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Surface mass estimation from GPS site displacements, modeled Ocean bottom pressure and GRACE

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We provide improved weekly estimates of global surface mass changes by combining data from GPS site displacements, GRACE gravimetry and modeled OBP data in a joint inversion approach. Most of the variations of the Earths gravity field originate from a thin layer consisting of the hydrosphere, cryosphere and atmosphere. They are caused by the redistribution of masses, associated with hydrological, oceanic, atmospheric and ice sheet related processes. These mass redistributions cause: 1) a direct change in the gravitational field, 2) a loading deformation of the solid Earth and 3) an indirect change of the gravitational field due to this deformed state. Up to date, mass changes derived from filtered GRACE estimates and in situ observations are mostly considered separately. Furthermore, as GRACE is unable to detect geocenter motion one must apply, possibly inconsistent, corrections to account for this.

In the framework of the JIGOG project (Joint inversion of GPS site displacements, Ocean bottom pressure and GRACE gravimetry) we estimate improved surface mass variations by linking three complementary data sets in a least squares approach. Surface mass variation is related to IGS GPS site displacements through an elastic loading theory. Furthermore, OBP data from the FESOM (AWI) model is inputted as a direct pseudo-measurement of the loading. And finally, weekly GRACE solutions are linked to surface masses through the mechanism 1 and 3 described above. New here is that our estimates include the geocenter motion and that they combine data in a consistent manner. We show first results of the combination and provide a discussion on the (in)consistencies, accuracies and weighting of the data sets.