



## **Ionosphere and thermosphere variability during the solar minimum of solar cycles 23/24**

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The deep solar minimum of solar cycles 23/24 was exceptionally quiet, with sunspot numbers at their lowest in at least 75 years. During this unique solar minimum epoch, however, solar wind high speed streams emanating from near-equatorial coronal holes occurred frequently and are the primary contributor to the continuous geomagnetic activity at the Earth. These conditions enable the isolation of forcing by geomagnetic activity on the preconditioned solar minimum state of the upper atmosphere caused by Corotating Interaction Regions (CIRs). Meanwhile, the thermosphere and ionosphere can be significantly changed by the perturbations originating from the lower atmosphere. These perturbations are most likely tied to atmospheric waves, including atmospheric tides, planetary waves, and gravity waves. In this invited presentation we will report our recent results of the ionosphere and thermosphere variability associated with the CIR storms and stratospheric sudden warming event during this deep solar minimum on the basis of the measurement from the CHAMP and COSMIC satellites.