HTT08-01 　　　　　　　　　:203　　　　　　　　　　:5　20　09:00-09:15

VLF
Measurement of VLF sferics to monitor activity of cloud-to-ground lightning discharges in the Maritime Continent

[1*], [2], [3], [4], [5], [6], [6], [6]

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Electromagnetic wave radiated from lightning discharge is called as sferics. Measurement of sferics is one of the most efficient tools to monitor global activity of lightning discharges. There are mainly two advantages to observe sferics in extremely Low Frequency (ELF: less than 3 kHz) range and Very Low Frequency (VLF: 3-30 kHz) range.

One is a radio propagation characteristic in ELF and VLF range. Attenuation rate of ELF and VLF sferics is quite low. Therefore, radio waves emitted by cloud-to-ground (CG) lightning discharges can propagate long distance. This feature allows us to monitor the activity of CGs on a regional scale or on the globe with single or few observation sites.

The other is that electrical property of individual CGcan be derived based on the observation in ELF and VLF sferics. Methodology to estimate polarities, charge moment, and peak current of CGs has been established in previous works. These techniques make it possible to evaluate not only the activity of CGs but also that of thunderstorm.

We have developed new system to measure ELF and VLF sferics and applied to the observation to monitor the lightning activity in the Maritime Continent. Waveforms of vertical electric fields and horizontal magnetic fields are obtained with vertical dipole antenna and orthogonal loop antennas, respectively. This instrument has been installed at Tainan in Taiwan (23.1^{o}N, 121.1^{o}E), Saraburi in Thailand (14.5^{o}N, 101.0^{o}E) and Pontianak in Indonesia (0.0^{o}N, 109.4^{o}E).Furthermore, we prepare to install new system in the Philippines and Vietnam.

In this presentation, we introduce the speculation of our observation system. Estimated CGs distribution in the Maritime Continent based on our VLF observation is also shown as an initial result.

:　　　，　　，ELF, VLF,
Keywords: lightning discharge, sferics, ELF, VLF, Maritime Continent

HTT08-02   :203   :5   20   09:15-09:30

Lightning in Typhoons
Lightning in Typhoons

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We have recently shown that lightning observations in intense typhoons precede the maximum intensity of the storms by approximately 30 hours. In this presentation we further this study by modeling the lightning activity in typhoons using the Weather Research and Forecasting (WRF) meso-meteorological model. The WRF model successfully simulates the growth and decay of typhoons, and accurately forecasts their development, tracks and intensities. The modeled lightning scheme correctly predicts that the maximum lightning activity occurs before the maximum sustained winds of the storms, with a similar lag of 30 hours as shown in the observations. In addition, the model simulations show that the location of the maximum lightning activity migrates from the outer bands of the typhoon toward the eye during intensification, with the maximum lightning activity closest to the eye approximately 12 hours before the maximum intensity of the hurricane. It is suggested that a sharp increase in forecast lightning, and the inward migration of the lightning maximum, can serve as markers from which to gain greater confidence in predictions portending further intensification of typhoons or conversely their decay.

: lightning, typhoon, VLF, model
Keywords: lightning, typhoon, VLF, model

HTT08-03   :203   :5   20   09:30-09:45

Color of glaciers observed from satellites

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Color of glaciers is not always blue or white. It shows variety of color, such as brown, black, red, green, and yellow. These colors are usually due to impurities in snow and ice. Mineral dust blown from desert could change the color to brown, and black carbon from fuel or biomass burning could change to black. Microbes growing on snow and ice could change the color to red, green, yellow and black. Color of glaciers is glaciologically important since change of surface color results in reduction of surface albedo and accelerating glacier melting. However, we still do not exactly know geographical distribution of color of glaciers in the world. Sattelite remote sensing could be useful for investigating the spatial distribution of impurities of snow and ice over a large area of snowfields and glaciers.

