Since the early 1990's, the world-wide network of GPS receivers has been used to produce global total electron content (TEC) maps. As the density of receivers increased, the fidelity of these maps improved. By the early 2000's, TEC maps began to reveal important geophysical connections. For example, magnetosphere-ionosphere (MI) coupling was revealed in the images of storm enhanced density. More recently, analysis of TEC maps has shown a lower atmosphere-ionosphere connection in the signatures of stratospheric warming. Having a large number of GPS receivers allows these coupling signatures to be analyzed at a higher cadence and at finer grid scales. Increasing the available number of receivers also aids the receiver bias estimation procedure, a parameter needed to derive the TEC information from GPS signal delay differences. Currently GPS coverage is good over the continental United States and Japan. Elsewhere, there is a relative paucity of receivers. We report here on a number of new concepts that can address this paucity of receivers. First, we will describe new features in the MIT GPS TEC processing. MIT processing algorithms for estimating the GPS (GNSS) biases have recently been changed (Vierinen et al., 2015) to take advantage of a denser network of receivers. We have also increased the number of dual-frequency receivers that are being processed on a daily basis by including receivers deployed for non-scientific purposes, such as precision farming and highway construction. We will highlight the advantages to that these changes have made in the output MIT TEC maps. In conclusion, we will describe our recent deployment of GPS receivers in Alaska using the Mahali architecture. These receivers are powered by solar panels and data can be directly downloaded to cell phones, allowing for easy deployment. Eventually, a Mahali-like architecture may provide some of the infrastructure needed to increase the density of GPS receivers deployed worldwide, especially in hard to reach locations.

J. Vierinen, A. J. Coster, W. C. Rideout, P. J. Erickson, and J. Norberg, Statistical framework for estimating GNSS bias Atmos. Meas. Tech. Discuss. , 8, 1-26, 2015, www.atmos-meas-tech-discuss.net/8/1/2015/, doi:10.5194/amtd-8-1-2015