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Relationship of tsunami amplitudes caused by Feb 2010 Chile earthquake at GPS buoys and coastal stations

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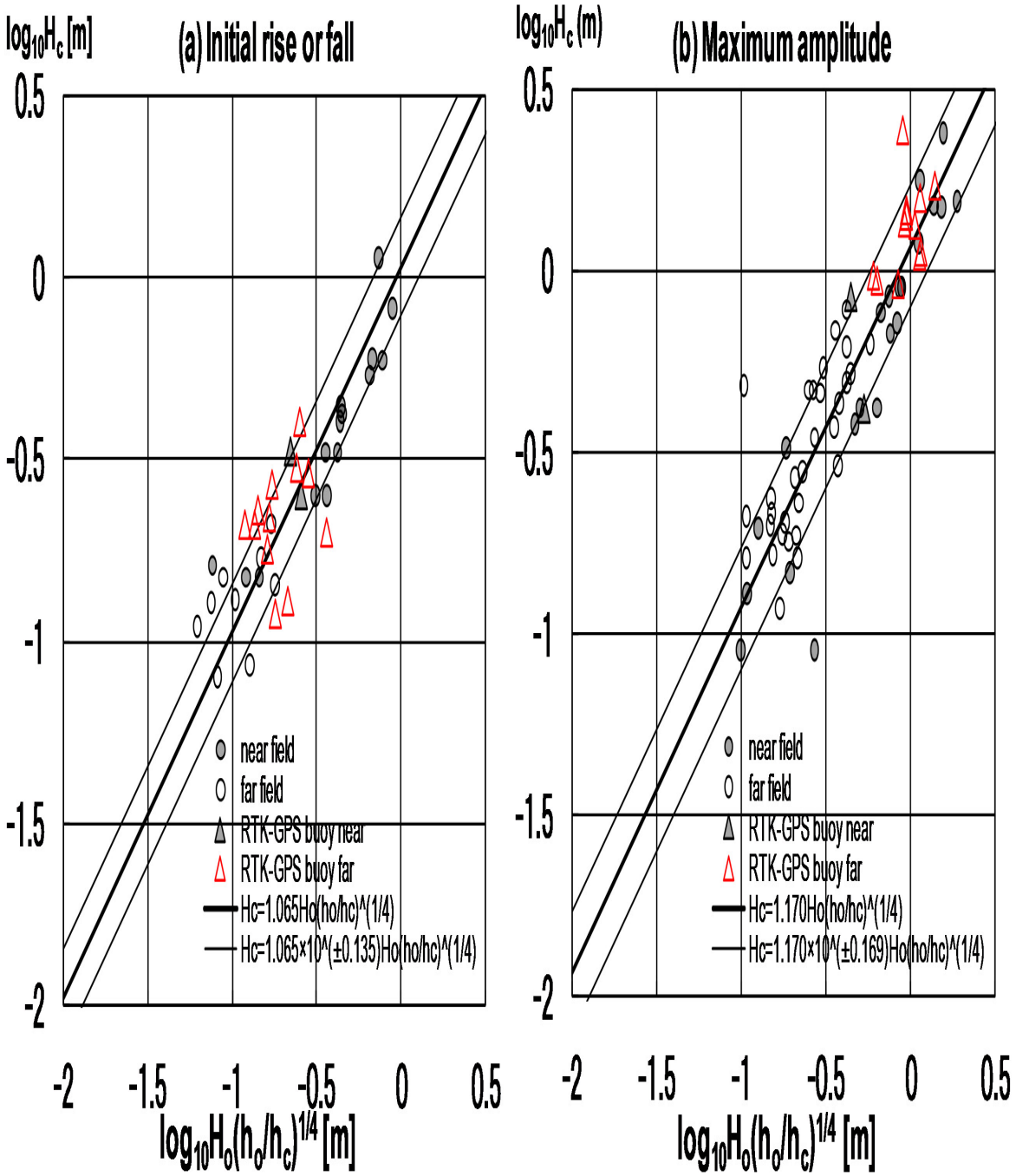

Study on an empirical relationship between offshore and onshore tsunami height has just started. Takayama (2008, Pap. Meteor. Geophys.) derived relationship of maximum tsunami height observed between ocean-bottom pressure gauge and tidal station. Hayashi (2010, EPS) has derived empirical relationship of tsunami initial rise and maximum tsunami amplitude between by NOWPHAS wave stations (RTK-GPS buoys are included) and by onshore tidal station.
February 27, 2010, a great earthquake (Mw=8.8 by USGS) occurred at Central Chile (Feb 2010 Central Chile earthquake). It caused tsunami over 1m in maximum heights at several tidal stations facing Pacific in Japan. 11 RTK-GPS buoys installed in the 2-20km away from the shore, also detected tsunami.
Initial tsunami rises and maximum tsunami amplitudes at RTK-GPS buoy and at each nearby tidal station during Feb 2010 Central Chile earthquake tsunami were read from the time-series of water -level data. Then, they (red triangles) were compared to both the empirical relationships (the center line is the regression), which were derived by Hayashi (2010), and dataset (black circles and triangles), which were employed in his study (Figure). Then, applicability of the empirical relationships in the previous study can safely be extended to RTK-GPS buoy data and significantly large far-field tsunami. The pair of tsunami data at any offshore point, whose environment is similar to RTK-GPS buoy stations or NOWPHAS offshore wave stations, and its nearby coastal point, whose environment is similar to tidal station, also probably satisfies the relationship. Offshore points are generally located within 20 kilometer from the nearest coast where water depth is 30 - 400 m ; tidal stations are generally installed at artificial coast where water depth is several meters.
Such wide applicability of the empirical relationships suggests that there are two more possible applications. The first one is the benchmark for near coast tsunami numerical calculation; pairs of calculated tsunami heights between virtual offshore cites and virtual coastal cite should be satisfy the relationships in the statistical context so that calculation is considered to be realistic. The other is the application in designing scenario-based tsunami database; instead of calculating tsunami at the coast, data which should be stored in the database can be interpreted from the calculation results at a virtual offshore cite and the relationships.

Keywords: empirical relationship, NOWPHAS,
real-time kinematic global positioning system (RTK-GPS), offshore tsunami,
real-time tsunami forecast, tsunami scenario database