



Within-the-hour variability: levels and their probabilities

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Perturbations of the ionization density at the heights of the ionospheric F-region are permanent features. Therefore, meaningful longer term predictions can only have statistical character, i.e. specify probabilities (e.g. Rawer, 1957, 1993). Systematic studies on the day-to-day and hour-to-hour variability of the critical frequency of the F-region, foF2, and of the total electron content, TEC, have shown that these perturbations, with negative and positive response, depend on local time, season and location (Kouris et al., 1998, 1999, 2002, 2005; Rawer et al., 2003). Moreover, variations of foF2 in the interval time of an hour have been reported in different papers (Kouris et al., 2000; Fotiadis et al., 2001; Zolesi et al., 2001; Buresova and Lastovicka, 2001) showing that a variation of foF2 around 10% (positive or negative) with respect to the hourly daily value measured at the standard-hour time, is always present. This ionospheric variability “within-the-hour” or otherwise “ionospheric density noise” can be estimated from the variation of the relative deviations of 5-minutes foF2 measurements with respect to the hourly daily value of foF2 measured at the corresponding standard hour. The diurnal variation of the 5-minutes relative deviations shows clearly that in certain hours and under particular circumstances, values of variability greater (in absolute value) than 10% of the corresponding hourly daily value can be occurred (Kouris et al., 2000; Buresova and Lastovicka, 2001; Fotiadis et al., 2001). In this work using 5-minutes values of foF2 measured at Rome during the years 1998-2001, the 5-minutes relative deviations, counted in each interval of an hour of a given day/month/year, are statistically investigated to provide quantitative prediction bounds of the within-the-hour variability for all hours of the day and different seasons. The analysis points out that the within-the-hour variability in foF2 may reach values greater in absolute value

than 20% (and less than 30%) of the corresponding hourly daily value measured at the standard hour, during around sunrise and/or after sunset when a magnetic activity seems to be present ($K_p > 2$). To be noted, however, that the opposite does not hold. In other words, when K_p is greater than 2 and even up to 8 for example, the within-the-hour variability level might be that of the “quiet variability” levels, i.e. about 0.10, which is of the same order of the variations observed in the critical frequency of the E-layer (Kouris and Fotiadis, 2002). The analysis shows also that these high values of the within-the-hour variability are seasonal dependent. These results suggest that an estimation error might occur when predictions are based only on hourly daily measurements.