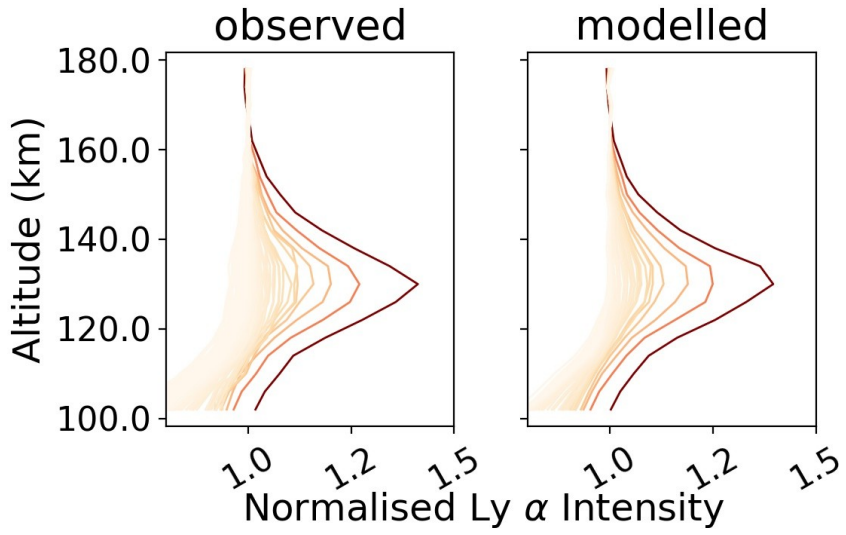
COMPREHENSIVE STATISTICAL ANALYSES AND DATA-DRIVEN MODELING OF ELECTRON AND PROTON AURORAS ON MARS USING EMM AND MAVEN OBSERVATIONS. D. B. Dhuri[1] , M. Simoni[1], D. Atri[1] and A. Alhantoobi[2], [1] Center for Space Science, New York University Abu Dhabi, Abu Dhabi, UAE, [2] Khalifa University, Abu Dhabi, UAE.

Introduction: Auroras are an important probe for characterizing the interaction of solar wind with the induced magnetosphere of Mars and understanding the evolution of Mars's atmosphere. Since their first discovery in 2005, Mars auroras have been studied extensively, particularly using the observations from NASA's Mars Atmosphere and Volatile Evolution (MAVEN) [1]. Electron auroras with discrete and diffuse morphology are observed on the nightside of Mars whereas proton auroras are observed mainly on the dayside of Mars. Recently the Emirates Mars UV Spectrometer (EMUS) onboard the Emirates Mars Mission (EMM) has discovered new morphologies of sinuous electron auroras [2] and patchy proton auroras [3] on Mars. In this work, we perform comprehensive statistical analyses of aurora observations to understand the processes responsible for the varied auroral activity on Mars. We systematically isolate electron aurora regions from the nightside EMUS observations and characterize their occurrences and emissions with respect to the crustal magnetic fields, IMF, and electron energies measured by MAVEN. We also develop a purely data-driven model of proton auroras on Mars using MAVEN in-situ observations and UV limb scans between 2014-2022 to train an artificial neural network (ANN). We show that the ANN faithfully reconstructs the observed proton aurora limb scans profiles. We use the trained ANN to analyze the influence of Mars' crustal magnetic field and IMF on the occurrence rates of the proton auroras using gradient-based attribution maps.

Digital Formats:



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References:

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