



Korean CAT-I GBAS Ionospheric Threat Model

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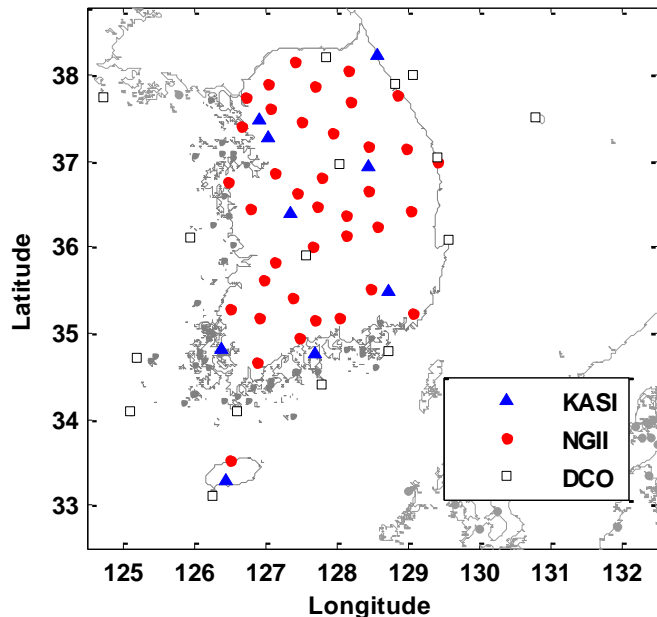
Ionospheric Threat Model Development for GBAS Category I Operation in the Korean Region

- In order to mitigate ionosphere threats occurring in different geographical regions, ionospheric threat models have to be established for the relevant regions.
- To allow the certification of a GBAS ground facility in South Korea, a Korean ionospheric threat model has be determined

Data Used to Construct Korean Ionospheric Threat Model

Korean GNSS Reference Stations	# of stations (as of 2004)
National Geographic Information Institute (NGII)	38
DGPS Central Office (DCO)	15
Korea Astronomy and Space Science Institute (KASI)	10
Total	63

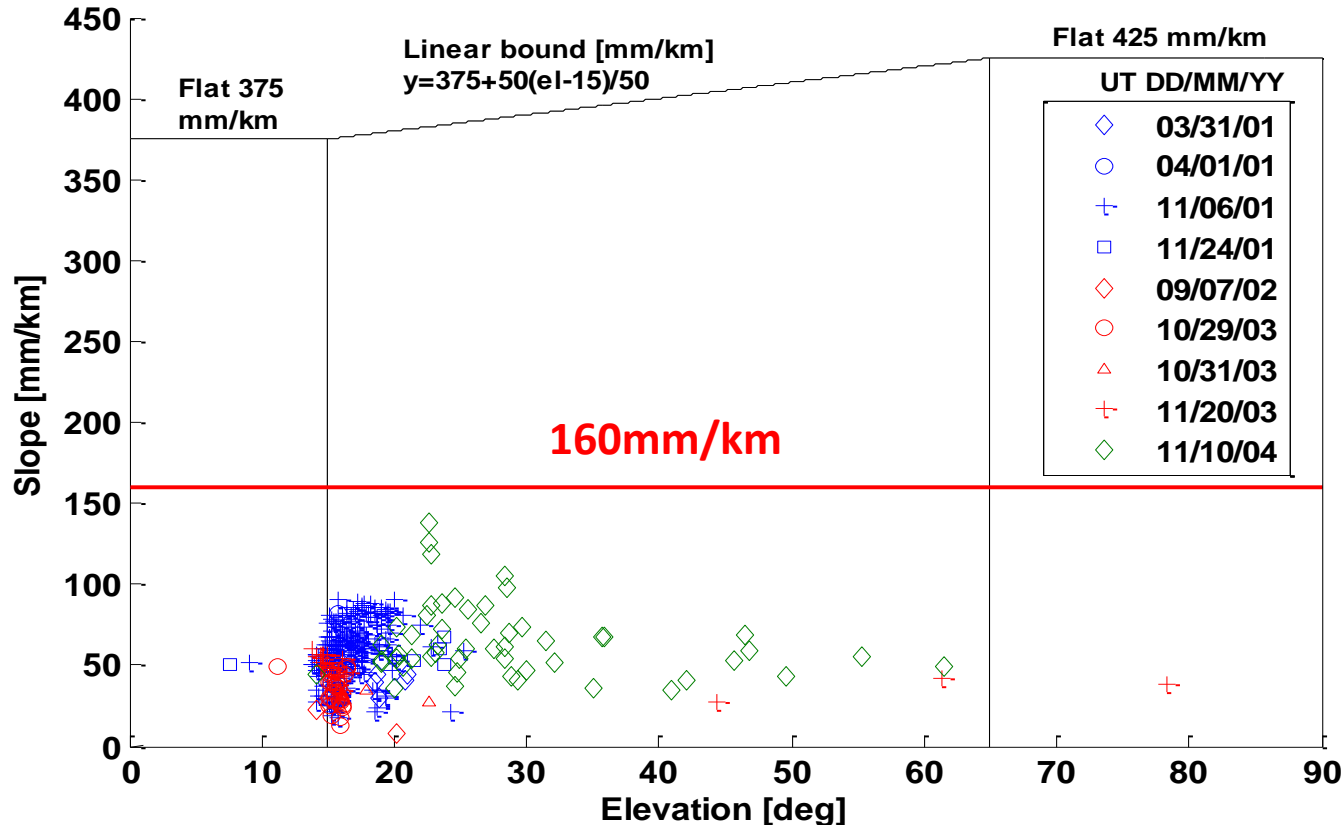
YYYY	MM/DD	Kp (Final)	Dst	YYYY	MM/DD	Kp (Final)	Dst
2000	04/06	8.3	-287	2003	09/07	7.3	-177
	04/07	8.7	-288		10/29	9.0	-350
	07/15	9.0	-289		10/30	9.0	-383
	07/16	7.7	-301		10/31	8.3	-307
	08/12	7.7	-235		11/20	8.7	-422
	09/17	8.3	-201		11/21	6.7	-309
2001	03/31	8.7	-387	2004	07/17	6.0	-76
	04/01	5.7	-228		11/08	8.7	-374
	04/11	8.3	-271		11/09	8.7	-214
	04/12	7.3	-236		11/10	8.7	-263
	11/06	8.7	-292				
	11/24	8.3	-221				



