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Assessment of the accuracy of global geodetic satellite laser ranging observations 1993-2013

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We continue efforts to estimate the intrinsic accuracy of range measurements made by the major satellite laser ranging stations of the ILRS Network using normal point observations of the primary geodetic satellites LAGEOS and LAGEOS-II. In a novel, but risky, approach we carry out weekly, loosely constrained, reference frame solutions for satellite initial state vectors, station coordinates and daily EOPs (X-pole, Y-pole and LoD), as well as estimating range bias for all the stations. We apply known range errors a-priori from the table developed and maintained through the efforts of the ILRS Analysis Working Group and apply station- and time-specific satellite centre of mass corrections (Appleby and Otsubo, 2014), both corrections that are currently implemented in the standard ILRS reference frame products. Our approach, to solve simultaneously for station coordinates and possible range bias for all the stations, has the strength that any bias results are independent of the coordinates taken for example from ITRF2008; thus the approach has the potential to discover bias that may have become absorbed primarily in station height had the coordinates been determined on the assumption of zero bias. A serious complication of the approach is that correlations will inevitably exist between station height and range bias. However, for the major stations of the Network, and using LAGEOS and LAGEOS-II observations simultaneously in our weekly solutions, we are developing techniques and testing their sensitivity in performing a partial separation between these parameters at the expense of an increase in the variance of the stations' height time series. In this paper we discuss the results in terms of potential impact on coordinate solutions, including the reference frame scale, and in the context of preparations for ITRF2013.