

This manuscript presents a case study of ionospheric altitude variations during the October 2023 annular solar eclipse using observations from three Brazilian stations—Araguatins, Jataí, and São José dos Campos—experiencing different levels of solar obscuration (89%, 55%, and 38%, respectively). The focus on the temporal evolution of fixed-frequency isolines (3–8 MHz) provides a novel and useful approach for examining vertical motion and structural changes in the ionosphere. The analysis reveals altitude reductions, time lags, and latitude-dependent recovery processes.

The study is timely and well-motivated, particularly in the context of eclipse impacts on the equatorial and low-latitude ionosphere. The data analysis is generally sound, and the figures illustrating isoline dynamics (Figs. 2–5) are clear and informative.

However, minor revisions are required to improve quantitative rigor, resolve ambiguities in physical interpretation, enhance figure clarity, and better contextualize the findings within the existing literature on this eclipse event. The following minor comments are offered to improve clarity, accuracy, and quantitative rigor.

Minor comments

1. Manuscript Organization

The paper would benefit from a brief paragraph at the end of the Introduction outlining the manuscript structure. For example: “This paper is organized as follows: Section 2, 3, 4 describe ...”

2. Ambiguity in Physical Mechanism Must Be Resolved

Lines 97–98 state that the observed altitude reduction “can be either due to a decrease in ionization at higher altitudes or downward motion,” but the manuscript does not subsequently disambiguate between these mechanisms. The authors should clarify which interpretation is favored by the observations (or under what conditions each applies), supported by quantitative or physical arguments.

3. Initial Partial-Eclipse Enhancement Is Inadequately Demonstrated

The manuscript repeatedly states that an increase in the altitude of iso-frequencies occurred immediately after the start of the partial eclipse (Lines 9–10, 142–144, 194–196, 225–226). However, this claim is **not uniformly supported by the figures**.

Inspection of Figures 2 (Araguatins), 3 (Jatai) and 4 (São José dos Campos) indicates that:

- A discernible initial altitude increase is mainly evident in **lower-frequency isolines** (3–4 MHz, corresponding to lower ionospheric altitudes) at the onset of the partial eclipse.
- Higher-frequency isolines (7–8 MHz, corresponding to higher altitudes), show little to no uplift and, in some cases (particularly at São José dos Campos), begin decreasing immediately at the onset of the partial eclipse.

Revise the Abstract, Results, Discussion, and Conclusions to clearly state that the initial uplift is most pronounced at lower frequencies/lower altitudes, while higher-frequency isolines show limited or no increase and, in some cases, an immediate decrease. Quantify the altitude changes (in km) for the lower-frequency isolines.

4. Inconsistency Regarding 6 MHz Isoline Behavior

The manuscript states that a slight increase in the altitude of the 6 MHz isoline was observed at all stations immediately after the onset of the partial eclipse. However, Figure 5 reveals **station-dependent behavior**:

- **Araguatins:** No clear initial increase; instead, a small dip followed by a gradual diurnal rise.
- **Jataí:** All three daily curves show an upward inflection after eclipse onset.
- **São José dos Campos:** A clear decrease immediately after eclipse onset, continuing beyond eclipse end.

This discrepancy should be explicitly addressed in the text, and the statement generalized or revised accordingly.

5. Figures Require Significant Improvement

Figures 2–4 (Isoline plots):

Improve the color scheme of the isoline plots: the 3–8 MHz isolines should be shown using discrete, dark, and clearly contrasting colors to enhance readability and prevent ambiguity between adjacent isolines.

6. Abstract & Introduction

- Line 8: Clarify location → “a time lag of approximately 1.5 hours at Araguatins”
- Lines 14–15: Rephrase to avoid confusion: “.. *with obscuration as low as* Sau Jose dos Campos (38%)”
- Line 28: Typo → “enhacement” → **enhancement**
- Line 50: Correct obscuration value for Jataí → **55%**, consistent with Abstract and Figure 6

7. Results

- Line 93: Briefly explain PRE mechanism.

- Line 115: Date error → **2023**, not 2025.
- Line 122: The sentence “A very slight progressing of the frequencies though the altitudes..” is unclear. Please rephrase for clarity.

8. Discussion

- Line 154: Quantify illumination: at 89% obscuration, ~11% of the solar disk remains visible.

Lines 135–140: The following factual inconsistencies were noted between the text and Figure 5:

- **Line 135:** The text states the response “occurred immediately following the maximum eclipse.” However, Figure 5 shows that the 6 MHz descent at Jataí begins roughly 30 minutes **before** maximum eclipse.
- **Line 136:** The text states the altitude “remained lower until approximately 23:00 UTC.” Figure 5 indicates the Jataí 6 MHz isoline recovers much earlier, near 21:40 UTC.
- **Line 139:** The text states the São José dos Campos behavior “resembles the Jatai case.” This is misleading; Figure 5 shows a distinctly different response, with a clearer and more immediate descent at São José dos Campos.
- **Line 140:** The text states the altitude remained lower “until 22:30.” Figure 5 shows recovery occurring much earlier, near 21:20 UTC.

Please verify these timings against Figure 5 and correct the text accordingly.

- Lines 182–185: Address why responses at Jataí (55%) and São José (38%) are described as “similar” despite different obscuration levels.

9. Conclusions

The "Main Findings" listed in the Conclusion (Lines 220–226) contain a contradictory sequence. They state:

1. "A reduction in the altitude ... was observed at all stations **after the onset...**"
2. "An increase in the altitude ... was observed at all stations **immediately after the commencement...**"

This phrasing incorrectly implies both a decrease and an increase occurred at the same time ("after the onset"). The observed sequence was: a brief initial increase (predominantly in lower-frequency isolines) at the **onset**, followed later by a more pronounced reduction at the **peak** of the eclipse. Please revise the listed findings to clarify this correct chronological order.

Line 216 – Quantify Results:

Please provide quantitative estimates for the reported altitude changes to clarify the magnitude of the ionospheric response. Include approximate values (in km or as a percentage) for:

1. The initial increase in altitude at onset (for lower-frequency isolines, e.g., 3–5 MHz) at each station.
2. The subsequent altitude decrease near maximum obscuration (for 3–8 MHz isolines) at each station.

Example:

“At Araguatins, the 3–4 MHz isolines increased by $\sim X$ km at onset, while the 3–8 MHz isolines decreased by $\sim Y$ km near maximum obscuration.”

- Line 229: Maintain consistency → use **38%**, not 39%

10. Data Availability

- Line 232: “Data can be requested from...” is not compliant with open-science policies.
Required actions:
 - Archive data in a public repository (e.g., CEDAR, Zenodo, Figshare, Pangaea)
 - Provide a DOI, or state that the data will be archived upon acceptance
- Clarify availability of the UDIDA software (open-source repository link or access conditions).