

How Well Do We Know Solar Irradiances on Climate Time Scales and How Can We Improve These?

*Greg Kopp
Univ. of Colorado / LASP*

The main energy source driving Earth's climate – by nearly a factor of 10,000 – is the incident total solar irradiance. Water vapor and other greenhouse gases, aerosols, land use, and several additional natural and anthropogenic influences affect the amount of this incoming solar energy that is absorbed and thus influence climate, but none contribute to the net incident energy. While the Sun is generally (and fortunately) very stable, it does have short- and long-term variations that, not surprisingly, affect climate, so when determining the causes of climate change, variations in total solar irradiance must be included.

The spaceborne total solar irradiance climate data record is now nearly 32 years long. It is from these recent continuous measurements that proxies allow reconstructions of historical solar inputs to the Earth's climate system, from which climate sensitivity to this natural forcing mechanism is estimated. The accuracies of these reconstructions, and thus of estimates of climate sensitivity, depend on many factors including observational sunspot records, solar magnetic field propagation models, variability measurements of Sun-like stars, and heliospheric influences on cosmogenic isotopes, not to mention the accuracy and stability of the irradiance data record itself upon which these reconstructions are based.

While it may be too late to improve historical observations, current and future solar irradiance measurements are being improved. I will derive the climate-driven requirements for total solar irradiance measurement accuracies and stabilities needed for determining climate sensitivities and discuss progress for improving this solar climate data record.