

Ann. Geophys. Discuss., referee comment RC1
<https://doi.org/10.5194/angeo-2021-41-RC1>, 2021
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Comment on angeo-2021-41

Anonymous Referee #1

Referee comment on "Estimation of date and magnitude of four major earthquakes using integration of precursors obtained from remote sensing data" by Mohammad Mahdi Khoshgoftar and Mohammad Reza Saradjian, Ann. Geophys. Discuss.,
<https://doi.org/10.5194/angeo-2021-41-RC1>, 2021

This work is a retrospective analysis of four earthquakes (EQs) searching for possible precursory anomalies in some ionospheric and atmospheric parameters measured by satellites, in particular: electron and ion density, electron temperature, TEC, LST, SST, SLHF and AOD. By the way, TEC is an integrated parameter which is characteristic of both atmosphere and ionosphere, but, of course, it is more indicative of ionospheric state, because it is the ionosphere to contribute more to its value. At first glance, the results seem to confirm both magnitude and time of occurrence of EQs. However, after a more detailed attention, there are some potential flaws in the analyses. I am sorry to say that the paper in its present state cannot be published. I leave the Editor to decide whether to provide some possibility to the Authors to try meet my requests or to reject the paper, so that the Authors can have more longer time to revise it deeply and resubmit it again.

Table of equivalence between Dx and Magnitude ranges (Table 1).

It seems to me a strange coincidence that there is an exact correspondence between integer ranges of Dx and magnitudes. Why? Is there any physical reason for this? Or is it just an empirical decision, rounding the limits of each range to the closest integers.

The space-time domain of analysis.

The period of study is about 50 days before each EQ and 10 days after, looking for

anomalies in a circular region, around the EQ epicenter, that is defined by Dobrovolsky formula, where the radius scales with magnitude. Therefore, the analysis considers a region that is related with EQ magnitude, so the authors implicitly impose the knowledge of magnitude. Also the period points to about 50 days where searching the anomalies: if then one defines the possible period of EQ occurrence of 15 (or 16) days after the found anomaly, the probability to guess the true time of occurrence is rather high.

In addition, what about to extend back the analysis? For instance, to about three months before EQ: what happens to the search for anomalies? Are there other new ones? This extension would be useful also because there are some evidences that the precursor time could scale with magnitude of the impending earthquake (Rikitake law; Tectonophysics, 1987), while here the Authors impose the same precursory time for all EQ magnitudes.

Wrong EQ occurrence Predictions.

Some predictions are wrong. In Table 6 and Table 8, some predictions of Samoa EQ occurrence are clearly wrong: the ionospheric anomalies found on 5 September produce a prediction period 6-20 September and NOT 6 Sept.-20 Oct., so missing the true EQ occurrence of Samoa EQ.

MSE of the different precursors.

This work considers 8 types of precursors. The authors use MSE to provide a good estimator for each EQ parameter prediction. However, I suspect that the prediction is highly biased by the fact that some estimators are each other dependent: for instance the ionospheric parameters, or most of the atmospheric parameters (temperature in its different aspects). To be more correct, I would suggest to group all atmospheric or all ionospheric parameters, define V and M for each group and then finally estimate a mean and the absolute deviation between the best result from each group. Of course, this operation would not be important for Gaussian independent variables, but here the analysed precursors are not independent and neither Gaussian.

Minor points

Line 34. Please change "facilitate" with "facilitated"

Lines 36-39. Some recent important references about satellite precursors are missing, as likely the Authors did not read them before writing this paper: e.g. De Santis et al (Scientific Reports, 2019; <https://doi.org/10.1038/s41598-019-56599-1>) analysed Swarm satellite magnetic field and electron density data. They also found confirmation of the

Rikitake law, for which the larger the impending EQ magnitude, the longer the anticipation time of the precursory anomaly; Picozza et al. (Frontiers in Earth Sc., 2021; <https://doi.org/10.3389/feart.2021.676775>) made a critical review of satellite EQ precursors.

Line 57. The "temperature (K)" is mentioned twice.

Line 84. Is "SLHF" here actually "SST"?

Line 126. Is here "intense" actually "intensity" or (probably better) "strength"?

Eq. (1). Probably for "m" you mean "M" to be in agreement with following equations (2) and (4). You should also change it in the text (line 124)

Line 194. Please correct "December" with "September".