

MIS026-P01

会場: コンベンションホール

時間: 5月24日 14:00-16:30

## 落石岬におけるエアロゾル粒子の粒径分布の通年観測

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

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海洋生物起源粒子の生成プロセスを調べるため、基礎生産性の高い海域に面した北海道落石岬において、エアロゾル粒子の粒径分布の無人通年観測を行った。

北海道根室にある国立環境研究所落石モニタリングステーションにおいて、2008年5月22日～6月18日、2009年10月16日～2010年9月7日に連続観測を行った。屋上のシェルターに設置した走査型移動度分析計 (SMPS, TSI 3034) と光散乱式粒子計数器 (OPC, RION KC01D または KC01E または KR12A) を用いて 10～5000nm にわたる粒径分布を測定した。無人観測のため、拡散ドライヤーは使わず、リボンヒーターにてチューブを暖め、試料空気を 40% 以下に乾燥させた。測定器インレット直前のチューブ内の温湿度を測定した。地上とタワーにおける高度 10, 30, 50m の気温の鉛直分布から逆転層の有無を求めた。また、化学天気予報 (CFORS) により硫酸塩、有機エアロゾル (OC)、黒色炭素粒子 (BC) の飛来を推定した。

粒径分布を見ると 100～200nm にピークが観測されることが多いが、時々、10～30nm にピークが見られる。3時間以上続いて 20nm 以下の粒子濃度が高濃度となるイベントが観測期間中 36 回観測された。そのうちの 7 回は初夏に、残りは秋か冬に観測された。新粒子生成に特徴的なバナナシェイプの変化 (粒子の成長) がわずかではあるが、21 回見られた。CFORS の予想によると、硫酸塩、OC、BC の飛来はそれぞれ 11, 26, 30 回あった。これらと気圧配置、地上風向、後方流跡線解析の結果をもとにエアマスの起源を推定したところ、26 回が大陸性起源だった。明らかに海洋起源と判断できるイベントはなかったが、海洋起源と思われるイベントは年中観測された。

#### 謝辞

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キーワード: 粒径分布, 新粒子生成, 化学天気予報

Keywords: size distribution, new particle formation, CFORS

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## 衛星観測で得られた雷放電に伴う VHF 帯電磁放射の特徴と波形解析

## Lightning observations by the satellite and the characteristics of the electromagnetic wave-forms

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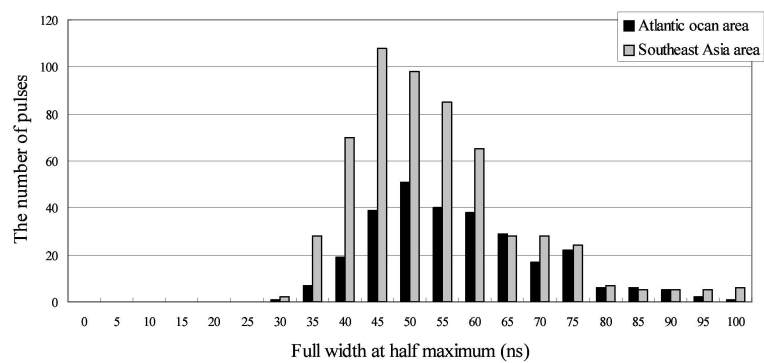
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The well-developed thundercloud causes local downpours and tornadoes accompanied with the lightning discharge. These climatic phenomena in a short period of time are difficult to monitor in real time with an existing system. The monitoring of the thunderstorm 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 Mado-1 observed the lightning discharges from February to October 2009. We indicated the recorded data with the Mado-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 Mado-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 Mado-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 lightning activity in the satellite observation range and in five minutes around the time of the satellite observation. Second, the received pulse number by the Mado-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 Mado-1. This result indicated the clear link between the number of the received pulses by the Mado-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.



キーワード: 電磁波, 電波伝搬, 雷放電, 衛星観測

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

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## 全球落雷位置標定装置 WWLLN による地中海域における雷活動の季節変化 Seasonal variability of lightning activity in the Mediterranean using the World Wide Lightning Location Network

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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 inland 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.

キーワード: 冬季雷

Keywords: winter lightning

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## 日本における静穏日大気電場の経年変化 Long-term trend of global geomagnetic Sq field

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1958年から2008年までの期間についての柿岡と女満別における静穏日大気電場の長期変化をその季節変化・地方時変化と共に調べた。柿岡の大気電場は1980年に最大になった後は一貫して減り続けており、それはほぼどの季節、どのUTについても見られ、特に1997年以降は減少が加速しているのに対し、女満別の大気電場は柿岡とは傾向が異なり1970年頃が極大でそれ以降1995年頃まではほぼ一定であるが、1997年以後はこちらも減少していることが分かった。さらに季節変化や地方時変化のパターンにも長期変化に変化が見いだされたが、詳しくは学会時に議論する予定である。

キーワード: 大気電場, 長期変化, 季節依存性, 地方時変化

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

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## バルーン観測用小型大気電場測定装置の開発 Development of small-size field mill for balloon measurement

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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.

キーワード: 大気電場, フィールドミル, 大気イオン

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