Japan Geoscience Union Meeting 2011
(May 22-27 2011 at Makuhari, Chiba, Japan)

ACG032-P01 Room:Convention Hall Time:May 27 16:15-18:45

JAMSTEC Climate Observation and Synthesis

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The spation-temporal coerage of hydrographic data is still sparse. To obtain more accurate/dense estimation of the global ocean, 4-dimensional variational (4D-VAR) data assimilation system has been developed which is capable of providing an optimal synthesis of the obseravational data and a climate model by solving a nonlinear least square problem. The obtained dynamically self-consistent 4-dimensional dateset can offer greater infomation content on ocean climate changes than can be derived from models or data alone.

Keywords: ocean, climate change, data assimilation, four-dimensional variational method

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A 140-year historical global reanalysis for water isotopes

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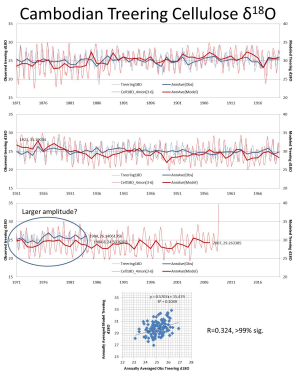
Yoshimura et al. [2008] completed 30-year Reanalysis-”nudged” isotope-incorporated AGCM simulation. In their method, large scale forcing was taken from NCEP/DOE Reanalysis 2, and water isotopes were fully predicted, including their sources and sinks, without utilizing any water isotope observations. Several direct comparisons between the dataset and isotope measurements revealed that the dataset is accurate enough to serve as an alternative to water isotope assimilation analysis. Thus the dataset was found to be very useful for investigating the atmospheric behavior responsible for isotope variability in precipitation and vapor. Moreover, Stott et al. [in prep] has shown that the model simulates the history of decadal variability during the late 20th century as reconstructed from d18O of cellulose extracted from the annual rings of the long-lived Bristlecone Pine from White Mountain in Southern California. The close match between the simulated and measured isotope records is a further validation of the model’s ability to accurately simulate regional-scale atmospheric behavior over the Southwestern US. This is particularly important because tree ring chronologies from these long-lived trees have been used previously to reconstruct recurrent decadal-length drought throughout 20th century and beyond. Using the new isotope enabled GCM allows us to investigate questions such as how isotopically distinct sources of atmospheric moisture have changed in the past and whether such changes arise from similar and recurrent ocean/atmospheric variability. The initial simulation is however, too short to investigate longer-term variability. Therefore, in the present study we begun to extend the model simulations to include AD1871 to AD2008, using the so-called ”20thC Reanalysis” atmospheric dataset [Compo et al., 2010]. One of the preliminary results includes a simulation of sea surface d18O, which can now be compared to coral records. The preliminary results indicate the simulated surface water d18O closely matches coral-based reconstructions from the Philippine Sea. Additional details of this investigation and its potential implications will be presented at the meeting.



Keywords: water isotopes, climate proxy, coral, tree ring cellulose, 20th century reanalysis

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Ocean reanalysis dataset produced with the ocean data assimilation system of the Meteorological Research Institute

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In the Meteorological Research Institute (MRI), we have been developing an ocean data assimilation system, named the Multivariate Ocean Variational Estimation System/ MRI Community Ocean Model (MOVE/MRI.COM). It is composed of the ocean general circulation model developed in MRI (MRI.COM), and the Three-dimensional Variational (3DVAR) analysis scheme using coupled temperature-salinity Empirical Orthogonal Function (EOF) modal decomposition. MOVE/MRI.COM has three variations with different resolutions and horizontal domains. MOVE-G has a nearly global domain (75S-75N) and the horizontal resolution of 1 degree with meridional equatorial refinement to 0.3 degree within 5S-5N. MOVE-NP has a domain extending over the North Pacific (15S-75N, 100E-160W) and the horizontal resolution of 0.5 degree. Another variation is MOVE-WNP which has the domain extending over the western North Pacific around Japan (15-65N, 117E-160W) and the resolution of 0.1 degree. These systems are operationally employed in the Japan Meteorological Agency (JMA) for the monitoring and forecasting of the ocean state around Japan and the equatorial Pacific associated with the El Nino phenomenon, as well as the seasonal forecasting.

