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Response of the ionosphere to the total solar eclipse on August 21, 2017 in the United States

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The total solar eclipse crossing the United States from west to east on August 21, 2017 provided a good opportunity to study the variation of the ionosphere during a solar eclipse. In this presentation we use US CORS GNSS data, ionosonde foF2 data and Millstone Hill ISR Ne data to analyze the response of the ionosphere to the total solar eclipse. The average value of one day before and one day after the eclipse was used as a reference value, and the absolute change and the change relative to the reference value were calculated.

Results show that the vertical total electron content (VTEC) of the ionosphere begins to decrease after the solar eclipse. The region of the decrease of VTEC moves with the solar eclipse towards the southeast. The maximum decrease is close to 10 TECU, the relative change is nearly 50%. The region with the largest decrease does not coincide with the center of the total solar eclipse, but is located in the west of the center, indicating that the ionosphere has a delayed response to the solar eclipse. The absolute change of VTEC is more obvious on the south side of the total solar eclipse path, while the relative change is not much different on the north and south side, and decreasing with the increase of the distance from the path of the total solar eclipse.

Results of ISR Ne show that there are significant differences in the variation of Ne at different heights. The Ne above 200 km is 60% lower than the reference value for up to 6 hours, while below 200 km it is only 10% lower for a time span of only 2 hours. The foF2 of the four ionosonde stations shows obviously also the solar eclipse response. It begins to decrease one hour after the solar eclipse, and reaches its maximum one hour after the maximum of the solar eclipse, then it gradually increases and exceeds the reference value.