Japan Geoscience Union Meeting 2012
(May 20-25 2012 at Makuhari, Chiba, Japan)

PEM08-P01 Room:Convention Hall Time:May 22 17:30-18:00

Long-term variation relationship between the strength of EEJ and atmospheric disturbance in the MTI region

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The equatorial electrojet (EEJ) is a huge eastward current which flows at the dayside equatorial region of the Earth's ionosphere, in a narrow channel (+-3~5 degrees in latitudinal range). The EEJ current is observed as an enhanced magnetic variation of horizontal component of geomagnetic field at the dayside magnetic dip equator. In the past studies, many researchers showed that the main mechanism of EEJ is an effect of polarization electric field in the E region of the ionosphere at the dip equator caused by the horizontal magnetic field at the magnetic equator [e.g., Forbes, 1981]. In a recent study, the observation of atmospheric radars located at the equatorial region showed the existence of neutral wind in the E region of the ionosphere and vertical polarization electric field derived from ionospheric dynamo generated by the gravity wave originating from the lower atmosphere [Aveiro et al., 2009]. In addition, Fang et al. (2008) shows the relationship between wind dynamo effect and EEJ by using their simulation model. However, lack of the long-term comparison analysis of geomagnetic field and wind data obtained from ground magnetometer and atmospheric radars, the detailed relationship between the EEJ and neutral wind fluctuation at the mesosphere and lower thermosphere (MLT) regions has not yet been revealed.

To clarify the relationship between the variations of the EEJ strength and neutral wind at the MLT regions, we perform the long-term comparison analysis of geomagnetic field and neutral wind data obtained from ground magnetometer and medium frequency (MF) radar located at the equatorial region. We use the neutral wind data estimated from the MF radar at Pamuenpauk, which has been operated by Research Institute for Sustainable Humanosphere, Kyoto University. We also used many magnetometer data observed at CEB (geomagnetic latitude=2.53, geomagnetic longitude=195.06), DAV (-1.02, 196.54), YAP (1.49, 209.06), ANC (0.77, 354.33), and EUS (-3.64, 34.21). CEB, DAV, and YAP are located in the Asia and Pacific region, close to the MF radar. ANC and EUS are located at the South America region, far from the radar site. All the magnetometers belong to MAGDAS managed by Space Environment Research Center, Kyushu University. We can observe global and local effect by using these magnetometers and radar data. The analysis period is from 1996 to 2011, over one solar cycle.

As a result, the relationship between the variations of zonal wind and the residual-EEJ showed a clear inverse correlation. Here, the residual-EEJ is defined as the deviation from the second order fitting curve between the F10.7 solar flux and the EEJ amplitude. This trend is observed in not only the Asia Pacific region (close to the radar) but also the South Africa region (far from the radar site). In addition, we performed the frequency analysis to quantitatively define the relationship of zonal wind and residual-EEJ. These results suggest that the vertical current (Jz), which is generated by the dynamo action due to the zonal wind perpendicularly across to the background magnetic field, changes the Cowling conductivity derived under the condition of Jz=0. On the other hand, there was no correlation between the variations of the meridional wind and the residual-EEJ amplitude. This implies that the meridional wind parallel to the background magnetic field does not contribute to the dynamo action. These results allow us to solve the Cowling conductivity including the neutral wind effect, and offer new insight into the study of ionosphere-aerosphere coupling at the equatorial region.

Keywords: equatorial electrojet, MF radar, magnetometer, IUGONET, neutral wind

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Observation of atmospheric gravity waves with lithium release from sounding rocket

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As WIND-2 Campaign, S-520-26 sounding rocket was launched from ISAS/Kagoshima Space Center (131.08E, 31.25N) at 05:51 on January 12, 2012. The rocket installed Lithium Ejection System (LES), which releases the lithium atom in the thermosphere. The Lithium cloud was observed from Uchinoura, Sukumo and Muroto to estimate the wind and gravity wave in the thermosphere.

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Toward estimating plasmaspheric density along 210MM by using MAGDAS/CPMN stations

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The ultimate goal of this study is to monitor the plasma density distribution in geospace by using ground magnetometers. A method for it is to use the field-line resonance (FLR) frequency, but it is often difficult to identify. Frequently-used methods to identify it, called "two-station methods" below, need data from two closely neighboring stations. However, many ground stations are not close enough to each other to enable the two-station methods. Therefore, in this paper we focus on the H/D method (also called "one-station method" below); it is a method which uses the data from a single station. However, it is known that this method can also detect events different from FLR events (called "Type-B" events below). In this study, we improve the H/D method to decrease Type-B events, by using MAGDAS/CPMN data.

Among the CPMN stations, we have at least two pairs of stations close enough to each other, enabling the two-station method. We applied the two-station methods and the one-station method to those stations' data during 2001/8-2002/6, and by comparing the results, we improved the one-station method: That is, we set thresholds for the H/D value and for the H-component power spectral density (PSD). The optimum values for the two thresholds were found by numerical search so that as many Type-B events as possible were removed while as many "Type-A" events as possible were kept ("Type-A" refers to the events identified by all of the two-station methods and the one-station method).

As a result, we found the following:
(1) We could remove 95% of the Type-B events.
(2) The thresholds for the H/D value and the H-component PSD depend on the L-value.
(3) The threshold for the H/D value depends on season.

By using the improved H/D method, we have estimated the plasma mass density as a function of the L-value using the CPMN stations along 210MM (210 degrees magnetic meridian). The result shows the same trend as the plasma mass density observed by past satellites (Gallagher et al., 2000).