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Determination of positions and velocity of Riyadh SLR station using satellite laser ranging observations to Lageos1 and Lageos2 satellites

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Riyadh Satellite Laser Ranging (SLR) station (7832) has been established since 1995 and situated in the Arabian plate which is countering a north east motion. Laser ranging observations of about 20 global SLR stations to the LAGEOS-1/LAGEOS-2 for 13-year (1996-2010) have been used to determine station positions and velocity of Riyadh SLR station. The NASA Godard's GEODYN-II orbital software has been used to perform orbit determination of these two satellites. The computations were performed based on 114 monthly arcs of observations with total number of normal points of 33708 and 40168 for LAGEOS-1 and LAGEOS-2 respectively. The geocentric coordinates were computed and then transformed to the topocentric North-South, East-West, and Vertical components in the ITRF2008 reference frame. Effects of normal points for each arc and the empirical acceleration coefficients on estimated station coordinates have been investigated. In order to achieve a lower standard deviation (less than 1 cm) of estimated coordinates, the number of the normal points per SLR station had to be greater than 50. The range biases were 7.5mm and 7.2 mm with long term biases stability 2.5 mm and 2.0 mm for LAGEOS-1 and LAGEOS-2 satellites, respectively. RMS of fit was calculated for all stations and found to be 17.2 mm for the whole period. Time series of positions and velocities have been computed for Riyadh SLR station with stability of $\pm$10.1 mm, $\pm$9.3 mm, and $\pm$9.0 mm for X, Y, and Z coordinates, respectively. The estimated velocity is 29.1 mm/year, 31.6 mm/year, and 1.9 mm/year in North-South, East-West and vertical directions, respectively, with a 3D velocity 42.9 mm/year. 3D deviation from the ITRF2008 was equal 4.5 mm. To recover tectonic motion affecting the station, further analysis of velocity estimates has shown general agreement of Riyadh SLR station in comparison with recent GPS estimates for the Arabian plate motion.