

**ABSTRACT ONLY**

VARIABILITY OF WATER VAPOR IN THE  
INTERNAL ATMOSPHERE OF MARS  
ASSOCIATED WITH THE SOLAR ACTIVITY  
CYCLE

J. N. Molina Córdoba<sup>1</sup>, S. Vargas Domínguez<sup>1</sup> and  
J. I. Zuluaga Callejas<sup>2</sup>

This work explores the intricate relationship between Mars’ atmospheric variations and dynamic solar activity patterns. We focus on periodic oscillations in H<sub>2</sub>O vapor and the Pectinton solar flux index in the  $\lambda = 10.7$  cm radio band, around the characteristic 11-year solar cycle. Periodic Mars activity was studied using data from Mars Express’ SPI-CAM instrument spanning 2004-2018. The Lomb-Scargle Periodogram method was applied to analyze the power spectra of both signals around this period, calibrated using peaks associated with the seasonal Martian cycle. This method was validated by analyzing power spectra of chemical species abundances in Earth’s atmosphere, obtained from the NRLM-SISE 00 empirical model provided by the National Oceanic and Atmospheric Administration (NOAA). Model executions reproduced chemical abundance data for various atmospheric species (N<sub>2</sub>, O<sub>2</sub>, N, H<sub>2</sub>, Ar, and He) at two reference heights (upper mesosphere and low ionosphere) over a 1961-2021 time span. Results suggest a connection between variability in H<sub>2</sub>O vapor concentration in Mars’ atmosphere and fluctuations in the Pectinton solar flux index. We propose the Lomb-Scargle Periodogram method as a heuristic for studying oscillatory activity in planetary atmospheres with non-uniformly sampled data. While our results provide valuable insights, further analysis, cross-referencing with data from different orbiters, is required to deepen our understanding of these findings in the fields of planetary climatology and atmospheric physics.

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<sup>1</sup> Universidad Nacional de Colombia, Observatorio Astronómico Nacional, Carrera 45 No. 26-85. Ed. 413 Bogotá, Colombia (jomolinac@unal.edu.co, svargasd@unal.edu.co)

<sup>2</sup> SEAP/FACom, Instituto de Física - FCEN, Universidad de Antioquia, Calle 70 No. 52-21, Medellín, Colombia (jorge.zuluaga@udea.edu.co)

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