We implement ocean reanalysis experiments repeatedly using different variations of MOVE/MRI.COM with different configurations, and the several results of the experiments are saved as reanalysis datasets for use of oceanic and climate studies. For example, MOVE-G RA07 is a result of the reanalysis experiment in the period of 1950-2009 using MOVE-G. This dataset has been employed for analyses of the ocean heat content, salinity variability, the current fields, etc. We also has a high resolution reanalysis dataset with the resolution of 0.1 degree produced with MOVE-WNP, and used for the analyses of the Kuroshio variability etc.

Keywords: Ocean Dataset, Ocean Reanalysis, Data Assimilation, 3DVAR

Japan Geoscience Union Meeting 2011
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Re-calibrated NOAA/AVHRR Daily-PAL Dataset

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Long-term dataset revealed by satellite observations are important for the terrestrial studies. The longest records are daily observations by the AVHRR boarded on NOAA spacecrafts. However, NOAA/AVHRR data are affected by spacecraft orbital delay. The Pathfinder AVHRR over Land (PAL) used a time-dependent calibration method. This presentation introduce how to re-calibrate PAL to reduce the effect of time-dependent calibration. In addition, we will promote the new-re-calibrated dataset.

Keywords: Vegetation, Satellite Data, global, long-term

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JAXA's sea-ice dataset derived from passive microwave sensors

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Japan Aerospace Exploration Agency (JAXA) plans the launch of Global Change Observation Mission ? Water (GCOM-W) in 2011. A variety of products are planned for observe the parameter related at the water cycle. The sea-ice product estimates the sea-ice concentration, the sea-ice vector, and the thin ice region. Moreover, a long-term of observation is important in the understanding of the environmental variation. The passive microwave sensor from space has been observed for over 30 years since 1978. Therefore, the sea-ice area was able to be observed to be minimized in 2007. The observation frequency of GCOM-W is the same as the Advanced Microwave Scanning Radiometer (AMSR) series. Therefore, the observation of the sea ice change can be continued to aftertime. However, the data of Scanning Multichannel Microwave Radiometer (SMMR) and Special Sensor Microwave/Imager (SSM/I) is necessary go back to the past. The observation frequency is almost the same as these sensors. However, the resolution and the incidence angle are different. Therefore, the correction between each satellite is needed for the presumption of a consecutive sea-ice area. We are making the data set of the corrected long-term area change.

Keywords: GCOM-W, sea-ice product, passive microwave sensor, sea-ice area, long-term dataset

Japan Geoscience Union Meeting 2011
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ACG032-P06 Room:Convention Hall Time:May 27 16:15-18:45

GeoScience Data Release in DIAS

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Amount of earth science data use by geoscientist, such as satellite observation data, sensor data or the result of simulation, is rapidly growing in the era of the data intensive science. Our project, DIAS (Data Integration and Analysis System) started in 2006, has a purpose of constructing data infrastructure that can integrate earth observation data, numerical model outputs, and socio-economic data effectively. DIAS also has a purpose to create knowledge enabling us to solve earth environment problems and to generate socio-economic benefits. The number of researchers of DIAS exceeds 150 and they participate from multi-disciplinary research fields; hydrological cycle, weather, ocean, agriculture, biodiversity, ecosystem, information science, etc.

Four years has elapsed from the start of the development of DIAS, and various kinds of geosciences data has been accumulated in DIAS.

We have decided to release these data, for converting them into more useful information and creating additional scientific or social value. And we, data providers, multiple disciplines' researchers, and system developers, have discussed many times for developing the systems for data release, and finally in last October, we released data to public.

The data in DIAS is classified into 4 categories:

1. Datasets created by DIAS researchers,
2. Datasets created at antecedent projects or related projects,
3. Mirror-data (research purpose satellite data, research purpose model output data, and research purpose Metrological data), And
4. Working datasets created by DIAS researchers.

The target categories of data release are 1, 2, and 3.

The applicable fields of datasets are agriculture, biodiversity, climate, disaster, ecosystem, energy, hydrological cycle, weather, etc.

In order to use data in different fields from data providers' research field, it is important to provide not only data itself but also documents written by data providers based on their knowledge.

We have developed a document centric metadata registration system.

We asked data providers to create metadata and document describing the dataset to be released using this system.

We asked to create 2 kinds of metadata and document, Japanese and English. That is, Japanese document about overseas' dataset, or English document about Japanese dataset is available. This is our outreach effort for both Japanese and overseas people.

