Increasing Carbon Dioxide Concentration in the Upper Atmosphere Observed by SABER

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Carbon dioxide measurements made by the Sounding of the Atmosphere using Broadband Emission Radiometry (SABER) instrument between 2002 and 2014 were analyzed to reveal the rate of increase of CO_2 in the mesosphere and lower thermosphere. The CO_2 data show a trend of ~5% per decade at ~80 km and below, in good agreement with the tropospheric trend observed at Mauna Loa. Above 80 km, the SABER CO_2 trend is larger than in the lower atmosphere, reaching ~12% per decade above 110 km. The large relative trend in the upper atmosphere is consistent with results from the Atmospheric Chemistry Experiment Fourier Transform Spectrometer (ACE-FTS). On the other hand, the CO_2 trend deduced from the Whole Atmosphere Community Climate Model (WACCM) remains close to 5% everywhere. The spatial coverage of the SABER instrument allows us to analyze the CO_2 trend as a function of latitude for the first time. The trend is larger in the northern hemisphere than in the southern hemisphere mesopause above 80 km. The agreement between SABER and ACE-FTS suggests that the rate of increase of CO_2 in the upper atmosphere over the past 13 years is considerably larger than can be explained by chemistry-climate models.