Ground to space atmospheric turbulence monitoring by satellite laser ranging

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The millimeter accuracy Satellite Laser Ranging (SLR) is becoming of certain interest for geodesy and geophysics on a global scale. We are presenting a new method of atmospheric turbulence monitoring on slant ground to space paths by means of high repetition rate SLR followed by a special data analysis algorithm. The method is based on the relation between the integral strength of the turbulence along the laser beam path, which is the unknown quantity, and the contribution of the turbulence to the laser ranging error budget, which is determined from the SLR data. We have already proved applicability of the theoretical model describing this relation by direct measurements performed at the satellite laser ranging station in Graz, Austria, equipped by a 2 kHz laser system. During these measurements, the turbulence along the beam path was measured independently and compared to the values obtained from the SLR data analysis. The results show a good agreement between the theory and experiment for a horizontal path to a ground-based target, as well as for slant paths to space when ranging to satellites. Using the Portable Calibration Standard based on a three picosecond resolution Pico Event Timer and Seeing Monitor we have been applying and planning to carry out this procedure at different SLR sites – Chinese SLR network and some others, as well.