Keywords: glacier, albedo, snow algae, cryoconite

HTT08-04 :203 :5 20 09:45-10:00

A new potential in the Ocean Color Observation by Micro-Satellites

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Since the launch of the Coastal Zone Color Scanner (CZCS) onboard Nimbus-7 in 1978, many ocean colour sensors, mostly in sun-synchronous orbit, have been launched into space by space agencies worldwide to observe biological and biogeochemical variables in the coastal and global oceans. These ocean color missions by the space agencies tend to be independent, providing separate data sets. However, a recent activity includes a merge of the satellite data set obtained from different sensors or missions, and shows an advantage to utilize many satellites for an increased data coverage and observation frequency. To put the advantage forward in the future ocean colour missions, practical issues, such as economic cost of launching many satellites, have to be solved. Meanwhile, technologies have also been evolving to result in manufacturing low-cost and small satellites (i.e. micro-satellites). Thus, we are now in a position to move forward from the classical observation style using an independent and single satellite to a new style using multi-satellite observation. In this presentation, we propose a utilization of multiple micro-satellites in the field of ocean colour observation as an example, showing some practical applications potentially useful for Asia.

Keywords: micro satellite, ocean colour

Robust Monitoring Techniques on Large Scale Carbon Dynamics for REDD+ in Tropical Peatland-Forest

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The Earth remaining tropical forests are found mainly in the peatlands and lowland of the Amazon, Central Africa, and Southeast Asia, especially in regions of Kalimantan, Sumatra, and Papua New Guinea, where rich biodiversity can still be found and large amounts of carbon are stored in peat soils (UNDP, UNEP, WB, and WRI, 2000). Indonesia, for example, has a peatland area and carbon stocks of about 20Mha and 45-55GtC respectively, and a forest area and carbon stocks of about 88Mha and 10-26GtC respectively, indicating that more than half the amount of carbon in tropical peat is stored in the peat of Indonesia (Maria Strack ed., 2008, J. Jaenicke et al., 2008, J.O. Rieley et al., 2008, H. K. Gibbs et al., 2007). It is estimated that the Indonesian peat contains between 7.5-24.2 times more carbon below-ground than above-ground.

Therefore, REDD+ is very important for storage of carbon as well as the conservation of biodiversity. To establish REDD+, an MRV system that is coupled with two components ? satellite sensing and grand tools - is urgently required. Presently, our JST-JICA Project on "Wild Fire and Carbon Management in Peat-Forest in Indonesia" is the only project in the world to propose all aspects of MRV in tropical peatlands, enabling it to contribute significantly to biodiversity estimation.

REDD+ itself is only considerd as one of Carbon Credit Mechanisms. However as MRV for REDD+ is composed of integrated system of satellite sensing and grand tools, REDD+ and MRV system contribute to develop new scientific fields and advance forest research in various tropical forest ecosystems, including forest management and social activity research. Thus, this JST-JICA project intends finally to establish REDD+ system in tropical peatland.

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: Biodiversity, Carbon Flux Model, Grand Tools, MRV, REDD+, Satellite Sensing
Keywords: Biodiversity, Carbon Flux Model, Grand Tools, MRV, REDD+, Satellite Sensing

HTT08-06   :203   :5   20   10:45-11:00

Assessment of Field and Airborne Hyperspectral to Detect Peat Forest Degradation in Central Kalimantan, Indonesia

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Microsatellite is a new paradigm in Remote Sensing technology. Toward a new paradigm to attach the hyperspectral sensor on board microsatellite in the very new future, it need some more efforts to assess the sensors performance for operational use. Integration field, airborne or current space-based hyperspectral sensors is still important to reveal the physical and biophysical correlation with spectral reflectance for environmental issue such as peat forest degradation.

