

MIT HAYSTACK AUTOMATED PROCESSING OF GPS DATA
TO PRODUCE WORLDWIDE TEC MAPS

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The method in use at the MIT Haystack Observatory for the automated processing of GPS data is described. The processing of GPS data includes applying the satellite biases, determining and applying the receiver biases, and recognizing and removing the bad data points. The final GPS product is used to produce worldwide Total Electron Content (TEC) maps. The satellite biases are downloaded automatically from the web. Receiver biases for over 1000 GPS receivers are determined using a novel approach involving least-squares fitting among sites with coincident data, and minimizing the elevation versus vertical TEC "scalping" effect. It will be shown that incorrect receiver biases cause vertical TEC measurement at low elevations to be systematically either higher or lower than vertical TEC measurements at high elevations, yielding a scalloped look when plotted. Minimizing this scalping yields an absolute estimate of the receiver bias. For a group of GPS receivers with overlapping data, only one absolute bias measurement is needed after the differential biases are determined via a least squares fit. This one absolute bias can be determined by averaging the receiver biases found via the minimum scallop method for all the receivers in the group. This procedure works well outside of the polar region. Inside the polar region, a separate method is used which assumes that the TEC goes to zero at some point during the day. After biases are determined, another procedure is used to cull the bad data. The effectiveness of any automated processing of GPS data can be determined by measuring the average difference between the vertical TEC measured for all coincident points. Examples of worldwide two-dimensional TEC maps produced via this method will be given.

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