Japan Geoscience Union Meeting 2014
(28 April - 02 May 2014 at Pacifico YOKOHAMA, Kanagawa, Japan)

MIS26-01 Room:422 Time:April 29 09:00-09:15

Magnetosphere-Ionosphere coupling events and Atmospheric electricity at Syowa station, Antarctica

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At Syowa Station(69.0S, 39.6E), located on East Ongul Island near the continent of Antarctica, atmospheric electric field observation has been carried out with an electric field mill. We extracted 'fair-weather' electric field data over six years, from 2006 to 2012. We considered the 'fair-weather' electric field data and Geomagnetic field by comparison, and found an event which suggests variations of electricity in ionosphere caused by magnetosphere-ionosphere coupling. In this presentation, we will show atmospheric electric field, aurora activity, HF radar, etc. during the event, and discuss the influence of Solar-Terrestrial environment on atmospheric electricity.

Keywords: fair-weather, Antarctica, atmospheric electricity, Magnetosphere-Ionosphere coupling, global circuit

Japan Geoscience Union Meeting 2014
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MIS26-02 Room:422 Time:April 29 09:15-09:30

Changes in atmospheric electricity over about eighty years

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The Japan Meteorological Agency has observed atmospheric electric field at Kakioka magnetic observatory (KMO) since 1929. This observation has been carried out by a water-dropper instrument without replacing. Meteorological observations at KMO stopped in 1997, and fair-weather days of atmospheric electricity have been extracted from data of atmospheric electricity itself and precipitations. We extracted clear weather days with weather satellite images and all-sky photos at KMO, and derived diurnal variation of the atmospheric electric field in calm days. In this presentation, we will show the diurnal curve at present and past, from 1931 to 1935, and discuss changes in atmospheric electricity over about eighty years.

Keywords: atmospheric electricity, diurnal variation, fair weather, water dropper, cloud grid information

Japan Geoscience Union Meeting 2014
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MIS26-03 Room:422 Time:April 29 09:30-09:45

Snow electrification observed at Memanbetsu

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We investigate the snow electrification observed at Memanbetsu. In this presentation, we report a preliminary analysis of atmospheric data observed in Memanbetsu.

Keywords: Atmospheric electric field, Snow electrification

Japan Geoscience Union Meeting 2014
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MIS26-04 Room:422 Time:April 29 09:45-10:00

Spatio-temporal characteristics of subionospheric perturbations associated with annular solar eclipse

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In this paper, we analyse UEC's VLF/LF transmitter observation network data associated with annular solar eclipse in 2012. Clear temporal dependences of the VLF amplitude are observed by various transmitter-receiver paths. Numerical computations of VLF/LF signals with the ionospheric perturbations due to the solar eclipse are carried out by using 2D-FDTD method. As a result, temporal variations of the VLF/LF amplitude are in rather good agreement with those from the numerical modeling.

Keywords: Annular solar eclipse, Ionospheric perturbations, VLF radio waves, FDTD method

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MIS26-05 Room:422 Time:April 29 10:00-10:15

Electrical characteristics of the lightning discharges generating long-recovery VLF events

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In this paper, we focus on the special type of early/fast VLF event so-called long-recovery VLF event to study its generation mechanism. We identify many long-recovery VLF events by using UEC's VLF/LF transmitter signal receiving network. Electrical properties of causative lightning discharges of the long-recovery events are presented based on both the peak current and electrical charge moment changes by the ELF waveform observations.

Keywords: long-recovery event, ionospheric perturbations, charge moment, early/fast event, lightning discharge

Japan Geoscience Union Meeting 2014
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MIS26-06 Room:422 Time:April 29 10:15-10:30

Signature of subionospheric LF wave perturbations associated by Hokuriku winter lightning observed at the Zao station

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Intense electromagnetic pulses (EMP) radiated from lightning discharge could cause heating and ionization and alter the conductivity in the ionospheric D-region. Quasi-electrostatic fields (QE Fields) which are generated due to the removal of electric charge could also affect it. The purpose of this study is to reveal influence of the lightning on the lower ionosphere and its dependence on properties of lighting discharges. The VLF/LF signature of subionospheric perturbations associated with winter lightning in the Sea of Japan (around Hokuriku) has been observed during December 16-31, 2009. LF (60kHz) radio observation was made at Zao (Miyagi) for Haganeyama JJY transmitter (border between Saga and Fukuoka) whose great circle path (GCP) passes over the coast area of Hokuriku. The amplitude and phase of the JJY signal are recorded every 0.1 seconds. In addition to the subionospheric LF observation, lightning locations are determined by a lightning location network (WWLLN). The number of total lightning event identified in the area of 35-37 degrees N and 134-137 degrees E is 1002. Based on the LF observation, subionospheric perturbations which occur immediately after the causative lightning (early event) were detected. The number of the total detection of the early event in the selected area is 72. Early events identified will be compared with peak current and charge moment of the causative lighting which are derived from LF and ELF waveform observations, respectively, to investigate the relation between early event properties and magnitude of EMP and QE fields.

