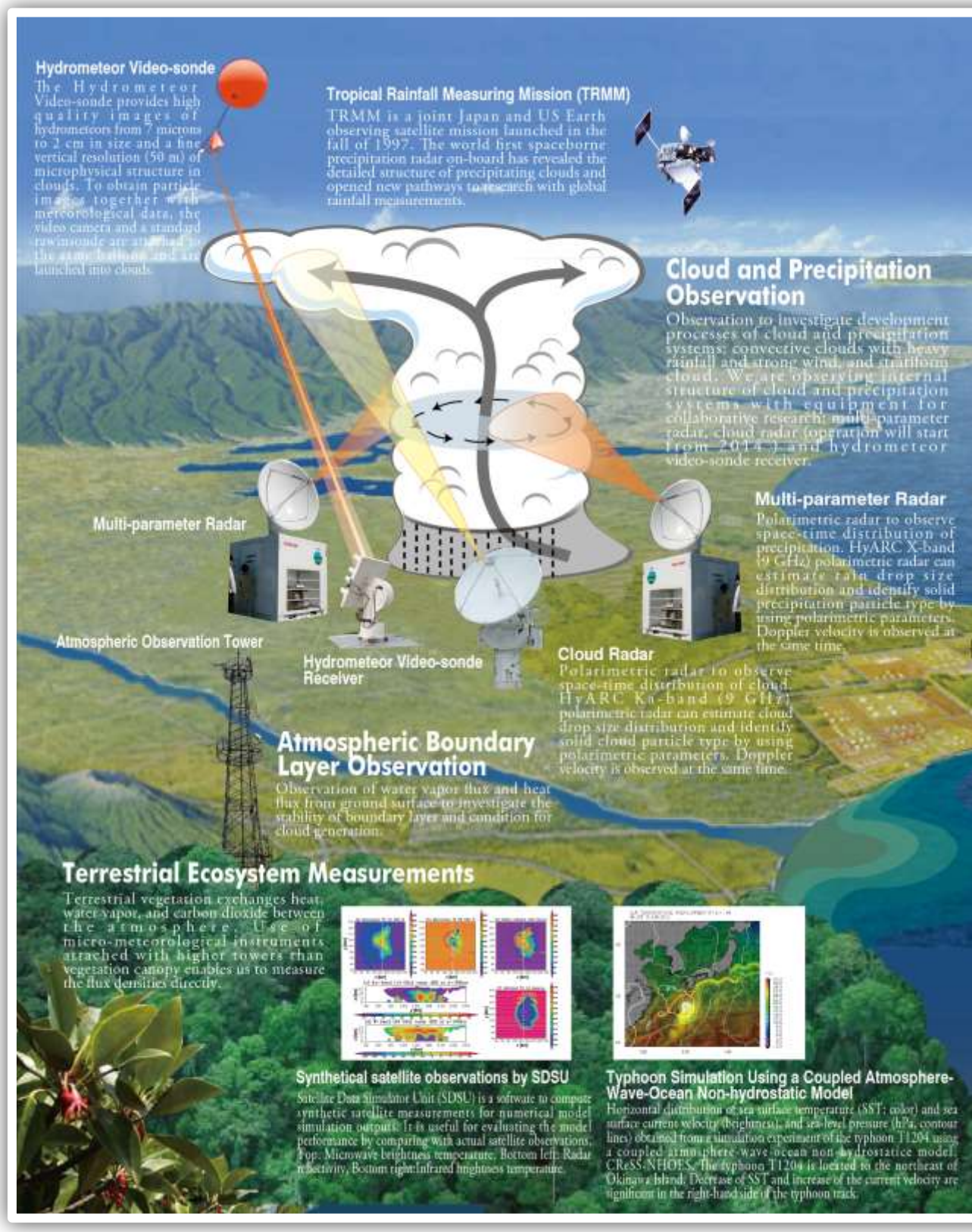
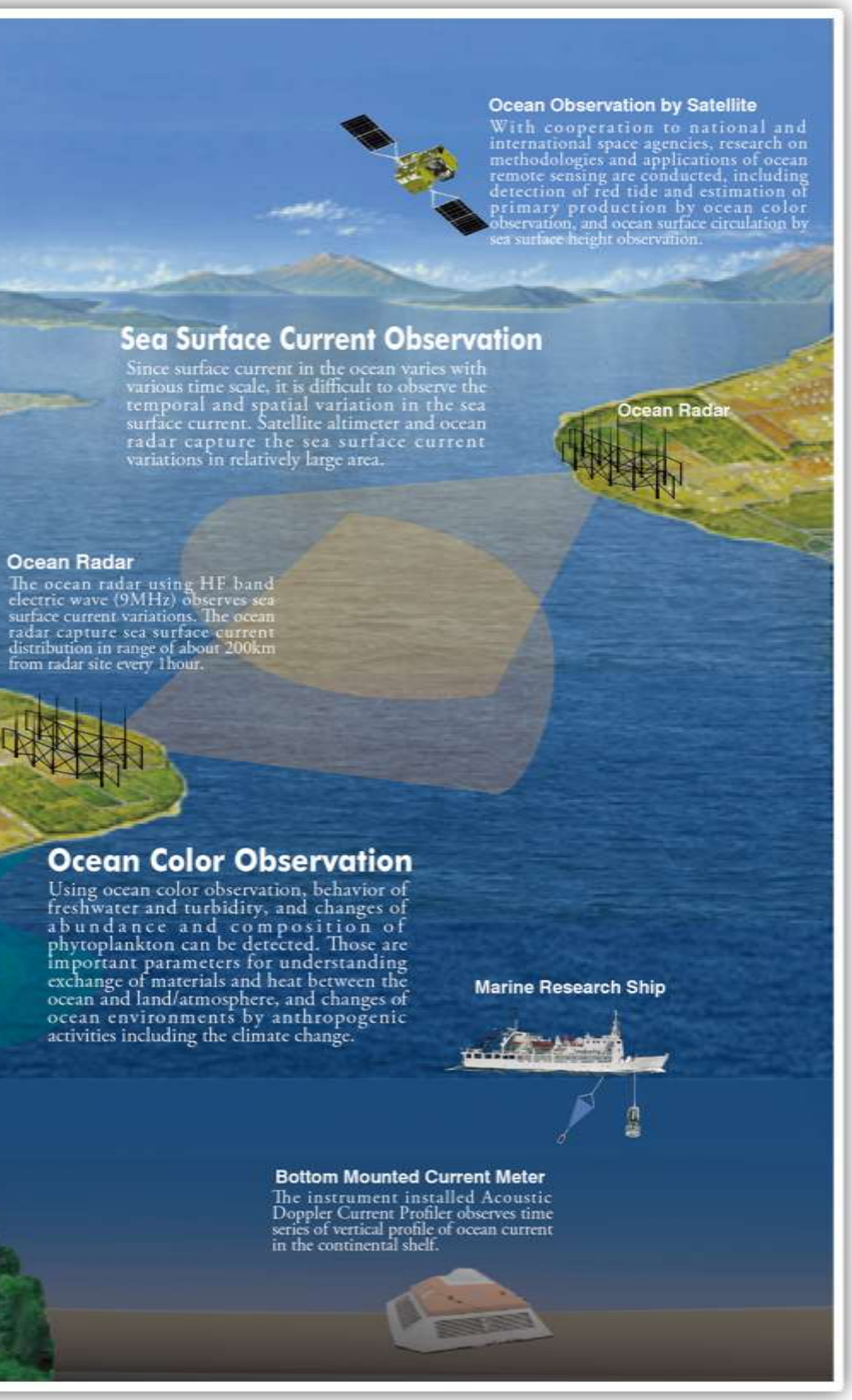
Hydrospheric Atmospheric Research Center

Nagoya University

Research in Hydrospheric Atmospheric Research Center





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Contents

Foreword

Hydrospheric Atmospheric Research Center

Prof. Joji ISHIZAKA, Director

There is large volume of water (1370 x 10^6 km^3) on the earth surface. The 97% is seawater and 2% is snow or ice; therefore, only less than 1% is freshwater. This much of water can be used by human very quickly; however, water circulates and freshwater for our life is always regenerated. Especially, in Japan surrounded by ocean, fairly warm and humid environment is kept by the surrounding ocean, and resulting high precipitation, abundant freshwater, and rich forests. However, there are many areas where water is not enough on the earth. On the contrast, many disasters related water, such as torrential rainfall, typhoon, and flood are happening in some parts of the world. Recently, the water circulation seems to be changing with possible climate changes, and the detail research is necessary.

