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Title

First Spaceborne Observation of an Earth-Reflected GPS Signal

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Abstract

We present the first spaceborne observation of a Global Positioning System (GPS) signal reflected from the Earth's surface, specifically from the Pacific Ocean. Cross-correlating a three-parameter phase model with four seconds of Spaceborne Imaging Radar-C (SIR-C) calibration data, recorded after a Galapagos-Islands imaging pass, results in a signal having the expected temporal shape and coherence properties. The high-gain antenna used in this experiment is shown to dominate the signal shape. Routine, space-based observations of reflected GPS signals, like the one presented here, may enable a new class of ocean-topography measurements, unavailable from Topex/Poseidon-like instruments, and surface-wind measurements. Making such observations with a sufficient signal-to-noise ratio (SNR) will require unusually large, high-gain antennas. The measurement presented here can be scaled to assess the expected SNR for those applications, however, this result lies in a non-linear scaling regime requiring special care. The correct scaling equations are presented and an example scaling for ocean altimetry accuracy is presented to illustrate the more important contributions to the signal. Finally, a qualitative wind-speed determination is extracted from the observed signal.