Keywords: lightning, subionospheric perturbations, electromagnetic pulses, quasi-electrostatic fields

Japan Geoscience Union Meeting 2014
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MIS26-07 Room:422 Time:April 29 10:30-10:45

Generating position identification of high-energy radiation associated with the summer thundercloud

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We perform the observation on the Fuji mountaintop in the summer from 2008 to elucidate mechanism of the high energy radiation of the thundercloud origin. This presentation is the result of observation in 2013.

Keywords: thundercloud, high-energy radiation, Mt. Fuji

Japan Geoscience Union Meeting 2014
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MIS26-08 Room:422 Time:April 29 11:00-11:15

Development of broadband lightning monitoring system and its application

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We have been designing and developing Broadband Observation network for Lightning and Thunderstorm (BOLT) in Kinki area to study lightning discharges and thunderstorms. The BOLT consists of 11 sensors which detect LF radiation form lightning discharge and locate emission sources in 3D. We have been developing both hard ware and algorithm to locate lightning so that the BOLT produces detail progression of lightning discharges, including stepped leader and negative recoil leader in negative charge region. In this presentation, we show clear 3D BOLT images of lightning discharges and compare the results with VHF source locations.

Keywords: lightning discharge, thundercloud monitoring, remote sensing

Japan Geoscience Union Meeting 2014
(28 April - 02 May 2014 at Pacifico YOKOHAMA, Kanagawa, Japan)

MIS26-09 Room:422 Time:April 29 11:15-11:30

Simultaneous observations of VHF waves and optical emissions for lightning from the International Space Station

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Since Novenber 2012, Global Lightning and sprIte MeaSurements (GLIMS) mission has been conducted on Exposed Facility of Japanese Experiment Module (JEM-EF) of the international space station (ISS) which is orbiting the earth at an altitude 400 km. The VHF broadband digital interferometer (VITF) attached on JEM-EF is designed to estimate the direction of arrival of electromagnetic waves. The VITF has th bandwidth from 70 MHz to 100 MHz. The VITF consists of two antennas, band-pass filters, amplifiers, and 2-channel-AD-converter. The electromagnetic radiations from lighting discharges received by the antennas are digitized by the AD converter synchronizing with another channel through the filters and the amplifiers. The band-pass filter and the amplifier of the VITF are exactly the same as the ones of the VHF sensor on Maido-1 satellite. The basic specification and most of devices in the AD converter of VITF.

In previous study, the Array of Low Energy X-ray Imaging Sensors (ALEXIS) satellite (1993) had a high-speed VHF receiver/digitizer (Blackbeard) for studying the effect of lightning and electromagnetic impulse from lightning and other man-made noise, which means TV and FM carrier interference. Furthermore, the Blackbeard reported the unique characteristics of VHF waves radiated from lightning known as transionospheric pulse pairs (TIPP). In 1997, the Fast On-orbit Rapid Recording of Transient Events (FORTE) satellite recorded many VHF pulses associated with lightning discharges.

The observation results of the VITF of the JEM-GLIMS mission were described. As a case study, the lightning event captured by the two optical sensors (photometers and CMOS sensor) was analyzed. In these events, the waveform data of VITF were used to estimate the arrival direction of EM waves. There are two methodologies which are the interferometry technic and the group delay characteristic of EM waves. We compared the results of direction of arrival estimation with CMOS sensor data. The results agreed with the position of the lightning emission captured by the CMOS sensor. We also compared the results of VITF with that of the photometers in order to find the temporal relationship. The results indicated that the frequency of the VHF radiations recorded with the VITF had a positive relationship with optical waveform captured with the photometers.

Keywords: lightning, radio wave propagation, VHF waves

Japan Geoscience Union Meeting 2014
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MIS26-10 Room:422 Time:April 29 11:30-11:45

Magnetotelluric measurements of volcanic lightning at Sakurajima, Japan

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Magnetotelluric (MT) method uses the natural electromagnetic (EM) field variation to image subsurface resistivity structure, and usually involves measuring two horizontal electric field components (Ex and Ey) and three magnetic field components (Bx, By, and Bz) at the Earth's surface, where the subscripts x and y indicate the N?S and E?W directions, respectively. In the MT data recorded 3 km away from the active crater of Sakurajima volcano, pulse-like signals that synchronize with the volcanic lighting are frequently observed within 3 minutes from the eruption onset (Aizawa et al. 2010). However the sampling rate on that paper was so low as 15 Hz that the physical properties of volcanic lightning, such as waveform of EM radiation, amplitude of electric current, and its duration, were not investigated.

