Hydrospheric Atmospheric Research Center
Nagoya University

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.

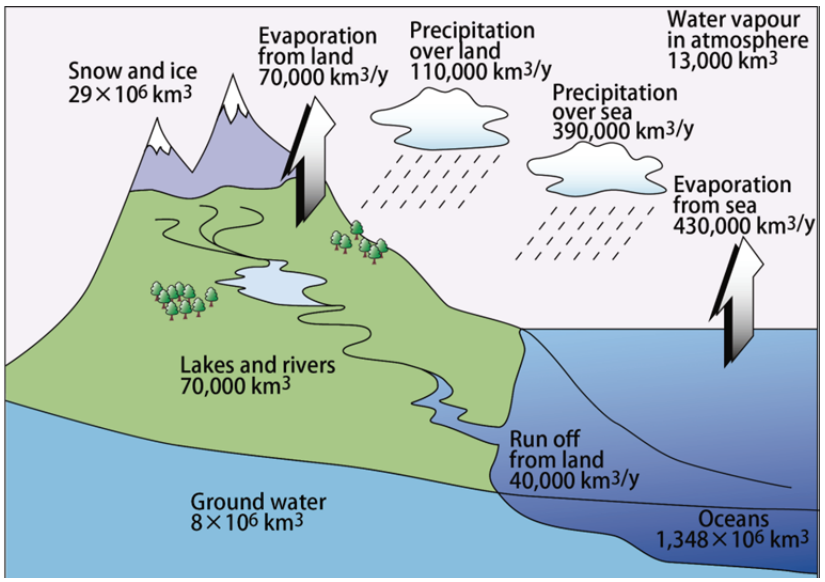
Chronology

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?

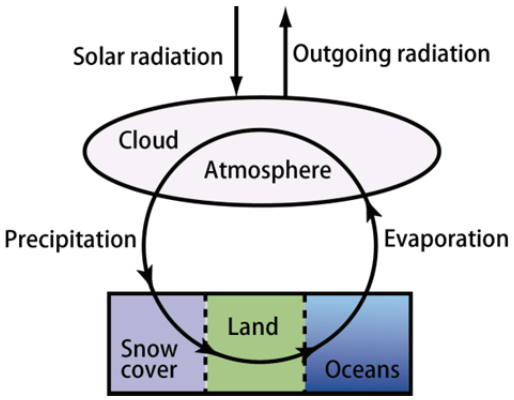
Water circulates in the whole of the Earth surfaces with different phases (states) such as ice (solid), water (liquid), and water vapor (gas). Water also plays an important role on the re-distribution of the energy and material on the Earth by not only the vertical interactions between the ocean and 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)

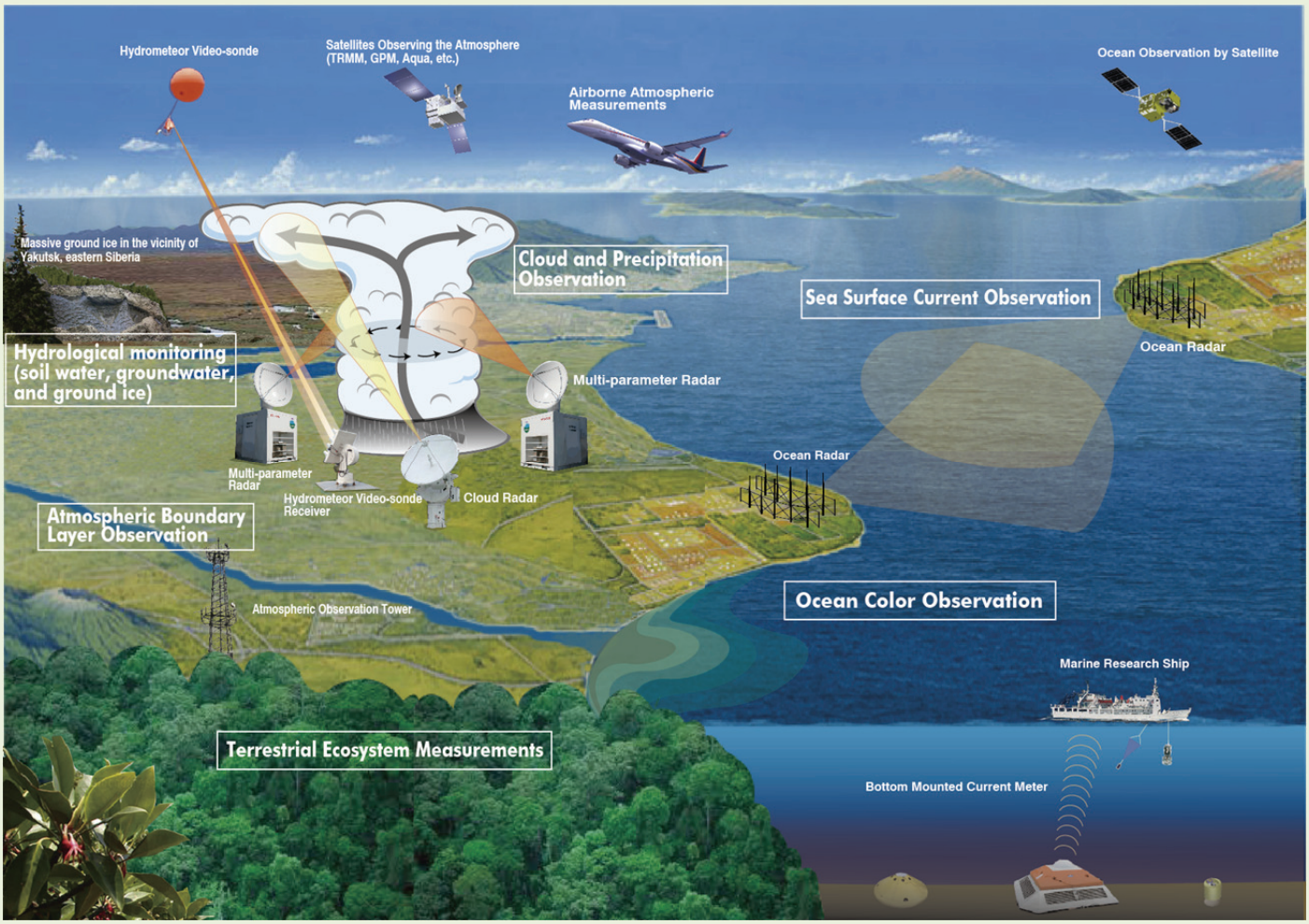


Water cycle

(Reference: 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 in HyARC



HyARC investigates water, energy, and material cycles in the atmosphere, land, and ocean by using various methods. Field observations are our main focus. We conduct field observations not only in Japan but also overseas using radar and radiosonde for meteorology, observation towers for hydrology, and research vessels and ocean radar for oceanography. Observed phenomena are analyzed and understood through satellite data and numerical models.

