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Crustal displacement in Amazon River basin using GRACE and a river routing model

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Water mass redistribution causes elastic displacement on Earth's surface. Given spatio-temporal variations of surface water mass, crustal displacements can be estimated. Since 2002, GRACE has provided changes of surface water mass load at a basin scale, and thus there have been attempts to estimate the crustal displacements associated with water mass redistribution and compare them with observations using GNSS. Many studies showed that estimated crustal displacements largely agreed with GNSS observations while there were difference between the two which is necessary to be reconciled. This disagreement probably results from the difference of spatial sensitivity between GRACE and GNSS observations. In particular, the differences in horizontal components which are sensitive to the direction of mass loading are apparent. In this study, we estimated the crustal vertical and horizontal displacements in Amazon drainage basins based on GRACE observations and compared them with GNSS observations. We adopt a river routing model to consider high spatial variability of surface water mass load that was smoothed in GRACE data. Modified surface mass load incorporating the river routing model shows a higher agreement between estimated and observed crustal displacements.