

Ionospheric imprint of a seismic source: possibilities & challenges

E. Astafyeva¹, A. Le Blevec¹, P. Lognonné¹, L. Rolland²

1 - Institut de Physique du Globe de Paris (IPGP), University of Paris, CNRS UMR 7154, 35-39 Rue Hélène Brion, 75013 Paris Cedex, France, email: astafyeva@ipgp.fr;

2 – GéoAzur, Observatoire de la Côte d'Azur, 250 rue Albert Einstein, 06560 Valbonne - France

Abstract

It is now well demonstrated that earthquakes can generate perturbations in the ionosphere. During an earthquake, a sudden impulsive forcing from the ground or ocean floor generates atmospheric pressure waves that propagate upward into the ionosphere. These perturbations are called co-seismic ionospheric disturbances (CID), they can provide information on a seismic source (i.e., seismic fault region) as early as 8-9 min after an earthquake onset. The ionosphere-based information could be used for tsunami warning in the near-real time.

The method of seismo-ionospheric imagery is based on use of high-rate 1Hz data from ground-based GNSS-receivers. Information on the seismic fault can be obtain if we detect the direct acoustic waves launched from the ground/ocean floor and reaching the ionosphere.

In this work we demonstrate the possibility to obtain the ionospheric imprint of a seismic source for several earthquakes with moment magnitudes M_w from 7.4 to 9.0. Our results confirm that, despite several difficulties and limitations, high-rate ionospheric GPS data can be used for determining the seismic source parameters for both giant and smaller/moderate earthquakes.