



Total solar irradiance during the last three solar cycles: Consequences for the reconstruction back to 1900.

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The record of total solar irradiance (TSI) during the past 35 years shows similarities of the three solar cycles, but also important differences. During the recent minimum with an unusually long periods with no sunspots, TSI was also extremely low, namely 25% lower than in 1996, relative to its cycle amplitude. Together with the values during the previous minima this points to a long-term change related to the strength of solar activity. On the other hand, activity indices as the 10.7 cm radio flux (F10.7), the CaII and MgII indices and also the Ly- α irradiance, show a much smaller decrease. This means that proxy models for TSI based on the photometric sunspot index (PSI), and on e.g. MgII index to represent faculae and network have to be complemented by a further component for the long-term change. TSI values at minima are correlated with the simultaneous values of the open magnetic field of the Sun at 1 AU and thus, these values may be used as a surrogate for the long-term change component. Such a 4-component model explains almost 85% of the variance of TSI over the three solar cycles available. This result supports also the idea that the long-term change of TSI is not due to manifestations of surface magnetism as the solar cycle modulation, but due to a change of the global temperature of Sun modulated by the strength of activity - being lower during low activity. To explain the difference between the minima in 1996 and 2008 we need a change of only 0.25 K. Using this information together with the reconstructed open field of the Sun at 1AU from the aa index and the record of CaK observations from Mt.Wilson since 1913, TSI can be reconstructed reliably back to the beginning of the last century.