

WAAS Technical Report
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DR 137: Loss of L2 tracking due to Ionosphere Phase Scintillation at high-latitude WRS's caused UDREi to be set to Not Monitored

Discussion

Short Wide Area Augmentation System (WAAS) LPV200 service outages were observed in the Continental United States (CONUS) and Canada on several days in March 2017. During this time, the GPS User Differential Range Error (UDRE) internal monitor threshold tripped at high-latitude WAAS reference stations (WRS) tracking IIF satellites at high elevation angles (>30 degrees) at the same time as the WAAS LPV200 service outages. Loss of L2 tracking due to Ionosphere Phase Scintillation caused the User Differential Range Error Indicator (UDREi) for the satellite to be set to Not Monitored (UDREi = 14) for short periods of time, removing the satellite from being used for precision approach during that time. Table 1 lists the GPS UDRE internal threshold trip events for high-elevation satellites observed in March 2017.

Table 1. GPS UDRE Internal Threshold Trip Events March 2017

Date	GMT Time	GPS Time of Week	WRS/PRN Number
March 2	07:40 GMT	373170–373175	OTZ/PRN 25
March 2	19:38 GMT	416319–416330	YFB/PRN 26
March 3	12:29 GMT–12:44 GMT	477007–477888	OTZ/PRN 8
March 3	08:12 GMT–08:22 GMT	461571–462914	BRW/PRN 26
March 7	19:31 GMT	243093–243098	YFB/PRN 26
March 27	14:03 GMT–14:39 GMT	137053–139170	JNU/PRN 1
March 31	05:48 GMT–05:56 GMT	452929–453420	YFB/PRN 6

Reference 1 details the fast Code Noise and Multipath (CNMP) algorithm that was implemented in WAAS as part of the CY16 release, the L1/L2 biases for G-III receivers and IIF satellites, and the reacquisition of the signal that contributed to the GPS UDRE internal monitor threshold trips. Reference 2 discusses the proposed solution to be integrated in the CY18 release of the WAAS system.

Figure 1 shows the WAAS LPV200 Availability contour for March 27, 2017, in which the GPS UDRE internal monitor threshold trip event resulted in minimally degraded northern Canada service.