10 dates previously chosen to construct the current CONUS threat model

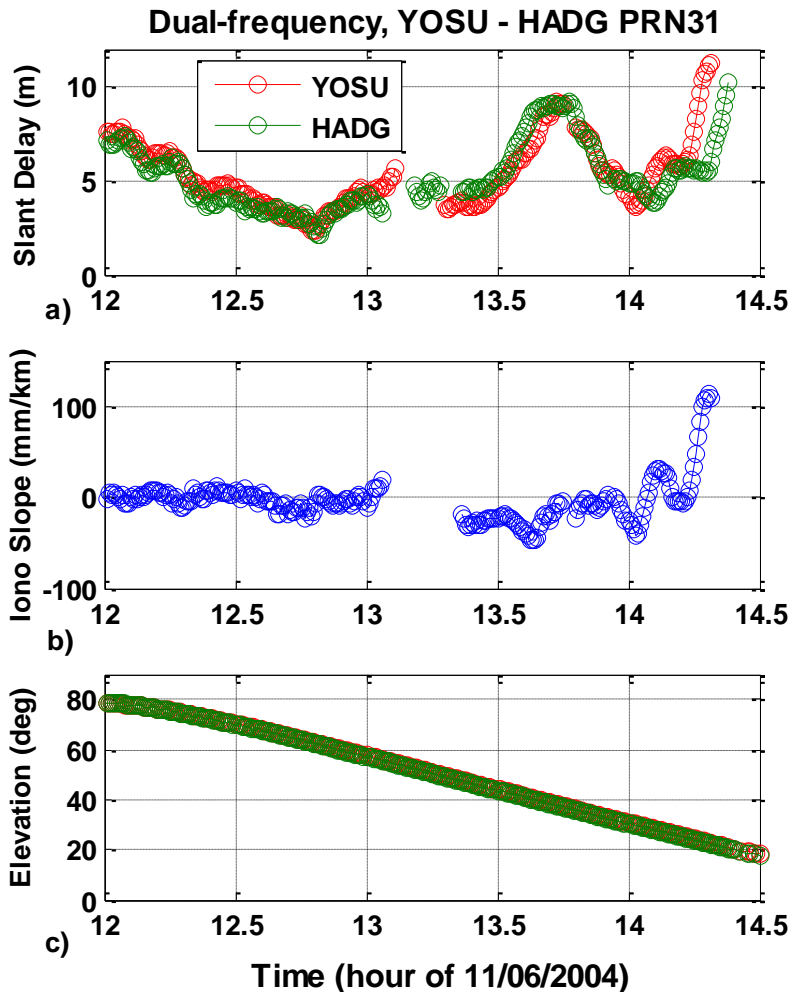
12 additional dates were selected based on Kp and Dst

