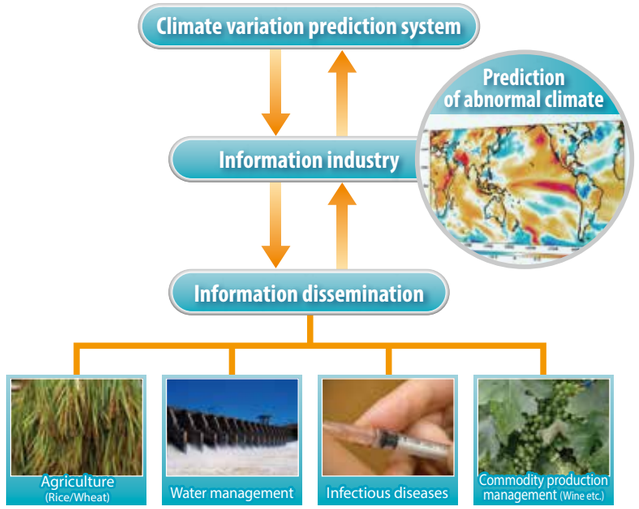
Earth Simulator
The world's largest vector supercomputer. It is particularly geared toward calculations related to the atmosphere, ocean and other fluids.

Our predictions are used globally in various fields.



Application Potential of Climate Prediction Data to Various Fields

Agriculture in Australia

In 2006, the positive Indian Ocean Dipole mode(IOD) resulted in drought and brought enormous damage to Australia's agriculture. The SINTEX-F system predicted this event months ahead. As a result, some farmers in Australia now use APL' s seasonal forecasts and IOD information for crop and livestock management.

Agriculture in Africa

Lack of rain results in lower yield and poor quality of the products in South Africa. Risks can be mitigated if droughts are foreseen based on seasonal forecasts and countermeasures are taken such as setting up water storage facilities. A pilot study was conducted to assess this under a JICA/JST SATREPS project.

Infectious diseases in southern Africa

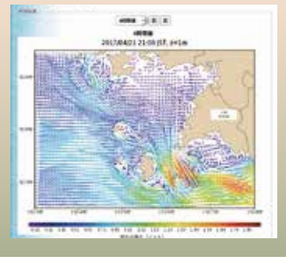
Infectious diseases pose immense health risks in the southern African region. The outbreak of these diseases is often associated with climate variations. In collaboration with the Institute of Tropical Medicine at Nagasaki University, APL is investigating the climate link to some of the infectious diseases (malaria, respiratory and diarrheal diseases) in South Africa. It is found that high rainfall in local regions and Mozambique together with several climate phenomena (such as La Niña and Indian Ocean Subtropical Dipole) increases the risks of malaria incidence in South Africa. An early warning system is under development for malaria and other infectious diseases based on the superior skills of the SINTEX-F' s climate predictions.

SIMSEA

The Sustainability Initiative in the Marginal Seas of South and East Asia (SIMSEA) is an international alliance of natural and social scientists working together to meet the regional challenges of biodiversity conservation, sustainability of marine ecosystem services, and protection of human well-being in light of population pressure, environmental degradation, and climate change/variability. The overall goal is to generate knowledge that can bring about transformative change toward sustainability in the marginal seas of South and East Asia, and contribute toward sustainability at the global level.

SUKUMO

Co-working with local stakeholders in Sukumo Bay, Kochi Pref., APL has developed a fine-resolution (200 m) ocean prediction system (SUKUMO500) that provides hourly updates via the APL website. The information has been used for fishery activity as well as oil spill removal. Local stakeholders have provided in-situ observation data in order to evaluate and improve the ocean prediction system. Mutual interaction between local stakeholders and scientists will benefit the integrated coastal management in Sukumo Bay.



Application Laboratory http://www.jamstec.go.jp/apl/

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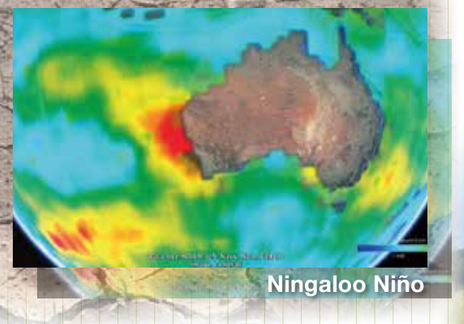
JAMSTEC
Japan Agency for Marine-Earth Science and Technology

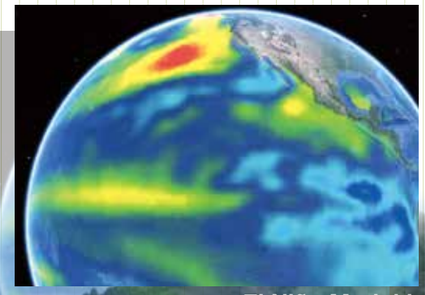
2017.05

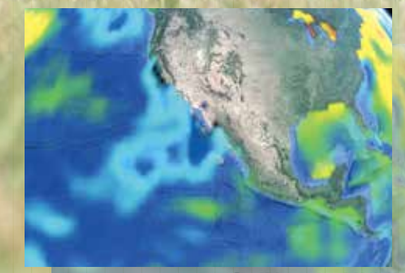
APL aims for realizing innovation through mutual enlightenment and sustainable collaboration between research and society