Observation of cloud and precipitation

Various types of clouds and precipitations are important components of the atmospheric water circulation. Their horizontal scales are wide ranges: cloud particles, a convective cloud, organized system of convective clouds, and global distribution of clouds. They are all research objectives of the research center and observations are performed by using the hydrometeor sounding system (HYVIS), polarimetric radars, and satellites. We study structure and mechanism of cloud and precipitation systems and processes of water circulation in the atmosphere of the earth.

Typhoon cloud observation in Okinawa by HYVIS.

Cloud and precipitation observation near Mt. Fuji using polarimetric and Ka-band radars.

Snowfall observation in Rikubetu-town, the eastern Hokkaido using polarimetric radar.

Field observations in tropical rain forests and boreal forests

The Southeast Asian tropical rainforests represent the highest biological diversity in the world, with many kinds of plants and animals observable especially in the upper part of the forest.

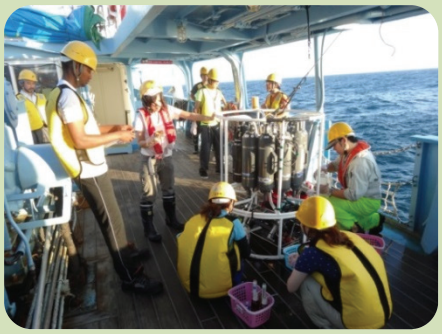
We are investigating the plant physiology and the heat, water, and carbon transfer by the field experiment in the tropical rainforest in Malaysia and other countries, so as to clarify the function of the "unknown" ecosystems in such tropical rainforests.

Installation of the sap flow sensor, which measures the flow rate of water in the stem.

A valley covered with frozen water in the summer of eastern Siberia. Origin of the frozen water is inter-permafrost groundwater which discharged from the permafrost beside the valley.
Continuous sampling and the chemical analyses of hydrological tracers made possible to estimate ground-ice melting rate in the region.

Ocean Observation

Large volume of freshwater from land is supplied in East China Sea and Ise Bay, and the biological production of the areas are high. On the other hand, those areas are easily influenced by human activities. We are studying the influences with collaborations of other universities.

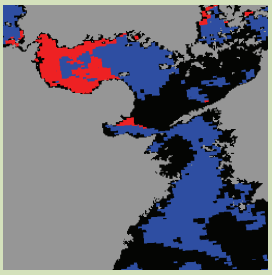


Observation in the East China Sea with a training vessel of Nagasaki University: Sea water sampling and giant jellyfish.

Satellite Observations

In our center, we employ Earth observing satellite data as well as in-situ observations to conduct our research on the global water cycle. Among the many satellites operated by JAXA and NASA that we utilize, we are currently participating in the initial evaluation program for the Global Precipitation Measurement (GPM) satellite launched at the JAXA Tanegashima Space Center on February 28th 2014. We also participating the algorithm development of Global Change Observation Mission-Climate (GCOM-C) planning to launch on 2017. Especially, we are contributing the estimation of ocean primary production related to global carbon cycle and fish production, and the detection of red tide damaging to aquacultures in coastal area.

GPM core satellite（provided by JAXA）

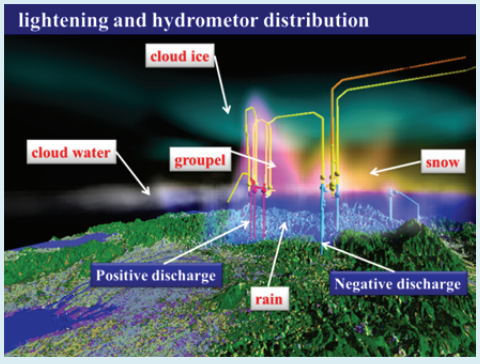


Red tide distribution in Suo-nada area.

Ocean Radar Observation

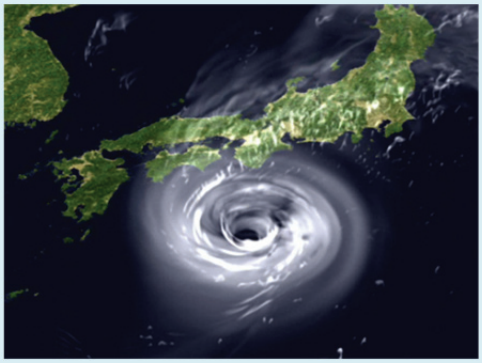
Since ship speed of research vessel is approximately 18 km/h, it is difficult to measure ocean currents in the wide area with high temporal and spatial resolution. We have set up ocean Radar in 2 islands, and sea surface current within 150 km from Radar sites is observed. Bottom mounted current meters are moored in the Radar observed area in order to validate the Radar data.

Ocean Radar in Tsushima.

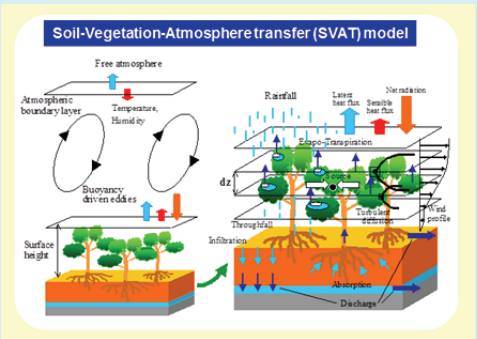


Simulated convective clouds using the cloud resolving model CReSS. The three dimensional color shadings show cloud water, rain, cloud ice, snow and groupel. The lines in the figure indicate lightening simulated in the model.

numerical model



A simulated typhoon using the cloud-resolving model CReSS.



By inputting the meteorological data to this model, we compute the transfer of heat, water, and carbon between the soil, vegetation, and the atmosphere within and above the plant canopy.

Joint Usage/Research Center

HyARC as Joint Usage/Research Center

HyARC's goal is to understand supracrustal water and material cycles, which are important for earth systems. This goal requires globally advanced research of the Earth's water cycle. We offer public subscriptions of collaborative research and progress the research by working in collaboration with domestic and international water cycle research projects. We promote the use of instruments at the Joint Usage/Research Center and provide numerical models and databases.

Collaborative Research

We have offered 4 collaborative researches as follows in 2014, and 27 issues are adopted.