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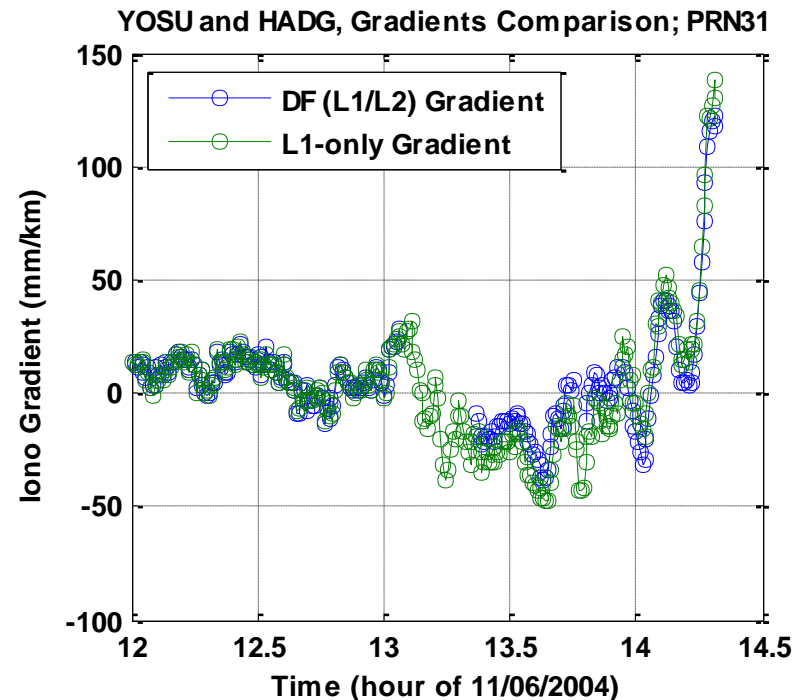


- A total of **288** threat points were validated.
- By adding a margin of about 15% to the largest gradient, the upper bound on Korea ionospheric treat model is **160 mm/km** (no elevation dependency) and is well under the bound of the current LAAS CONUS threat model.

