(200)

A Validation of Observed Meteotsunami in the West Coast of Sri Lanka with European Centre of Medium Range Weather Forecasts (ECMWF) Modelled Data

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Abstract

Metetsunamis are local regional events originating from perturbation of water levels by the impulse of particularly pressure drop in a disturbed atmospheric weather system and amplified to a destructive Tsunami wave with the combined effect of resonance. For the preliminary investigation a Meteotsunami event was analysed for one minute's frequency data collected in situ sea level measuring station established in Colombo, Sri Lanka under the authority of National Aquatic Resources Research and Development Agency (NARA) with the supervision of Intergovernmental Oceanographic Commission (IOC). The contribution of disturbed weather system was analysed using wind speed (ms^{-1}), atmospheric pressure (hPa) 10 min frequent reading from the Meteorological Department of Sri Lanka and weather station established under the bilateral project of University of Notre dame and NARA. The observed Meteotsunami event was validated using gridded modelled data (12.5 km resolution) obtained from the European Centre of Medium Range Weather Forecasts (ECMWF) and analysed using 6 hourly frequent atmospheric pressure (hPa) data, U and V at wind data at 10 m height and significant wave height. For the identification of Meteotsunami events, observed tide gauge readings were analysed in few different steps. The tidal constituents were quantified using harmonic analysis to obtained astronomical effect removed sea level variation and filtered to isolate Meteotsunami events using math lab software.According to the in situ observation data the atmospheric pressure gradient was recorded as 1008-1001 milibar hours while the modelled value dropped from 1009 to 1002 milibar hours. The observed wind speed was increased from 14.21 to 31.90 mph within 4 hours of time period and ECMWF wind speed increased from 11.02 to 19.94 mph with positive deviation. The observed wave height of Metiotsunami event was >0.3 m while model derived wave height was 0.6 m during the low tide period of the day. According to the threshold criterion suggested by Monserrat for classifying Meteotsunami, resulted wave amplitude of observation data exceeded 4 x σ, where σ is standard deviation of astronomical effect removed residual sea level time series. Further studies are required for the investigation of propagation mechanism with amplifying through the bays with the resonance effects. Further high frequency data are insufficient for the investigation of correlation with synoptic scale meteorological event.The ECMWF model is highly recommended for the prediction of disturbed atmospheric system and related ocean based extreme event forecast for prevention of ocean, atmospheric hazards and mitigation of vulnerability with the effect of global change giving real value of lives in the earth.

Keywords: Sea level, Meteotsunami, Tsunami, Atmospheric, Resonance