- Study on meso-micro scale phenomenon in atmosphere and ocean using numerical model and remote sensing.
- Study on current, biological productivity, and material cycle in coastal area using ocean color sensor of geostationary satellite
- Study on vegetation-climate interaction over the Asian monsoon region.
- Evaluation of numerical m
- odels using satellite data simulators

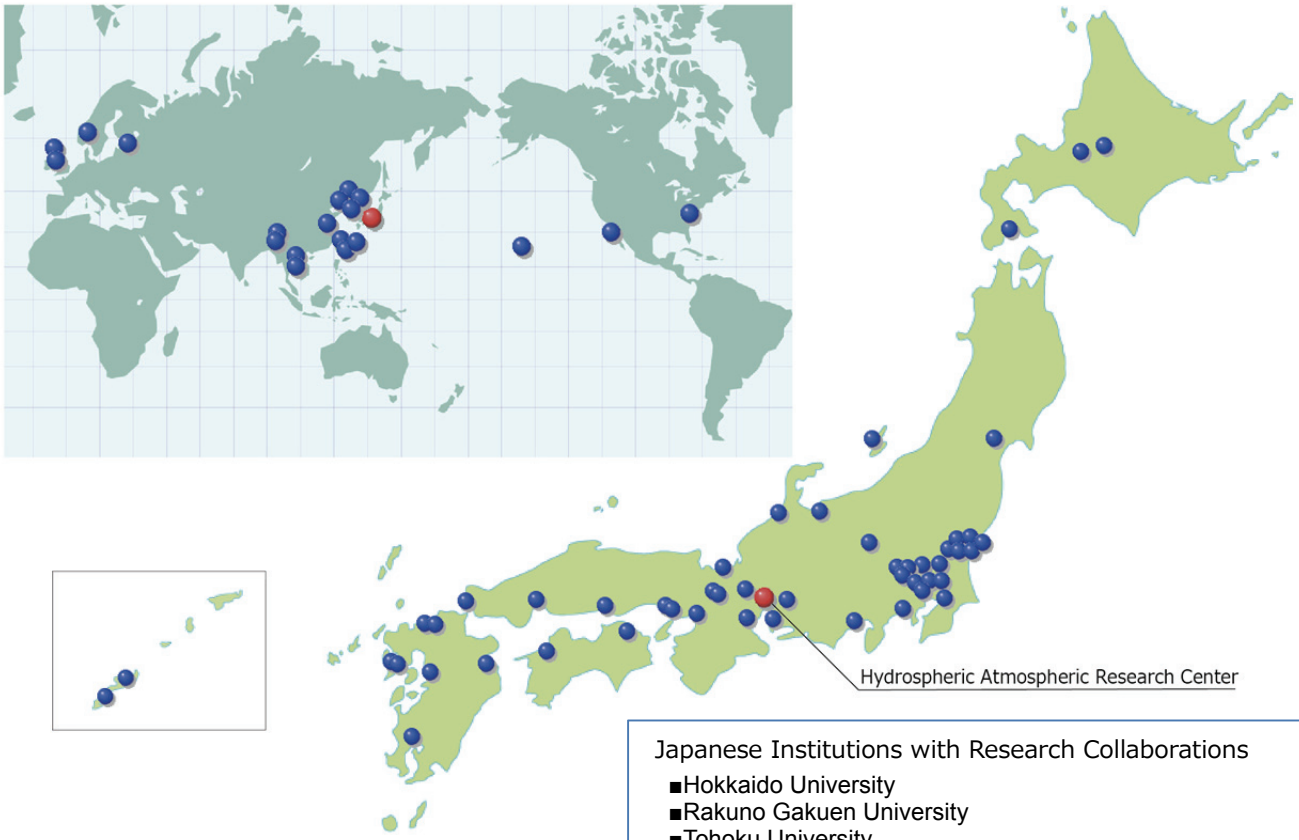
Workshop

- Workshop on ocean-atmosphere interaction
- Workshop on the development of satellite-based high-accuracy precipitation retrieval techniques and research planning for their hydrological applications
- The meteorology covering global- and meso-scales
- Study on climate change and vegetation-climate interaction over the Asian monsoon region.
- Physical, chemical and biological processes controlling material cycle on the East China Sea continental shelf
- Aircraft observation for atmospheric sciences and climate system studies

Instruments for Joint Usage/Research Center

Observation equipment
・ Upper-air sounding systems (2 sets) VAISARA MW-15 Data recoding computers
・ Polarimetric radars (2 sets) <kin and gin radar> Toshiba
・ HYVIS/Video sounding system Meisei Electric Co.
・ Elemental analyzer/mass spectrometer

International and National Counter Parts for the Research Collaborations



Foreign Institutions with the Academic Exchange Agreement

- ■Pukyong National University（Korea）
- ■Korea Ocean Satellite Center, Korea Institute of Ocean &Technology（Korea）
- ■National Taiwan University（Taiwan）
- ■Taiwan Ocean Research Institute of National Applied Research Laboratories（Taiwan）
- ■Bangladesh University of Engineering & Technology（Bangladesh）
- ■SAARC Meteorological Research Centr（Bangladesh）

Foreign Institutions without the Academic Exchange Agreement

- ■The University of Edinburgh（United Kingdom）
- ■University of Aberdeen（United Kingdom）
- ■Norwegian University of Science and Technology（Norway）
- ■University of Tartu（Estonia）
- ■Scripps Institution of Oceanography（USA）
- ■University of Hawaii（USA）
- ■Duke University（USA）
- ■Keimyung University（Korea）
- ■Korea Polar Research Institute（Korea）
- ■East China Normal University（China）
- ■National Cheng Kung University（Taiwan）
- ■Chulalongkorn University（Thailand）
- ■Burapha University（Thailand）
- ■Institute of Marine Environment and Resources（Vietnum）

- ■Aichi Fisheries Research Institute
- ■Research Institute for Humanity and Nature
- ■RIKEN Advanced Institute for Computational Science
- ■National Fisheries University
- ■Fukuoka Fisheries and Marine Technology Research Center
- ■Seikai National Fisheries Research Institute, Fisheries Research Agency
- ■Agriculture, Foresty and Fisheries Research and Training Center, Oita Prefecture