Hydrospheric Atmospheric Research Center, Nagoya University, is the only one research center in Japan, focusing water circulation through atmosphere, land, ocean and biosphere, and established in 2001. The center is conducting research of the water circulation on the earth surface and the dynamics from local weather events, such as typhoon, to precipitation in large areas, as well as the interactions between the weather and climate with land vegetation and ocean ecosystem. Researches with field and satellite observations and numerical modeling are conducted. From 2010, this center was approved as one of the Joint Usage/Research Centers by Ministry of Education, Culture, Sports, Science and Technology (MEXT), Japan, and is conducting cooperative research with many universities and research institutes.

History

Water is essential for life. It circulates on earth, and even small fluctuations of the water cycle may cause serious problems on human life. The fluctuation, viz. temporal and spatial distributional variation of water, results from multiple factors at different time and spatial scales. These include natural factors as well from human induced changes on the earth system. The complex nature of the multi-scale temporal and spatial variability of the water cycles makes its understanding and prediction difficult. It is therefore desirable, to overcome this difficulty, to conduct integrated studies of various aspects, such as physics, biology and chemistry and/or air, land and oceans, on the structure and variability of the multi-scale water cycles as parts of a whole water cycle system in the earth system.

The Institute for Hydrospheric-Atmospheric Sciences (IHAS) has been established 1 April 1993 to conduct integrated studies on the structure and dynamics of the hydrosphere and atmosphere aiming at understanding the relationship of processes in water and material cycles in a changing earth environment. IHAS had been appreciated by its important contribution in the coordination of national and international joint research projects on earth environmental studies. During the 8-years history of IHAS the global warming and connected environmental changes became an urgent societal issue, and hence serious discussion on the future research strategy has been made in the IHAS.

The conclusion was to bifurcate activities of IHAS. First to concentrate on the intensive integrated research of the water cycle which is to be conducted by a nation-wide collaborative Hydrospheric Atmospheric Research Center, HyARC. Second to disseminate achievements of the Science of Hydrosphere and Atmosphere acquired at IHAS. Third to conduct multidisciplinary studies on "Environmentology" in collaboration with researchers with broad background of science, technology and humanities. The conclusion was materialized with the joint efforts of many people in Nagoya University, the Government of Japan and the Scientific Societies who supported the idea.

HyARC designed to be a national core research center to facilitate national and international interdisciplinary cooperative studies on the global water cycles in order to reveal the multi-scale structure of the water cycle and to understand its variability.

HyARC comprises of two research divisions according to the time and spatial scales of the water cycles of interest. The division for Regional-Scale Water Cycle Processes conducts observational research for the various processes in the water cycles as well as development of numerical models.

The division for Global-Scale Water Cycle Variations conducts analysis of time-series data on variability of water cycle systems to develop numerical models. The target time scale ranges from seasonal to decades, and spatial scale from an observational site to Asia-West Pacific regions. HyARC puts emphasis on biological activities on land and in the oceans. The biological activities, maintained by water cycles, are invariably associated with material exchange between the cells and environments, and this is why the biota is situating at the crossover point of the water and material cycles. Biology is considered to play key roles in large scale and long-term variability of the water cycle systems, but little is yet known. This would be one of the challenges of the HyARC.

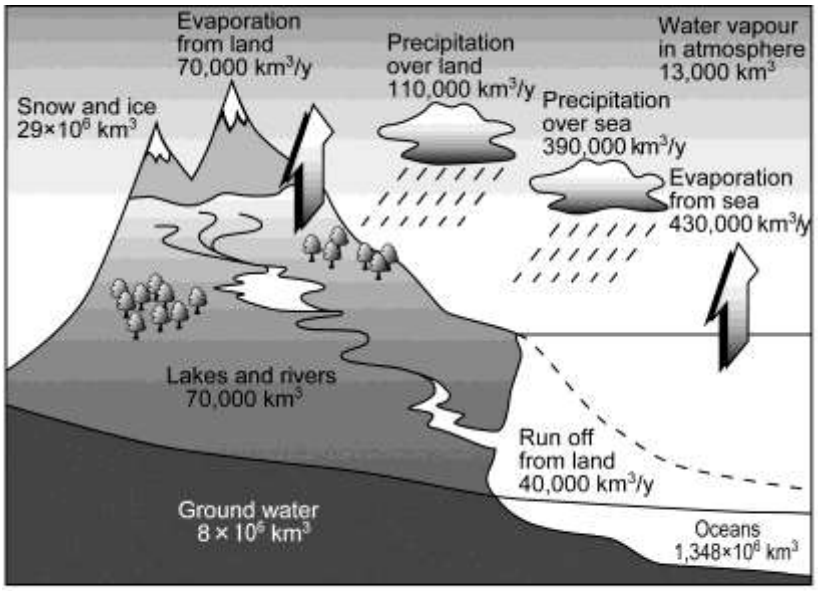
Chronology

April, 1957: Established as the Water Quality Science Research Facility, Faculty of Science, Nagoya University
September, 1973: The Institute for Hydrospheric Sciences, Nagoya University
April, 1993: The Institute for Hydrospheric-Atmospheric Sciences (IHAS), Nagoya University
April, 2001: Hydrospheric Atmospheric Research Center (HyARC), Nagoya University

What is Water Circulation?

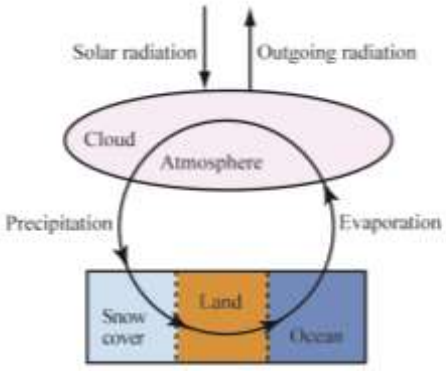
Water circulates in the whole of the Earth surfaces with different phases (states) such as ice (solid), water (liquid), and water vapor (gas). Water also plays an important role on the re-distribution of the energy and material on the Earth by not only the vertical interactions between the ocean and the atmosphere, land-atmosphere, and horizontal movement between land and ocean, but also global scale circulations in the ocean and the atmosphere via tropics - sub-tropics - temperate - cold regions. Our Earth has not homogeneous distributions of land and ocean, and terrestrial elevation; thus, temporal and spatial circulations of water have been changing with wide variability.

HyARC focuses on the spatial and vertical structure of water cycle over the globe. HyARC also mentions the activities of lives, and takes a leadership for investigations of water cycle, by carrying out the overall field experiments, using satellites dataset, and numerical models for water cycles.



The amount of water

(Reference : ENCYCLOPEDIA of HYDROLOGY AND WATER RESORCES,1998)



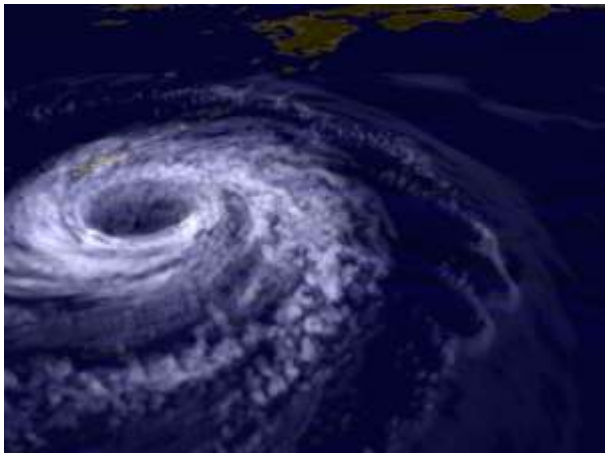
Water cycle

(Referernce: University of Tokyo Press)

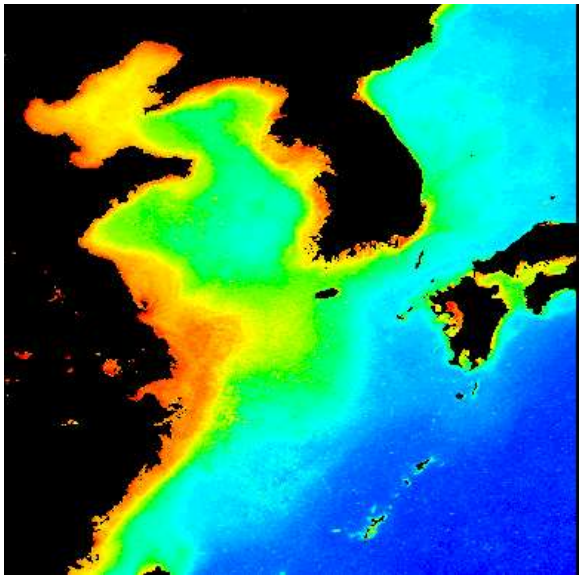
Cloud processes, including diabatic heating and radiation, have are important for the global energy and water circulation (left: cumulus cloud over the Western Pacific Ocean, right: stratocumulus cloud over the East China Sea).

