Abstract

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Progression of Solar Cycle 24 As Seen in Acoustic Mode Frequencies of the Sun

By examining the acoustic waves observed on the surface of the Sun, one can infer the internal structure and dynamics of the Sun through the technique of helioseismology. In this study, we use full-disk high-cadence Dopplergrams and magnetograms from the Helioseismic and Magnetic Imager (HMI) on board Solar Dynamics Observatory (SDO) to investigate the progression of Solar Cycle 24 by analyzing high-degree acoustic mode frequencies. The frequencies are derived through the local seismology technique of ring diagram and cover a period of about nine years from June 2010 to May 2019. The temporal variation in frequencies is explored by examining the physical measures of the solar activity, e.g., international sunspot number (ISN), 10.7 cm radio flux and a local magnetic activity index (MAI). Our analysis confirms that the high-degree frequencies strongly correlate with the changes during the solar cycle. The analysis of MAI and ISN of individual hemispheres shows that the northern hemisphere peaked in activity before the southern hemisphere. The same trend is also observed in the oscillation frequencies. We further analyze the oscillation frequencies as a function of latitude and find that the latitudinal bands of higher magnetic activity correlate best with the frequency shifts computed at those latitudes. It is expected that the latitudinal variation with the progression of the solar cycle may provide useful insight into different solar dynamo models.