Reviewer comments to the paper by Zossi et al. "Revising the sunspot number…"

The problem of long-term changes in the ionospheric F2 region is widely known and numerously considered in literature. A choice of proper solar proxy to reject the solar activity (SA) effects in the initial data is a very important point of all such considerations.

The authors have numerously discussed that point deriving trends in the critical frequency foF2 and height hmF2 of the ionospheric F2 layer. Their conclusions were that the best SA proxies for deriving ionospheric trends are F30 and MgII.

In the Introduction, the authors briefly describe the problem and emphasize the need in selection of the best SA proxies for describing F2-layer parameters behavior and looking for their trends.

In the paper under review, the solar proxies Rz, F30 and F10.7 and considered. Their ability to model foF2 for the period 1960-2023 is analyzed. To do that, the well-known ionospheric index IG is considered.

The foF2 monthly medians obtained at 10 ionospheric stations (both in the Northern and Southern Hemispheres) are used as initial data. Some "cleaning" of the initial data is briefly described.

The mean values of foF2 at 10 stations are compared to the IG index over the 1960-2023 period. Fig.1 demonstrates that the agreement is excellent (R^2 =0.996).

The authors are using several approaches to the comparison of foF2 description by the three SA proxies. The results of the firs approach are shown in Fig. 2. It shows the 11-year moving squared linear correlation between IG and solar proxies and demonstrates that the F10.7 proxy provides in some periods a relatively low correlation (R2 below 0.96) as compared to F30 and Rz. I think that is a good explanation of the fact that F10.7 is found the worst in many publications dealing with ionospheric trends.

In the second approach, the authors perform a linear modeling of IG with F30 and RZ and compare the results with the observed IG. Their point here is that around 2020 the real IGs go slightly lower than the modeled IGs and that could be a cause of negative trends in foF2 obtained by many authors within the recent decade. That conclusion is in a slightly different way supported by Fig. 4 (left).

In the third approach, the authors show (Fig. 5) the linear and quadratic regression between proxies and IG separately for periods 1960-1997 and 1985-2023. Again, they see different results in different periods. Rz and F30 are the best in the first and second periods, respectively.

Then the authors try to get rid of the saturation effect in the foF2 dependence on Rz. They state that the "de-saturating" improves substantially the correlation between Rz and IG.

The results of application of the linear regression with different SA proxies to the observations at all 10 aforementioned stations are shown in Table 1. The authors claim that "…quadratic regression using Sn is, on average, the most effective to predict the ionospheric foF2, followed by Sn de-saturated and quadratic F10.7".

The authors estimate briefly the foF2 trends with using Rz as an SA proxy. Analyzing only the years of solar minima, they obtain a trend of -0.79% per decade. They clime that it is in a good agreement with the results of trend modeling.

I have to confess that I agree not to all approaches and conclusions of the authors. However, I think that there are some interesting and unexpected results which would make over researchers in the field to consider in their trend studies. I recommend the paper for publication with minor revision.

Me critical comments are as follows.

1. The statement in line 143-144 is: "Among them, the more reliable were always the oldest, the sunspot number, and the solar fluxes at radio wavelengths…" It is hardly correct,

because in many publications of the authors, as well as in the papers by Lastovocka and Russian group, the sunspot number was behind the F30, MgII and even Ly-a proxies.

2. The authors state that the trend in foF2 they show at the end of the paper is close to theoretical estimates. However, it is worth mentioning that -0.79% per decade is much lower than the estimates based in the experimental data in many publications, including the authors recent papers. A value of -0.079% per year means (if we conventionally take average foF2 as 10 MHz) –0.0079 MHz per year. In the majority of recent papers, the trends are obtained of the order of –(0.02-0.05) MHz/year. I think that it is worth mentioning it in the paper.