From Sumatra 2004 to Chile 2015 (through the revolutionary observations of Tohoku-Oki 2011): what we learn about Tsunami detection by ionospheric sounding

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Abstract: The tsunamigenic Tohoku earthquake (2011) strongly affirms, again, after the 26 December 2004, the necessity to open new paradigms in oceanic monitoring. Detection of ionospheric anomalies following the Sumatra earthquake tsunami (*e.g.*, Occhipinti et al. 2006) demonstrated that ionosphere is sensitive to earthquake and tsunami propagation: ground and oceanic vertical displacement induces acoustic-gravity waves propagating within the neutral atmosphere and detectable in the ionosphere. Observations supported by modelling proved that tsunamigenic ionospheric anomalies are deterministic and reproducible by numerical modeling via the ocean/neutral-atmosphere/ionosphere coupling mechanism (Occhipinti et al., 2008). To prove that the tsunami signature in the ionosphere is routinely detected we show here perturbations of total electron content (TEC) measured by GPS and following tsunamigenic eartquakes from 2004 to 2011 (Rolland et al. 2010, Occhipinti et al., 2013), nominally, Sumatra (26 December, 2004 and 12 September, 2007), Chile (14 November, 2007), Samoa (29 September, 2009) and the recent Tohoku-Oki (11 Mars, 2011). Based on the observations close to the epicenter, mainly performed by GPS networks located in Sumatra, Chile and Japan, we highlight the TEC perturbation observed within the first hour after the seismic rupture. This perturbation contains informations about the ground displacement, as well as the consequent sea surface displacement resulting in the tsunami. In addition to GPS/TEC observations close to the epicenter and measured by GEONET network, new exciting measurements in the far-field were performed by Airglow measurement in Hawaii: those measurements show the propagation of the IGWs induced by the Tohoku tsunami in the Pacific Ocean (Occhipinti et al., 2011). This revolutionary imaging technique is today supported by two new observations of moderate tsunamis: Queen Charlotte (M: 7.7, 27 October, 2013) and Chile (M: 8.2, 16 September 2015). The potential idea to put an Airglow camera on a satellite opens new exciting perspectives for tsunami detection.

In this talk we present all this new tsunami observations in the ionosphere and we discuss, under the light of modelling, the potential role of ionospheric sounding in the oceanic monitoring and future tsunami warning system by GPS, Airglow and OTH radar (Coisson et al., 2011).

The review presented in this talk is published by AGU as “The Seismology of Planet Mongo: the 2015 Ionospheric Seismology Review” (Occhipinti, 2015).
All ref. here @ www.ipgp.fr/~ninto

Biography: Giovanni Occhipinti, *aka* Ninto, graduates at the Università di Bologna, Italy, than he received his PhD at the Institut de Physique du Globe de Paris, France. After post-doctorate studies at the Jet Propulsion Laboratory (NASA) and Seismological Laboratory (Caltech), he returned to France as Assistant Pr. at the Paris Diderot University. He currently main his research at the Institut de Physique du Globe de Paris and strongly collaborate with several institutes worldwide (ONERA, ETH, ERI, EOS, etc). Ninto consecrated his research to the detection and modeling of Earthquake and Tsunami by ionospheric sounding, as well as on the studies of the ionospheric background based on tomographic methods.