Research Topics in HyARC

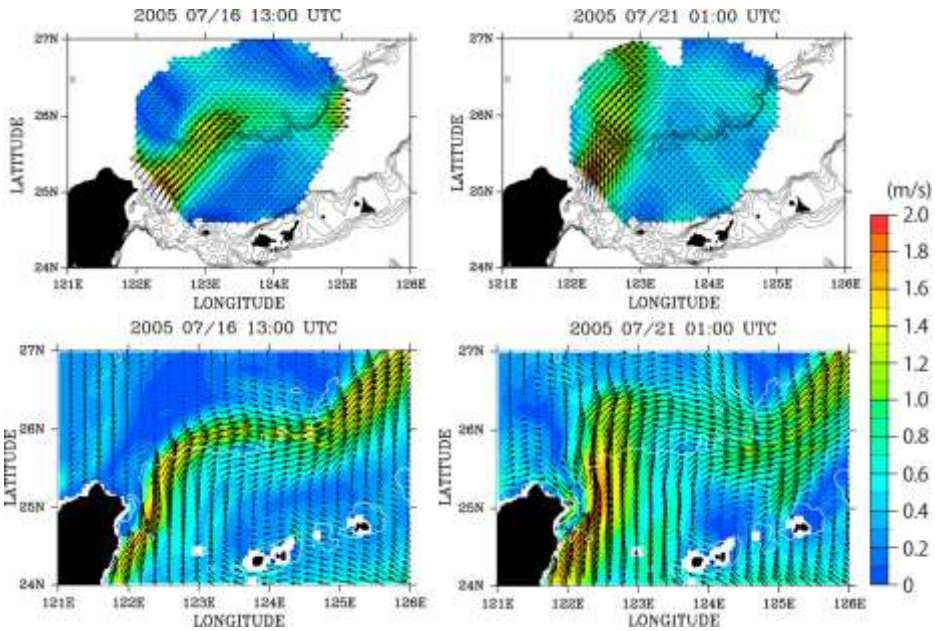
- Research on local atmospheric phenomena such as heavy rainfall, tornados, and generation of cumulonimbus due to atmospheric convection
- Research on organized precipitation systems including the Baiu frontal region and typhoon
- Study on biosphere-aerosol-climate interaction
- Research on the interactions between tropical atmospheric dynamics and convective clouds
- Research on transfer processes of water, heat and mass exchanges over various terrestrial ecosystems
- Research on precipitation activity in various spatial / temporal scales using satellite remote sensing
- Research on marine biological activity and related water cycles using satellite remote sensing
- Variability of the Kuroshio in the northeast of Taiwan by using ocean Radar and atmosphere-ocean coupled model.



Three-dimensional typhoon T0418 structure simulated by the Cloud Resolving Storm Simulator (CReSS) using 1-km horizontal grid resolution. The white smoke-like color indicates the amount of liquid cloud water outlined by Persistence of Vision Ray Tracer (POV-Ray). Courtesy of Professor T. Aoki and Ms. S. Sato, Tokyo Institute of Technology.



Phytoplankton pigment (chlorophyll-a) concentration in August from 1998 to 2006 determined by ocean color remote sensing. Increased phytoplankton with nutrients from the influence of the Chinese river, Changjiang, reached almost Japan.



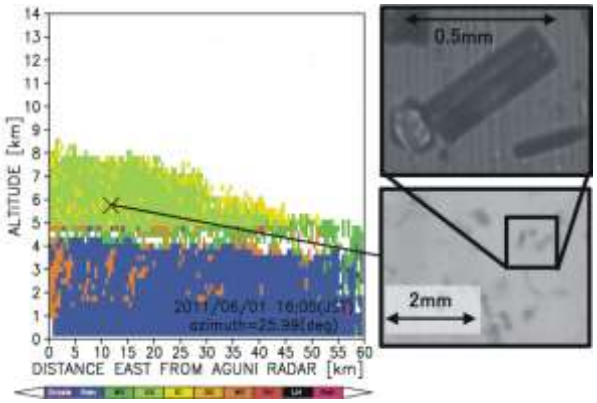
Kuroshio variation before and after passage of typhoon Hai-Tang, which is observed by ocean Radar and is reproduced by a model.

We investigate water cycle processes linked to the atmosphere, continents, and oceans by means of field experiments, data analyses, and numerical simulations. Our research targets include the dynamical and microphysical processes of cloud and precipitation systems and interactions among the atmosphere, land surface, and ocean, including the roles of vegetation and biological processes in the context of the global water cycle.

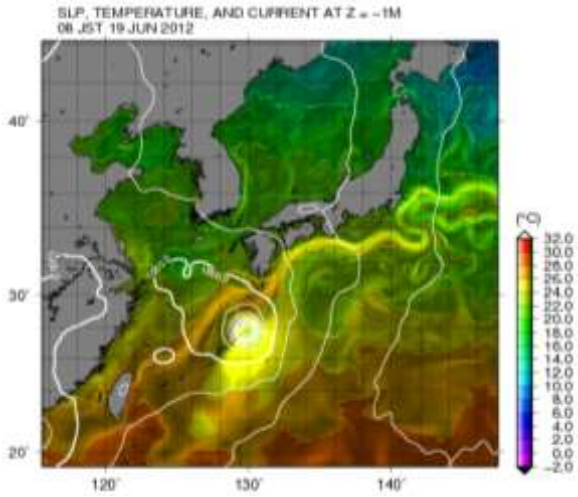
In field experiments, we perform observations of the water cycle in many different ways. Precipitation systems in the Baiu front and typhoons around the East China Sea and the Japan Islands are observed using polarimetric Doppler radars. At the same time, we are developing a cloud-resolving numerical model to examine the detailed structure of heavy rainfall/snowfall systems, typhoons, and tornados. In addition, we investigate the mechanisms of diurnal, intraseasonal, seasonal, and annual variations of Asian monsoon using reanalysis data and climate models. Satellite data are fully utilized for regions beyond the reach of ground observational networks.

In an effort to establish strategies to exploit observations and model simulations complementarily, we are exploring methodologies to validate cloud-resolving numerical simulations using ground-based and satellite data. Analysis tools and datasets obtained from our observational and modeling studies will be made available to the public. Our objective is to obtain a comprehensive understanding of the Earth's water cycle by continuing and further expanding ongoing research on individual processes and interactions among the atmosphere, hydrosphere, and biosphere.

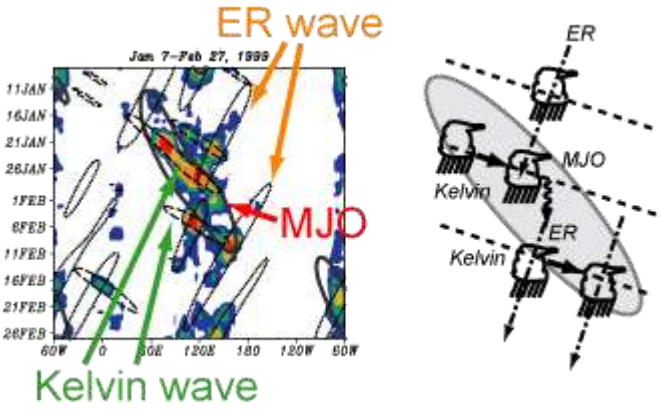
An X-band polarimetric Doppler radar of Nagoya University is installed at Ngarchelong State, Republic of Palau. An intensive observation is conducted in June 2013 to clarify mesoscale convective systems with vortices forming a typhoon over the western Pacific Ocean.



Particle identification obtained by an X-band polarimetric Doppler radar of Nagoya University at Aguni Island, Okinawa on June 1, 2011. Green, light green, and orange colors show the existence of "dry snow (aggregate)," "ice crystal," and "dry graupel" estimated by polarimetric parameters. Particle images obtained by a hydrometeor videosonde (HYVIS) around the mark (X) show the existence of "column type" ice crystals.



Horizontal distribution of sea surface temperature (SST; color) and sea surface current velocity (brightness), and sea-level pressure (hPa, contour lines) obtained from a simulation experiment of the typhoon T1204 using a coupled atmosphere-wave-ocean non-hydrostatice model, CReSS-NHOES. The typhoon T1204 is located to the northeast of Okinawa Island. Decrease of SST and increase of the current velocity are significant in the right-hand side of the typhoon track.