WAAS LPV200 Coverage Contours
 03/27/17
 Week 1942 Day 1

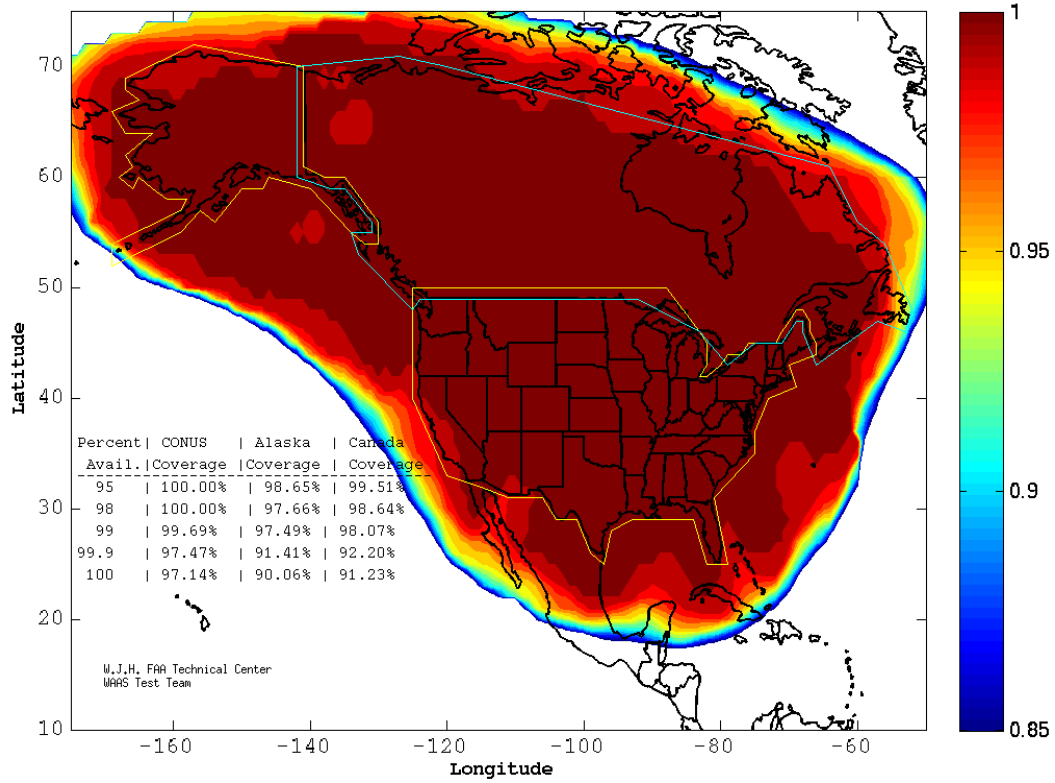


Figure 1. WAAS LPV200 Availability Contours—March 27, 2017

Figure 2 shows the WAAS LPV200 Availability contour for March 31, 2017, in which the GPS UDRE internal monitor threshold trip event resulted in minimally degraded CONUS service.

WAAS LPV200 Coverage Contours
 03/31/17
 Week 1942 Day 5

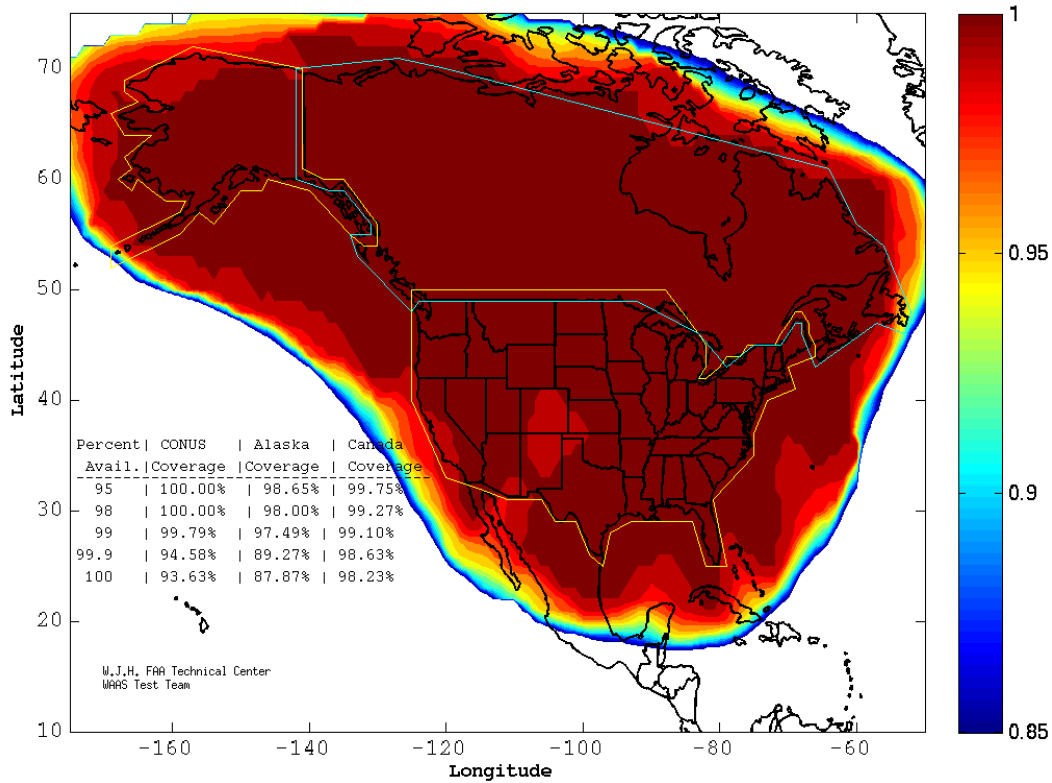


Figure 2. WAAS LPV200 Availability Contours–March 31, 2017

Conclusion

Ionosphere Phase Scintillation of L2 at high-latitude WRSs caused the UDREi for IIF satellites to be set to Not Monitored and caused GPS UDRE internal monitor threshold trips. The exclusion of these satellites from WAAS during the time the UDRE is set to Not Monitored has caused minimal degradation of WAAS LPV200 service.

References:

1. Karl Shallberg, Zeta Associates, “CNMP Observations from UDRE Spikes,” April 2017.
2. Karl Shallberg, Zeta Associates, “CY18 Update CNMP OSPs Mitigating UDRE R/T Trips,” May 2017.