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Are different Total Solar Irradiance records and reconstructions consistent with each other ? A statistical view.

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The existence of a long-term trend in the Total Solar Irradiance (TSI) is a topic of considerable importance, and has been hotly disputed in the last few years. Different TSI composites have been built out of the nine observations that were made since 1978, and they partly disagree. Recently, empirical or semi-empirical models have been used to advocate one or the other composite.

Here, we use a newly developed gap filling technique to investigate this problem from a statistical point of view, with no model bias. The strong correlation between the different observations is used to extrapolate the record from each instrument. This allows us to reconstruct the missing observations as if each instrument had been continuously operating since 1978, by assuming that the statistical properties of each record with respect to the others has not changed. Interestingly, these reconstructions readily reveals which records suffer from instrumental artefacts. This allows us to intercompare the different TSI records and to show when the observations started to disagree. This information is important for improving present composites.

We compare these reconstructions with a TSI estimation based on solar magnetism and we conclude on the pertinence of the different existing composites.