We have discussed about the following issues carefully:

1. The unit of dataset to manage and retrieve, and
2. Representation in both Japanese and English.

We have decided about "what is the unit of dataset" through discussion between data providers and system developers with actual data one by one.

As a result, there are datasets composed of millions of files, and at the same time there are datasets composed a few files.

However, each file in the same dataset has the same dataset agreement and reference agreement.

And user access right is also managed by the unit of dataset.

We have developed our systems, such as search system and file download system, with both English and Japanese interfaces.

The functions necessary for data release are:

1. Seamless operation among data look down, data discovery and data download.
2. User management including new user registration
3. Access right management for each user and dataset
4. Report of data download history to data provider

To achieve these functions, we have developed the user management system, the DIAS look down and discovery system, and the access management system.

Anyone can use the DIAS look down and discovery system by accessing http://dias-dss.tkl.iis.u-tokyo.ac.jp/ddc/finder, and can download data files through the system. User registration is required before file download.

Keywords: DIAS, Release of Geoscience data, Data Centric Science

Japan Geoscience Union Meeting 2011
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Data archive to the GEOSS/Asian Water Cycle Initiative (AWCI)

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[1]The University of Tokyo

Under the framework of GEOSS, representatives of hydrological and meteorological organizations and science communities in Asia gathered together, and began to discuss about how to address the water-related issues in Asia in cooperative ways by making maximum use of GEOSS. This is the Global Earth Observation System of Systems / Asian Water Cycle Initiative (GEOSS/AWCI).

Observation convergence is essential for making possible advanced research into the water cycle phenomena and for transformation of the scientific findings into the information usable for policy- and decision-makers to develop effective policies and make sound decisions in an Integrated Water Resources Management (IWRM) manner. GEOSS/AWCI approach for converging earth observation satellites, in-situ reference site networks, and operational observation systems, for integration of the observed data, numerical weather prediction model outputs, geographical information, and socio-economic data, and for dissemination of usable information is adopted from and designed in cooperation with the GHP (former Coordinated Energy and Water Cycle Observations Project (CEOP)) of the Global Energy and Water Cycle Experiment (GEWEX), World Climate Research Programme (WCRP).

As originally produced by the various sources, the data is in a wide variety of formats and structures. GEWEX/GHP had developed a prototype data integration, analysis, and dissemination system that has been further elaborated and expanded into the Data Integration & Analysis System (DIAS), which was launched in 2006 as part of the Earth Observation and ocean Exploration System, which is one of five National Key Technologies defined by the 3rd Basic Program for Science and Technology of Japan. DIAS provides cooperative opportunities for constructing GEOSS/AWCI data archives, and developing data integration and analysis functions. A Standardized Metadata Model has been developed in cooperation with the international standardization communities in order to assure full interoperability of the DIAS system.

The basis for the GEOSS/AWCI collaborative framework is the mutual consensus among participating countries and international organizations that defines data sharing and exchanging policy and responsibilities for data processing, management and archiving.

The purpose of this poster is the introduction of the GEOSS/AWCI and its data archiving activity.

Keywords: GEOSS/AWCI, in-situ data, water cycle, DIAS

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Comparison of Microbaroms at SYOWA Station, Antarctica and Woomera Prohibited Area, Australia

Yoshiaki Ishihara[1*], Masa-yuki Yamamoto[2], Masaki Kanao[3], Yoshihiro Hiramatsu[4], Muneyoshi Furumoto[5]

[1]NAOJ, [2]Kochi Univ. of Tech., [3]NIPR, [4]Kanazawa Univ., [5]Nagoya Univ.

Infrasound is sub audible sound (pressure wave), and that frequency range is cut-off frequency of sound (e.g., 3.21 mHz for 15 degree Celsius isothermal atmosphere) to 20 Hz (that is lowest frequency of human audible band). This frequency range is one of the new horizons of the remote sensing in the Earth's atmosphere, for example, a large earthquake in Sumatra region generated great Tsunami also produced such kinds of waves in atmosphere and shaking Earth itself by free vibration mode as well as affected even upon the upper atmosphere. Last decade, for the purpose of monitoring nuclear tests, a global infrasound network is constructed by CTBTO. The CTBT-IMS infrasound network has 60 infrasound stations and each station contains at least 4 infrasound sensors (arrayed station), they can detect a some-kiloton TNT level atmospheric explosion in range of some 1000 kilometers. This network is enough for monitoring nuclear tests, but much sparse for detecting and analyzing in detail of natural infrasound phenomena.

