

## ***Interactive comment on “Ionospheric Anomalies Associated with Mw7.3 Iran-Iraq Border Earthquake and a Moderate Magnetic Storm” by Erman Şentürk et al.***

### **Anonymous Referee #2**

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The manuscript presents an observational study of the ionospheric TEC precursors of the 12 November 2017 Iran-Iraq Border Earthquake. The study analyzed the TEC data from IGS stations surrounding the epicenter and the CODE GIMs using Short-time Fourier Transform method and a running median process. The study also analyzed space weather data to determine the contribution of geomagnetic activities to the TEC anomalies before the earthquake. The outcome of the study showed two groups of TEC anomalies with different causes: the anomalies 1-6 days before the earthquake were caused by a geomagnetic storm, while the anomalies 8-9 before the earthquake were related to the earthquake.

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I find the manuscript fairly well-written in general. The study delivers interesting science results and would be inspiring to the community. In particular, the study presents a very nice demonstration of separating the space weather contribution from the earthquake contribution to TEC anomalies. However, there are certain ambiguities in methodology and results that need to be addressed, which are listed below.

1. The relation between the TEC anomalies on November 3-4 and the earthquake is weak given the evidence shown in the manuscript. The authors claim that the TEC anomalies on November 3-4 are earthquake precursors because of quiet space weather, local dispersion and proximity to the epicenter. Instead of quiet space weather, Figure 3 shows a mild geomagnetic activity on November 3-4, with elevated Kp comparing to days immediately before and after. Is it possible that the TEC anomalies on November 3-4 are due to this mild geomagnetic activity? To exclude this possibility, the authors have shown a) the localized anomaly on GIMs of November 3-4, and b) the negligible variations of prompt penetration electric fields on November 3-4.

For a), GIMs are interpolated GNSS TEC maps. It is not clear how many and where the GNSS stations are in generating the GIMs. Are the five IGS stations surrounding the epicenter included for the GIMs? To directly demonstrate that the TEC anomalies on November 3-4 are localized, why not show the lack of anomalies for IGS stations further away from the epicenter (outside of the earthquake preparation area), using the exact same methodology for analyzing the existing 5 stations? A few more panels on Figure 5 for other stations would say it all.

For b), I could not find how the PPEFs are calculated and what is the “Quiet” curve in Figure 10. Does the variation of PPEFs correlate with the TEC variations due to space weather? More explanation would be helpful.

2. Have the authors look into the wave characteristics, for instance the wave period/frequency and duration of the TEC anomalies on November 3-4? Are they similar to the characteristics of earthquake TEC precursors found in previous studies? This

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would better support the argument that the TEC anomalies on November 3-4 are the earthquake precursors.

3. Line 15: molecules are separated into positively charged particles and electrons?

4. Second paragraph of Introduction: some of the references are for ionospheric anomalies during and after earthquakes, which has very different physical mechanisms from the earthquake precursors. I noticed that referee #1 has also pointed this out. I hope the authors successfully address this in the paper revision.

5. Line 46 and Line 79: GIM and STFT are not defined in the main text.

6. Line 95: Any references for CODE GIM?

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