In the presentation, we show the result from the temporal MT observation with the sampling rate of 65 kHz. The MT data were recorded at two sites approximately 3km away from the active crater between October 27 and November 6, 2013. The preliminary analysis shows the following features of volcanic lightning;

(1) There are two types of discharges. One is the assemblage of several pulses. Another is the EM burst that continues several ms.

(2) The duration of each pulse in the assemblage type is short as a few tens of micro seconds, but its amplitude is far strong than that of EM burst.

(3) Regarding the discharges of the pulse type, there are examples that the first discharge is weaker than the second and third discharges.

The points of (1) and (2) are similar to the lightning in the thundercloud. However, its duration is approximately 1/10˜1/100 of that of thundercloud. In addition, we will show the data of physical unit (mv/Km and nT) which was recovered by incorporating the frequency response of the logger and induction coil, and will closely investigate the relationship between MT signals and the corresponding lighting movie. In addition, the 32 Hz MT data since December 2011 will be presented.

References

Aizawa, K., A. Yokoo, W. Kanda, Y. Ogawa, and M. Iguchi (2010), Magnetotelluric pulses generated by volcanic lightning at Sakurajima volcano, Japan, Geophysical Research Letters, 37, L17301, doi:10.1029/2010GL044208.

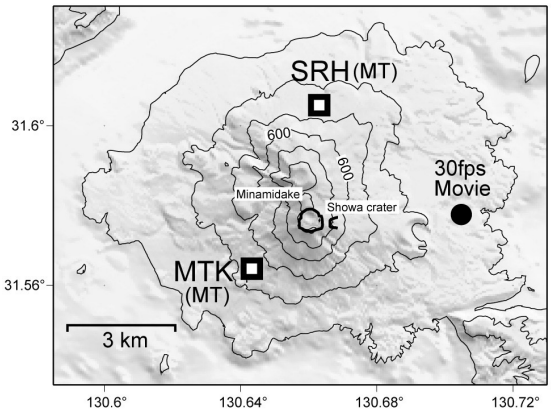

Fig.1

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MIS26-11 Room:422 Time:April 29 11:45-12:00

Pressure field of a tornado observed by POTEKA project

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A tornado event, which occurred in Midori city Gunma prefecture on 16 September 2013, was observed by the fine-mesh surface weather station network named as POTEKA. The pressure field around the tornado revealed the pressure dip pattern at the time of the wind damage and useful for the judgement of the cause of wind damage.

Keywords: surface weather station, tornado, downburst, gust front

Japan Geoscience Union Meeting 2014
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MIS26-12 Room:422 Time:April 29 12:00-12:15

Discrimination between downburst and gust-front by the surface dense observation network POTEKA

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[1]National Defense Academy, [2]Meisei Electric

On the evening of 11 August 2013, a severe thunderstorm passed over the Takasaki and Maebashi city, Gunma prefecture, and produced gusty wind damages. The change of surface weather elements was recorded by dense observation POTEKA when gust occurred. In this study, we follow the development and propagation of gust-front and downburst through the analysis of features of pressure field observed by POTEKA. The result of this analysis reveals that the reason of gust caused damages in Maebashi city is downburst.

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MIS26-13 Room:422 Time:April 29 12:15-12:30

Doppler Observation of Cumulonimbus Turret Generation by 95GHz Cloud Radar in Boso Peninsula on 30 August 2012

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Simultaneous observations of cumulonimbus turrets using a 95GHz W-band cloud radar, an X-Band radar, the MTSAT-1R rapid scan and photogrammetry were held during the summer in 2012 in Kanto Region, Japan to understand the convection initiation and the structure of cumulonimbus turrets. During these observations, the cloud radar was installed in the middle of Boso Peninsula, where cumuli and cumulonimbi frequently generate in mid-summer season.

Cumulonimbus turrets were developed above the W-band cloud radar after 12:30 on 30 August 2012. The turrets continued development and degeneration for two hours above the radar. In a previous study, we have shown the Doppler analysis by X-band radar which indicated convergence of horizontal winds below 1.5 km around the cloud radar site at the initiation of the first cumulonimbus turret generation.

In this presentation, we show the vertical Doppler analysis result of the cloud radar at the initiation of the cumulonimbus turret generation. The result indicates the existence of a strong updraft of over 6 m/s at the initiation of the first cumulonimbus turret generation.

Keywords: cumulonimbus, turret, cloud radar, Doppler