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Rover station positional accuracies from OPUS as a function of reference station spacing and occupation time

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This research is aimed at determining how, and to what extent, rover station coordinate accuracies from the Online Positioning User Service (OPUS) at the National Geodetic Survey (NGS) are influenced by reference station spacing and rover station occupation times. The first phase of the experiment was to treat each station in the CORS network as a rover site by collecting and submitting RINEX datasets of various occupation times to OPUS. The duration of the datasets from each rover station were chosen to be from one to five hours, mainly because datasets of this duration are frequently collected and processed by engineers, surveyors and GIS/LIS professionals.

In the processing phase, rover datasets for each duration were then submitted to OPUS, but only after specific conditions were met. The foremost condition was to constrain how far each of the three reference stations could be from the rover. In all, six cases were performed where OPUS constrained the rover-reference station baselines to be < 100, < 200,...,< 600 kilometers respectively. OPUS then used the L1 and L2 carrier phase data from the rover and the three reference stations to compute the best set of ITRF2000 coordinates for the rover station. Although three single-baseline solutions were computed and then averaged, the solutions were not considered to be independent because local biases from the rover datasets, such as multipath, were not averaged out. This approach does, however, allow a submitter to identify problems pertaining to specific baselines. Peak-to-peak variations among the three baselines were reported by OPUS for *xyz* and north-east-up components and can be considered as a more conservative measure than the root mean square (RMS) during the analysis

phase. Another benefit in using the peak-to-peak errors is its ability to estimate the accuracy from known results. CORS coordinates are considered to be accurate and in most cases, have been computed from many years of data. Since the rover datasets in this experiment are actually subsets from 24-hour CORS datasets, the computed coordinates from OPUS for each submitted rover can then be compared to the "true" coordinates for the subsequent CORS station.

The initial results from this experiment show that the accuracies derived from OPUS processing primarily depend on the duration of the datasets and to a much lesser extent, the baseline distance between the rover and reference stations. Coordinate accuracies for one hour datasets had larger peak-to-peak values while datasets which had between two and six hours of data showed significantly smaller peak-to-peak values. The effect from rover and reference station separation was only noticeable after the baseline between the two started to exceed 500 kilometers. One possibility for this is the needed improvement on how to model the troposphere surrounding the rover station. Another may be due to the baseline processing mode rather than performing a network adjustment. Also, it is anticipated that the results from the experiment will provide additional avenues on how to improve the algorithms which select the OPUS reference stations and to determine if it is feasible to modify OPUS for international usage where the baselines will be significantly longer.