Satellite data analysis of the interaction among the Madden-Julian Oscillation (MJO) and equatorial atmospheric waves (and its schematic). The result offers a new insight into the atmospheric dynamics governing tropical convective clouds.

Lab. of Meteorology

UYEDA Hiroshi (Professor) tel: (052) 789-3492 e-mail : uyeda@rain.hyarc.nagoya-u.ac.jp

Major works are field experiments in moist Asia and data analyses aiming to reveal the generation and development mechanisms of precipitation systems. Energy and water circulation in the area from the west Pacific ocean to the Baiu/Meiyu frontal zone are investigated by jointly synthesized observations and diagnostic analyses with numerical simulations, solving the problems of boundary layer flux, cumulus cloud formation and cloud physical processes. He is aiming to clarify the characteristics of precipitation systems in moist Asia and to reveal the impact of precipitation systems in climate change by investigation of various precipitation systems in Asia.

TSUBOKI Kazuhisa (Professor) tel: (052) 789-3493 e-mail : tsuboki@rain.hyarc.nagoya-u.ac.jp

Water circulation of the atmosphere is characterized by clouds and precipitation. Their formation and evolution are diverse and complex. In order to study the mechanism and structure of clouds, both observation and numerical modeling are important. I perform field experiments and develop a cloud model (the Cloud Resolving Storm Simulator; CReSS) to study the nature of clouds and precipitation.

SHINODA Taro (Assoc. Professor) tel: (052) 789-3494 e-mail : shinoda@rain.hyarc.nagoya-u.ac.jp

I have studied the development process and structure of deep convective clouds by using results of radar observations and numerical simulation. I am also interested in the generation of shallow convective clouds around the top of the convective mixing layer. Especially, I consider that the land-atmosphere interaction and the humidity in the middle troposphere are affecting the development of deep convective clouds. I will research the process of the boundary layer an cloud physics in order to improve the parameterizations utilized in GCMs (General Circulation Models) and RCMs (Regional Climate Models).

OHIGASHI Tadayasu (Designated Assist. Prof.) tel: (052) 789-3493 e-mail : ohigashi@rain.hyarc.nagoya-u.ac.jp

Extreme phenomena such as heavy rainfall/snowfall and high winds occur occasionally in the atmosphere. My interests lie in how extreme phenomena start, develop, and are maintained. Recent progress of both simulation models and computer performance enables us to create an apparently realistic computer-simulated atmosphere. This provides valuable information for us to understand the phenomena, while numerical models cannot completely simulate the real atmosphere. Observation provides us with accurate data. However, this information is fragmentary in space and time. By the complementary use of computer simulation and observation with imperfect information, I am attempting to clarify the mechanisms causing the extreme phenomena.

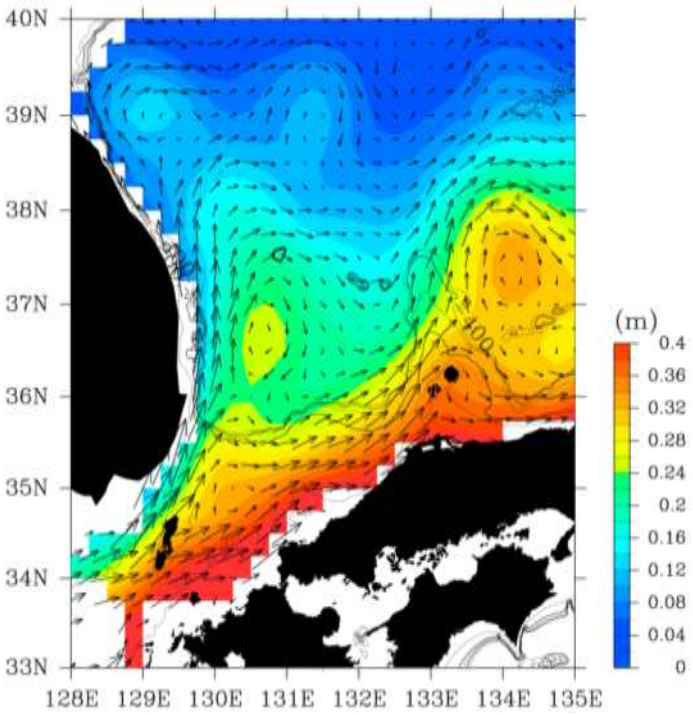
Lab. for Cloud and Precipitation Climatology

MASUNAGA Hirohiko (Assoc. Professor) tel: (052)789-5413 e-mail: masunaga@hayrc.nagoya-u.ac.jp

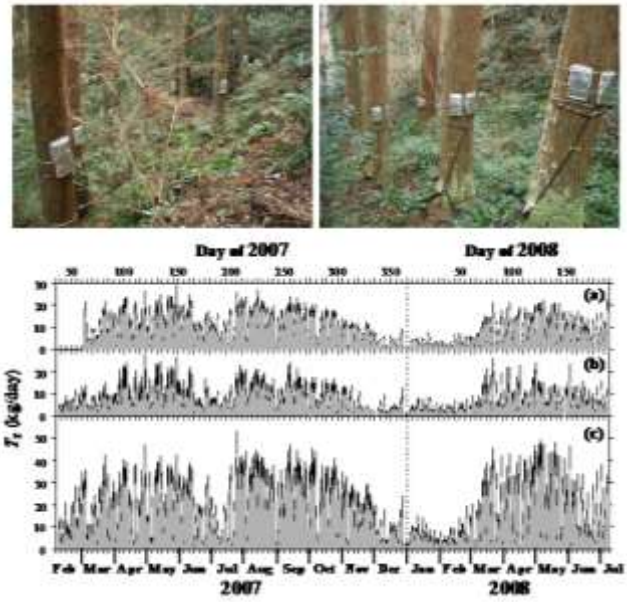
Clouds and precipitation are not only susceptible to ambient climate changes but are also crucial for climate formation. Our objective is to further understand the Earth's climate system by thoroughly and carefully examining clouds and precipitation present around the globe. Observations from satellite radars and radiometers, together with other research tools including numerical models, are instrumental in the projects we have underway. We also aim at contributing to international satellite programs via the development of data analysis algorithms.

This division conducts scientific investigations on the nature and mechanisms of variability of the global water circulation system mainly by data analysis and global numerical modeling with an insight into interactions between the water cycle, material cycle and biological processes. The data from satellites and other sources, which are of different quality, will be assimilated into reconciled grid data by the use of the numerical model prior to data analysis.

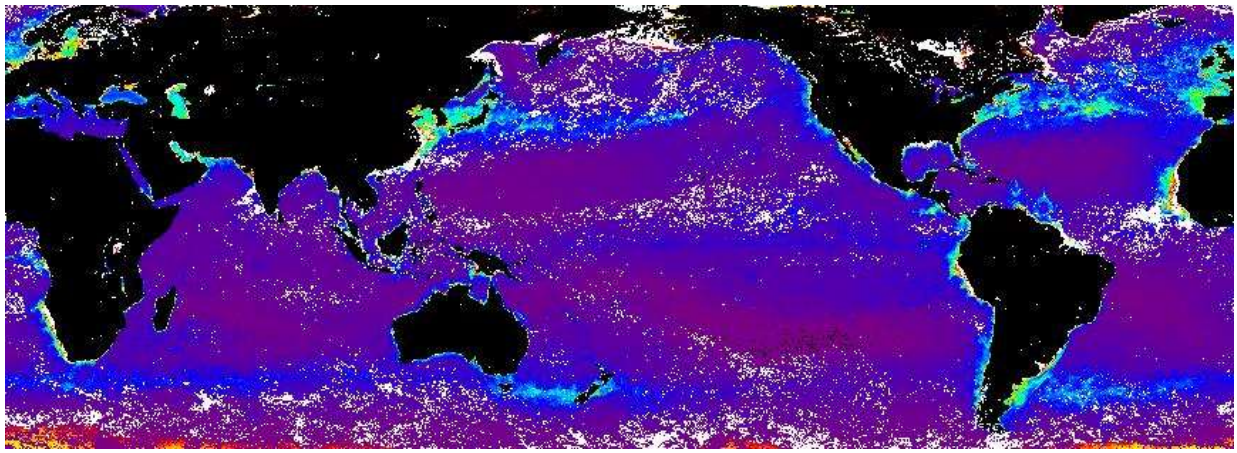
Since the variability of the water circulation system depends not only on internal factors inherent in the system, but also on external ones, individual parameters of these factors will be examined for its responsibility for and sensitivity to the system variability by data analysis and the global numerical model. By combined use of the results from these examinations, we will clarify the mechanisms regulating the variability of the global water circulation system.