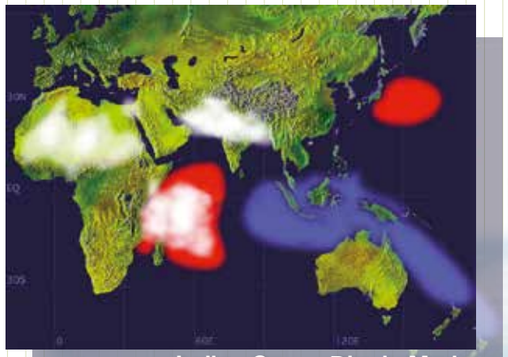
Application Laboratory

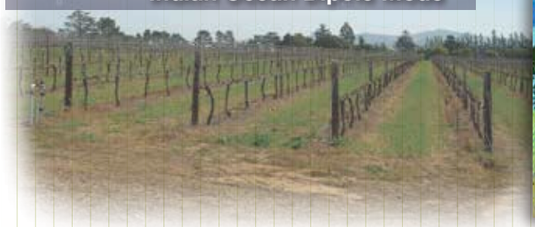
Innovations from Earth Science

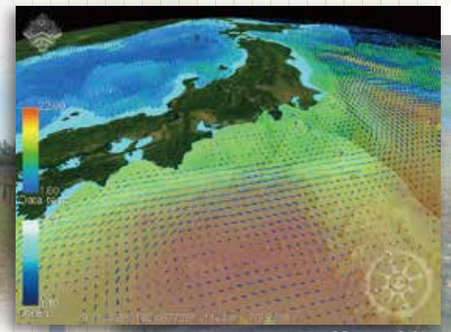












JAMSTEC

Application Laboratory (APL) endeavors to realize a sustainable world through innovations and prudent interactions between science and society.

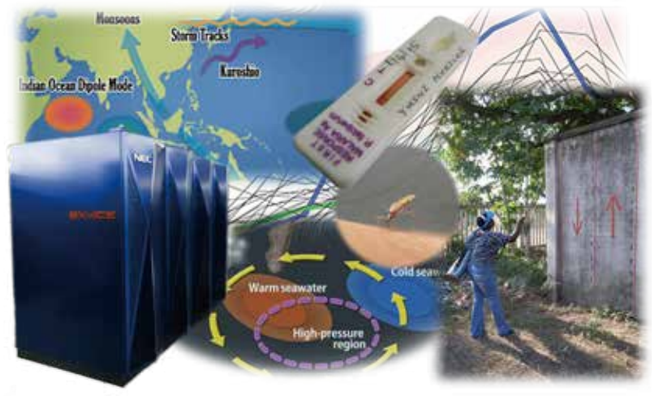
The Application Laboratory a premier research establishment in JAMSTEC aims to contribute to the society by developing numerical simulation technologies and by finding ways and means to apply ensemble model predictions for the benefit of human health, agriculture, fisheries, water management, and air and water quality.

Director, Application Laboratory ***Swadhin Behera***

CVPARG Climate Variability Prediction and Application Research Group

Group Leader ***Masami Nonaka***

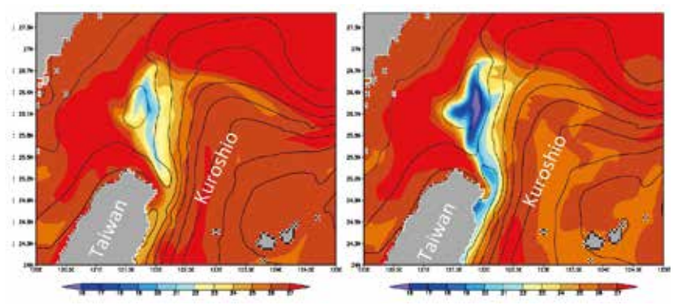
We carry out climate predictions that aim to forecast events, such as El Niño, up to two years in advance. For this purpose we use a state-of-the-art coupled ocean-atmosphere model, "SINTEX-F", which can calculate the evolution of atmosphere and ocean simultaneously. The SINTEX-F forecast skill ranks as one of the highest among the world's leading prediction centers. These forecasts are freely available through the APL web page (Seasonal forecasts). We are currently working on applying these prediction data toward reducing the spread of infectious diseases in South Africa and toward agriculture and water management in Southeast Asia. Our vision is to develop a prediction system that can predict climate events with time scales from one month to one decade. We also strive to predict the mid–latitudes, which remain one of the grand challenges of climate prediction.