Colored Dissolved Organic Matter (CDOM) of peatland water in canal and forest canopy were measured by using ground-based spectroradiometer and HyMap sensor onboard an airplane, which ranged from 350 nm up to 2500 nm, respectively.Coinciding with the duration of airborne hyperspectral measurement, the physical and biophysical parameters such as soil moisture, underground water level, tree species, tree height, trees diameter of breast height (DBH), and crown cover were measured on the ground.

In finding the best correlation among physical and biophysical parameters with hyperspectral reflectance, waveband ranged from 350 to 2500 nm explored to find the optimal wavebands against physical, biophysical parameters and water index. Meanwhile, several indices such as Water Band Index (WBI) and Normalized Difference Water Index (NDWI) were applied from spectral transformations (obtained from selected optimal waveband) to improve sensitivity of ground water analysis. The present study is directed (1) to analyze the empirical correlation between spectral characteristic and forest degradation condition, (2) to find the appropriate indices (vegetation or water), (3) to find the correlation between forest degradation and underground water level. The initial results of study will contribute to develop a monitoring system for forest degradation, and to build a new approach to assess the carbon emission from peatland soil to the river as an optional tool of MRV to reach REDD+ monitoring target.

      : remote-sensing, satellite, hyperspectral, airborne, peat forest
Keywords: remote-sensing, satellite, hyperspectral, airborne, peat forest

HTT08-07 :203 :5 20 11:00-11:15

Remote sensing of forest condition — estimation of foliar chemical components by using hyperspectral reflectance data

[1*], [1], [2], [1]

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[1] , [2]

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Hyperspectral remote sensing is one of the strong tools for the detection of chemical/structural characteristics of plant tissue. Although several researchers have reported the potential of multiband reflectance-based indices (*ex*. NDVI) for the monitoring of leaf phenology and productivity of forest, new monitoring method using hyperspectral reflectance data and spectroscopic analyze technique is recently spotlighted for the detection of more detail biological characteristics such as leaf thickness and leaf concentrations in photosynthetic pigments, carbohydrates and nutrients (they are generally called 'leaf traits') (Asner and Martin, 2008; Asner *et al*., 2011). In this presentation, we summarize the current studies on the remote estimation of leaf traits of forest tree species briefly, and introduce our field studies about hyperspectral remote sensing of tree leaf traits under warming environment.

In some deciduous forests in Hokkaido region, we have carried out warming experiments to study the potential effects of global warming on forests. For example, in the Tomakomai Experimental Forest of Hokkaido University, soil temperature in 5 x 5 m area around mature oak (*Quercus crispula*, approx. 20 m height) has been elevated to 5 degC above control soil temperature from 2007 by heating cables dug into the soil (Nakamura *et al*., 2010). Several parameters have been monitored such as photosynthesis, herbivory, leaf traits and phenology. We measured the reflectance of intact leaf at visible-shortwave infrared spectral region (350-2500 nm) using a portable spectrometer (FieldSpec FR, ASD) after the monitoring of herbivory in July and September of each year. Hyperspectral images at the visible-near infrared region (400-1000nm, 150bands) of the oak canopy were captured at daily interval using the spectral camera system (ImSpector V10, Specim).

In 2009, the ratio of herbivory in summer and autumn was lower in soil warmed trees than control trees significantly. The leaf concentrations of total N and lignin were reduced and the concentrations in total phenol and tannin were increased in canopy leaves by soil warming. This result suggests that the soil warmed oak tree increased chemical materials rather than structural materials to protect against herbivory. To estimate the chemical defensive materials from hyperspectral reflectance data, we tested the utility of (1) simple regression model using Normalized Difference Spectral Index (NDSI) and (2) Partial Least Square (PLS) regression model. Root mean square error of cross validation (RMSECV) was smaller in PLS model than NDSI simple regression model. When the spatial variation of phenol concentration in the canopy top leaves was predicted by calculating the PLS regression in each pixel of hyperspectral canopy images, higher phenol concentration in the warmed trees was visualized successfully. Although future studies on validity of this method are needed, our results indicate that the monitoring of hyperspectral reflectance is an useful method in estimating specific canopy leaf traits in a cool temperature forest. We believe that such methods are essential to help us understand how forest will respond to future climate conditions.

