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

MIS026-P01 Room:Convention Hall Time:May 24 14:00-16:30

A Year-round Observation of Size Distribution of Aerosol Particles at the Cape Ochiishi, Japan

Kazuhiko Miura[1*], Ryou Kawata[1], Hitoshi Mukai[2], Shigeru Hashimoto[2], Mitsuo Uematsu[3]

[1]Tokyo University of Science, [2]National Institute for Environ. Studies, [3]AORI, The University of Tokyo

New particle formation by nucleation of gas-phase compounds emitted from marine biogenic sources is very important for climate change. To clarify the mechanism of the formation, size distribution of submicron aerosols was measured at the Cape Ochiishi, facing the North Western Pacific Ocean where primary productivity is high. To perform an automatic year-round observation, a test observation was done from 22nd May to 18th June 2008 and a year-round observation was performed from 16th October 2009 to 7th September 2010.

The size distribution from 10 nm to 487 nm and from 300 nm to 5000 nm in diameter was measured with a scanning mobility particle sizer (SMPS, TSI 3034) and optical particle counters (OPC, RION KC01D, KC01E, KR12A), respectively. Sample air was dried to lower than 40% with a ribbon heater. Transport of sulfate, organic carbon (OC), and black carbon (BC) was estimated with Chemical weather FORecasting System (CFORS). CFORS was developed by Prof. Itsushi Uno and Mr. Koji Ishihara in Research Institute for Applied Mechanics (RIAM), Kyushu University, Japan. The system migrated to National Institute for Environmental Studies (NIES) with financial support by Center for Global Environmental Research (CGER) in June 2002. (http://www-cfors. nies.go.jp/ ˜cfors/research/). Outline of RIAM-CFORS (by Prof. Uno, RIAM, Kyushu Univ.) is shown in the web (http://www-cfors.nies.go.jp/˜cfors/ outline.html). Existence of inversion layer was estimated with temperature profile measured at surface, 10m, 30m, and 50m in altitude.

The burst of the particles smaller than 20nm in diameter continuing longer than 3 hrs was observed 36 times during these observation periods. Seven events were observed in early summer and the other was in autumn and winter. Banana shape was faintly observed 21 times. Transport of sulfate, OC, and BC was observed 11, 26, 30 times, respectively. Source of air mass was estimated with these elements, weather map, surface wind direction and backward trajectory analysis. The air mass of 26 events was estimated to continental. It suggests that the maritime nucleation is observed during a year, however clearly nucleation related to marine sources was not observed.

Acknowledgments
This study was partly supported by the Grant-in-Aids for Scientific Research on Priority Areas from the Ministry of Education, Culture, Sports, Science and Technology, Japan (18067005). The observation was performed at the monitoring station of the National Institute for Environmental Studies.

Keywords: size distribution, new particle formation, CFORS

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

MIS026-P02 Room:Convention Hall Time:May 24 14:00-16:30

Lightning observations by the satellite and the characteristics of the electromagnetic waveforms

Hiroshi Kikuchi[1*], Ryuutaro Tanaka[1], Satoru Yoshida[1], Takeshi Morimoto[1], Tomoo Ushio[1], Zen-Ichiro Kawasaki[2]

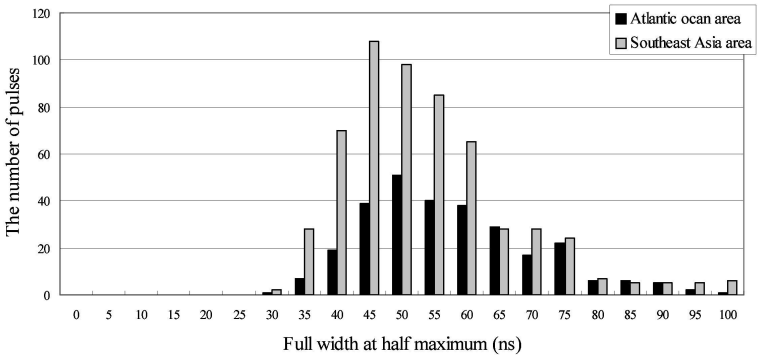
[1]Osaka University, [2]E-JUST, Osaka University

The well-developed thundercloud causes local downpours and tornadoes accompanied with the lightning discharge. These climatic phenomena in a short period of time are difficult to monitor in real time with an existing system. The monitoring of the thunderstorm activities is useful to prevent the weather disasters. The present study aims to monitor the thunderstorm activities from space. In our research group, the Broadband Digital Interferometer (DITF) has been already used to observe the lightning activities above ground. The DITF is a system to locate the sources of impulsive VHF radiation based on the digital interferometric technique. In other words, the DITF is a equipment to visualize lightning channel by VHF radio observations. The remarkable feature of the DITF is its bandwidth (from 25 MHz to 100 MHz) and implicit redundancy for the direction-of-arrival (DOA) estimation. The fairly high resolution and the compactness of the system are great advantage to be the spaceborne system. The goal of this study is to realize the spaceborne DITF and to monitor constantly the thunderstorm activities with the satellites. The Maido-1 observed the lightning discharges from February to October 2009. We indicated the recorded data with the Maido-1 above Southeast Asia area and the Atlantic Ocean area. The pulse width and the number of the pulses are thought to be highly affected by the propagation length through the ionosphere and the lightning activity level, respectively.

