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Laser Ranging Contributions to Earth Rotation Studies

The Earth's rotation varies on all observable time scales, from subdaily to decadal and longer. The groundwork for a new field in the geophysical sciences—space geodesy—was laid in the 1960s with the development of satellite and lunar laser ranging systems, along with the development of very long baseline interferometry systems, for the purpose of studying crustal plate motion and deformation, the Earth's gravitational field, and Earth orientation changes. The availability of accurate, routine determinations of the Earth orientation parameters (EOPs) afforded by the launch of the LAser GEOdynamics Satellite (LAGEOS) on May 4, 1976, and the subsequent numerous studies of ranging observations to this and other satellites, has led to a greater understanding of the causes of the observed changes in the Earth's orientation. Satellite laser ranging observations of the EOPs now span 40 years, making it the longest available space-geodetic series of Earth orientation parameters. Such long duration homogenous series of accurate Earth orientation parameters are needed for studying long-period changes in the Earth's orientation, such as those caused by climate change. In addition, laser ranging to the Moon allows the rate of lunar recession to be determined along with the associated slowing of the Earth's spin. In this presentation, the contribution of satellite and lunar laser ranging observations to Earth rotation studies will be reviewed.