Mean sea surface current (vector) and mean sea surface dynamic height (tone) in the southwestern part of the Japan Sea calculated from satellite drifters and altimetry data.



Measurements of individual tree water use (upper panels) and the results obtained on each day at the center of the south-facing slope (a), an upper position (b) and a lower position (c) of the north-facing slope. Using many such sensors distributed over a forest watershed, we can examine the environmental response of forest water use at a catchment scale.



Global ocean primary production in April 2009. It was calculated from phytoplankton pigment (chlorophyll-a) concentration, sea surface temperature, photosynthetically available radiation from satellite data with a model.

Eco-Climate System Lab.

KUMAGAI, Tomo'omi (Assoc. Professor) tel: (052)789-3478 e-mail: kuma@hyarc.nagoya-u.ac.jp

Life is controlled by exogenous environmental physical factors, and vice versa. Based on the concept of energy and matter flows in the Soil-Plant-Atmospheric Continuum (SPAC), I investigate such interactions between the biosphere and atmosphere at various time and spatial scales, i.e., from cell to community of life. In particular, to clarify the impact of climate and land use changes on regional water and carbon cycles in Southeast Asian tropics, I am conducting detailed observations on microclimate, energy/water/carbon eddy flux, and ecophysiology and analyzing those data using mathematical models.

FUJINAMI Hatsuki (Assist. Professor) tel: (052)789-3474 e-mail: hatsuki@hayrc.nagoya-u.ac.jp

I study the space-time variability of convection and associated atmospheric circulation over the Asian summer monsoon regions using satellite data, global objective analysis data, and surface observation data. I focus on the land areas affected by Asian summer monsoon (e.g., the Tibetan Plateau, the plains of the eastern part of China, Nepal, and Bangladesh). The target timescale ranges from diurnal to interannual. I will investigate the relationship between land surface conditions (e.g., topography, vegetation, etc.) and the convective variability.

Lab. of Satellite Biological Oceanography

ISHIZAKA Joji (Professor) tel: (052)789-3487 e-mail: jishizak@hyarc.nagoya-u.ac.jp

Primary production of marine environment is conducted mostly by microscopic phytoplankton and is the most important process for energy and material flows through marine ecosystem. Primary production of the marine environment is studied by satellite remote sensing, ship observation, and analysis of the past dataset. Currently, coastal environment is the main target because it is under the influence of human impact through changes in freshwater input and nutrient load and under the influence of climate change through modification of ocean current and wind. The research areas are mainly East China Sea, Japan Sea, and Ise/Mikawa Bays.

MINO Yoshihisa (Assist. Professor) tel: (052)789-3491 e-mail: kuro@hyarc.nagoya-u.ac.jp

Marine biological processes contribute significantly to the absorption of atmospheric CO_2 by the oceans, which in turn controls atmospheric CO_2 concentration on long time scales and thereby influences global climate. My study involves the evaluation of spatial-temporal variability in such biological processes, mainly carbon fixation by phytoplankton and sinking of biogenic debris, and the elucidation of their controlling mechanisms using stable isotopes ($\delta^{13}C$ and $\delta^{15}N$) in the marine organic matter. The physiological responses of algae to the environmental changes, associated with global warming, are also investigated with help of both laboratory experiments on algal cultures and field observations.

Lab. of Bio-Physical Oceanography

MORIMOTO Akihiko (Assoc. Professor) tel: (052)789-3433 e-mail: amorimoto@hyarc.nagoya-u.ac.jp

Variability of the sea surface current field in the ocean, which affects the material cycle, is investigated by using satellite, ocean radar, and hydrographic data. I focus on the variability in the current field and the response of the ecosystem to the current variability in the Asian marginal seas such as the East China, Yellow, and Japan seas. The marine environments in the East China and Japan seas are drastically changing due to climate change and construction of the Three Gorges dam. To investigate the marine environment change, we conducted hydrographic observation in the Tsushima Straits, which connect the East China Sea to the Japan Sea.


Floating wind turbine

Japan's energy policy has drastically changed since the Great East Japan Earthquake and Fukushima Daiichi nuclear accident that occurred on March 11, 2011. In contrast to its past efforts to promote nuclear power generation projects, Japan has now entered an age of denuclearization.

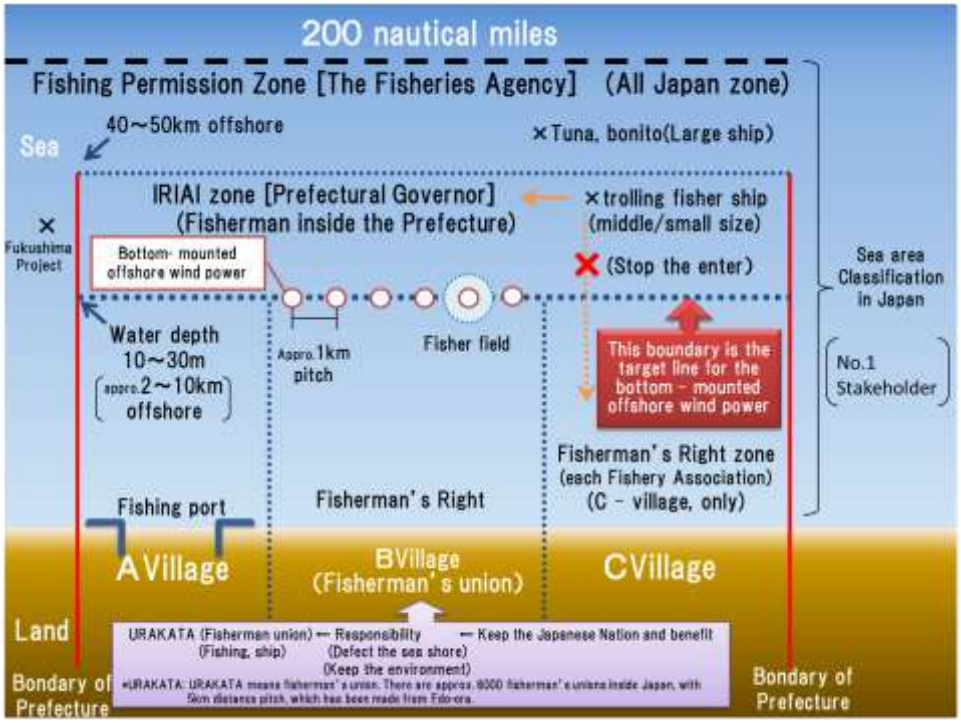
As support for renewable energy gains momentum, Japanese citizens are becoming increasingly interested in the use of offshore wind power—the most abundant of the various forms of renewable energy. Furthermore, the Japanese government has begun implementing a number of experimental research projects related to offshore wind power generation.

However, a number of these projects have been thwarted by conflicts with fishery operators. Because the consent of fishery operators is required for installing offshore structures, negotiations with these operators pose major challenges.

Offshore wind power generation projects have the potential to develop into a significant new industry in the future; however, the growth of these projects undoubtedly depends on the cooperation of fishery operators or *stakeholder management*. Research on stakeholder management of offshore wind power generation projects is still in its early stages, and currently, there is an insufficient number of case studies to facilitate research in the field. In Japan, a country in which fishery operators possess unique fishing rights, offshore wind power generation projects are still relatively new and researchers in the field of stakeholder management must collect more case studies and closely examine their content.

We are currently discussing these issues with a large number of fishery cooperatives and individuals connected with the fishing industry. We expect to discover a method for resolving the existing issues through a successful discussion process.

In September 2011, having gained the cooperation of the Fisheries Agency, the Nagoya University group that is investigating the industrialization of offshore wind farms took the next step by enhancing links with University has played a municipalities and prefectural fishery associations in areas with suitable wind conditions and by commencing discussions with fishery operators. Since March 2012, we have continued to hold further discussions with various fisheries associations, having gained the full support of the Society for Aqua Wind Research. Nagoya central role in these discussions.



Stakeholder Management Research Lab.