We organize a community called Infra-Sound Observation Project (ISOP) for propose of to develop *regional scale* infrasound observational networks in the Japanese Islands and around the Japanese Antarctic Stations. Now, the networks are construction and pilot observation phase. A Chaparral sensor was firstly put on the field of the Japanese Main Antarctic Station (SYOWA Station) as a part of the JARE 49 expedition in 2008. Until now, we have continued single sensor pilot observation to assess reliability of the observation system under the extreme climate condition of Antarctica.

In this talk, we will show current status of pilot observation and briefly summarize characteristics of infrasound recorded at SYOWA Station, Antarctica. In addition, at June 2010, we had done infrasound observation of reentry of the HAYABUSA at Woomera Prohibited Area (WPA), Australia. So, we will make a comparison between microbaroms detected at SYOWA station and that detected at WPA.

Keywords: Infrasound, microbaroms, ocean atomosphere coupling, Syowa Station

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Development of the dataset of bias-corrected GCM outputs for water resources management

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In order to use the data outputted by a General Circulation Model (GCM) in climate impact studies, it is vital that a bias-correction method be applied to it. In hydrological impact studies, the correction of precipitation and temperature generates satisfactory results. Many correction methods have been proposed. Several studies have investigated their correction ability in detail; however, it has been noted that a number of these studies have used the aforementioned methods without adequate validation. Moreover, these methods have not been compared adequately. The objective of this study is to compare the results of the bias-correction methods. Because of their high cost of calculation, we applied these methods to monthly averaged temperature and total monthly precipitation data obtained from GCMs that are available from the Phase 3 of the Coupled Model Intercomparison project (CMIP3) although many previous studies focused on and proposed daily scale methods. This study focuses on the statistical characteristics of bias-corrected data. Therefore, the methods proposed using previous methods were organized from this viewpoint. Two analyses were conducted in this study. The first is reproductive experiment, which has the calculation span including the period in which observation data exist. In this experiment, the data from 1948 to 1968 were used as baseline period data, and that from 1978 to 1998 were corrected using these methods. The corrected data are compared with the observed data. For evaluation, we split the world into six climate zones. These methods are evaluated by comparing the reproducibility of statistical characteristics such as the mean and standard deviation of bias-corrected data in each climate zone. The second is a future projection experiment. In this experiment, the bias-corrected data of the future period have been generated, and the future data corrected using different methods were compared. The results revealed the characteristics of individual methods. Although the mean of the series calculated using each bias-correction method does not differ greatly, the standard deviation and extreme values exhibit a significant difference. The difference between the results of the bias-correction of GCM models is minor to be the mean of the bias-corrected data but not minor to be the standard deviation or extreme values. Furthermore, in the future projection experiment, the distribution of the bias-corrected CMIP3 GCM data indicates significant differences in their values of standard deviation and extremes. From this analysis, the existence of a non-negligible difference between the results obtained from each method is apparent. Therefore, researchers should notice when a bias-correction method is applied to remove model bias in CMIP3 GCMs, else it will generate considerable bias in the analyses.

Keywords: bias correction, climate change impact assessment, temperature, precipitation

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Operational air quality monitoring data in Japan

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Hourly concentration of air pollutants are operationally observed in Japan. Monitored concentrations are available through web page of the Atmospheric Environmental Regional Observation System (AEROS; ”soramame-kun” in Japanese). After December 2010, we make spatial distributions of major four pollutants (sulfur dioxide (SO2), nitrogen oxides (NOx), photochemical oxidant (Ox), and suspended particulate matter (SPM)) and predicted surface wind fields which is obtained from the mesoscale model of the Japan Meteorological Agency. Archived images can available after April 2009.