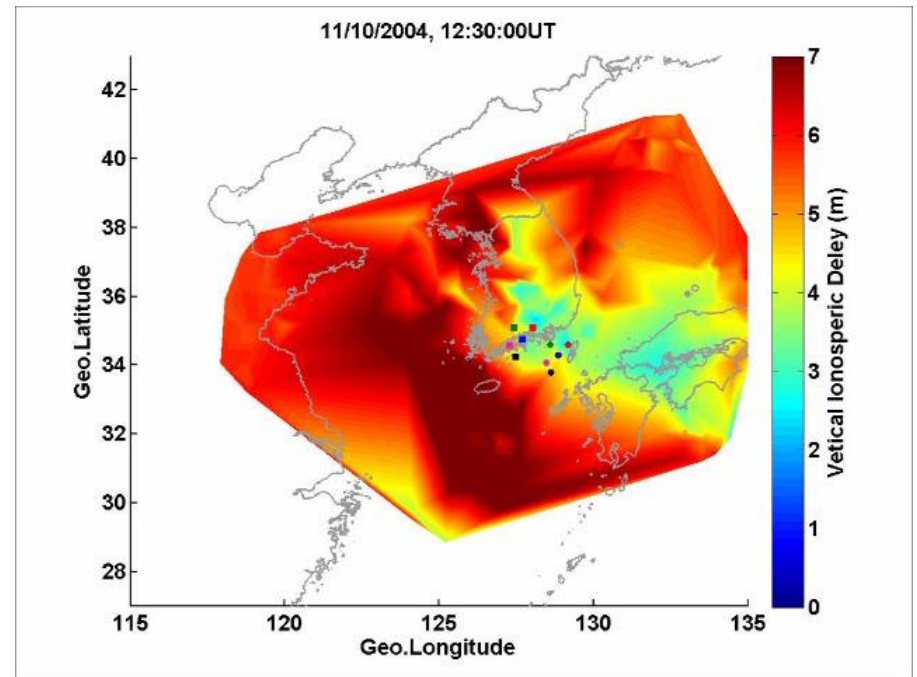
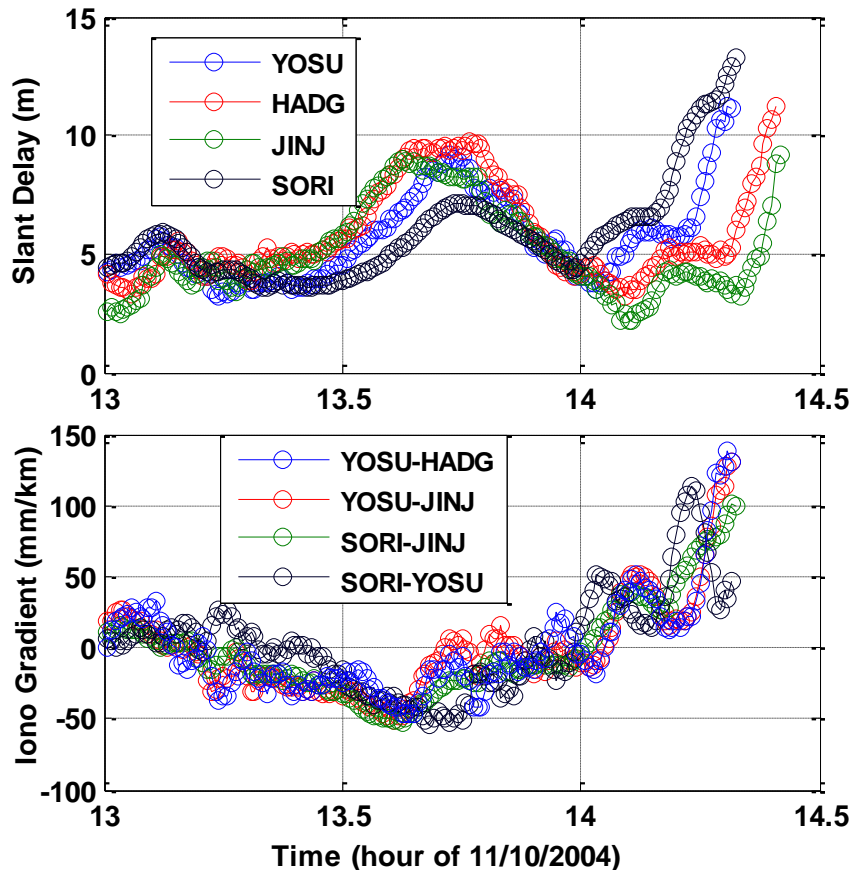
Case Study 1: The Most Extreme Ionospheric Gradient on Nov. 10, 2004



Pair	PRN	Time (HH:MM:SS)	Slope (mm/km)	Elev. (deg.)	Dist. (km)
YOSU-HADG	31	14:18:00	138.5	22.6	44.95



Station-Wide Validation and Localized Disturbances on Nov. 10, 2004

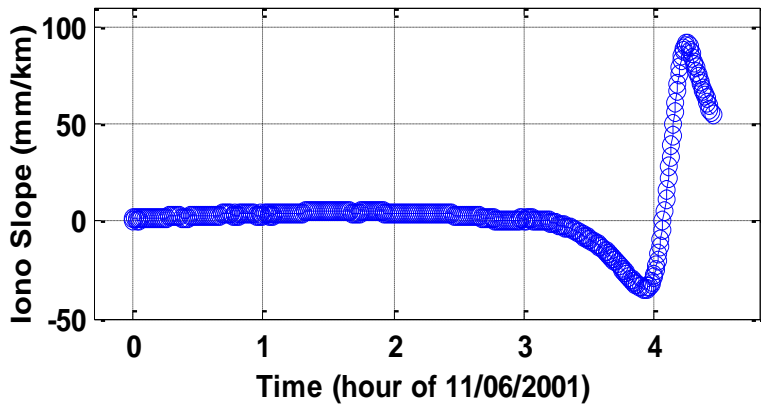
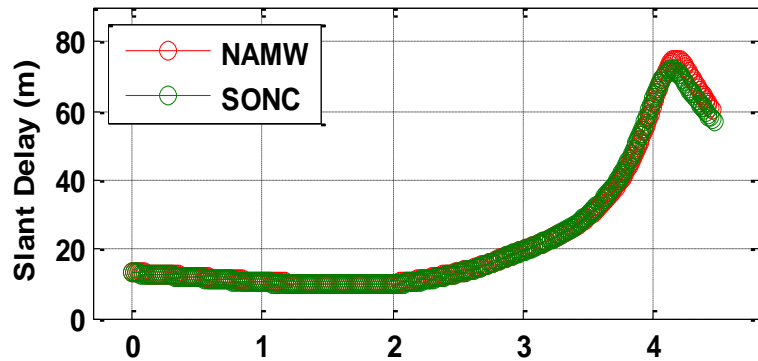


