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Lithosphere–atmosphere–ionosphere coupling during the September 2015 Coquimbo earthquake

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This study explores temporal variations in seismic data, interplanetary parameters, and geomagnetic indices during the 2015 Coquimbo earthquake. We employ wavelet transform techniques to investigate potential coupling mechanisms between the lithosphere, atmosphere, and ionosphere (LAI), even during geomagnetically disturbed periods. Our analysis is strengthened by evaluating geomagnetic data and all-sky images within a 2000–3000 km radius of the epicenter. We explore the post-Chilean earthquake seismogenic perturbations in the upper atmosphere on September 16–17, 2015. Coseismic and post-seismic events emerge in the Brazilian region 1–3 hrs after the earthquake onset. The co-occurrence and subsequent response of these disturbances to seismic events suggest their seismogenic nature. Additionally, we utilize geomagnetic storm and interplanetary magnetic field (IMF) indices to differentiate magnetic fluctuations arising from solar storms during seismic events. While our study detects magnetic disturbances associated with seismic activity, distinguishing them from the effects of solar storms in the geomagnetic records or all-sky images remains challenging. These observations prompt further investigation into the intricate interplay between geomagnetic and ionospheric disturbances and their connection to seismic and geomagnetic storm activity.

Keywords. Lithosphere–ionosphere coupling; wavelet transform; geomagnetic storms; earthquake; tsunami.

1. Introduction

Scientists have long been fascinated by the puzzling process that underlies earthquake production during the most recent part of a seismic cycle, which has sparked discussions. Seismicity arises from dynamic processes within the Earth's lithosphere (Shalimov and Gokhberg 1998). Efforts in earthquake prediction center on understanding the physical conditions and precursor processes led to seismic ruptures (Pulinets *et al.* 2002, 2018; Sharma *et al.* 2017).

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