Review of "Deducing spatial characteristics of global thunderstorm activity using the observed Schumann resonance frequencies" by Koloskov et al.

The paper sets a valuable goal, namely to provide comprehensive formulas for determining the effective source–observer distance and the spatial extent of the area occupied by global thunderstorm activity based on Schumann resonance (SR) frequency observations. I agree with the authors that the combined use of the first and second SR modes, or magnetic and electric field measurements, has unexplored potential in the study of these important characteristics of global lightning activity. However, I see several substantive issues in the manuscript that need to be addressed, which are related to the presentation and contextualization of the results (see below). Therefore my recommendation is that the manuscript should be returned to the authors for major revision.

Recommendation: Return the manuscript to the Authors for major revision.

Substantive issues:

(1) Distance dependence of the peak frequencies

In Section 2, the authors write the following:
"*The nodal zone is also asymmetric with respect to the distance axis. Because the resonance peak vanishes in the nodal zone, the frequency experiences a discontinuity when crossing the 10 Mm distance. As the distance increases from D < 10 Mm to the D > 10 Mm, the peak frequency of the corresponding mode initially* ***decreases****. Then, the resonant peak disappears at D = 10 Mm. Afterwards, the maximum of intensity reappears at* ***higher*** *frequencies. The reappeared resonant peak gradually drifts to* ***lower*** *frequencies with growing distance D > 10 Mm.*"

However, the described distance dependence of the peak frequencies is not consistent with frequency-distance curves presented in earlier studies (see, for example, Figure 2 of Satori et al., 2024 for the electric field component and Figure 3 of Kulak et al., 2006 for the magnetic field component). My expectation is (also based on Figure 1 of the manuscript) that the frequencies **increase** as the source moves toward the nodal zone, where they drop down and then begin to **increase** again. The authors need to clarify this important issue.

(2) The lack of units in Figure 1.

Figure 1 does not indicate whether the values shown on the colormap are calibrated or in arbitrary units. For the sake of comparability with other works, it would be benefitial to display calibrated values.

(3) The impact of the geographical location of the station on the calibration curves

The authors determine the calibration curves for a single station (Vernadsky), but do not discuss the important aspect of how the geographical location of the station affects their results. How different would the calibration curves be for other stations? Could these calibration curves be used as an approximation at other stations? These are important questions that the manuscript should address.

This is particularly important in light of the fact that, in my opinion, the authors provided the calibration curve for the Nagycenk station in equations (3a) and (3b) and not for the Vernadsky station. This also needs to be clarified.

(4) The use of the second electric mode

The manuscript does not discuss an important limitation of the use of the 2nd electric SR mode, namely that although the peak frequency does indeed vary monotonically with source-observer distance in the distance range shown in Figure 3, there are two nodal zones outside this range (see Sátori et al., 2024, Figure 2). This means that if there are sources in these regions, they can significantly affect the observed peak frequencies.

(5) The use of log-log scale for displaying and fitting the calibration curves

The authors use a log-log scale to display and fit the calibration curves (unlike in Nickolaenko and Rabinowicz, 1995), which makes it difficult to perform a quick estimation for the expected frequency changes based on the figures. I believe it would be beneficial to present them on linear scales as well, at least in the Appendix.

(6) Figure captions

The figure captions are very brief and do not describe every detail of the figure. It should be possible to interpret the figures without reading the main text.

Minor issues:

Line 16 There is a “-” after “*distance*” that should be deleted.

Line 34 I think “*form*” should be replaced by “*forming*”.

Line 49-52 I think it would be appropriate to cite Kulak et al. (2006) somewhere here.

Line 133 The authors state that the Vernadsky station "*hosts the longest series of SR observations*", but this is simply not true (see Nagycenk observations which started in 1993). The authors could write "*hosts **one of** the longest series of SR observations*".

Line 191 There is an unnecessary comma after "*size W*".

References

Kulak, A., Mlynarczyk, J., Zieba, S., Micek, S., & Nieckarz, Z. (2006). Studies of ELF propagation in the spherical shell cavity using a field decomposition method based on asymmetry of Schumann resonance curves. Journal of Geophysical Research, 111(A10), A10304. https://doi.org/10.1029/2005JA011429

Nickolaenko, A. P., & Rabinowicz, L. M. (1995). Study of annual changes of global lightning distribution and frequency variations of the first Schumann resonance mode. Journal of Atmospheric and Solar‐Terrestrial Physics, 57(11), 1345–1348. https://doi.org/10.1016/0021-9169(94)00114-4

Sátori, G., Bozóki, T., Williams, E., Prácser, E., Herein, M., Albrecht, R.I., and Beltran, R.P. (2024). How do Schumann resonance frequency changes in the vertical electric field component reflect global lightning dynamics at different time scales? Journal of Geophysical Research: Atmospheres, 129, e2024JD041455. https://doi.org/10.1029/2024JD041455