Supplementary Materials: Ionospheric Behavior During the 10 June 2021 Annular Solar Eclipse and Its Impact on GNSS Precise Point Positioning

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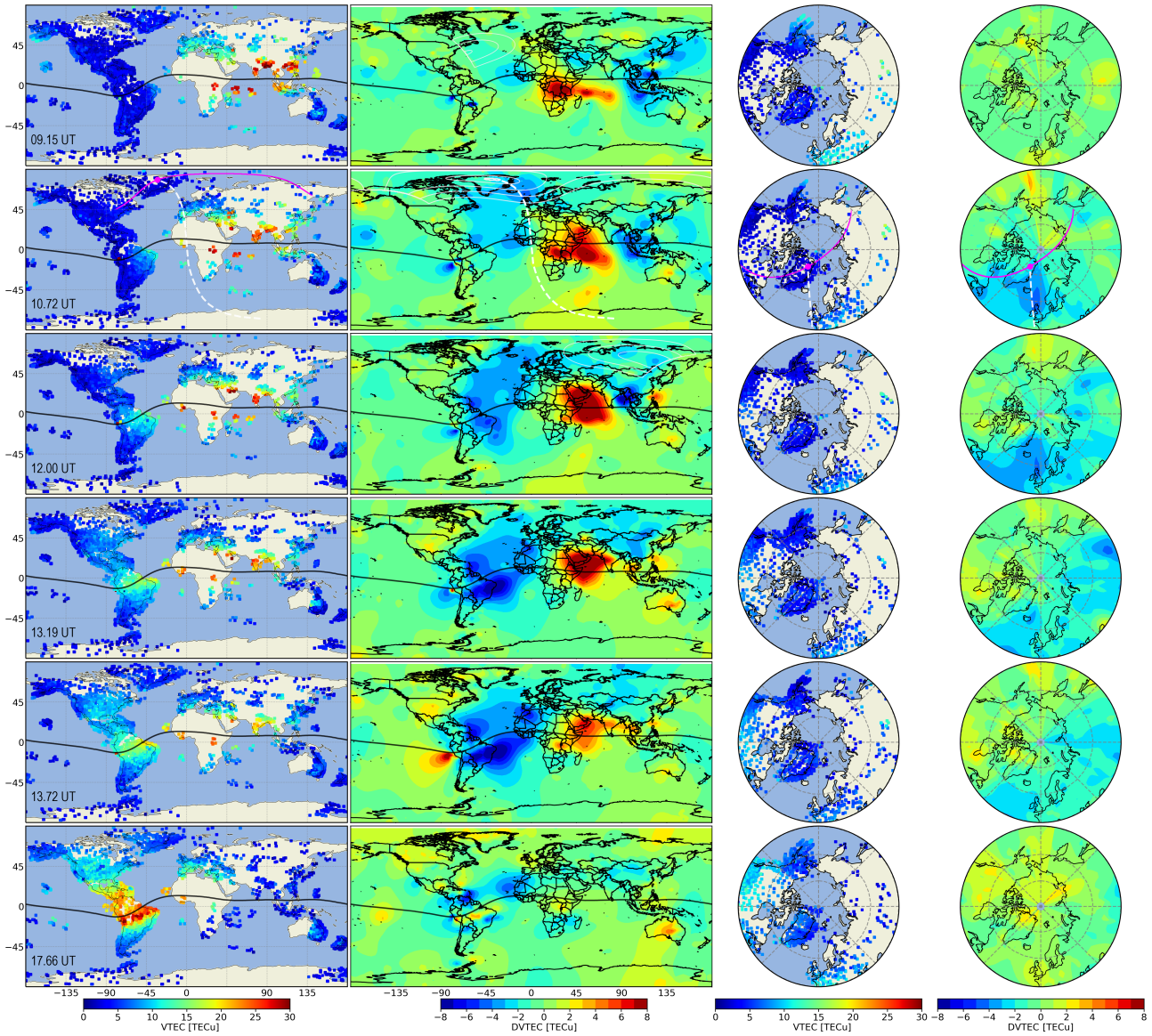