Japanese Institutions with Research Collaborations

- ■Hokkaido University
- ■Rakuno Gakuen University
- ■Tohoku University
- ■Niigata University
- ■University of Tsukuba
- ■The University of Tokyo
- ■Dokkyo University
- ■Chiba University
- ■Tokyo Metropolitan University
- ■Senshu University
- ■Tokyo Metoroloitan University
- ■Tokai University
- ■University of Yamanashi
- ■Meijo University
- ■Mie University
- ■The University of Shiga Prefecture
- ■Fukui Prefectural University
- ■Kanazawa University
- ■University of Toyama
- ■Kyoto University
- ■Osaka University
- ■Kobe Gakuin University
- ■Okayama University
- ■Hiroshima University
- ■Ehime University
- ■Kagawa University
- ■Kyushu University
- ■Fukuoka University
- ■Nagasaki University
- ■Kumamoto University
- ■Kagoshima University
- ■University of the Ryukyus
- ■Japan Meteorological Agency
- ■Japan Aerospace Exploration Agency
- ■Forestry and Forest Products Research Institute
- ■National Research Institute for Earth Science and Disaster Prevention
- ■National Institute of Polar Research
- ■National Institute of Information and Communications Technology
- ■Japan Agency for Marine-Earth Science and Technology

Research Division

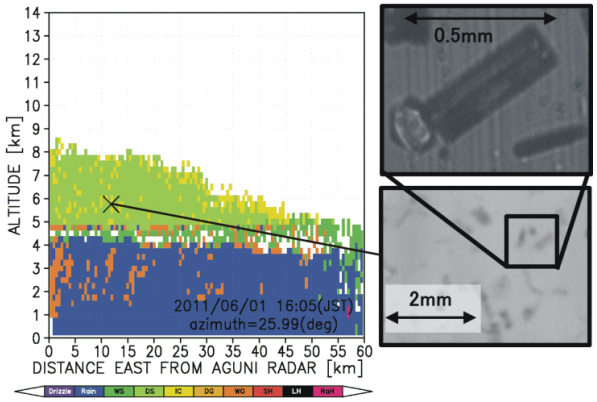
Regional-Scale Water Cycle Processes

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.

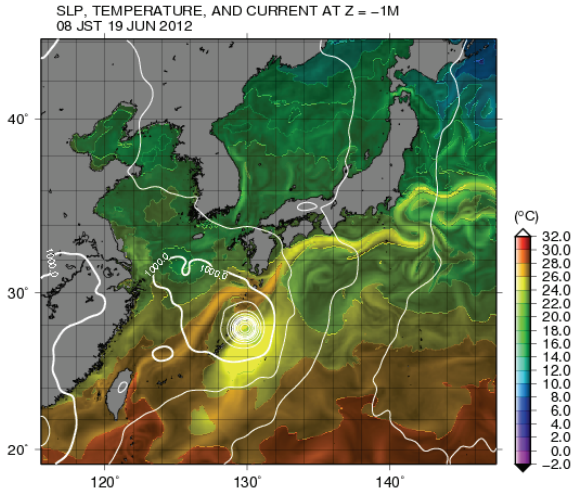
In field experiments, we perform observations of the water cycle in many different ways. Precipitation systems in the Baiu front and typhoons around the East China Sea and the Japan Islands are observed using polarimetric Doppler radars. At the same time, we are developing a cloud-resolving numerical 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.

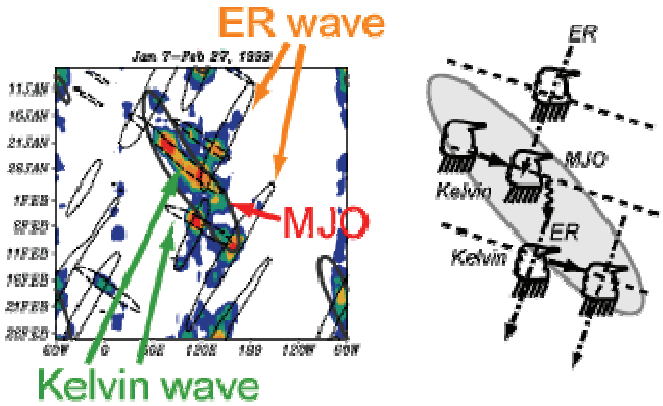
An X-band polarimetric Doppler radar of Nagoya University is installed at Ngarchelong State, Republic of Palau. An intensive observation is conducted in June 2013 to clarify mesoscale convective systems with vortices forming a typhoon over the western Pacific Ocean.



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.

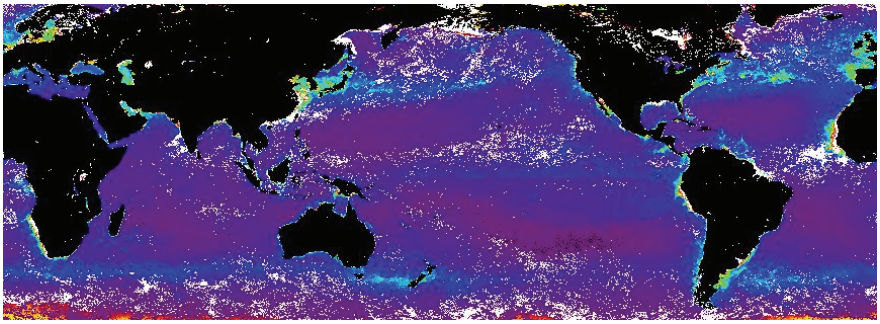
Lab. for Cloud and Precipitation Climatology

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

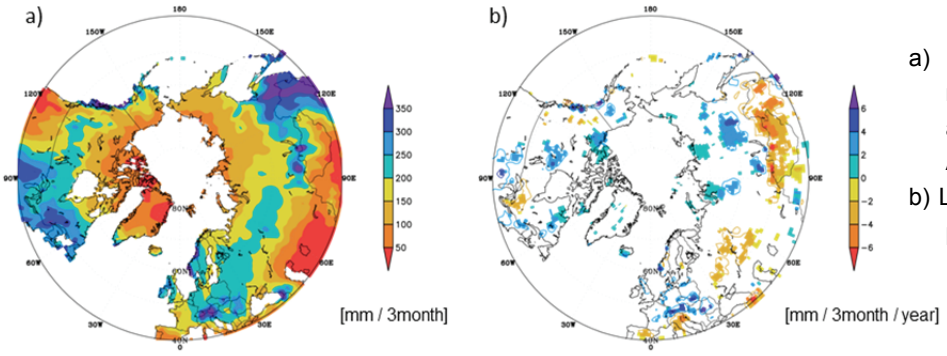
Clouds and precipitation are not only susceptible to ambient climate changes but are also crucial for climate formation. Our objective is to further understand the Earth's climate system by thoroughly and carefully examining clouds and precipitation present around the globe. Observations from satellite 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.