Keywords: regional-scale air pollution, operational air quality monitoring

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Overview of geostationary satellites dataset by the VL project and characteristics of global cloud activities

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[1]CEReS, Chiba University

As one of the main targets of the ongoing project, ”Formation of a virtual laboratory for diagnosing the earth’ s climate system”, in the Center for Environmental Remote Sensing (CEReS), Chiba University, archiving, processing, and publishing geostationary meteorological satellites: GMS series and MTSAT by JMA, FY2 series by CMA, Meteosat and MSG series by the EUMETSAT, and GOES series by NOAA. Each raw data format is entirely different, and there are few sites to archive and provide all of the data in long term. CEReS processed re-sampled dataset in the geo-coordinates in recent 12 years in simple and almost the same file format. The spatial resolution of 0.04 degree for 2 or 3 IR channels and 0.01 degree for the VIS channel, in a latitude range of 60 degree in north and south hemispheres. All of the re-sampled data except Meteosat and MSG series because of their data policy is available via anonymous ftp sites. From this dataset, CEReS has been developing merging techniques among the satellites with well calibration, and algorithms to retrieve the earth’s radiation budget and physical parameters such as cloud optical thickness, cloud liquid water, direct and diffuse radiation at the top of the atmosphere and the surface, and so on.

Recently several low orbit earth observing satellites carrying cloud / precipitation radar and microwave imager are available to investigate cloud / precipitation characteristics. Their sensors directly detects cloud / precipitation system compared with VIS and IR sensors, however, it is never free from sampling problems (i.e. sampling frequency with bias in local time). Although it is something classical technique, one of the best advantages of the earth observations by geostationary satellites is to obtain IR and VIS data with high resolution in both space and time. This dataset available in global regions, therefore, it would greatly contribute to study on global cloud characteristics. As one of the interested characteristics, global distributions of peak local time with amplitudes of the cloud activities derived from IR band are investigated. Time distributions are generally consistent with previous studies, but their amplitudes are more distinct.

Keywords: geostationary meteorological satellite, virtual laboratory

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Security assessment of Food, Energy and Water resources

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Nobody could live without food. But FAO of the United Nations estimated that a total of 925 million people are undernourished, suffering from hunger in 2010. Moreover, world food demand in the future is expected to increase by population and economic growth. In this century, future food security is a serious challenge which we face. In addition to that, we should consider bioenergy. It is of large significance as a renewable energy source and reduction effects of carbon dioxide. What is more, bioenergy can avoid geopolitical risk because these materials are plants which spread widely. It is predicted that world primary energy in 2050 is 2.4 times as large as present primary energy. In addition, there are concerns about depletion of fossil fuel. Bioenergy which has above mentioned merits is expected to be a major energy carrier in the future. It has been suggested that 4 billion people by 2100 may be falling into high water stress due to changed water resources and increased water demand. 70% of global water consumptive accounts for the amount of agricultural water use are likely to continue increasing production of foods and bioenergy due to population growth. It is concerned that competitions for limited land and water between food and bioenergy occur water depletion. So, estimation which deals with food, bioenergy and water all together from past to future is required for realizing sustainable water use.

Firstly, we focused on the objective to assess the impact on water resources in global scale of the 20th century by considering only irrigated agricultural area changes, which is most important water use sector accounting for about 90% of total consumptive use, without under climate change. As a first step, we make the global spatial database of historical irrigated agricultural area change. Then, the water cycles were simulated on global-scale at resolution of 1.0 degree x 1.0 degree using this irrigated area data and an integrated global water resources model (H08). H08 can simulate both natural flow and anthropogenic water withdrawals etc. In the model, our three experiments were performed to simulate with human impact using volumetric fraction of withdrawal from only river, large reservoirs and NNBW (Non-local Non renewable Blue Water) which is the conceptual water source represents groundwater etc. As a result, agricultural water supply change from NNBW during the past 50 years agreed well with the observed groundwater abstraction. In addition, spatial distribution of the change from NNBW appeared many of the well-known hot spots of groundwater depletion: northeast Pakistan and the Ogallala Aquifer etc. This result was successful in simulations of global water withdrawals from groundwater.

Secondly, we modeled global energy crop potential. Three different land-cover types were chosen as potential area for cultivation of biofuel-producing crop: fallow land, grassland, and portion of forests (excluding areas sensitive for biodiversity such as frontier forest). We attempted to estimate the maximum global bioenergy potential and it was estimated to be 1120EJ (274EJ in fallow land, 770EJ in grassland, and 76EJ in 10% of forest). It is 2.4 times as large as primary energy and same as predicted primary energy in 2050. Finally, in order to handle this global challenge, we need to assess food security in terms of water, land and energy. In advance of the assessment, we estimate world food demand in the future with making several scenarios, such as one assuming that food consumption per capita will keep the present values or one assuming that hunger will be eradicated all over the world. We estimated that the demand of cereals (incl. fodder) will increase by 20˜70% until 2050.