Figure S1. Ionospheric TEC maps during the 10 June 2021 Annular Solar Eclipse. World in cylindrical equidistant projection (**left, center-left panels**); and Northern Hemisphere polar plots between 45° N and 90° N (**right, center-right panels**). VTECe at IPP (**left, center-right panels**). DVTEC[TECu] using the Kriging interpolation method (**center-left, right panels**). From top to bottom panels: 09.15 UT, 10.70 UT (GE time), 12.00 UT, 13.19 UT (P4 time), 13.72 UT, and 17.66 UT. Eclipse obscuration mask from 20% obscuration and with intervals of 20% (white line), annular eclipse path (magenta line) and the maximum obscuration (magenta dot) at 350 km altitude are also shown. The white dashed line start from the maximum obscuration of the solar eclipse to its conjugate location in the southern hemisphere at 350 km altitude.

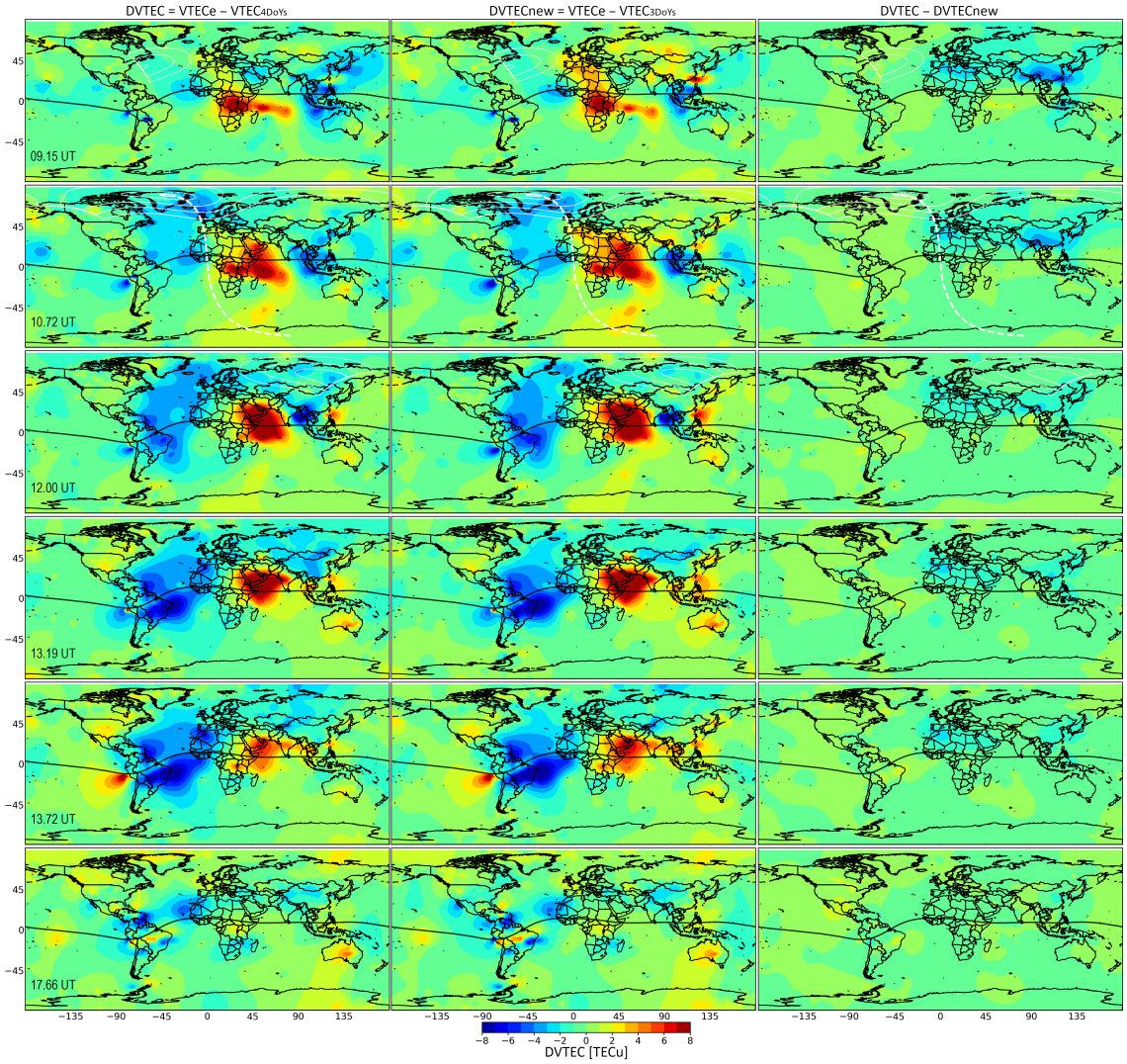

Figure S2. DVTEC[TECu] maps using the Kriging interpolation method to the eclipse day. DVTEC estimated with four reference days (DoYs 159, 160, 162, and 163) (**left panels**). DVTECnew calculated with three reference days (DoYs 159, 160, and 163), without the DoY 162 (**middle panels**). DVTEC-DVTECnew (**right panels**). From top to bottom panels: 09.15 UT, 10.70 UT (GE time), 12.00 UT, 13.19 UT (P4 time), 13.72 UT, and 17.66 UT. Eclipse obscuration masks from 20% obscuration and with intervals of 20%, at 350 km altitude (white line) are shown. The white dashed line start from the maximum obscuration of the solar eclipse to its conjugate location in the southern hemisphere.

Table S1. Mean and standard deviation for each map of Figure S2 (right panels).

(DVTEC - DVTECnew) Map	Mean [TECu]	Standard Deviation [TECu]
