Dominic Fuller-Rowell
Senior Division Mathematics & Computer Sciences
Dual Frequency GPS Accuracy with a Single Frequency Receiver

In the past few years GPS receivers have been recognized for their potential and they now play a vital role in our everyday lives. The current accuracy of GPS is at best three meters. This renders certain applications impossible, such as the GPS guided car. The majority of position discrepancy is introduced in two specific calculations made by a GPS receiver. The most influential source of error is the inaccurately assumed speed of the satellite signal. The speed of light, and thus the speed of the signal, can vary due to weather in the upper atmosphere called total electron content (TEC caused by the ionization of atoms and molecules in the ionosphere). Inconsistency in the signal speed introduces error in the calculation of pseudorange (distance to a satellite) necessary for triangulation. Imperfect algebraic models predict the position of the satellites and can be mistaken by a few meters resulting in further inaccuracies. I wrote a program in C++ to correct for these sources of error. The program streams TEC data from the Space Weather Prediction Center as well as more accurate satellite orbit predictions from the National Geodetic Survey. The function applies a correction to the pseudorange by 0.54 nanoseconds per TEC unit as well as utilizing more accurate satellite orbits in the position calculation. The actual calculated accuracies increased from 8.54 meters to 3.37 meters (61%) for a 15-minute data collection period. Sub-meter real-time kinematic positioning is potentially feasible with lower latency and more accurate TEC predictions.