental response and adaptation mechanisms of marine ecosystems
3. Prediction of changes in marine ecosystems.

- We will conduct geophysical observations, environmental DNA (eDNA) analysis, and laboratory experiments while focusing on "regime shifts", which are rapid structural shifts in marine ecosystems over a wide area.
- We will employ AI machine learning approaches to conduct integrated computational analysis of big data on ocean physics and ecosystems, and build an marine ecosystem change model for global application.

Partnerships



■ Promoting international brain circulation and higher education through global collaboration and partnership

■ Co-creating scientific knowledge with domestic and international stakeholders to contribute to planetary stewardship