GPS SBAS L1/L5 Bistatic Radar - Altimetry

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Bistatic radar uses Global Navigation Satellite System (GNSS) signals as a passive radar source. GNSS signals are transmitted from the satellites, reach the Earth and are reflected off all kind of surfaces. When the GNSS signals, which are designed to be right hand circular polarized (RHCP), are reflected off a surface the polarization changes to be left hand circular polarized (LHCP). Thus the reflected GNSS signals can be received using a LHCP antenna.

Bistatic radar has been explored as an altimetry tool since it was first suggested in 1993. Since then, a number of research teams have explored the possibilities of Bistatic radar and scatterometry in order to measure altitude, wind speed and wind direction as well as measuring snow, ice and land properties using similar methods. This research effort will forcus on exploring the benefits of altimetry using the WAAS L5 signals in respect to using the WAAS L1 signals. Since the L5 signals have a higher chipping rate and a wider bandwidth, they are expected to provide higher resolution of the measurements compared to L1 signals.

A Bistatic data collection system was built in 2012 and installed on the National Oceanic and Atmospheric Administration (NOAA) hurricane hunter airplane, Kermit, the same year. The Bistatic system collected data during a test flight on the coast of Florida, as well as during the hurricanes Sandy and Rafael. The data that will be presented here was collected during a 2 hour long test flight in October 2, 2012 13:05 to 15:03 UTC.

The collected data was post-processed using a code tracking algorithm slaving the reflected signal to the properties of the direct signal. The optimal combination of coherent and non-coherent integration times were found for both L1 and L5. Altimetry was then estimated for all three WAAS satellites combined together, for L1 and L5 respectively, and the resolution was compared to the onboard Radar Altimeter. This work presents the initial results from processing of the test flight data.