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HTT08-08 :203 :5 20 11:15-11:30

TRMM-LIS

Climatological lightning frequency over Asian-Australian monsoon region observed by TRMM-LIS

[1*], [1], [1], [2], [1], [3]
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We explored regional and seasonal variations of climatological lightning frequency over Asian-Australian monsoon region in monthly and 10-day basis by utilizing 10-year (1998-2007) product of TRMM Lightning Imaging Sensor (LIS) data and precipitation data. Several high frequency lightning regions are detected in northeastern Pakistan and northern Bangladesh, and on the Malacca Strait. The last place is a peculiar place, since most of other high frequency areas are located over the land. There are some secondary peaks in the eastern Indochina Peninsular, southern India, and northwestern Australia. Although they are, in general, located in the relatively high precipitation areas, their peak locations and period are not exactly coincide.

: , TRMM-LIS, ,
Keywords: lightning, TRMM-LIS, monsoon, pre-monsoon

HTT08-09   :203   :5   20   11:30-11:45

Wildfire detection using imagery from small satellites

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1.

8   9

REDD+

2.

1990   NOAA/AVHRR   2000   TERRA/AQUA
MODIS   MODIS   MOD14
AVHRR   MODIS
1   1   2
1km   MTSAT   30
4km   MODIS

LANDSAT7   ETM+   6   60m   16
TERRA   ASTER   5   90m   16

200m   3   1

3.

BIRD
BIRD   German Aerospace Center(DRL)   2001   10   94kg
, 0.84-0.90 μ m , 3.4-4.2 μ m, 8.5-9.3 μ m   350m   2004   2
13
4 μ m   9 μ m

4.

HTT08-09 　　　　　　　　 :203 　　　　　　　　　　　 :5 　20 　11:30-11:45

5.

FFMC 　FWI

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Keywords: wildfire, detection, small satellite

HTT08-10 :203 :5 20 11:45-12:00

Application to Earth observation satellite of Uncooled micro bolometer camera

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The 50 kg class satellite that detect a radiance of forest fire of 10 um band by a micro bolometer camera at an early stage for contributing to digestive activities is developed in the UNIFORM (UNiversity International FORmation Mission). It realizes low cost, quick fabrication, and on-demand operation, and the constellation operation of 3 satellites are planned in the mission. The heritage of Akatsuki Venus climate orbiter has been applied to the developing of the micro bolometer camera in the mission, and this application to Mars, asteroid, and lunar missions are also expected. Application to Earth observation satellites and the future view of Uncooled micro bolometer camera are shown in the presentation.

HTT08-11　　　　　　　　　:203　　　　　　　　　:5　　20　　12:00-12:15

Advanced remote-sensing sensors using a liquid crystal tunable filter and their applications

1*,　　　　　1

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New types of remote-sensing sensors for 50-kg class macro-satellites have been developed at Hokkaido University, a member of UNIFORM and Hodoyoshi projects promoted by the Japanese government. In those sensors, a liquid crystal tunable filter (LCTF) is applied to a space borne sensor for the first time. The LCTF is a kind of optical band pass filter that electrically controls the center wavelength in the visible (420-700 nm) and near infrared (650-1050 nm). Compared to conventional multispectral sensors using a rotating filter wheel with (normally less than 20) selected spectral bands, the advanced sensor using the LCTF has the great advantage of enabling multispectral observations with hundreds of bands. The LCTF can also reduce size, weight, and power consumption of multispectral sensors. In this presentation, applications of the advanced sensor using the LCTF to Earth observations by microsatellites are introduced.

