



Study of VLF phase and amplitude variations before the Turkey Syria Mw 7.8 EQs

Mohammed Y. Boudjada¹, Pier Francesco Biagi², Hans Ulrich Eichelberger¹, Patrick H.M. Galopeau³, Konrad Schwingenschuh⁴, Maria Solovieva⁵, Giovanni Nico¹, Helmut Lammer¹, Wolfgang Voller¹, and Manfred Stachel

¹Institut für Weltraumforschung, Extraterrestrial Physics, Graz, Austria (mohammed.boudjada@oeaw.ac.at)

²Department of Physics, University of Bari, Bari, Italy

³LATMOS-CNRS, UVSQ Université Paris-Saclay, Guyancourt, France

⁴Institute of the Earth Physics, RAS, Moscow, Russia

⁵Institute for Applied Mathematics (IAC), National Research Council of Italy (CNR), Bari, Italy

We investigate the recent earthquakes (EQs) that occurred on 06 February 2023 principally in the central southern part of Turkey and north western of Syria. The tectonic plate movements between Anatolian, Arabian and African plates are well known to be subject to EQs. The coordinate of the epicenter was 37.08°E and 37.17°N with depth in the order of 10 km and a magnitude Mw7.8. Beside aftershocks, a few hours later a strong Mw7.7 earthquake occurred in the same region. We consider in this analysis the Bafa VLF transmitter (TBB) signal emitting at frequency of 26.7 kHz and localized in the Anatolia region (Turkey) at longitude of 27.31°E and latitude of 37.40°N. TBB transmitter signal is daily monitored by the VLF Graz facility (Biagi et al., 2019; Galopeau et al., 2023) with a sufficient signal to noise ratio principally during night observations. We study the variations of the phase and amplitude of TBB signals, as detected by Graz facility (15.43°E, 47.06°N) few weeks before the earthquakes occurrence. It is essential to note that the geographical latitudes of the epicenter and the TBB transmitter are about 37°N, and the distance, in the order of 850 km, is found smaller than the radius of the earthquake preparation zone, as derived from Dobrovolsky et al. (1979), when considering the magnitude of the seismic event, i.e. Mw7.8. We have applied the terminator time (TT) method to make evident the presence of sunrise and sunset time shifts at terminators one week to ten days before EQs. We discuss essentially the anomalies, in the phase and the amplitude of TBB transmitter, which are probably linked to the electron density variations at the formation and the destruction of the ionospheric D-E-layers.

References:

Biagi et al., **The INFREP Network: Present Situation and Recent Results**, *Open J. Earth. Research*, **8**, 2019.

Dobrovolsky et al., **Estimation of the size of earthquake preparation zones**, *Pageoph*, **117**,

1979.

Galopeau et al., **A VLF/LF facility network for preseismic electromagnetic investigations**, *Geosci. Instrum. Method. Data Syst.*, **12**, 2023.