

Pre-combined GNSS-SLR solutions for the ITRF2013.

D. Thaller¹, K. Sosnica², P. Steigenberger³, O. Roggenbuck¹, R. Dach²

¹Federal Agency for Cartography and Geodesy (BKG), Richard-Strauss-Allee 11, 60598 Frankfurt/Main, Germany, daniela.thaller@bkg.bund.de

²Astronomical Institute, University of Bern, Switzerland.

³Technische Universität München, Germany (now at DLR, Oberpfaffenhofen, Germany).

Introduction: The call for participation for the ITRF2013 explicitly asked for pre-combined contributions. As pre-combined solutions are requested for the first time, it is expected that they won't be included in the final ITRF2013 solution. However, studies will be carried out to find the best possible way for combining single-technique and pre-combined contributions in order to have adequate procedures ready for ITRF solutions beyond ITRF2013.

Pre-combined GNSS-SLR solutions: Among the different types of pre-combined solutions, we focus on the two satellite techniques GNSS and SLR [1]. In addition to the "standard" data sets used for ITRF computations (i.e., microwave observations from GNSS satellites and SLR observations to LAGEOS and Etalon) we use the SLR observations carried out to the GPS and GLONASS satellites [2,3]. These data have the advantage that they provide an additional link between the two space-geodetic techniques because the GNSS satellites act as a co-location platform and the estimated orbits are based on both observation types. Unfortunately, SLR observations to GNSS satellites are not available to all satellites for the entire time span. This has two reasons: First, only two GPS satellites carry laser reflector arrays (LRAs), thus, the remaining GPS satellites simply cannot be measured by SLR stations. Second, the tracking list of the ILRS contained only a subset of the GLONASS satellites in early years in order to get a reasonable amount of data by the stations. Fortunately, the tracking capacity of the stations increased during the last years, thus, many stations track the full GLONASS constellation since 2011.

We reprocessed the GNSS and SLR data in the context of the ITRF2013 preparations using the Bernese GNSS software. Combined solutions were generated for the years 2002 (i.e., starting of the GLONASS data being included in the microwave analysis) until 2013.

Benefit for the ITRF: We study the impact of including the SLR data to GNSS satellites into pre-combined solutions. In the context of the ITRF, the scale and the geocenter are of special interest. Both parameters are expected to benefit from the SLR contribution [1,3]. Other parameters like satellite antenna offsets or range biases are, however, correlated with

the scale. The pre-combined solutions allow us to estimate satellite antenna offsets for the GNSS microwave antennas as well as LRA offsets and range biases that are consistent with the scale provided by SLR. We investigate the consistency with the offsets provided as standard values and to what extent the stability of the scale of the combined solution is influenced by the satellite antenna offsets and range biases [4]. Apart from the space ties we can also validate the local ties [5]: they are not introduced as a priori information into the combination, thus, the estimated coordinate differences are fully independent of the local tie information.

References:

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