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

PEM08-09 Room:301B Time:May 21 16:20-16:35

Discrepant EUV-Proxy Correlations on Solar Cycle and Solar Rotation Timescales and the Manifestation in the Ionosphere

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The variations of solar EUV irradiance significantly affect the ionosphere. Solar proxies are used to indicate EUV variations when direct EUV observation is unavailable. SOHO/SEM 26-34 nm EUV observations, the F10.7 and Mg II proxies, and ionospheric data were collected to investigate the variability of solar EUV and proxies and its manifestation in the ionosphere. Both EUV and proxies show significant variations on solar cycle (long-term) and solar rotation (short-term) timescales, but the correlations of EUV and proxies on the two timescales are discrepant. Short-term EUV-proxy correlations are poorer than the long-term correlations and variable during the solar cycle; the slopes of short-term EUV against proxies vary from solar rotation to solar rotation, and they are generally lower than those of long-term EUV against proxies. EUV and proxies show discrepant evolutions during the episode of major active regions, which is primarily responsible for the poorer short-term EUV-proxy correlation and the variable short-term EUV-proxy slope. Mg II is a better proxy than F10.7 for 26-34 nm EUV owing to its better indications for short-term EUV. Global electron content (GEC) significantly responds to the long and short-term variations of EUV. Accordingly, the correlations between short-term GEC and proxies are poorer and obviously lower than those between short-term EUV and proxies, and short-term GEC-proxy slopes are lower than the long-term slopes. F10.7 and Mg II are improved by combining the daily and 81-day averaged components of them with weighted factors which are designed to decrease the difference between long and short-term EUV-proxy slopes. The improved proxies can effectively upgrade the indications of proxies for solar EUV.

Keywords: Solar EUV Irradiance, Solar Proxy, Ionosphere