We calculated the change of the pulse width with the electromagnetic wave propagation in the ionosphere. The pulse width grows wider in the medium because the short duration VHF pulse with lightning activity has the wide band frequency characteristic. We conducted the propagation simulation in order to understand the change of the waveform. The ionospheric model was developed to calculate the change of the pulse width in the ionosphere. It was divided into the multi-layered media to consider the altitude distribution of the electron density. The model assumes that the ionosphere and the earth are the spherical shape with their origin at the center of the earth. The each layer has the thickness at 10 km. The values of the electron density are used the international reference ionosphere 2007 (IRI-2007) model. In the each layer, the value of the electron density and the refractive index stay constant. The full width at half maximum (FWHM) changed about the tens of nanoseconds. Next we compared to the pulse width of the received pulses by the Maido-1 satellite at the two observation areas. The results in the Atlantic Ocean area had the greater FWHM than those in the Southeast Asia area. The deference of the FWHM was about 5ns. The results had a similar finding for the ground-based observations.

Then we discussed the relationship between the number of the received pulses and the lightning activity. The relationship was calculated by using the observation results of the Maido-1 and the WWLLN. As the first step, the lightning activity factor is defined as the lightning detected number of the WWLLN. The lightning detected number indicates the number which the WWLLN detected the lighting activity in the satellite observation range and in five minutes around the time of the satellite observation. Second, the received pulse number by the Maido-1 was counted using the fitted pulses with the LogisticCum function. Then, we compared the detected number by the WWLLN with the received pulse number by the Maido-1. This result indicated the clear link between the number of the received pulses by the Maido-1 and the detected number by the WWLLN.

We concluded that the pulse width and the received pulse number with the VHF lightning satellite observation indicated the probability of the reference indexes for monitoring the lightning activities.



Keywords: Electromagnetic wave, Radio propagation, Lightning discharges, Satellite observation

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

MIS026-P03 Room:Convention Hall Time:May 24 14:00-16:30

Seasonal variability of lightning activity in the Mediterranean using the World Wide Lightning Location Network

Yoshitaka Nakamura[1*], Heba Gamal[2], Takeshi Morimoto[1], Tomoo Ushio[1], Zen Kawasaki[3]

[1]Osaka University, [2]E-JUST, [3]E-JUST, Osaka University

The Mediterranean Climate is the dominant climate in the Mediterranean region, and there are typically dry summers and wet winters. For this feature, the intensity of lightning activity in winter is stronger than one in summer in the Mediterranean region. In particular, winter thunderstorms are different from summer thunderstorms in terms of charge distributions for low altitudes of the tropopause. Thus, it is thought that the frequency of upward cloud-to-ground (CG) lightning flashes and the positive CG lightning flashes, transferring the large charge to ground, is high in winter than in summer. To fully understand lightning discharges in the Mediterranean region, we must recognize characteristics of their lightning activities. The World Wide Lightning Location Network (WWLLN) operated by the University of Washington has more than 50 sensors in the world and locates lightning discharges on the globe in real-time. In this study, we estimate monthly lightning distribution maps in the Mediterranean from 2007 to 2010 using the WWLLN. The lightning activity observed over the Mediterranean Sea in March moves to the European Continent from April to June. In July and August, we detect lightning flashes over inlands of the northern Mediterranean and Algeria. Meanwhile, there is no lightning activity over the greater part of the Mediterranean Sea. The lightning distribution on the European Continent moves south from September to October. From November to March, we detect lightning flashes over the Mediterranean Sea. Meanwhile, there is no lightning activity on the greater part of the inland south European Continent and inland North Africa. In this presentation, we will show some case examples in winter, and compare them with winter lightning in Japan and sea surface temperatures of the Mediterranean Sea.

Keywords: winter lightning

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

MIS026-P04 Room:Convention Hall Time:May 24 14:00-16:30

Long-term trend of global geomagnetic Sq field

Masahiko Takeda[1*]

[1]DACGSM, Fac. of Sci., Kyoto Univ.

Long-term variation, including seasonal and local time variations, of the atmospheric potential gradient (PG) at Kakioka (KAK) and Memambetsu (MMB) in Japan was investigated for the period 1958-2008. PG was observed in all seasons to have decreased steadily at KAK since 1980, but the decrease was accelerated after 1997. This pattern suggests that the height profile of the conductivity above KAK was modified, especially after 1997. The decrease in PG was also observed at MMB after 1997. More details together with seasola and local time variations will be shown in the presentaion.

Keywords: atmospheric electricity, potential gradient, long term trend, seasonal dependence, local time variation

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

MIS026-P05 Room:Convention Hall Time:May 24 14:00-16:30

Development of small-size field mill for balloon measurement

Hironobu Fujiwara[1*], Rikuma Sakai[3], Koji Inazaki[2], Masashi Kamogawa[3]

[1]Joshiseigakuin High School, [2]NEC system technology, [3]Dpt. of Phys., Tokyo Gakugei

We developed a small-size field mill equipped with a data logger for balloon measurement. Purpose of this system is to monitor atmospheric electric field variation generated by thunderstorm and non-thunderstorm. The system is operated not only by battery without a commercial electric power but also in low temperature. In the presentation, we introduce a performance of our system and preliminary observation results.

Keywords: Atmospheric electric field, Field mill, Ion-aerosol