Geophysical Research Abstracts
Vol. 21, EGU2019-6326, 2019
EGU General Assembly 2019

Comprehensive characterization of the counter equatorial electrojet

Yunliang Zhou (1), Hermann Lühr (2), and Patrick Alken (3)

(1) Department of Space Physics, School of Electronic Information, Wuhan University, 430072 Wuhan, China (zhouyl@whu.edu.cn), (2) GFZ, German Research Centre for Geosciences, Section 2.3, Geomagnetism, Potsdam, Germany (hluehr@gfz-potsdam.de), (3) Cooperative Institute for Research in Environmental Sciences, University of Colorado, Boulder, Colorado, USA (alken@colorado.edu)

By utilizing ten years of geomagnetic field observations from the CHAMP satellite, we made a comprehensive analysis of the counter equatorial electrojet (CEJ). It is found that CEJs can be observed during 18% of the time. The westward current density is typically smaller than that of the regular eastward equatorial electrojet (EEJ). About 70% of the CEJs exhibit peak current densities of less than 35 mA/m. CEJs occur preferably during early morning hours. At noon their occurrence rate is down to 4% and in the evening it reaches again 20%. However, the amplitude maximizes with an average current density of 33 mA/m around noon. The CEJ occurrence rate shows a clear annual variation with a peak around July-August and a secondary peak at January. We relate the late summer peak to the effect of meteor dust ablation. The CEJ amplitude is closely controlled by magnetic activity. There exists a good correlation between the activity index aP and peak current density. Main driver for CEJ events during quiet times are atmospheric tidal winds. Non-migrating solar tides are the main reason for longitudinal occurrence rate patterns. Most prominent during all seasons are wavenumber1 (WN1) longitudinal structures. They can be attributed to the semidiurnal SW3 and stationary SPW1 tidal components. During late summer-autumn season WN4 becomes largest, which can be related to the DE3 component. Also the influence of lunar tides is evident in the CEJ occurrence rate. Strongest modulation of the CEJ by the semidiurnal lunar M2 tide is observed around January, and in particular during years with stratospheric sudden warming events. These events are also responsible for the secondary CEJ occurrence peak in January. Both, the solar and lunar tidal waves appear out-of-phase between CEJ and EEJ. This implies that the same tidal mechanism is influencing both current systems. Changes of solar wind conditions can also influence the CEJ. Immediately after a sudden increase of solar wind input CEJs are depressed, but about 3 hours after that event they are strongly enhanced. We regard this latter effect to the disturbance wind dynamo, which is assumed to be the main reason for the CEJ amplification during magnetically active times.