Total Solar Irradiance and Photometric Indices during the Activity Minimum between Solar Cycles 23 and 24

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The minimum between Solar Cycles 23 and 24 has been the subject of a number of studies due to its long duration and number of spotless days. For this time period, we investigate the short-term temporal variability of the Total Solar Irradiance (TSI) from the Total Irradiance Monitor (TIM) on board the SOlar Radiation and Climate Experiment (SORCE) spacecraft, in comparison with the photometric indices derived from red and K-line images obtained on a daily basis at the San Fernando Observatory (SFO). We use an autoregressive gap-filling method to construct continuous series which can be analyzed via Fourier and wavelet spectral techniques in order to investigate the characteristics of the time signals on short temporal scales. Lomb-Scargle periodograms, which can handle time series with missing data, are used for comparison to ascertain that the gap-filling method does not affect the results. The cross-wavelet transforms between the TSI and the photometric indices signals are used to identify regions of high common power in the time-frequency maps. The wavelet transform coherence indicates local periods and times during which the photometric indices signals and TSI have significant coherence and phase locking, independent of the power. We find that variations in the TSI appear to be related to variations both in the photometric index ΣK, calculated from Ca II K-line photometric sums, and in the magnetic flux in the solar activity latitudinal band (as found in Benevolenskaya & Kostuchenko, 2013). This suggests that the TSI changes during the minimum are caused by the reduced line-blanketing effect of diffused magnetic field.