

# **Lunar Tide Effects on the Atmosphere during the 2013 Sudden Stratospheric Warming (SSW) as Simulated by TIME-GCM**

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## **Abstract:**

The lunar tides always have a slight effect on Earth's atmosphere, but during Sudden Stratospheric Warming (SSW), these slight effects are greatly amplified. To study the effect of the lunar tide on SSW, the Thermosphere Ionosphere Mesosphere Electrodynamics Global Circulation Model (TIME-GCM) was used. TIME-GCM is forced by WACCMX-GEOS5, which includes all the solar tidal forcing and can reproduce the variability observed during SSW. By differencing two TIME-GCM simulations of the 2013 SSW event, one taking into account the lunar tides and one omitting them, the lunar tide effects on neutral air density, temperature, and wind were quantified in the middle and upper atmosphere. Some surprisingly large effects were observed. For example, the lunar tides changed neutral air density at an altitude of 400km by up to 24% and at 150km by up to 15%. It also changed the thermosphere's zonal mean zonal wind by up to 100 meters per second, which became more westward propagating.