YASUDA Kimiaki (Professor) tel: (052) 747-6708 e-mail : kyasuda@iar.nagoya-u.ac.jp

In the past, there was a debate about “who owns the seas?”
Since then, wild animals, fish, and shellfish have been classified as ownerless properties in Japan, and the people who hunt these species have been able to claim ownership of them. However, in the Edo period, the Tokugawa shogunate established a feudal system by geographically and hierarchically immobilizing the population. To achieve a self-sufficient economic system at the coastal village level through fishing and agrarian populist policy, the shogunate and local feudal clans bestowed fishing rights on the coastal villages, which allowed them to subsist. Beginning in the Edo period, these coastal areas became home to the residents of fishing villages, and coastal land owners planted the idea of “we own the sea” in the minds of the villagers. This sense of entitlement continues to exist today, and the tendency for fishery operators to exercise their rights to “prevent others from using the seas freely” has constrained government operations. These conditions pose major challenges to the progress of offshore wind power generation projects in Japan.
Overseas, other societies are generally aware that “rather than belonging to fishery operators, the seas are the common property of the entire nation.” Therefore, there have been no major obstacles to the progress of offshore wind generation projects in Europe.
Our research division has been assigned the task of “applying specific methodologies to realign the attitude of fishermen and gaining approval for the growth of offshore wind power generation.”

TANOUE Eiichiro (Special Appointee Professor) tel: (052) 789-3472 e-mail : tanoue@nagoya-u.jp

We must introduce renewable energy to combat global warming and guarantee the safety of our energy generation activities. Of the various forms of renewable energy, offshore wind power is the most widely used, particularly in areas across Europe. Despite its high potential as a form of renewable energy in Japan, offshore wind power has yet to be developed and industrialized. This is partly because the understanding and consent of fisheries operating in Japan’s coastal zones must be obtained before wind turbines can be installed. I am exploring channels of cooperation with fishery operators from a natural scientific perspective based on my expertise in marine chemistry.

MOTOSU Memi (Assistant Professor) tel: (052) 747-6550 e-mail : motosu.memi@a.mbox.nagoya-u.ac.jp

Although most people have responded positively to wind power, conflicts have arisen between local residents and wind power project operators when wind turbines are actually installed in offshore areas, causing projects to be delayed. While these conflicts are largely due to concerns over the negative impact of wind farms on the fishing industry, it can be argued that issues such as distribution of project benefits and defects in the opinion consolidation process further serve to intensify the conflict. Therefore, I am investigating the consensus-building procedure for offshore wind power generation projects in Japan and analyzing the determinants of acceptance when offshore wind turbines are rejected or approved. Through these activities, I intend to press for a form of offshore wind power generation that is welcomed in local areas.

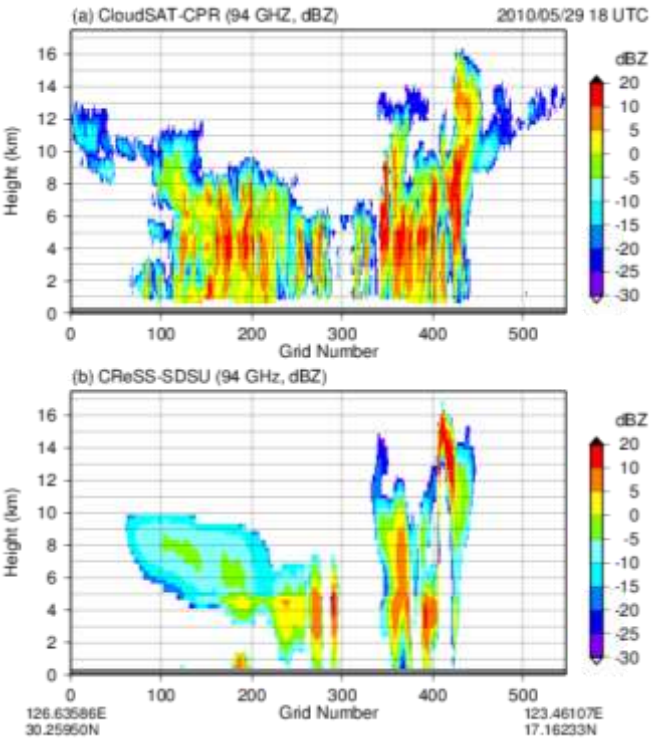
Stakeholder Management on Offshore Wind Endowed Research Division Steering Committee

FUJIYOSHI Yasushi	Prof., Institute of Low Temperature Science, Hokkaido University
KANZAWA Hiroshi	Prof., Graduate School of Environmental Studies, Nagoya University
YASUDA Kimiaki	Prof., Endowed Research Division Professor, Hydrospheric Atmospheric Research Center, Nagoya University
MATSUMI Yutaka	Prof., Solar-Terrestrial Environment Laboratory, Nagoya University
ISHIZAKA Joji	Director, Prof., Hydrospheric Atmospheric Research Center, Nagoya University
UYEDA Hiroshi	Prof., Hydrospheric Atmospheric Research Center, Nagoya University
TSUBOKI Kazuhisa	Prof., Hydrospheric Atmospheric Research Center, Nagoya University
MORIMOTO Akihiko	Assoc., Prof. Hydrospheric Atmospheric Research Center, Nagoya University

Research Programme

Formation of a virtual laboratory for diagnosing the Earth's climate system (VL)

To diagnose the Earth's climate system facing global warming, a virtual laboratory (VL) was established in 2007 as a joint program conducted by the following four research centers: (1) Center for Climate System Research (CCSR, currently Atmosphere and Ocean Research Institute or AORI), the University of Tokyo, (2) Center for Environmental Remote Sensing (CEReS), Chiba University, (3) Center for Atmospheric and Oceanic Studies (CAOS), Graduate School of Science, Tohoku University, and (4) Hydrospheric Atmospheric Research Center (HyARC), Nagoya University. The duration of this program is seven years. Each participating institute contributes to the program by exploiting their own strengths, for example, archiving datasets of greenhouse gases, aerosols, microphysical parameters of clouds, vegetation parameters, and the structure of cloud and precipitation systems. These data are crucial for validating and evaluating global circulation models (GCMs) and regional cloud-resolving model simulations. Furthermore, we aim at training young scientists through the research program. While a short training course is conducted every year by one of our participating institutes in turn, we exchange our staff and young scientists to give seminars.



Vertical distributions of reflectivity (color) obtained from (a) the satellite observation (CloudSat-CPR) and (b) the simulation (CReSS-SDSU) along a certain orbit around the Taiwan and Okinawa area at 18 UTC on May 29, 2010.

The VL members at HyARC conduct water budget studies with focus on cloud and precipitation using the Cloud Resolving Storm Simulator (CReSS) and the Satellite Data Simulator Unit (SDSU). In this program, we investigate six themes as follows:

(1) Development of the CReSS model
(2) Establishment of methodology to validate CReSS simulations using the SDSU
(3) Implementation of a data assimilation scheme for the CReSS
(4) Establishment of methodology to use CReSS simulations for improving the cloud parameterizations for GCMs
(5) Development of a two-way nesting scheme linking GCM and CReSS
(6) Establishment of data analysis techniques for X-band polarimetric radars

We started a pilot study to validate the cloud-top height (temperature) computed from CReSS simulations using the SDSU to compare that with satellite data provided from CEReS, Chiba University (see Figure). We are exploring methodologies to validate CReSS simulations in order to improve the microphysical scheme in the CReSS.

Study consortium for Earth-Life Interactive System

What is Study consortium for Earth-Life Interactive System (SELIS)?

As scientists work towards solving the current global environmental issues, there is a great need for a more complete understanding of the earth system. To achieve this aim it is essential to establish and promote a synthetic science of the Earth-Life Interactive System – a science that treats the close interaction between the atmosphere, the hydrosphere, the geosphere, and the biosphere. James Lovelock, a British environmental scientist, proposed the radical new "Gaia" concept- a proposal that the Earth's environment is actively controlled by the biosphere. However, the extent and ways in which the real earth system behaves like "Gaia" remain major unresolved issues. The mission of the new institute **SELIS (Study consortium for Earth-Life Interactive System**) is to achieve a deep understanding of the earth system – a system on which all the living creatures depend - and through this to propose a new discipline to study our planet Earth.

The departments and institutes contributing to SELIS in Nagoya University

- Hydrospheric Atmospheric Research Center (HyARC)
- Solar-Terrestrial Environment Laboratory (STEL)
- Center for Chronological Research (CCR)
- Graduate School of Environmental Studies (GSES)
- Graduate School of Bio-agricultural Studies (GSBS)

HyARC, STEL, CCR and GSES were participated in the 21st COE program "Sun-Earth-Life Interactive System" (the precursor of new SELIS) - and GSBS – an important new addition – which together will underpin research and education of the "Earth-Life Interactive System". Our organization is unique in Japan. We envisage SELIS playing an important role as an international base for both research and education related to studies on the earth system and environmental change in Asia. Collaboration with international global change programs such as ESSP, WCRP and IGBP will be an important part of this process. Within the university, SELIS is committed to educating students in earth environment studies, through a lecture series "Earth Study", cross-disciplinary seminars, and other activities.