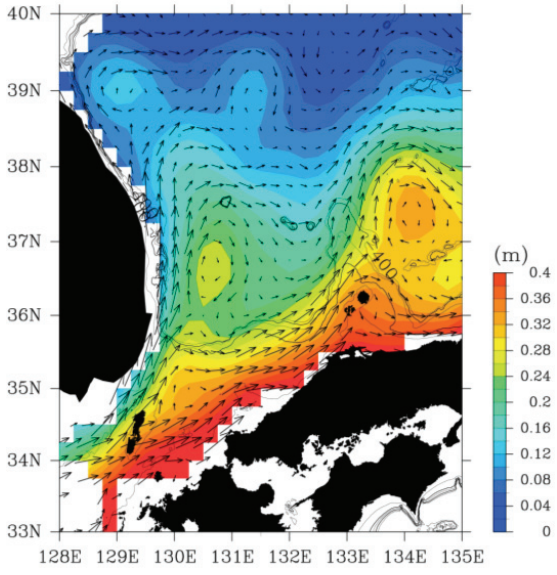
Since the variability of the water circulation system depends not only on internal factors inherent in the system, but also on external ones, individual parameters of these factors will be examined for its responsibility for and sensitivity to the system variability by data analysis and the global numerical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



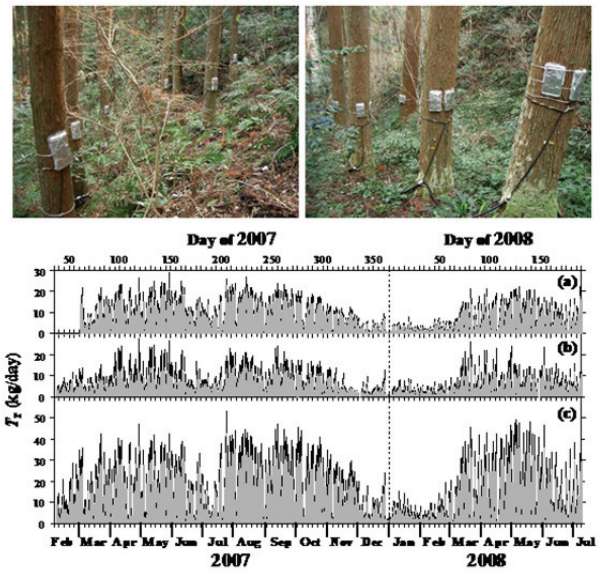
Global ocean primary production in April 2009. It was calculated from phytoplankton pigment (chlorophyll-a) concentration, sea surface temperature, photosynthetically available radiation from satellite data with a model.



a) Climatological (1958 - 2012) mean of summer (June, July and August) precipitation in the Arctic circumpolar region
b) Long-term trend of the summer precipitation from 1984 to 2011



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.

Eco-Climate System Lab.

HIYAMA, Tetsuya (Professor) tel: (052)789-5439 e-mail: hiyama@hyarc.nagoya-u.ac.jp

I investigate atmospheric - terrestrial water cycles focusing on the Arctic circumpolar region and the southern Africa semi-arid region. I intensively focus on the changes in water cycles associated with the global warming in the Arctic circumpolar region. Because there has been decreasing summer Arctic sea ice extent in the Eurasian continent side, changes in atmospheric - terrestrial water cycles in eastern Siberia has been also detected. I am conducting an interdisciplinary research on social adaptation to such changing water environments in eastern Siberia, with the use of knowledge in hydrology, meteorology, climatology, geocryology, ecology, and anthropology. Tower-based flux measurements and analyzing precipitation data, river discharge data, and atmospheric reanalysis data are my main tasks. In Namibia, locating at southern Africa, I focus on water - food security studies. This is because there has been large interannual variability in precipitation, and local residents severely damaged to water resources as well as crop (food) productions. I am collaborating with several researchers in crop science as well as development studies in order to introduce flood - drought adaptive cropping system to local farmers.

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.

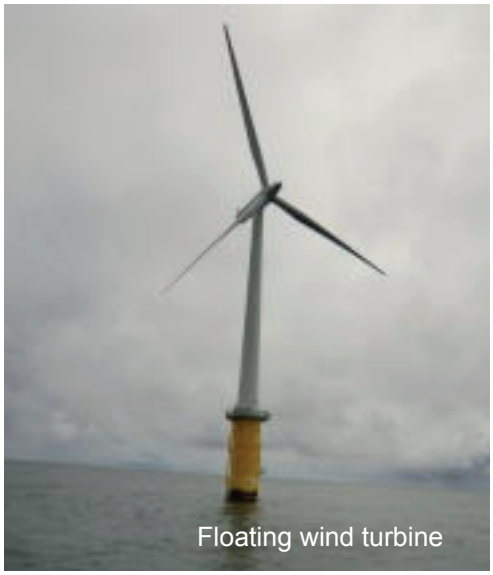
MINO Yoshihisa (Assist. Professor) tel: (052)789-3491 e-mail: kuro@hyarc.nagoya-u.ac.jp

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.

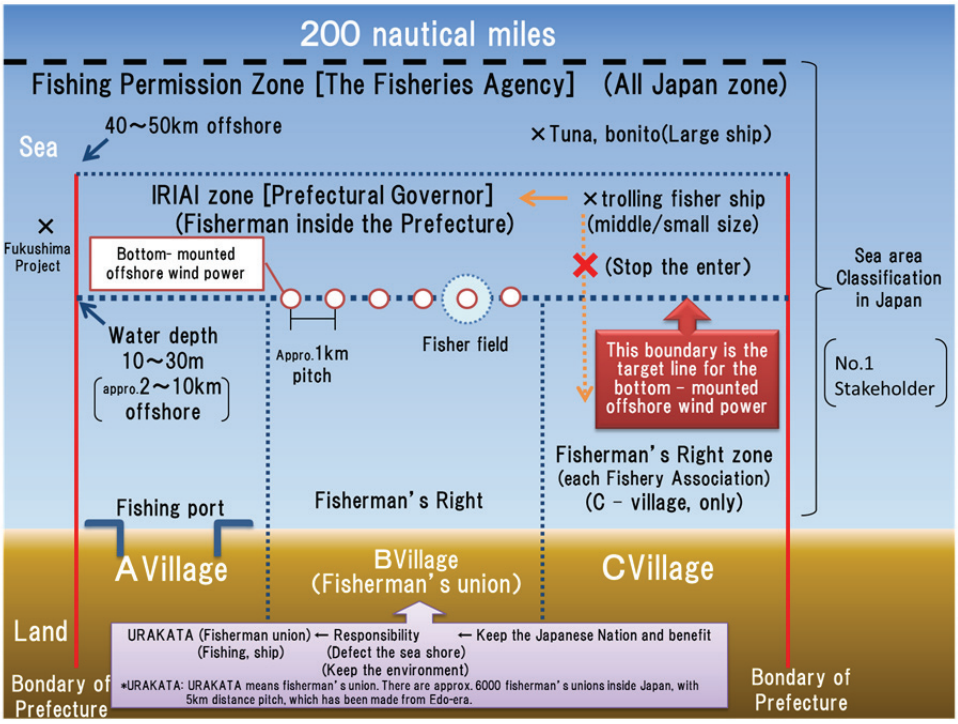
As support for renewable energy gains momentum, Japanese citizens are becoming increasingly interested in the use of offshore wind power—the most abundant of the various forms of renewable energy. Furthermore, the Japanese government has begun implementing a number of experimental research projects related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

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.

