Beacon Data Processing for the 2017 RAPID Deployment to Jicamarca

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In January 2017 a pair of RAPID field units were deployed to the Jicamarca Radio Observatory in Lima Peru. While deployed these software radio systems observed a number of beacon satellite overflights that were recorded and saved for later processing. A signal processing chain was then developed to extract measurements of total electron content (TEC) and the S4 scintillation parameter. The TEC measurements can give an integrated measurement of the ionosphere along the line of site from the satellite to the receiver, which can be used in tomographic reconstruction of the ionosphere if enough receivers are available. This measurement is determined by comparing the phase difference between two sinusoidal signals at different frequencies.

The software radio signal processing chain will be described in detail. This processing chain includes the removal of the satellite motion to the final differential phase measurement. The roots of this processing method are derived from the the Jitter Beacon Receiver project, (J. Vierinen, et al. Radio Sci, 49, pp. 1141 − 1152), which has been updated to use the open source Digital RF data format developed for RAPID.

The results of the beacon TEC processing will be shown and compared with GPS TEC during the same time interval. Measured TEC from to the two different sites will be compared to determine the accuracy of the results. Analysis of geophysical activity during the observation interval will also be discussed in detail. The software stack used to record and process the data has been released as part of the open source Digital RF software package.