Ionospheric Effects on SBAS

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This paper provides an overview of the many ways that the ionosphere affects SBAS performance. In the current form of SBAS, the primary ionospheric effect is TEC delay. An SBAS measures the slant delay at numerous reference stations and creates a correction model provided on a 5 degree by 5 degree grid. This model works extremely well during for typical quiet ionospheric behavior. However, there are periods when the ionosphere is disturbed that lead to less accurate ionospheric corrections. Further, in the absence of good sufficient measurement data, it can become difficult to determine whether or not the ionosphere is in a quiet or a disturbed state.

In the future, SBAS users will have access to dual frequency data from the navigation satellites. This will allow them to directly remove the first order delay TEC effect. However, there may still be a non-negligible effect from higher order delay and path bending terms. In addition, ionospheric scintillation may cause loss of lock of these signals leading to outages and potentially temporary losses of service.

This paper will describe how these effects have been mitigated for the existing systems, and how we intend to mitigate the dual frequency concerns for the dual frequency SBASs. We have created algorithms to detect ionospheric disturbances when it is well sampled. We have increased our levels of uncertainty when the ionosphere is poorly sampled. We have models of higher order delay effects to account for residual dual frequency user errors and we exploit multiple frequencies and constellations to reduce the effects of scintillation.