Purpose of SELIS

To understand the seamless-earth system - including the biosphere and humanosphere - and its changes, it is essential to further develop interdisciplinary research and education. Under these circumstances, we have established a new virtual institute **SELIS** within Nagoya university (NU) involving HyARC, STEL, OCR, GSES, and GSBS, which will function as an international center of excellence for global change studies, in collaboration with related national and international institutions and organizations. The purpose of this new SELIS is to promote an interdisciplinary study on the the seamless-earth system. Special attention will be paid to active roles of the biosphere and ecosystems in the earth climate system and its changes. In June 2009 a **Global COE Program** for the environmental studies at NU has been approved by the Ministry of Education, Science, Sports and Culture (MEXT), and SELIS is also playing an important role on coordinating interdisciplinary environmental studies in this Global COE Program.

SELIS website: http://www.selis.hyarc.nagoya-u.ac.jp

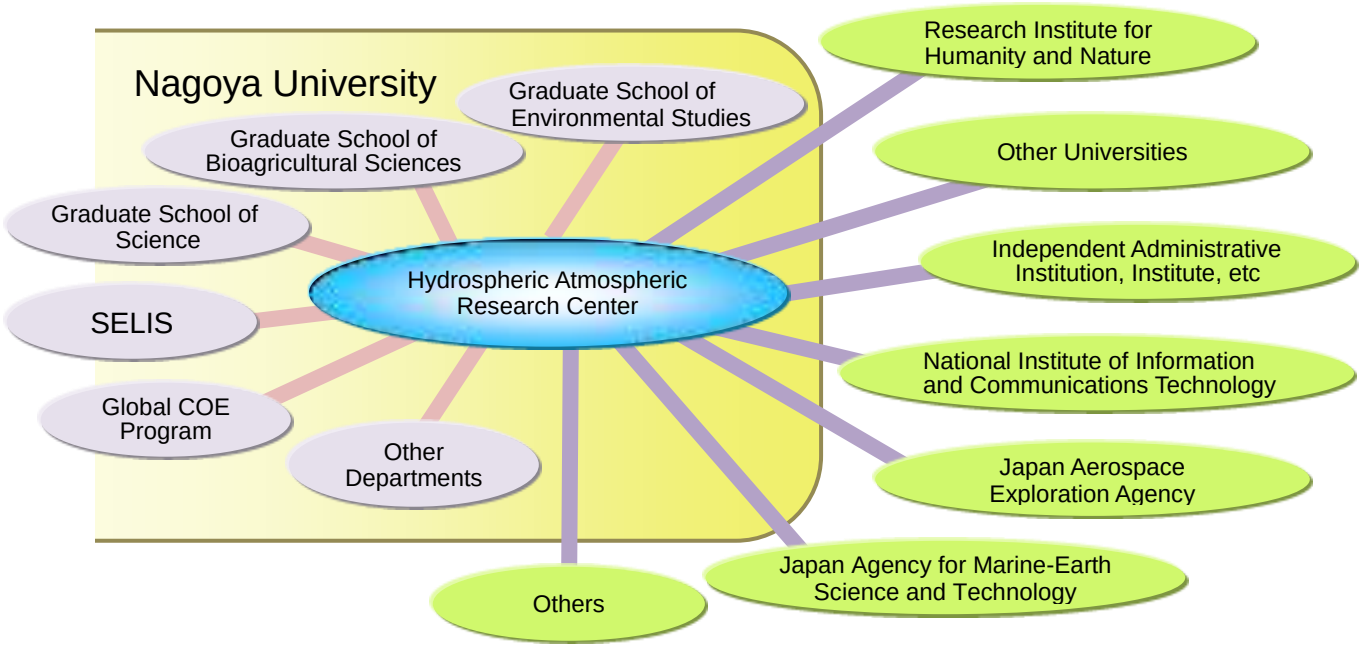
Other Important Activities

The Hydrospheric Atmospheric Research Center is also receiving research students, commissioned researchers and other researchers. Further, concerning UNESCO-IHP (International Hydrological Program), HyARC is receiving trainees dispatched from countries of especially East Asian and Southeast Asian for a short term every year who obtain special lectures and training on studies of global water cycles. As enlightening activity for the public, the Research Center holds every year some public lectures spoken in a plain language and explaining the basic scientific issues of global water cycles, global environmental problems and other subjects.

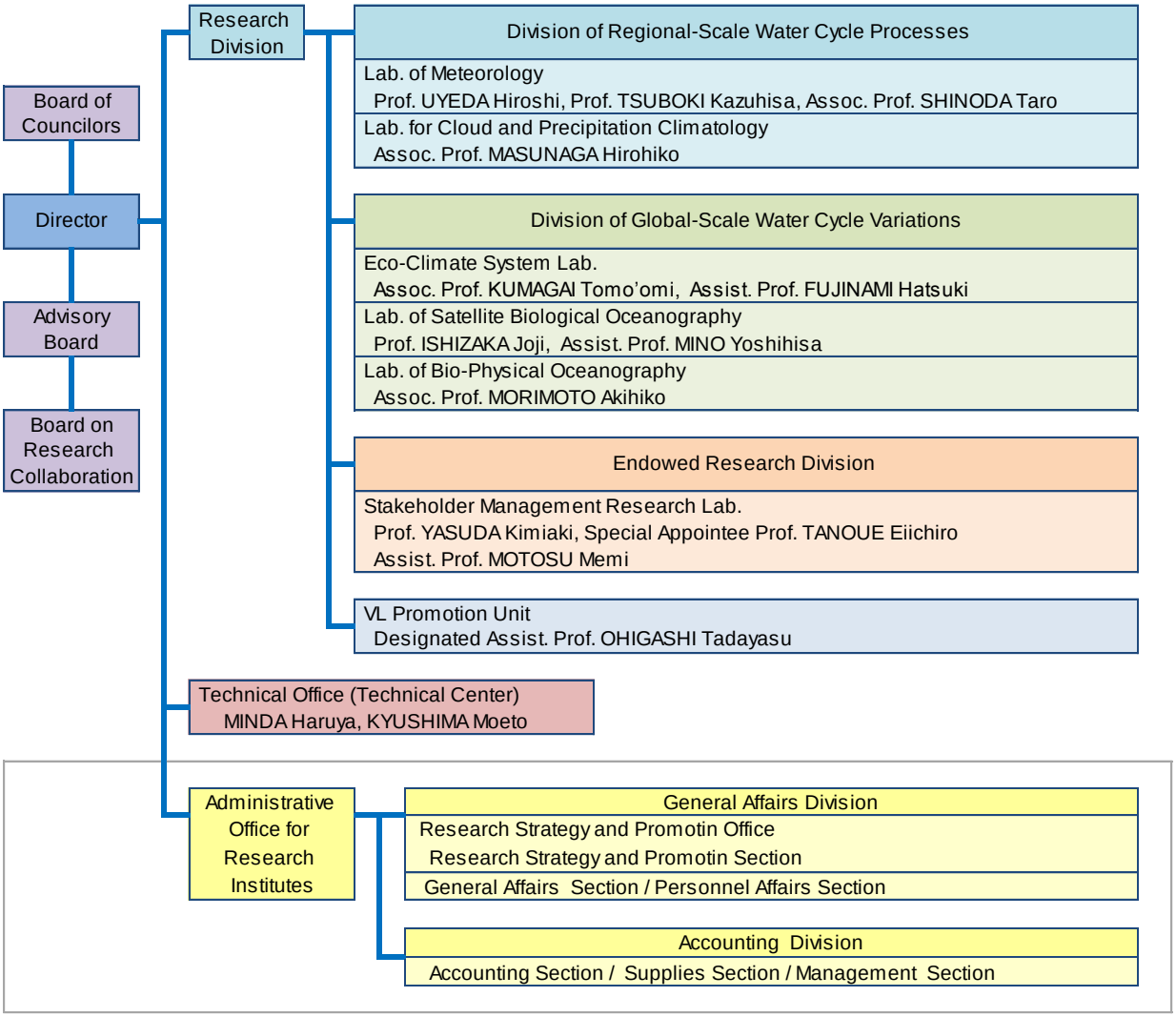
The water cycle is a very important component of the Earth's environmental system. HyARC arouses Special Research Projects and promotes basic studies on global water cycles in cooperation with researchers from other universities and institutes. HyARC is closely connected with the Research Institute for Humanity and Nature (RIHN). We participate in cooperative projects related to global water cycles in the world. Further the staff of HyARC connects actively with researchers working in other universities and institutes.