EVPARG Environmental Variability Prediction and Application Research Group

Group Leader ***Yasumasa Miyazawa***

Our group performs research on both the atmosphere and the ocean. The oceanic component aims to understand the detailed variability of the Kuroshio/Oyashio current system. In order to improve the skill of our forecast model, we perform and validate daily ocean current forecasts (Ocean weather forecast). The atmospheric component studies convective processes to understand the generation mechanisms of clouds and rainfall. These are notoriously difficult to predict and present one of the major obstacles for accurate predictions. The figure on the right highlights one particular aspect of our research that examines the effect of ocean waves on the exchange of heat, water and momentum between the ocean and the atmosphere. Through this influence waves play a crucial role in the climate system and their improved representation in climate models will eventually lead to improved forecast accuracy. We also predict the transport of air pollutants (Air pollution forecasts) and use marine forecasts and analyses to study the ecological variability of marine plankton and its effect on plankton-feeding fish.



Sea surface temperature (warm in red and cold in blue) and ocean currents after the passage of a typhoon as simulated in a coupled ocean-atmosphere model. The left panel shows the prediction without sea waves, the right panel the prediction with sea waves. Including the effect of sea-waves cools the temperatures, which leads to a more realistic simulation.

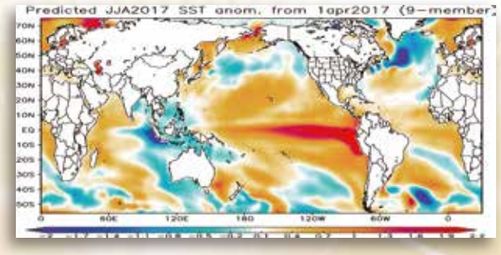
APL provides beneficial predictions for the world

The forecasts are available on the following page.

http://www.jamstec.go.jp/apl/

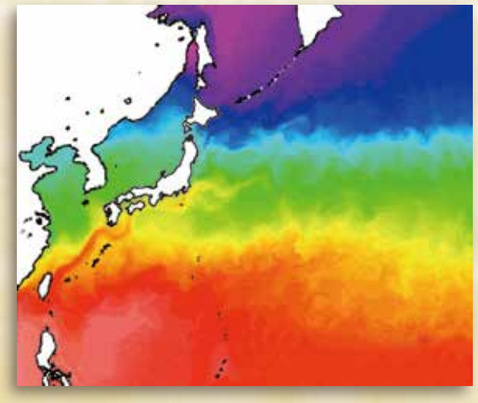
Seasonal Prediction(SINTEX-F)

Prediction of seasonal climate variability like El Niño, La Niña, Indian Ocean Dipole Mode and other events is achieved by simulating the coupled ocean-atmosphere system. This can be used to predict, e.g. the severity of winter and summer seasons.



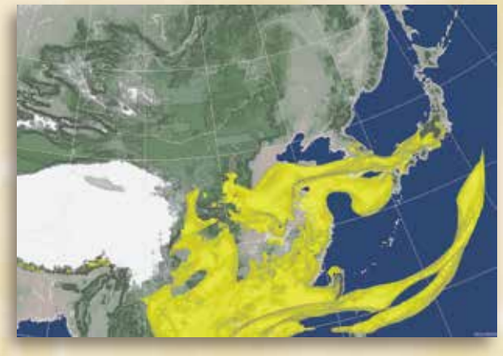
Regional Ocean Prediction (JCOPE)

Ocean current forecasts from the sea surface to the seafloor were achieved by using global ocean observation data from satellites, vessels, floating buoys and so on. These forecasts are utilized by cargo ships and the Japanese off-shore fishing industry.



Air pollution forecasts

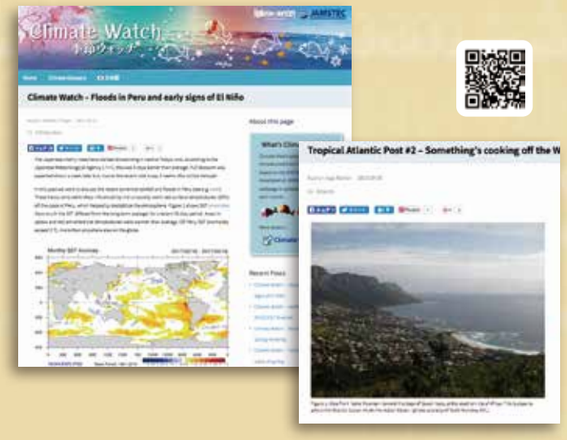
This system forecasts the distribution of air pollutants such as photochemical oxidants and has been operational since 2006. Daily forecasts are available through the web portal. Recent hot issues, such as cross-border pollution, are also covered.



Climate Watch

APL maintains a page dedicated to the discussion of seasonal forecasts and current climate events, called Climate Watch. The site contains monthly updates of the SINTEX-F seasonal predictions (both in English and Japanese) as well as posts on various topics of current interest, such as the Peru flooding in March 2017 or the extreme warming off the coast of southwest Africa in January 2016.

http://www.jamstec.go.jp/aplinfo/climate/?lang=en



Kuroshio-Oyashio Watch

Using the results from the Japan Coastal Ocean Predictability Experiment (JCOPE), this site discusses recent predictions, scientific issues, and hot topics regarding phenomena in the coastal regions around Japan, especially in the Kuroshio and the Oyashio.

http://www.jamstec.go.jp/aplinfo/kowatch/e/