

Cancellation of GLONASS Coarse Acquisition Code by Parametric Modelling.

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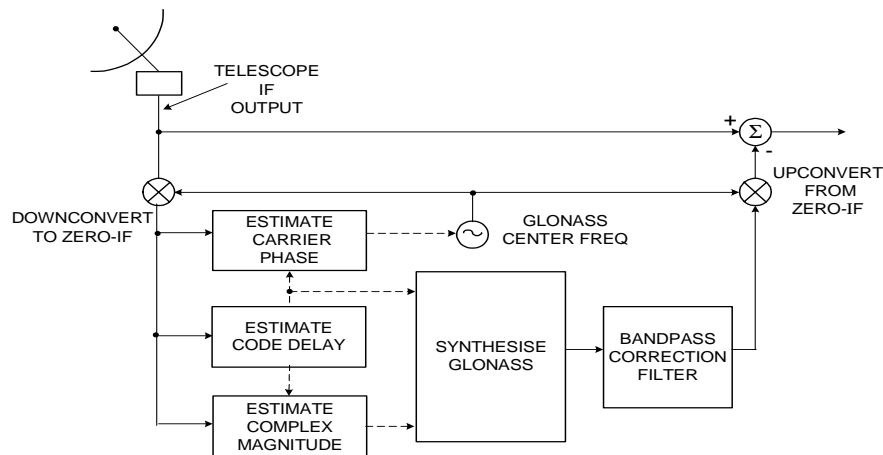


Introduction

GLONASS satellites broadcast in the frequency band 1602-1616 MHz and cause considerable interference to observations of 1612 MHz OH masers. This poster describes a system that eliminates the Course Acquisition C/A component of the interferer directly without the need for a reference signal. This makes the system useful for both single dish total power observations and synthesis observations.

Method

GLONASS provides a largely deterministic signal. Tracking of the carrier centre frequency and code phase allows the generation of a first-order estimate of the signal. Magnitude, phase and bandpass correction to this generates an accurate baseband representation. This is then up-converted to the telescope IF and subtracted to eliminate C/A component in the telescope signal. A system that performs these operations is shown below.

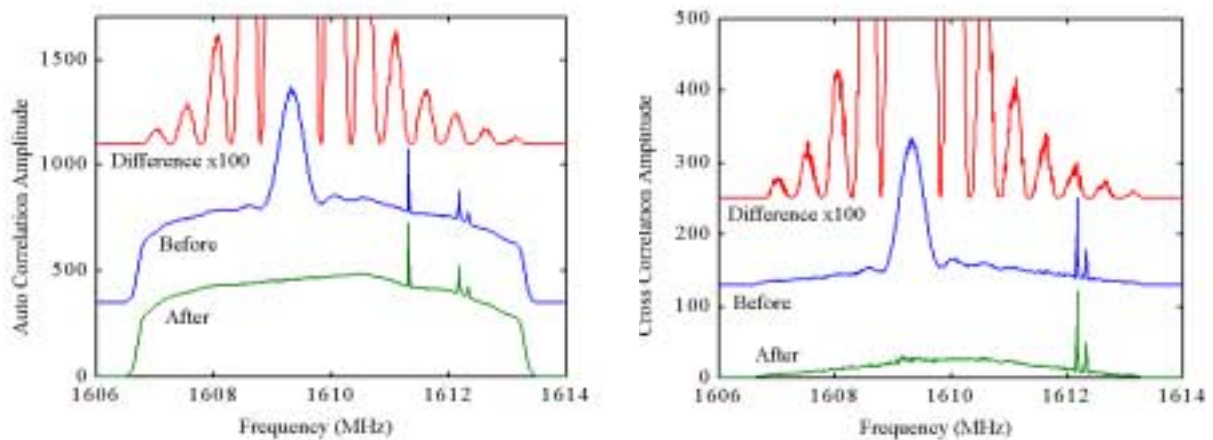


In this system the antenna signal is down-converted to ZERO-IF. This allows for a simple estimation of CODE DELAY. This estimate, together with the down converted signal, allows estimates of CARRIER PHASE and COMPLEX MAGNITUDE to be found. The CARRIER PHASE ESTIMATE is used to control the GLONASS CENTRE FREQ oscillator so that it tracks the telescope phase tracking and Doppler frequency changes of the GLONASS component in the telescope IF signal. This ensures that the GLONASS component of the ZERO-IF signal has no frequency offset.

The CODE DELAY and COMPLEX MAGNITUDE are used to synthesise a first-order two-state estimate of the ZERO-IF. A BANDPASS CORRECTION FILTER. Then corrects for magnitude and phase variations across the band. The estimate is then up-converted to the telescope IF band and subtracted from the telescope IF signal to cancel the GLONASS C/A code.

Results

The figure below shows the results of processing 4.8 seconds of data from the Australia Telescope Compact Array. Baseband data was recorded from each of the six antennas (Bell et al., PASA, in press). In this experiment no reference antenna was required and the GLONASS signals were cancelled using data from a single antenna. The raw data is shown in the middle curve of these plots. The bottom curve shows the data after the cancellation process has been applied. The subtracted signal, multiplied by 100, is shown in the top curve. The large number of side lobes of the GLONASS signal are clearly visible and have been removed without damage to the test tone at 1611.3 MHz and the OH maser source at 1612.15 MHz.



The figure on the right shows some cross correlations between two of the antennas. The middle curve is again raw data. The bottom curve is raw data from one antenna cross correlated with data from another antenna, from which the GLONASS C/A signal has been removed. The difference (x100) is again shown in the top curve. This provides a more sensitive test of how well the GLONASS narrow band signal was removed, without doing any damage to the OH maser. The wide band GLONASS Precision signal is now clearly evident in the bottom curve of the right plot, since this and the OH maser are the only remaining signals which correlate between the two antennas. While in principle, extraction of this signal is possible using the same technique, the details of the spreading code are not known. We have developed a further technique for removing this, which is described in a companion poster.