IHP Training Course: Technical Tours at Japan Aerospace Exploration Agency in Tsukuba.

As a member of the former Institute for Hydrospheric-Atmospheric Sciences, we took part in the GEWEX Asian Monsoon Experiment endorsed by the WCRP (World Climate Research Program) and managed the Experiment as a secretariat in and outside Japan. Moreover, we coordinated a process study in the Northwestern Pacific ocean under Joint Global Ocean Flux Study (JGOFS) being supported by International Geosphere-Biosphere Program (IGBP). Similar activities are also carried out by HyARC.



Organization



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TSUBOKI Kazuhisa: Prof., Hydrospheric Atmospheric Research Center

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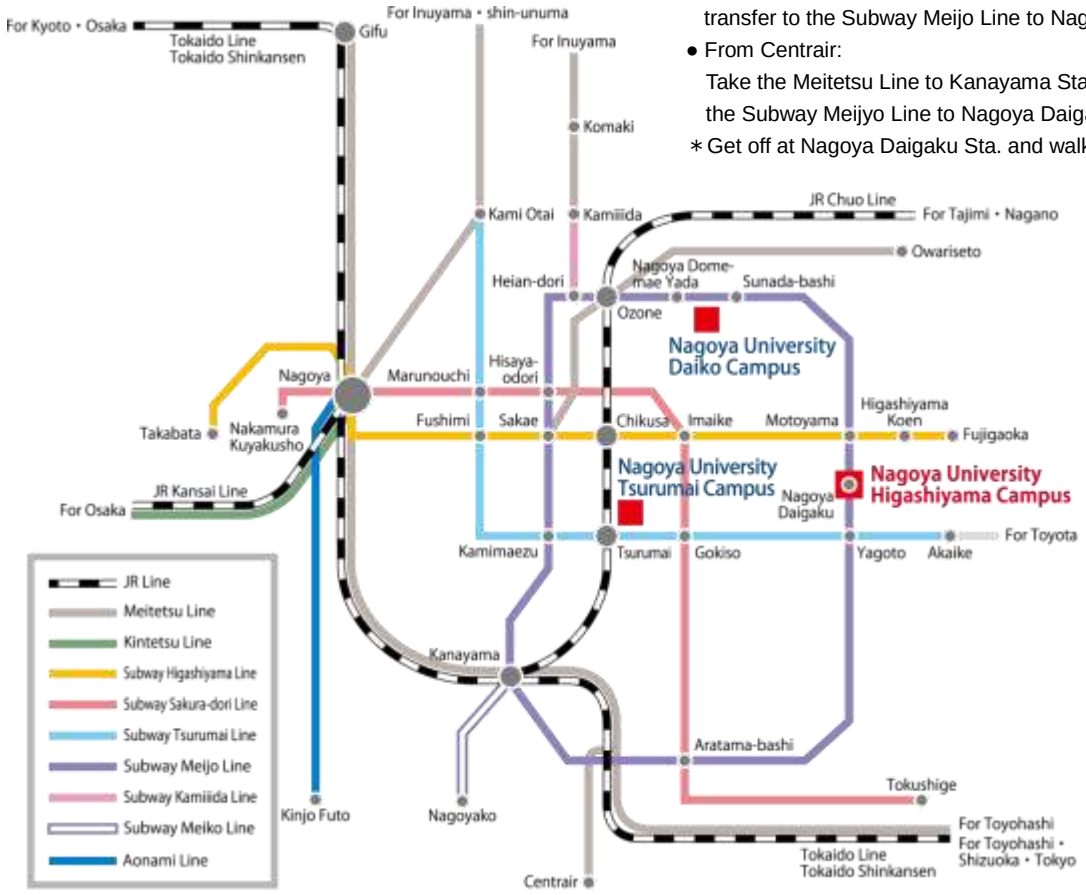
Access Guide・Map

Access Guide



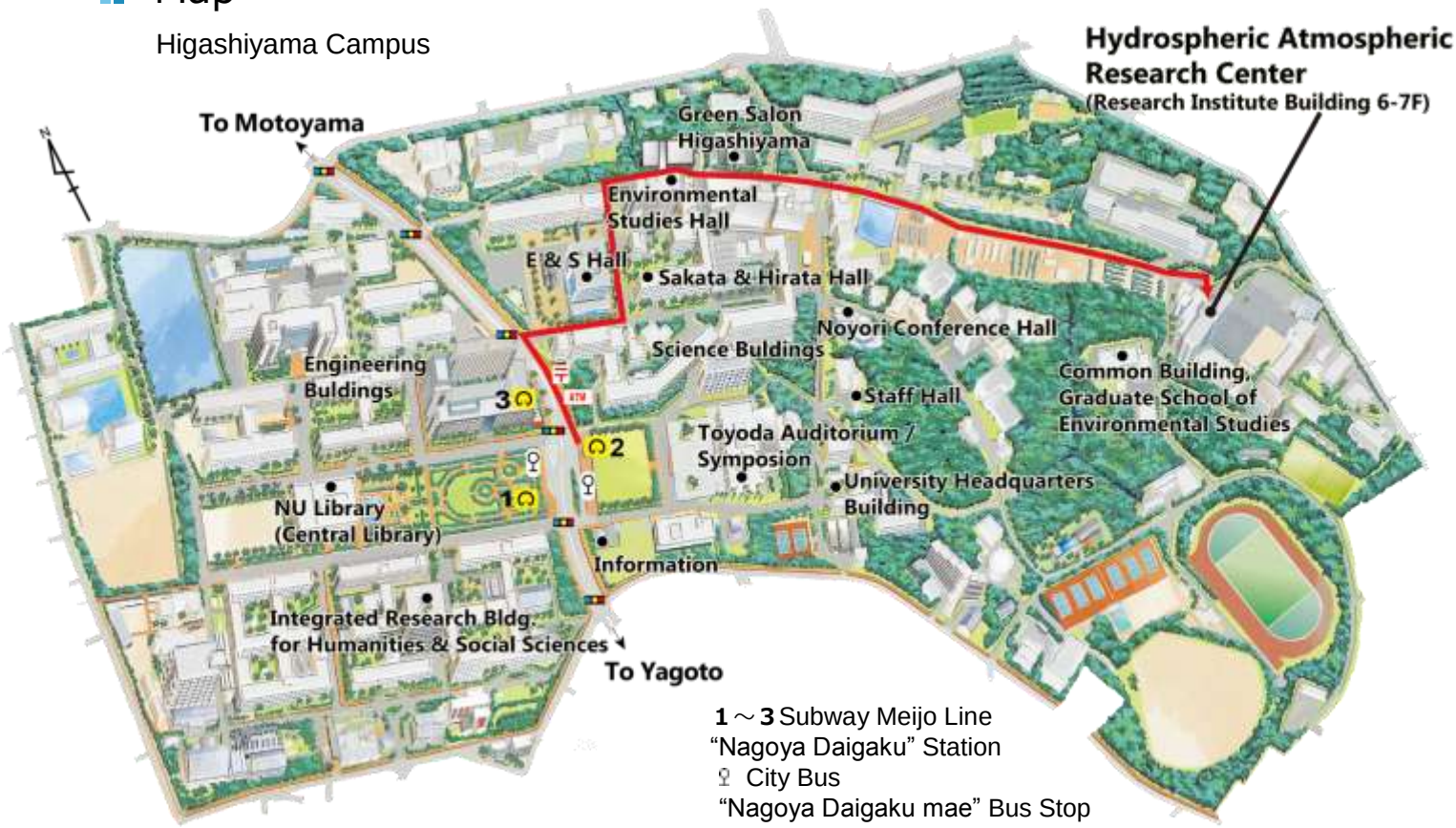
To Higashiyama Campus

- From Nagoya Station:
  Take the Subway Higashiyama Line to Motoyama Sta., then transfer to the Subway Meijo Line to Nagoya Daigaku Sta. (30min.)
- From Centrair:
  Take the Meitetsu Line to Kanayama Sta. (30 min.), then transfer to the Subway Meijyo Line to Nagoya Daigaku Sta.(21 min.).

＊Get off at Nagoya Daigaku Sta. and walk about 15 min.

Map

Higashiyama Campus



1～**3** Subway Meijo Line
"Nagoya Daigaku" Station
♀ City Bus
"Nagoya Daigaku mae" Bus Stop

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