Possible Solar Cycle Responses of Eddy Diffusion in the Mesosphere and Lower Thermosphere as Inferred from SABER CO_2

Cornelius Csar Jude H. Salinas *[ccjsalinas@gmail.com][1,2], Loren C. Chang[1,2], Jia Yue[3], Liying Qian[4], James Russell III[5], and Martin Mlynczak[6]*

1 *Center for Astronautical Physics and Engineering, National Central University, Taoyuan City, Taiwan*
2 *Graduate Institute of Space Science, National Central University, Taoyuan City, Taiwan*
3 *NASA Goddard Space Flight Center, Greenbelt, Maryland, USA*
4 *High Altitude Observatory, Natl. Center for Atmospheric Research, Boulder, Colorado, USA*
5 *Department of Atmospheric Sciences, Hampton University, Hampton, Virginia, USA*
6 *NASA Langley Research Center, Hampton, Virginia, USA*

This work presents a possible solar cycle response of eddy diffusion in the MLT region. We utilize global-mean SABER CO_2 to first derive global-mean eddy diffusion coefficients (K_{zz}) that span at least one solar cycle. Then, a multiple-linear regression is used to determine the response of these K_{zz} profiles to the solar cycle. It is found that K_{zz} decreases during solar maximum and increases during solar minimum (hereafter referred to as a negative solar cycle response). These are compared with simulations from the Specified Dynamics – Whole Atmosphere Community Climate Model – eXtended (SD-WACCM-X). Model simulations also indicate a negative solar cycle response in K_{zz}. To explain these solar cycle responses in global-mean K_{zz}, we analyzed the solar cycle response of zonal-mean CO_2 as well as the role of K_{zz} per season. Results show that all seasons show consistently a negative solar cycle response in zonal-mean K_{zz}. We did further analysis on June solstice and found that the negative solar cycle response of K_{zz} can be attributed to anomalies in gravity wave propagation.