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TITLE: Hydromagnetic simulation of the ionospheric disturbances generated by the 2011 Tohoku-oki tsunami and
associated acoustic-gravity waves

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AUTHORS (FIRST NAME, LAST NAME): Esfhan Alam Kherani[1], Philippe Henri Lognonne[2], Eurico R Paula[3], Lucie M Rolland[4]

INSTITUTIONS (ALL): 1. Instituto Nacional de Pesquisas Espaciais, sao jose dos Campos, Brazil.
2. Institute de Physique du Globe de Paris, Paris, France.
3. Instituto Nacional de Pesquisas Espaciais, Sao Jose dos Campos, Brazil.
4. Geoazur, Observatoire de La Cote d'Azur, Valbonne, France.

ABSTRACT BODY: Owing to the natural disturbances such as Earth quake/tsunami and tropospheric convection, Acosutic gravity waves (AGWs) are excited in the troposphere.
These AGWs propagates upward to
the thermosphere, attain large amplitude therein and subsequently dissipate, leading to the excitation of secondary AGWs which mainly propagate horizontally.
Both primary and secondary AGWs significantly modify the ionosphere, leading to the Total electron Content disturances, current and magnetic disturbances.
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Focus of the present work is the recent Japan tsunami that occurred on 11 March 2011 over Tohoku-Oki and caused enormous damage
in terms of human life and infrastructures. Moreover, it triggered nuclear catastrophe
that makes it a global disaster and much more alarming. The growing concern is towards
failure of short-term forecasting of this event in spite that the Japan is densely populated
with the various ground based seismic instrument as well with the GPS receivers that
may detect the activities in the space related to the tsunami. However, owing to these
dense networks, this event is examined much more thoroughly than other big events in the past,
leading to the knowledge of various interesting aspects that may be helpful in

the future
for the short-term forecasting of such event. One such aspect is that the effects of
the seismic activities occurring deep into the ocean, are detected much more efficiently
and in varieties in space (in the overlying atmosphere and ionosphere)
than over the ocean or Earth's surface.
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In the present work, hydrodynamic and hydromagnetic simulations of the atmospheric and
ionospheric anomalies are
performed for the Tohoku-Oki tsunami (11 March 2011).
The Tsunami-Atmosphere-Ionosphere (TAI) coupling mechanism via
AGWs is explored theoretically using the TAI coupled model.
In this mechanism, tsunami in the ocean excites the AGWs in the atmosphere
owing to the vertical uplift which subsequently interact with the ionosphere
to gives rise density, electric and magnetic field disturbances or anomalies.
For the modeled tsunami wave as an input, the coupled model simulates
the wind, density and temperature disturbances or anomalies in the atmosphere
and electron density/magnetic anomalies in the F region of the ionosphere.
Also presented are the GPS-TEC and ground-based magnetometer measurements
during first hour of tsunami and good agreements are found
between modeled and observed anomalies.
The high frequency component $\sim$10 minutes of
the simulated wind, TEC and magnetic anomalies in the F region
develops within 6-7 minutes after the initiation of the tsunami,
suggesting the importance of monitoring
the high-frequency atmospheric/ionospheric
anomalies for the early warning.
These anomalies are found to maximize across
the epicenter in the direction opposite to
the tsunami propagation
suggesting that the large atmospheric/ionospheric disturbances are
excited in the region where tsunami does not travel.

KEYWORDS: [2400] IONOSPHERE, [2427] IONOSPHERE / Ionosphere/atmosphere interactions.

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Sponsor

SPONSOR NAME: None

SPONSOR EMAIL ADDRESS: None

Additional Details

Previously Presented Material:

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