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Solar cycle influence on the infrared energy budget of the thermosphere

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We present direct observational evidence for solar cycle influence on the infrared energy budget and radiative cooling of the thermosphere. By analyzing nearly five years of data from the Sounding of the Atmosphere using Broadband Emission Radiometry (SABER) instrument, we show that the annual mean infrared power radiated by the nitric oxide (NO) molecule at 5.3 um has decreased by a factor of 2.9. This decrease is correlated (r = 0.96) with the decrease in the annual mean F10.7 solar index. Despite the sharp decrease in radiated power (which is equivalent to a decrease in the vertical integrated radiative cooling rate), the variability of the power as given in the standard deviation of the annual means remains approximately constant. A simple relationship is shown to exist between the infrared power radiated by NO and the F10.7 index, thus providing a fundamental relationship between solar activity and the thermospheric cooling rate for use in thermospheric models. The change in NO radiated power is also consistent with changes in absorbed ultraviolet radiation over the same time period.