RFI Mitigation and Testing Employed at GGAO for NASA’s Space Geodesy Project (SGP)

The problem at GGAO, and at the 4 other geodetic stations of the future being deployed by SGP, is that both DORIS and MGLR require emissions that are found in the VLBI broadband. For DORIS, path loss and blanking on the GGAO campus reduces the effect of RFI to that of raising the noise floor to a tolerable level. For MGLR, we have had to introduce low-hatiation instruments or “masks” to both the Laser Hazard Reduction System (LHRS) radars and the VLBI antenna. The LHRS works by changing the 4 GHz peak power output of LHRS radar so the main lobe (0.4-0.6 GHz) VRBI plane passes over, and the low band reduces the optical link to the receiver chain in effect blocking VLBI from high-band (5-14 GHz). In VLBI, low-band (3 GHz) does not use the same critical path, but the low band RFI (e.g. DORIS, with 1st sidelobe) would saturate as well, but can be carried back via coaxial cable.

In October 2012, at GGAO we conducted two different VLBI tests defining the reduced sky coverage impact of using masks to control the coverage of both the MGLR and the VLBI on the GGAO campus. We also ran tests earlier in 2012, characterizing the VLBI antenna beam parameters with 0.6-2.3 GHz (sidelobe suppression) became discernable by DORIS receivers in orbit above GGAO. (Direct line of sight) with less path loss and tuned to a slightly different frequency path loss and tuned to a slightly different frequency (5-14 GHz) does not use the same critical path, because the low band RFI (e.g. DORIS, with 1st sidelobe) would saturate as well, but can be carried back via coaxial cable.

Characterizing the 12m Antenna at GGAO

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Problem Statement:
The SGP combines the four geodetic techniques of Global Navigation Satellite System (GNSS), DORIS (Doppler Orbitography and Radiopositioning Integrated from Space), Space Geodesy Satellite Laser Ranging (SGSLR), and the VLBI Global Observing System (VGOS), primarily for precise Earth orientation and geodetic applications. Geodetic measurements at these stations will be used by organizations around the world for a wide range of applications, including mapping and navigation, climate monitoring, and geophysical studies. However, the stations are located in regions with high levels of Radio Frequency Interference (RFI), which can interfere with the geodetic measurements and degrade the accuracy of the results. Therefore, it is crucial to mitigate RFI and test the effectiveness of RFI mitigation techniques to ensure the integrity of the geodetic measurements.

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