<IPP tracks and regional vertical ionospheric delay map>

- The ionospheric event observed in South Korea on November 10, 2004 was caused by localized disturbances, rather than the enhanced TEC around the geomagnetic equator.

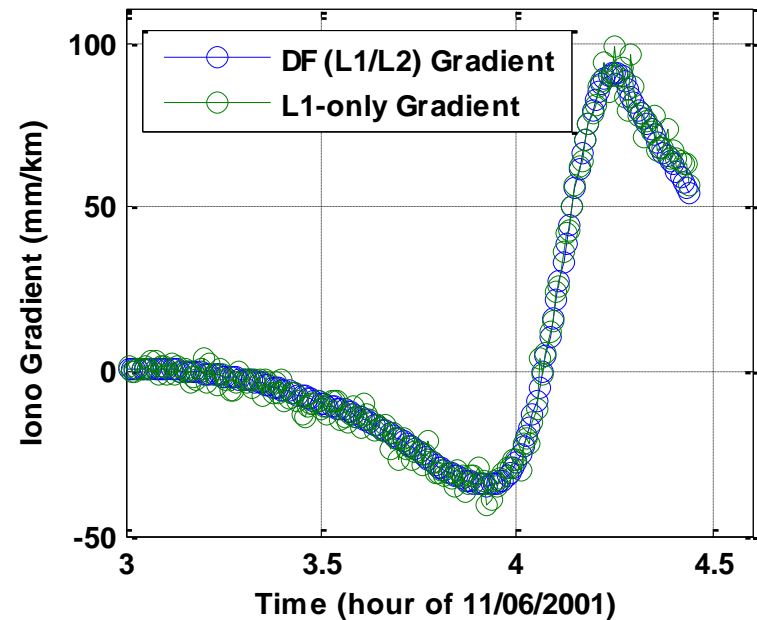
Case Study 2: The Second Largest Ionospheric Gradient on Nov. 6, 2001

