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HAZA-138 - Earth surface deformations bound up with global atmosphere and near-Earth environment disturbances

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Hide abstract

Earth observations by means of space-born geoscientific instruments provide new methods and comprehensive data systems being available to reduce the risks for natural disasters such as earthquakes and powerful tropical cyclones - hurricanes (typhoons). Although the long-range forerunners of strong earthquakes were preliminary described decades ago (Nersesov and Latynina, 1992) the first reliable observational results have been obtained owing to our ground-based and satellite data joint complexions (Dubrov M.N. et al, 2010). The phenomenon explanation, as an involvement of hurricanes in the earthquake triggering, is becoming to be understood together with an evidence that hurricane transient features are influenced by the solid Earth activity during earthquake preparing processes. Otherwise, powerful events in atmosphere having large horizontal scale are necessary to interact not only with the Earth surface, but also with higher layers of the thermosphere and near-Earth environment. In this paper, we present the results of comparison of geophysical field variations and seismic activity of the Earth, which show the correlation between lithosphere-atmosphere interactive disturbances, tropical cyclonic activity in the World Ocean, and seismic processes in the solid Earth. The found correlation can be interpreted as appearing or increase in amplitude the wide-band oscillations disturbed by typhoons and hurricanes which together with quasi-static pressure loading on the ocean bottom provoke powerful earthquakes through the triggering effect. The spatial and temporal tracks of tropical cyclones are coupled with place and time of occurring earthquake.

The examples of geophysical disturbances having near-Earth environment origin are presented and discussed too. The comet C/2011 L4 (PanSTARRS) transit on March 2013 has been recorded by spatially distributed and simultaneously operating ground-based instruments. We used the system of wide-band geophysical laser strainmeters, pendulum gravimeters, and tiltmeters in our observations. Data from four measuring sites in the East Europe are presented. The distance between separate instruments varies from a few hundred kilometers within local site installations, and up to thousands kilometers for a different remote sites and observatories. The datasets of geostationary satellites GOES13 and GOES15 of Space Weather Prediction Center (NOAA USA, 1998-2015) have been used in complementation to the ground-based instrument recordings. Earthquake and hurricane coupling effect during the recent strong earthquakes (Nepal, 25.04.2015, and Chile, 16.09.2015) are presented and analyzed.

Investigation of the observed phenomena and deployment the detailed interaction mechanisms of the atmosphere, lithosphere, and other adjacent geospheres would give a chance to find the regularity and origins of such natural disasters as earthquakes and hurricanes. The ground-based laser interferometer and gravity-inertial techniques being supplemented by satellite observational systems can be considered as promising methods for common earthquake and hurricane monitoring and prediction.

References:
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Dubrov M.N. et al, Living Planet Symposium 2010, ESA Special Publications, SP-686, CDROM, 2010
NOAA USA, 2015, Space Weather Prediction Center (available at www.swpc.noaa.gov/index.html)