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An incoherent scatter radar study of the midnight temperature maximum that occurred at Arecibo during a sudden stratospheric warming event in January 2010

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We present an analysis of the thermospheric midnight temperature maximum, a large increment of temperature around midnight. The analysis is based on data collected from the Arecibo incoherent scatter radar during January 14-21, 2010. The experiment overlaps with a major sudden stratospheric warming (SSW) event which commenced on Jan. 18 in 2010. Throughout the observation, the ion temperature exhibited moderate increase around post-midnight during Jan. 14-17 while it showed more intense increment during Jan. 18-21. In particular, on January 20, the amplitude of the MTM is 310 K, which is seldom seen at Arecibo. During the SSW, the meridional wind reverses toward the pole just before the commencement of the MTM. Then, the poleward wind and the ion temperature maximize almost at the same time. The variation of meridional wind and the MTM are consistent with the WAM model studies, which suggested that the variation is due to effects from an upward propagating terdiurnal tide [e.g., Akmaev et al., 2010]. On the nights of Jan. 18-19, the MTM showed clear phase variation at the heights of 265, 303 and 342 km. A strong terdiurnal tide has been observed during the SSW and it is likely generated from low atmosphere and propagating upward [Gong and Zhou, 2011]. Our results provide direct observational evidence that the propagating upward terdiurnal tide plays an important role in causing the MTM, which supports the WAM simulations [Akmaev et al., 2009; 2010].