# Comparison analyses between the equatorial electorjet strength and neutral wind fluctuation in the MTI region

# Shuji Abe[1]; Atsuki Shinbori[2]; Akiyo Yatagai[2]; Daisuke Ikeda[3]; Kiyohumi Yumoto[1]; Toshitaka Tsuda[2]
[1] ICSWSE, Kyushu Univ.; [2] RISH, Kyoto Univ.; [3] ISEE, Kyushu Univ.

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 the horizontal component of geomagnetic field at the dayside magnetic dip equator. 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 addition, according to recent studies, many researchers pointed out that the relationship between the EEJ and neutral wind fluctuations in the mesosphere and lower thermosphere (MLT) regions [e.g., Aveiro et al., 2009]. One of our research objectives is to find out the physical connection mechanism between these EEJ and neutral wind.

It is important to make simultaneously observation about geomagnetic field variation and neutral wind velocity for proper understanding of the relationship between these values. However, in past study, because of 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 fluctuations in the MLT regions has not yet been revealed with observational support. To solve the above problem, we used metadata database and analysis software supplied by IUGONET (Inter-university Upper atmosphere Ground Observation NETwork).

We compared the long-term variation of geomagnetic field data obtained from ground magnetometer with neutral wind data obtained from MF and meteor radars. These ground instruments located at the equatorial region. The magnetometers belong to MAGDAS managed by International Center for Space Weather Science and Education, Kyushu University. The radars are operated by Research Institute for Sustainable Humanosphere, Kyoto University. The analysis period is from 1990 to the current. As a result, we found that the relationship between the variations of zonal wind and the residual-EEJ showed a clear inverse correlation at 96km altitude (ionospheric E-layer). Here, the residual-EEJ is defined as the deviation from the second order fitting curve between the EUV flux and the EEJ amplitude. Following that, we compared these results with the neutral wind data observed by TIDI instrument on TIMES satellite, and found the same result. In addition, we performed the frequency analysis to quantitatively define the relationship of zonal wind and residual-EEJ, and found that both of the neutral wind and residual-EEJ have almost the same dominant frequency. Our 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, Fang et al., (2008) shows the relationship between wind dynamo effect and EEJ by using their simulation model. In this model, neutral wind has a height-dependent influence to EEJ. Now therefore, to more clarify the relationship of ionosphere-aerosphere coupling at the equatorial region, we performed comparison analyses among geomagnetic field, neutral winds, cover not just lower altitude but higher altitude (over 100km), observed by ground-based radar and satellite, and simulation model. These studies 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.