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New insights into ocean tide loading corrections on tidal gravity data in Canary Islands

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The Canary Islands are an interesting area to investigate ocean tides loading effects due to the complex coastline of the islands and the varying bathymetry. We present here the quality of five recent global oceanic tidal models, GOT00.2, GOT4.7, FES2004, TPXO.7.1 and AG2006, by comparing their predicted ocean tide loading values with results from tidal gravity observations made on three islands, Lanzarote, Tenerife and El Hierro, for the four harmonic constituents O1, K1, M2 and S2.

In order to improve the accuracy of the loading corrections on the gravity tide measurements, we have used the high resolution regional oceanic model CIAM2 to supplement the global models considered here. This regional model has been obtained by assimilating TOPEX/Poseidon altimetry at crossovers and along-track points and tide gauge observations into a hydrodynamic model. The model has a 5'×5' resolution and covers the area between the coordinates 26º.5N to 30º.0N and 19º.0W to 12º.5W.

The gravity tide observing sites have been occupied by three different LaCoste&Romberg (LCR) spring gravimeters during different periods of observation. We considered here the most recent gravity tide observations made with LCR Graviton-EG1194 in El Hierro Island, for a period of 6 months during 2008. In the case of Tenerife and Lanzarote sites we have used observation periods of 6 months and 8 years with LCR-G665 and LCR-G434 gravimeters, respectively. The last two sites have been revisited in order to improve the previous tidal analysis results. Thus, the gravity ocean tide loading corrections, based on the five global ocean tide models supplemented with the regional model CIAM2 allowed us to review the normalization factors (scale factor and phase lag) of both two gravimeters. Also, we investigated the discrepancies of the corrected gravimetric factors with the DDW elastic and inelastic non hydrostatic body tide model (Dehant et al., 1999). The lowest values are found for inelastic model in the case of M2 and O1 waves at three sites. However, the scatter between oceanic models seen at final residual vectors does not indicate clearly if tidal observations are close to elastic or inelastic body tide model.

Finally, after computing misfits of gravity tide observations and ocean tide loading calculations the level of agreement between the five global oceanic models is below 0.2 μGal (1μGal=10^{-8}ms^{-2}), except for the solar harmonic K1, which reaches a large value that reflects the thermal instability at three sites because the period of K1 is very close to that of S1. None of the five global models seems to give results that are clearly better than the other models.