Comparison of the ITRF reference frame with SLR station coordinates established via LEO on-board collocation

K.H. Neumayer, M. Rothacher, F. Flechtner, R. König, F.H. Massmann, S.Y. Zhu

GeoForschungsZentrum Potsdam, Telegrafenberg, 14473 Potsdam, Germany

In the definition of the ITRF2000 reference frame, LEO satellites do not enter the computation, therefore any derivation of a SLR coordinate system using LEO SLR data - such as provided by CHAMP and GRACE - is completely independent of the present ITRF and therefore excellently suited as an external tool for comparisons.

In our investigations, we started with satellite orbits for GPS-35/36, CHAMP and GRACE established in the GPS ground station frame using GPS data alone. The computation of SLR station coordinates thereof happened in three steps.

Forst, on-board offsets of SLR reflectors against GPS-SST receiver antenna phase centers were determined by a method called "on-board collocation".

Secondly, a possible geocenter motion was solved for and found to be of little influence.

In a final third step, the SLR station coordinates proper were derived from SLR observations, reversing the usual process of laser tracking: The satellite orbits are not adjusted, but kept fixed, whereas the station coordinates are solved for. As in that setting the station positions and motion rates are station-wise a-priori uncorrelated, their adjustment may be achieved station by station, somehow remniscent of the GPS point positioning method.

GRACE gravity field processing provided us as a by-product with high quality orbits of the GRACE-A and GRACE-B satellites of more than two years length that could be conveniently used in the above-mentioned procedure.

Helmert transform parameters have been derived from the comparison of the tradi-

tional ITRF coordinates and the newly computed ones, giving new insight into coordinate stability and possible scale differences between both frames of reference. We also wish to show that the suggested approach of on-board collocation may complement ground station collocation at least for SLR satellites.