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On the combined adjustment of tide gauge, marine geoid and sea surface topography towards the unification of the Greek vertical datum

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Countries like Greece with extensive coastlines and a large number of islands, usually suffer from the absence of a common, for the entire country, unified vertical reference system. This holds not only for the islands, where hydrostatic leveling has not been applied, but also for distant parts of the country where trigonometric and leveling benchmarks are not tied to the country's vertical zero, but to a local one usually coinciding with a local tide gauge station. Especially for Greece, no effort has been made until today for a common adjustment of all tide gauge data and for the unification of the country's vertical datum. The present work focuses on the utilization of available tide gauge and spirit leveling data with computed marine geoid and sea surface topography models, towards the determination of a common corrector surface for continental and insular Greece as well as the unification of the country's vertical datum. The aforementioned corrector surface provides correction values to be applied to local tide gauge data, so that the local zero height will coincide with that at the origin of the vertical system. The concept is based on a common adjustment of the available data in a parametric scheme imposing a condition concerning the value of the corrector model at the existing vertical origin of the country. The necessary observation equations are outlined together with the theoretical concepts of the data combination scheme. Various reference surfaces are investigated and validated against each other and in terms of the prediction error they provide. The results of this work successfully manage to provide correction values for the entire country, so that local heights tied to a local tide gauge station can be referred to the initial point of the country's vertical datum.