

Rotational Variations in Total Solar Irradiance Observations: From SORCE/TIM, ACRIM/ACRIM III, and SoHO/VIRGO

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The recent space-born Total Solar Irradiance (TSI) observations now provide a reliable estimate of the mean solar flux amount on Earth, but also the phase and amplitude of solar rotational variations, extending from 03/2003 to 12/2012 during SORCE (Solar Radiation and Climate Experiment) mission period. Three independent TSI data observed by SORCE/TIM (Total Irradiance Monitor), ACRIM (Active Cavity Radiometer Irradiance Monitor)/ACRIM III, and SoHO (Solar and Heliospheric Observatory/VIRGO (Variability of IRradiance and Gravity Oscillations Sun PhotoMeter) are analyzed to characterize the phase and amplitude of 27 days solar rotational variation.

Overall, the rotational variations of TSI are in good agreement among three observations, despite the possible causes of disagreement among overlapping observations as apparent in the previous studies. The mode decomposition clearly identifies a 27 day solar rotational signature.

During the declining phase, the amplitude of TSI change associated with the 27 days rotational cycle is up to 0.8 W/m² (~0.05%). During the rising phase of solar cycle 24, the amplitude is up to 0.4 W/m² (~0.04%). The correlation of the solar rotational mode between SORCE/TIM and ACRIM/ACRIM III is ~0.92 and the slope of the local peak values is ~0.98. The correlation between SORCE/TIM and SoHO/VIRGO is high as ~0.96 and the slope of the local peak values is ~0.98 very similar to that from ACRIM III.