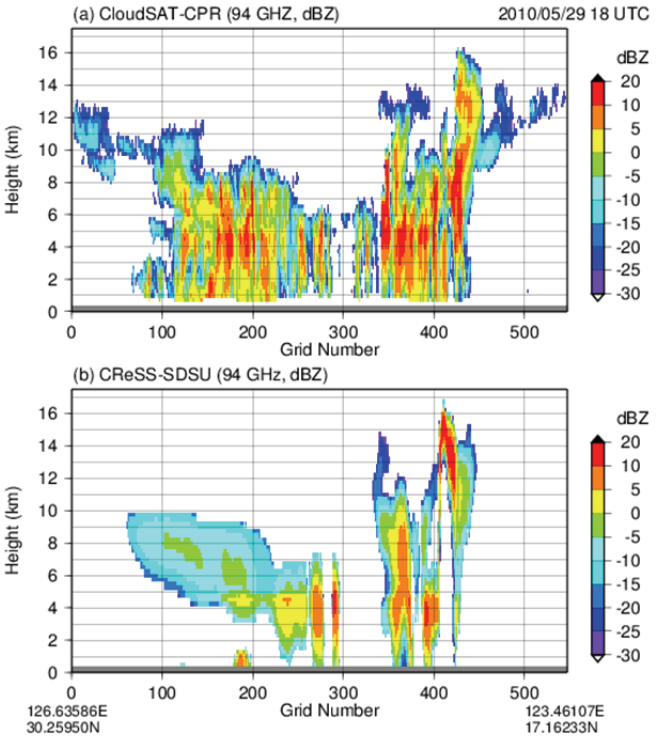
Stakeholder Management on Offshore Wind Endowed Research Division Steering Committee

FUJIYOSHI Yasushi	Specially Appointed 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
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.

This research is ongoing after the end of the original project period with the support of the each University and the Ministry of Education, Culture, Sports, Science and Technology.

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.

A virtual institute in Nagoya University, SELIS (Study consortium for Earth-Life Interactive System), was established in March 2008 with following centers, institute, and graduate schools, 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.

- 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" (SELIS-COE) starting from 2003. With the tight collaboration between those research and education organizations, we could formulate research and education system without boundary between the disciplines. Human activities are becoming one of the most important forcing of the earth system, and we realized that, not only the diagnosis of the earth environment, but a new approach like "basic and clinical environmental studies" is necessary to protect the earth system including humansphere. Thus, with the participation of GSBS, Global COE program "From Earth System Science to Basic and Clinical Environmental Studies"(GCOE-BCES) was started from 2009. This movement has been ahead of the newly starting international program of Future Earth.

SELIS supported GSES established Research Center for Sustainable Co-Development on 2014. SELIS is planning to support studies of variability and change of seamless earth system including biosphere and humansphere within the university as well as with national and international collaborations.

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

Education & Social Activities

HyARC is involved in teaching at the Graduate School of Environmental Studies. Master's and doctoral students obtain their degrees under the guidance of HyARC professors. HyARC employ researchers who are dedicated to cultivating young researchers. Many foreign students and researchers are members of HyARC and play an active role in their country. Three or four visiting professors are invited annually.

We disseminate the research progress to the society through extension lectures aimed at the general public, lectures organized for junior high school and high school students, and mass media. We have conducted the International Hydrological Programme (IHP) training course for over 20 years.

HyARC Seminar

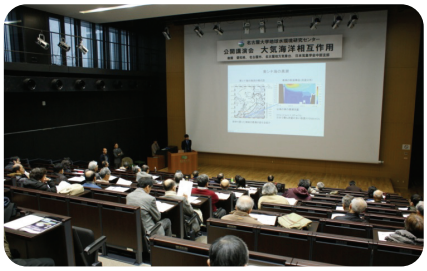
We have organized the HyARC Seminar more than 10 times; here, researchers from other organizations introduce their latest findings.

Cooperative Observation

Cooperative observation with researchers of various disciplines provides a good opportunity for students and young researchers to seek new research.

VL Training Course

The VL training course promotes cooperative research among students and young researchers.



Extension Lecture Meeting

Our annual extension lectures explain global environmental problems in simple terms to the general public.

On-site training

We provide lectures and on-site training to junior high school and high school students. Training includes microscopic observation of phytoplankton and radiosonde observations.

IHP Training Course

Every year, the HyARC and Disaster Prevention Research Institute in Kyoto University conducts a two-week training course, mainly attended by trainees from Asian countries who master observational methods and analytical techniques in hydrology.

