

Long-term trends in the ionosphere F2 region considering the effect of EUV solar radiation proxies during minimum activity levels

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Abstract:

Long-term trends in the F2-region of the ionosphere are expected due to the steady increase in greenhouse gases concentration during the last decades, and also as a result of the secular variation in Earth's magnetic field, among other natural forcings. In particular, the value of these expected trends in the case of the F2 critical frequency, foF2, should not exceed 5% of the variability of this time series in inter-annual to decadal time-scales. Since EUV solar radiation variability along the solar activity cycle explains around 90 to 95% of foF2 variability at these time-scales, its filtering is essential before proceeding with trend estimations. Solar EUV radiation proxies, such as Mg II, Lyman α flux, F10.7 or Rz, can be used for this purpose. However, trends can depend on the selected solar proxy and also on the period considered for the trend assessment. Periods of minimum solar activity level are especially problematic since the relationship between foF2 and EUV proxies seems to change, and even the proxies itself would not measure EUV solar radiation fluxes with the expected accuracy. The effect of solar activity minima in trend values assessment for the period 1979-2020 is analyzed in order to determine the possibility of spurious alterations, especially taking into account that the last two solar minima are almost abnormally low and are at the extreme of the analyzed period.

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