Geophysical Research Abstracts
Vol. 14, EGU2012-4764, 2012
EGU General Assembly 2012

Tides at the east coast of Lanzarote Island

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The main goal of this work is the study of the ocean tides at the east coast of Lanzarote (Canary Islands). We have analyzed time series of tide gauge and bottom pressure observations available in the region and we have made a further comparative validation with recent global and local ocean tide models.

Lanzarote island shows singular features, with regard its volcanic structure and geomorphological properties and, also, concerning the characteristics of the ocean tides in the surrounding waters. For this reason, this region experiences a great interest in Geodesy and Geodynamics. Particularly, an accurate modelization of the ocean tides is of great importance to correct with high accuracy the effect of the ocean over the multiple geodetic measurements that are being carried out in the Geodynamic Laboratory of Lanzarote, LGL (Vieira et al., 1991; 2006). Furthermore, the analysis of tide gauge and bottom pressure records in this area is of great importance to investigate sea level variations, to evaluate and quantify the causes of these changes and the possible correlation with vertical movements of the Earth's crust.

The time series of sea level and bottom pressure data considered in this work are obtained at two different locations of the island and, in each of them, using several sensors at different periods of time. First location is Jameos del Agua (JA) station, which belongs to the LGL. This station is placed in the open ocean, 200 meters distant from the northeastern coast of the island and at 8 meters depth. The observations have been carried out using 3 bottom pressure sensors (Aanderaa WLR7, SAIV TD301A and Aqualogger 210PT) at different periods of time (spanning a total of six years). Second location is Arrecife (AR) station, which is 23 km south of JA station. In this case, the sea level data come from a float tide gauge belonging to the Instituto Español de Oceanografía, installed at the beginning of the loading bay, and a radar tide gauge from the REDMAR network of Puertos del Estado placed at the end of the same loading bay.

Results obtained from the time series analysis at both locations, amplitude and phase of the main diurnal and semi-diurnal tidal waves, are compared with the most recent global ocean tide models, as TPXO7.2, EOT11a, HAMTIDE, FES2004, GOT4.7 and AG2006, and also with the high resolution regional ocean tide model for the Canaries CIAM2 (Arnoso et al., 2006, Benavent, 2011). Comparison of simulated harmonic constant (from global and local ocean tide model) with those obtained from tidal stations is done by means of the direct comparison between amplitudes and phase for each tidal wave and the root mean square (rms) of the differences in the complex plane. Finally the root sum square (rss) of residuals over all harmonic constituents considered is calculated.