Supporting Information for "First ICON-FUV nighttime NmF2 and hmF2 comparison to ground and space-based measurements"

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Introduction

Figure S1 provides Solar Local Time (SLT) and Solar Zenith Angle (SZA) dependence analysis for COSMIC-2 (C2) and ionosonde N_mF_2 and h_mF_2 differences.

Figure S1. FUV solar zenith angle and local time dependence

Figure S1 shows the SLT and SZA dependence for both ΔN_mF_2 and Δh_mF_2 for the comparison with the C2 (left panels) and ionosonde (right panels) datasets. For N_mF_2, the largest differences in the C2 comparison are found during the pre-dawn hours (Figure S1a, SLT slice 04-06). It must be mentioned that the number of conjunctions (255) related to this SLT slice remains small, despite the fact that it results from 39 different conjunctions at different seasons and locations. Larger ΔN_mF_2 values also occur just after sunset (SLT slice 18-20), suggesting a relationship with terminator-related ionospheric gradients. The largest N_mF_2 differences between FUV and ionosondes are mostly observed for the 00-02 SLT interval, which corresponds to very deep night conditions, when ionospheric gradients are weak and regular. However, deep nights conditions are also encountered in both datasets for SLT slices 20-22 and 22-24 and these are the SLT sectors for which minimum differences are observed. The SZA dependence analyzes differently the solar influence: for C2, we can observe a very slight negative trend between SZA and ΔN_mF_2 (Figure S1c). However, the slope is statistically non significant given the large scatter around the different mean values, the correlation coefficient being equal to -0.14, meaning than the SZA dependence only explains about 2% of the variability. This linear relationship is not observed in the ionosonde dataset, where a quasi-linear positive trend can be estimated between SZA and ΔN_mF_2 (Figure S1d). Regression analysis gives a correlation coefficient between these variables of 0.36, meaning that SZA accounts for about 13% of the ΔN_mF_2 variability. In general, SZA and SLT results are consistent with each other but C2 and ionosonde datasets lead to different conclusions, suggesting a difference between the pre-dawn and post-dusk conditions. The ionosondes used here are, however,

mostly located at mid-latitudes in the European and American sectors, which is a bias in contrast to the more global C2 coverage. Moreover, the ionosonde dataset is restricted to the January-February 2020 period, which corresponds to winter months in the northern hemisphere. This also limits the scope of the interpretation of ionosonde-related results, despite their undeniable high quality.

Turning to h_mF_2, the conclusions are rather similar to those for ΔN_mF_2. Firstly, the C2 dataset suggests that Δh_mF_2 is larger around the terminator (SLT slices 18-20 and 04-06) or for low SZA values. However, the very slight negative slope of the regression line between SZA and Δh_mF_2 is statistically non significant, which prevents stating any robust relationship between these variables. Secondly, the ionosonde dataset exhibits larger Δh_mF_2 values for deep night conditions (SLT slices 00-02 and 02-04), but the regression line computation does not give a statistically significant slope value. Like for ΔN_mF_2, if SLT and SZA results are mostly consistent, C2 and ionosonde datasets lead to different conclusions, preventing us to draw general conclusions about SLT and SZA influence.

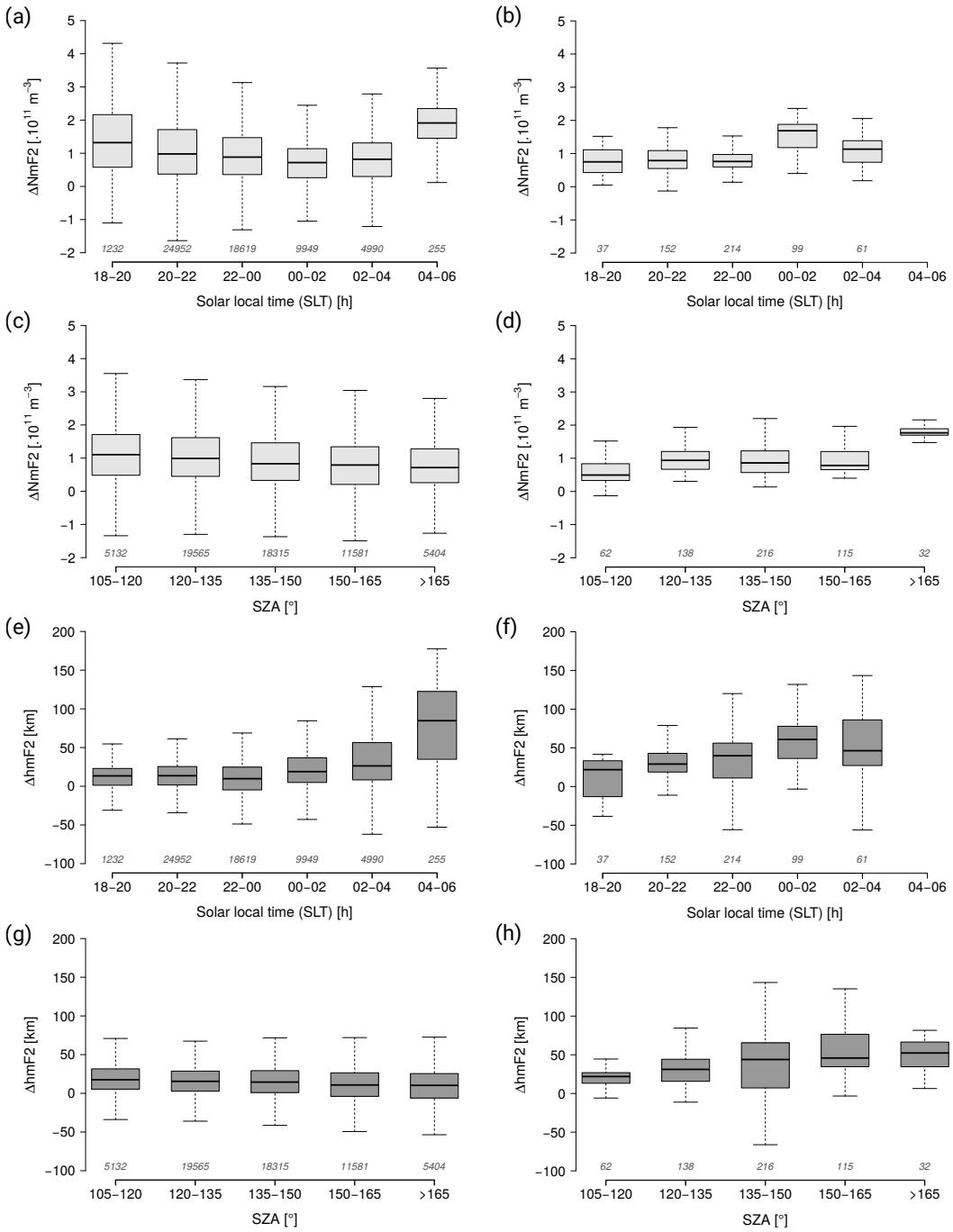

Figure S1. Dependence of $\Delta N_m F_2$ (panels a to d, in light gray) and $\Delta h_m F_2$ values (panels e to h, in dark gray) on SZA and SLT for C2 (left column) and ionosonde (right column) comparisons. The boxes represent the quartiles and the whiskers are located at 1.5 times the interquartile range. The small numbers in italic below the boxplots correspond to the sample size. Note that outliers have been removed from the plots for the sake of clarity.