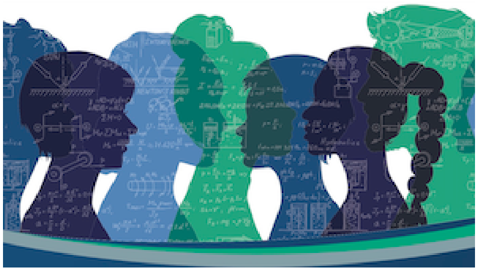

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Predicting Far-Side Helioseismology AR Accuracy Using Statistical Analyses

Sunday, January 22, 2023 9:06 AM (12 minutes)

Active regions (ARs), areas on the sun with strong magnetic flux, are indicators of where harmful space weather may originate. In order to better prepare for these phenomena, it is important to be able to predict how flux on the Sun evolves over time. This project aims to improve current models of flux evolution by quantifying the uncertainties in far-side helioseismic data from the Helioseismic and Magnetic Imager (HMI) instrument on the Solar Dynamics Observatory. Surface Flux Transport (SFT) models simulate the evolution of ARs on the far-side of the Sun, but are unable to include new ARs that emerge on the far-side. Helioseismology uses dopplergrams to measure the variations in solar wave propagations and create near and far-side maps of the flows on the Sun, which can then be used to detect locations of far-side ARs. However, there are systematic uncertainties in the far-side AR detections. Previously we incorporated all active regions into the Advective Flux Transport (AFT) SFT model for a single month in Feb. 2014, comparing with HMI observations as the ARs rotated onto the near side. We now expand our investigation by characterizing the uncertainties in the HMI derived far side maps based on location and area of the ARs by comparing them with far side solar observations obtained by STEREO from 2010-2014 in the 304 wavelength (which is known to be sensitive to a magnetic field). Ultimately, we hope to use these uncertainties to improve the accuracy of AR detections, propagate the quantitative uncertainties into helioseismically-derived far-side magnetic flux maps, provide a quantitative standard deviation of the far-side magnetic flux maps, and incorporate these data into AFT to provide the most accurate maps the photospheric magnetic flux over the entire surface of the Sun.

Presenter: RUSSELL, Alyssa (University of Michigan)

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