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Surface mass variations inferred from GPS and modelled OBP data

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GPS is capable to monitor the surface deformation due to the redistribution of the masses in the Earth's fluid envelop. But with a lack of data over the oceans and the un-even site distribution over the lands, the high-degree coefficients of the surface mass cannot be resolved from GPS alone. To overcome this problem, we will derive the annual and inter-annual variations of the spherical harmonic coefficients of the Earth's surface mass density field from a combination of present-day GPS displacement time series and modelled ocean bottom pressure (OBP). We will investigate the potential to use a GPS/OBP joint inversion as a reliable substitution for providing surface mass distribution during GRACE gaps and the anticipated time gap between GRACE and GRACE Follow-On. It is therefore important to optimize the joint inversion. Its uncertainty, reliability and fidelity are discussed in detail. Modelled OBP are often given with no a priori (co-)variance information. We employ a variance component estimation (VCE) to optimize the stochastic model for OBP input data and determine the uncertainty of the derived spherical harmonic coefficients. We then use a consider covariance analysis to discuss the aliasing effects of neglected higher degrees on the joint inversion. An optimal truncation degree for GPS/OBP inversion will be suggested. We further investigate the relative contribution of GPS data and modelled OBP. Two experiments are designed to study the real contribution of GPS data to the joint inversion, as the widely used resolution matrices only consider the percentage contribution in form of the spatial distribution of individual data. Finally the quality of surface mass changes from GPS/OBP is evaluated and validated by comparing with the independent coefficients from observed SLR and GRACE data.