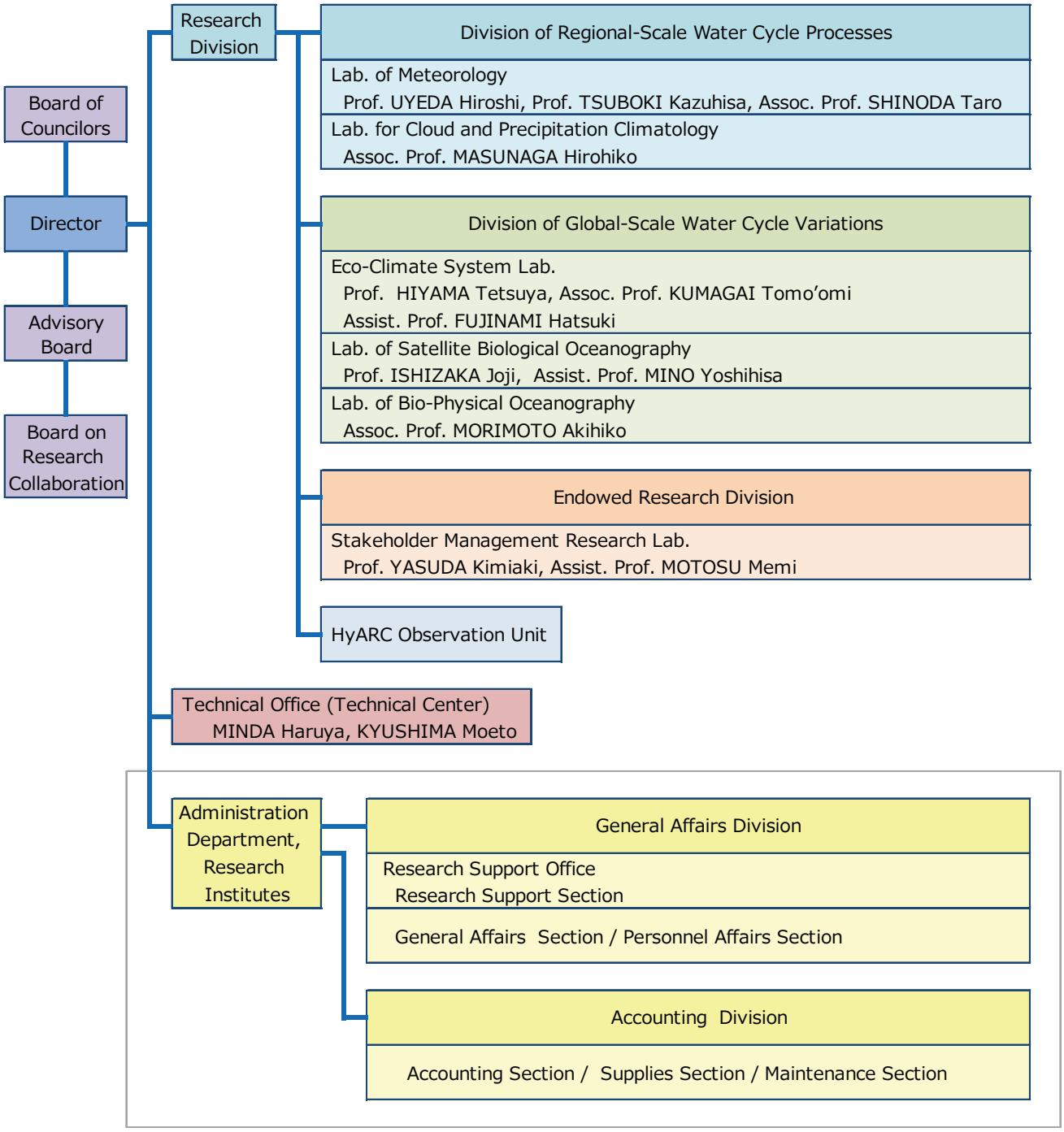
Dissemination of Information through Mass Media

Our research results are disseminated through mass media, such as newspapers, radio, and TV.

Lectures

We deliver lectures about our research to Japanese high schools, other Japanese universities, and foreign universities.

Organization



Administration

Advisory Board

●Members outside Nagoya University

FUJIYOSHI Yasushi: Specially Appointed Prof., Institute of Low Temperature Science, Hokkaido University
HANAWA Kimio: Prof., Graduate School of Science, Tohoku University
TERASHIMA Ichiro: Prof., Graduate School of Science, The University of Tokyo
NAKAMURA Kenji: Prof., Department of Economics on Sustainability, Dokkyo University
SUMI Akimasa: President, National Institute for Environmental Studies
YAMANAKA Manabu: Principal Scientist, Research Institute for Global Change, Japan Agency for Marine-Earth Science and Technology
TANIGUCHI Makoto: Prof., Research Institute for Humanity and Nature
OKI Riko: Senior Researcher, Earth Observation Research Center, Japan Aerospace Exploration Agency

●Members from HyARC, Nagoya University

UYEDA Hiroshi: Prof.
TSUBOKI Kazuhisa: Prof.
HIYAMA Tetsuya: Prof.
MASUNAGA Hirohiko: Assoc. Prof.
KUMAGAI Tomo'omi: Assoc. Prof.
MORIMOTO Akihiko: Assoc. Prof.
SHINODA Taro: Assoc. Prof.

Board of Councilors

●Members from Nagoya University

TANAKA Kentaro: Prof., Graduate School of Science
TSUJIMOTO Tetsuro: Prof., Graduate School of Engineering
TAKENAKA Chisato: Prof., Graduate School of Bioagricultural Sciences
KANZAWA Hiroshi: Prof., Graduate School of Environmental Studies
MATSUMI Yutaka: Prof., Solar-Terrestrial Environment Laboratory
ISHIZAKA Joji: Director, Prof., Hydrospheric Atmospheric Research Center
UYEDA Hiroshi: Prof., Hydrospheric Atmospheric Research Center
TSUBOKI Kazuhisa: Prof., Hydrospheric Atmospheric Research Center
HIYAMA Tetsuya: Prof., Hydrospheric Atmospheric Research Center

Board on Research Collaboration

●Members outside Nagoya University

FUJIYOSHI Yasushi: Specially Appointed Prof., Institute of Low Temperature Science, Hokkaido University
YAMANAKA Manabu: Principal Scientist, Research Institute for Global Change, Japan Agency for Marine-Earth Science and Technology
TANIGUCHI Makoto: Prof., Research Institute for Humanity and Nature
OKI Riko: Senior Researcher, Earth Observation Research Center, Japan Aerospace Exploration Agency

●Members from HyARC, Nagoya University

UYEDA Hiroshi: Prof.
TSUBOKI Kazuhisa: Prof.
SHINODA Taro: Assoc. Prof.