09.15 UT	-0.43	0.67
10.70 UT	-0.30	0.64
12.00 UT	-0.25	0.52
13.15 UT	-0.25	0.46
13.72 UT	-0.21	0.45
17.66 UT	0.01	0.39

Table S2. 3D-RMS, Greenland (36 stations), South America (335 stations). Where each column represents the percentage of stations with 3D-RMS in certain intervals between 8–14 UT.

Region	RMS	Percentage of GNSS Stations on DoYs				
	Intervals [cm]	159 [%]	160 [%]	161 [%]	162 [%]	163 [%]
Greenland	3D<2	28	31	2	5	0
	2⩽3D<3	67	64	81	78	86
	3⩽3D<4	3	3	14	11	11
	4⩽3D<5	0	0	0	0	0
	3D⩾5	2	2	3	6	3
South America	3D<2	32	30	17	20	33
	2⩽3D<3	54	53	61	56	51
	3⩽3D<4	9	11	13	16	10
	4⩽3D<5	3	4	6	5	4
	3D⩾5	2	2	3	3	2

Table S3. Maximum 3D positioning error, Greenland (36 stations), South America (335 stations). Where each column represents the percentage of stations with maximum 3D positioning error in certain intervals between 8–14 UT.

Region	MAX	Percentage of GNSS Stations on DoYs				
	Intervals [cm]	159 [%]	160 [%]	161 [%]	162 [%]	163 [%]
Greenland	3D<5	0	0	0	0	0
	5⩽3D<10	86	53	41	33	50
	10⩽3D<20	8	44	56	58	47
	20⩽3D<40	6	3	3	6	0
	3D⩾40	0	0	0	3	3
South America	3D<5	8	8	8	7	7
	5⩽3D<10	72	66	58	59	67
	10⩽3D<20	19	24	31	32	24
	20⩽3D<40	1	2	3	2	2
	3D⩾40	0	0	0	0	0

Table S4. Maximum ROTI, Greenland (36 stations), South America (335 stations). Where each column represents the percentage of stations with a maximum ROTI in certain intervals between 8–14 UT.

Region	ROTI	Percentage of GNSS Stations on DoYs				
	Intervals [TECu/min]	159 [%]	160 [%]	161 [%]	162 [%]	163 [%]
Greenland	0.25<ROTI	6	39	39	0	0
	0.25⩽ROTI<0.5	22	11	14	0	36
	0.5⩽ROTI<1	28	19	8	28	17
	ROTI⩾1	44	31	39	72	47
South America	0.25<ROTI	88	84	89	76	85
	0.25⩽ROTI<0.5	10	14	7	22	13
	0.5⩽ROTI<1	1	1	1	1	1
	ROTI⩾1	1	1	3	1	1