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Impact of Inter-technique Vector Tie Errors at Future GGOS Core Sites on the ITRF

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The Global Geodetic Observing System—GGOS, has identified as its main task the establishment, maintenance and wide distribution of the International Terrestrial Reference Frame (ITRF), requiring a high accuracy and stability goal set at 1 mm and 0.1 mm/y. The four "geometric" Services of the International Association of Geodesy (IAG), IDS, IGS, ILRS and IVS are responsible for the provision of the required analysis products that form the input in the ITRF development step. The network of sites that will host all four techniques with an optimal global distribution comprises the so-called "GGOS Core Sites Network—GCSN". Simulation studies over the past few years determined the size and distribution of the sites in order to meet the goals of GGOS. Assuming that all techniques are present with their state-of-the-art equipment, it has been determined that a network of about thirty sites is sufficient to achieve our goal. This result presupposes the ability of the techniques to relate their reference points, those to which their results refer, to a common one representing the site, with an accuracy that is better than 1 mm at any time. These "survey ties" between the invariant reference points between techniques are the subject of extensive research, theoretical as well as practical, in order to develop a modus operandi that realizes with certainty the required accuracy ties at all sites. One can separate the problem for each of the techniques into two distinct components: the survey that determines the offset of the common marker to a physical point of reference on the antenna or telescope used by the technique, and a second much more difficult to determine offset, of the physical point from the actual electronic or optical invariant point to which the observations of each technique refer. The first part is rather easily controlled with precision surveying, most likely through automated procedures using modern technology. The second part is the most difficult to determine and depends on several factors, from the type of the technique in question, to environmental changes, to tracking geometry and local conditions specific to each site. So far, the assumption is that the combined error from the two parts remains $\sim$1 mm. This is a topic of separate studies for each of the contributing techniques. A question that requires an answer before the final design of the survey system is the actual level of total error that one can tolerate at each site, before the GGOS network accuracy goal is compromised. Our presentation focuses on this question using simulations of survey errors at the core sites of a 32-site GCSN, with varying distribution of the site-tie errors in terms of the level of the errors as well as a function of the contributing techniques. These simulations will provide some guidelines on the level of effort that each of the techniques should devote in determining the technique-specific error component and the improvement (if any) required for the common survey tie component at each site.