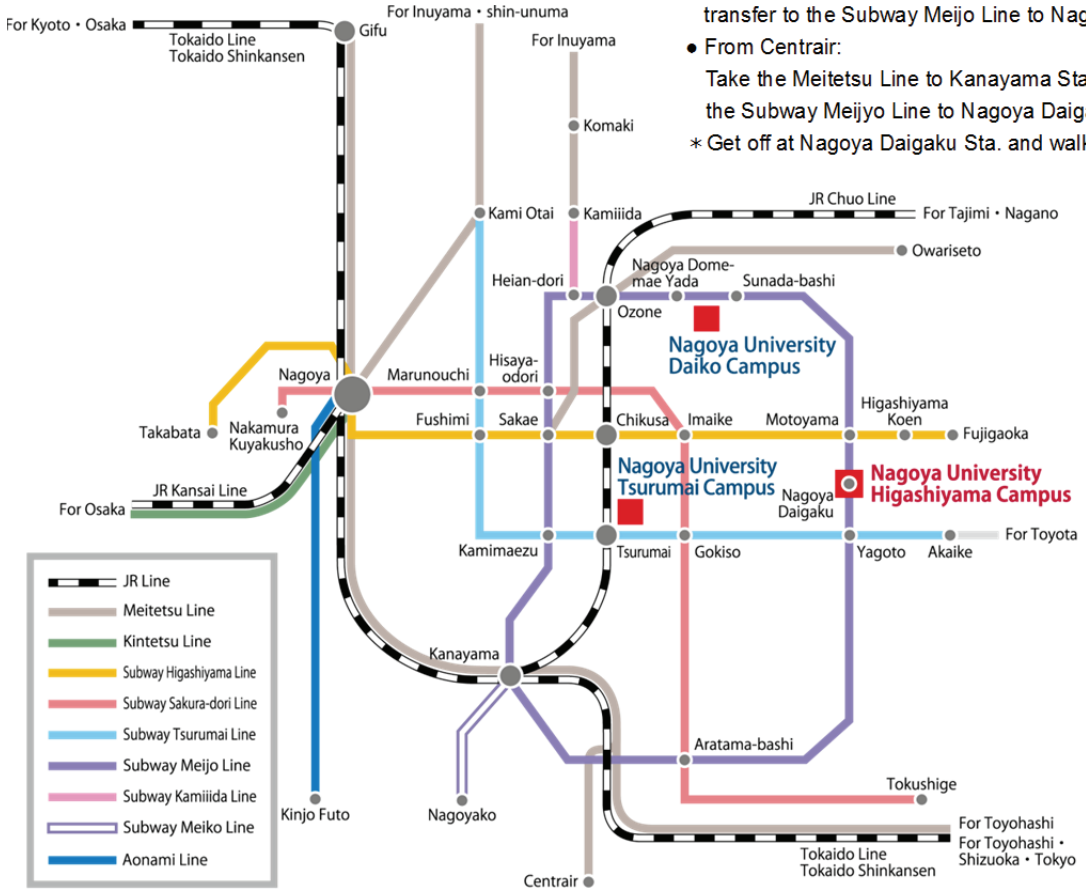
Access Guide・Map

Access Guide

To Higashiyama Campus

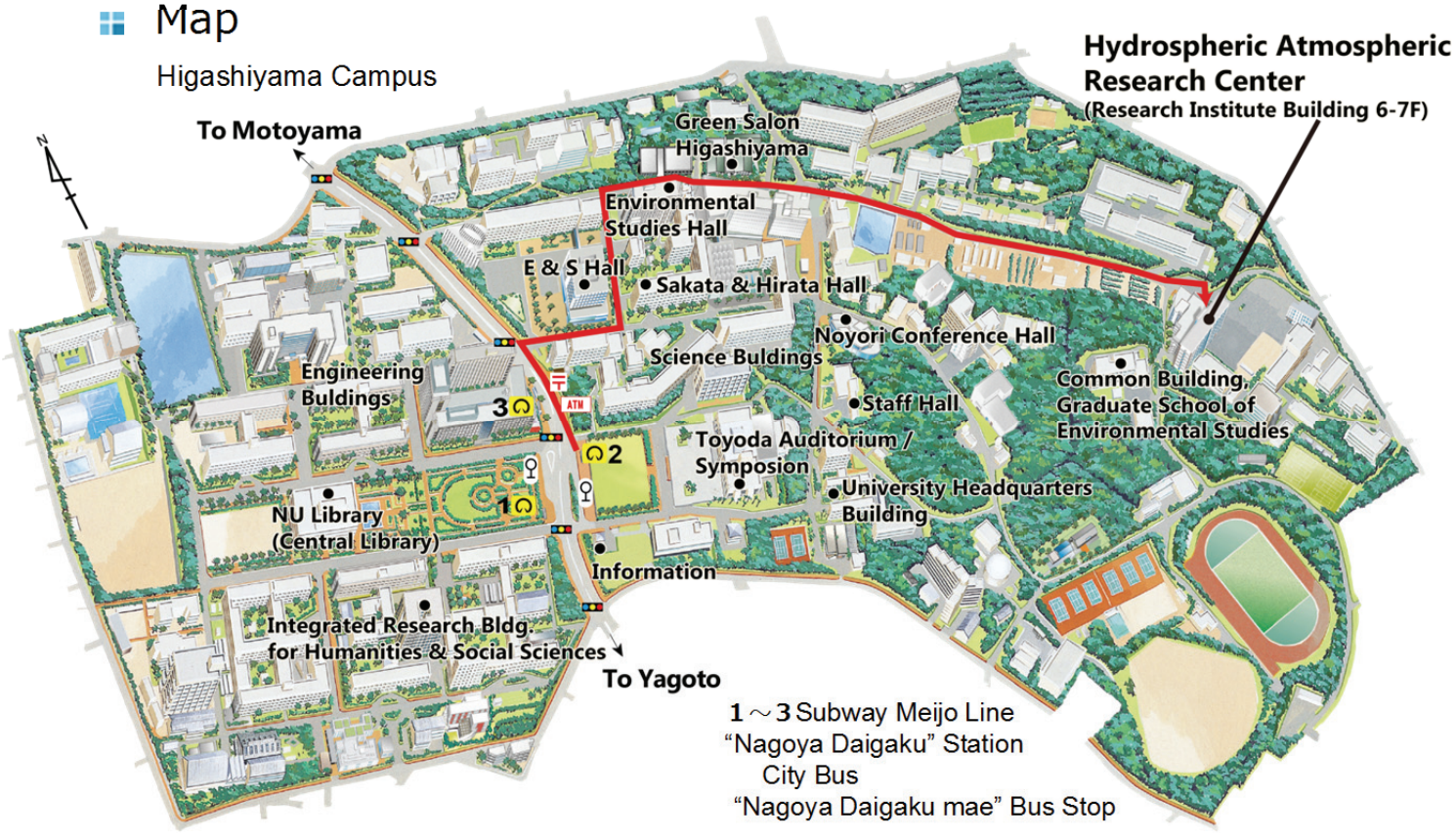
- From Nagoya Station:
  Take the Subway Higashiyama Line to Motoyama Sta., then transfer to the Subway Meijo Line to Nagoya Daigaku Sta. (30min.)
- From Centrair:
  Take the Meitetsu Line to Kanayama Sta. (30 min.), then transfer to the Subway Meijyo Line to Nagoya Daigaku Sta.(21 min.).

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



Map

Higashiyama Campus



Hydrospheric Atmospheric Research Center
Nagoya University
2014

Address: Furo-cho, Chikusa-ku, Nagoya 464-8601 JAPAN
Phone: +81-52-789-3466 FAX: +81-52-788-6206
URL http://www.hyarc.nagoya-u.ac.jp/english/