HTT08-12 :203 :5 20 13:45-14:00

Microsatellite as a new remote-sensing tool in Asia

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50-kg class micro-satellite has following great advantages compared to big satellite, namely, 1) Low cost fabrication compared to middle- or large sized satellite, namely, few M EUR including bus and mission payloads. The launch cost will be 1+ M EUR as piggyback, 2) quick fabrication: about one year for flight model, enabling application of the latest technologies, 3) Constellation flight, enabling frequent monitoring from low altitude, 4) On-demand operation, taking detail information at point of focus, according to requirement of users. Here we introduce the latest technologies for remote sensing, which will be launched onboard micro-satellites developed in universities, including high functional 5-m resolution telescopic camera, which can select any colors from 400-700 nm or 650-1050 nm at 1 nm step, and a bolometer array camera. We would suggest applications of micro-satellite and its constellation in order to monitor every subject which has dynamical variations, such as, cloud structure, hydrology including CO_2 flow, lightning, vegetation, agriculture, forest fire and smoke detection, dust, atmospheric and oceanic pollution, biology in ocean, glacier, and natural disasters. Here we show a sample application to thunderstorm monitoring which may contribute to the prediction of torrential rainfall and flood, combining a ground-based lightning detection network in SE Asia operated by Asian consortium on micro-satellite, which will involve experts in various research fields, especially with them in SE Asian countries.

: , , ,
Keywords: micro-satellite, Asia, remote-sensing

HTT08-13   :203   :5   20   14:00-14:15

Micro satellite development in Indonesia
Micro satellite development in Indonesia

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The micro satellite development in Indonesia, which is mainly conducted at the Indonesian National Institute of Aeronautics and Space (LAPAN), has been initiated after the applications of the remote sensing data result in significant contributions in various sectors (forestry, agriculture, meteorology, hidrology, disaster management, etc.).

The polar orbiting LAPAN TUBSAT (LAPAN A1) launched in 2007 is the first experimental micro satellite (57 kg weight) as the result of join cooperation between TU Berlin and LAPAN. Its payload carries two color video cameras for aerial surveillance monitoring. The LAPAN A2 micro satellite (70 kg weight) planned to be lauched in 2012 will have the similar characteristics with the LAPAN A1 except the LAPAN A2 is in the equatorial orbit. Next, the polar orbiting LAPAN A3 micro satellite (70 kg weight) will carry the multi-spectral imager payload and be lauched in 2013. Moreover, research analyses of the spectral performa, the geometric and radiometric correction algorithms, the camera band splitter design will be also explained.

: micro-satellite, remote-sensing, Indonesia, LAPAN
Keywords: micro-satellite, remote-sensing, Indonesia, LAPAN

HTT08-14   :203   :5   20   14:15-14:30

Micro-satellite User Community in Vietnam: roadmap and challenges

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1

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Located in the eastern part of the Indochina Peninsula, Vietnam is a region with complex topography, land surface conditions, coastlines. Under such geological conditions and largely influenced by monsoon, Vietnam is prone to natural disasters, such as typhoons, floods and droughts. Annual losses from natural disasters are nearly 1.5 percent of Vietnamese GDP. Given such circumstances, it is important to take measures for disaster damage mitigation and prevention in Vietnam. Thus a dense ground-based observation network as well as reliable remote sensing data are essential.

Recently, space technology in Vietnam has been strongly being supported by Vietnamese Government. The Space Technology Insitute was established in Nov 2006. The VINASAT-1 with weight of about 2800kg was launched in 2008. The Vietnam National Satellite Center, VNSC, was established in Sep 2011. VNSC is also implementing a project funded from the Japanese ODA loans, about USD 600 million, which aims to build a modern space center by 2018. Besides, several other satellites are under preparation phase. Since the current missions/projects mainly focus on large-size satellites, it appears that micro-satellites have not been sufficiently recognized inside the research community in Vietnam. Therefore, this presentation will discuss about potential vietnamese users and propose a roadmap in order to succesfully create an effective micro-satellite user community in Vietnam.

                    :   ,
Keywords: micro-satellite, Vietnam