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Very Long Baseline Interferometry (VLBI) is a highly accurate space geodetic technique that observes extragalactic radio sources to measure the time delay between arrival times of a plane wavefront at two distant radio telescopes. The gravitational deformation of the VLBI telescopes as a function of pointing direction, caused by gravitational forces acting on the massive telescope structures, mainly impacts the estimated station heights and can reach centimeter-level for large antennas. Thus far, this effect has not been considered in operational VLBI data analysis. In the next realization ITRF2020, it is envisaged to model this effect in an effort to reduce the persistent scale discrepancy in ITRF2014 between VLBI and Satellite Laser Ranging. Currently, there are models for only a minority of antennas available, six in total: Effelsberg, Gilcreek, Medicina, Noto, Onsala, and Yebes, which are provided by the International VLBI Service for Geodesy and Astrometry (IVS). In this study, the impact of the gravitational models on station positions, Earth orientation parameters and the network scale is assessed within VLBI data analysis. The standard 24-hours IVS-R1 and -R4 sessions are analyzed using the PORT (Potsdam Open-source Radio Interferometry Tool) software package. First results show that the gravitational models of the six antennas change the station heights by a few mm and the horizontal components by less than 1 mm (in case of Medicina).