About our future plan, we will simulate water supply and demand by increasing of food production and bioenergy on water cycles in the 21st century.

Keywords: Food demand, Bioenergy, Water resources, Integrated global water resources model: H08

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Erroneous variations of cloud cover obtained from the ISCCP data caused by satellites replacement

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This study examines variations in the Equivalent Black Body Temperature (TBB) and cloud cover during 1983-2008. These data were obtained from the International Cloud Climatology Project (ISCCP) D-series data. The ISCCP can observe cloud almost globally with using geostationary and polar orbiter satellites. The ISCCP calibrate the values of the TBB observed by each satellite with using those of NOAA-Afternoon (NOAA-A) polar orbiter satellites series for the purpose of dealing equally with observed values of each radiometer which has a different sensitivity. However, it has been found that the calibrated TBB has erroneous variations at a temperature of about 280K or higher. Shown in Fig.1 are the differences between the averaged TBB at a high temperature range obtained from ISCCP-calibrated GMS which are geostationary satellites series of Japan and that from non-calibrated GMS. Note that although Figure.1 shows the TBB of GMS, the differences clearly change as NOAA-A series (NOAA-7, 9, 11, 14, 16, 18) change from old one to new one. The erroneous effects of the inter-calibration show only at two temperature range which are higher than about 280K, or lower than about 220K.

Next it has been found that the erroneous variation of the TBB leads to erroneous variations of cloud cover. The difference between monthly averaged cloud cover from GMS and that from NOAA-A clearly changes from plus to minus while NOAA-A series change from NOAA-11 to NOAA-14, whereas differences of cloud cover between METEOSAT series which are another geostationary satellites and NOAA-A don't show such a sudden change through that time. In addition, the TBB of NOAA-A doesn't clearly change at a high temperature range from this term. These results suggest that the sudden change of cloud cover differences is regarded as the result of changing cloud cover of GMS. Since the decrease in the TBB at a high temperature range leads to decreases in the estimated clear sky TBB, in which case it becomes more difficult to detect cloud fractions from differences between the TBB of cloud and that of clear sky. The remarkable decrease of GMS cloud cover is believed to be due to the above mechanism. These analyses are carried out in such a way that the satellite from which we obtained data doesn't change its monthly averaged view angle for the period of the 25-year observation. This is because cloud cover observed from satellites is much larger near the edge than that in the center of their view areas. This error is called 'view angle dependence'.

The ISCCP inter-calibration lead to a decrease by 1.8K in the averaged TBB of GMS at a high temperature range in GMS region from the TBB averaged before the time which NOAA-A series change form NOAA-11 to NOAA-14 to the TBB averaged after the time. This leads to decreases in GMS Cloud cover to 3.0%, in which case long-term variations of GMS cloud cover show -2.2% per decade in the same period and area. As it is considered that a trend of NOAA-A cloud cover shows +0.5% per decade in the same situation, the inter-calibrations is thought of leading a considerable decreasing trend into GMS cloud data. Moreover it is predictable that the inter-calibrations will affect more severely on cloud height data because they are estimated directly from the TBB on the cloud top.

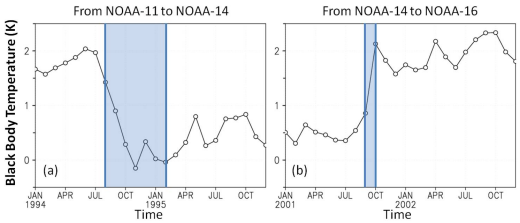

Figure 1. Differences between TBB obtained from ISCCP-calibrated GMS and those from non-calibrated GMS over the ocean close to GMS footprint. TBB are averaged monthly within higher temperatures than 280K. Blue lines represent time of NOAA-A series changing and blue shade in Fig. (a) express a term of data missing of NOAA-A. Intervals of the time axis are 3 month.

Keywords: cloud cover, satellite observations, ISCCP, satellite zenith angle, climate change

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Validation of the MRI/NPD-NHM over the tropical western Pacific

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We validate the mesoscale atmospheric model (MRI/NPD-NHM) over the tropical western Pacific during the 2008 and 2010 boreal summer. The calculations were originally conducted to support the observation project PALAU2008/2010. We focus on the variables related to typhoons (rainfall, vorticity, etc.) and discuss the possibility of the model.