Dual-frequency. NAMW/ SONC PRN 21

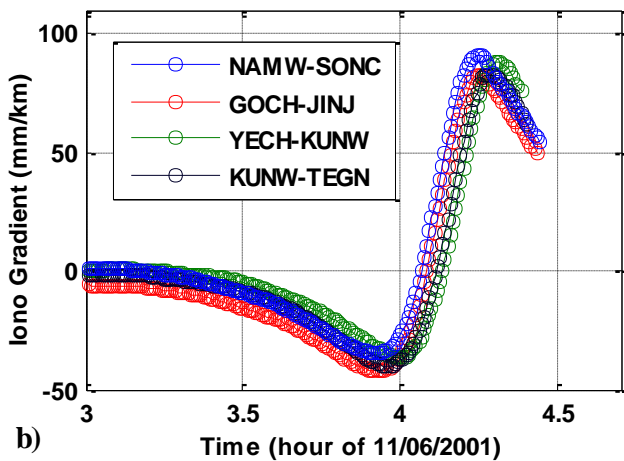
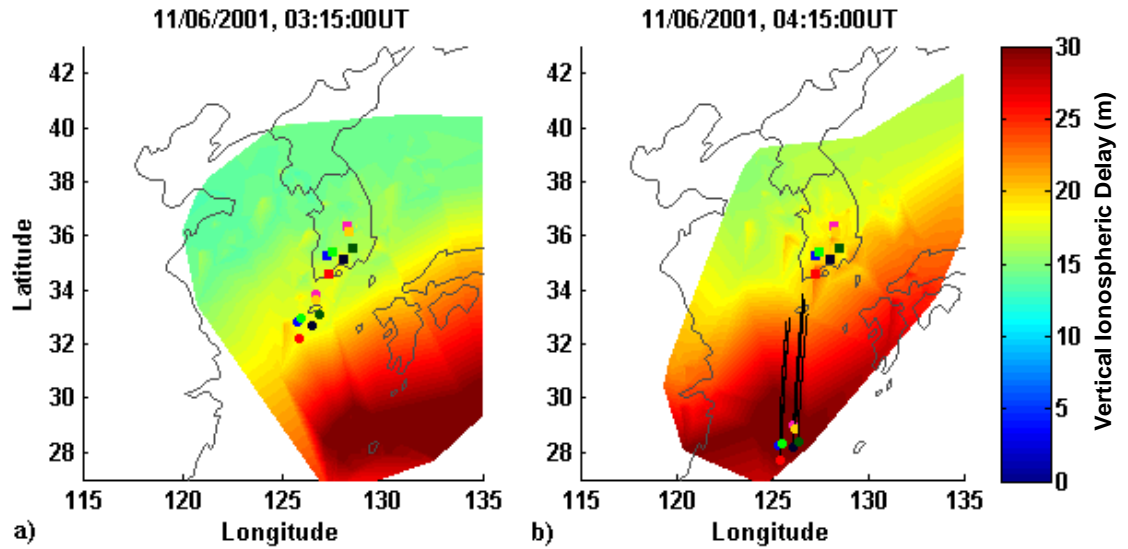
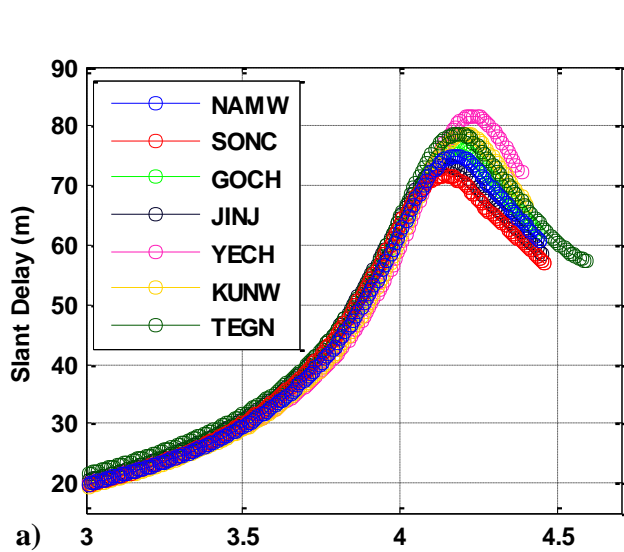


Pair	PRN	Time (HH:MM:SS)	Slope (mm/km)	Elev. (deg.)	Dist. (km)
NAWM -SONC	21	04:15:00	91 mm/km	20.1	52.3

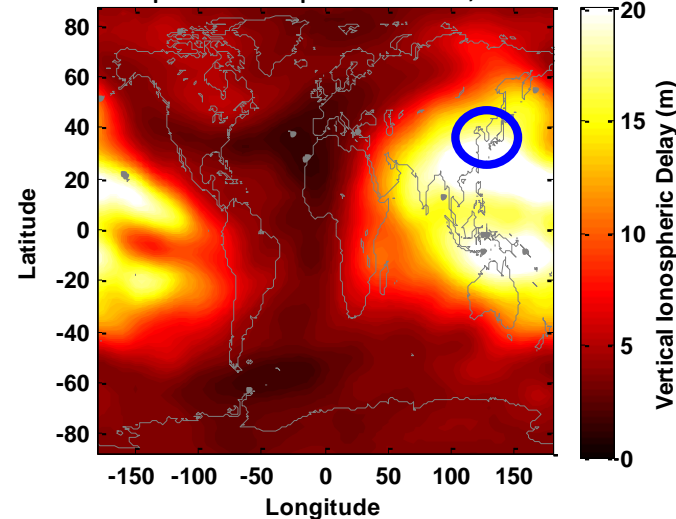
NAWM and SONC, Gradients Comparison ; PRN21



Station-Wide Validation and Enhanced TEC in Korea on Nov. 6, 2001



Global Ionosphere Map on Nov. 6, 2001 04:00 UT



Thank you for your attention