

## **On the Contribution of Quiet Sun Magnetism to Solar Irradiance Variations**

**Matthias Rempel** [rempe@ucar.edu], National Center for Atmospheric Research / High Altitude Observatory (NCAR/HAO), Boulder, CO, USA

While the quiet Sun magnetic field shows only little variation with the solar cycle, long-term variations cannot be completely ruled out from first principles. We investigate the potential effect of quiet Sun magnetism on spectral solar irradiance through a series of small-scale dynamo simulations with varying levels of small-scale magnetic field and one weak network case with an imposed vertical mean field of 100G. From these setups we compute the dependence of the outgoing radiative energy on the unsigned vertical magnetic flux density in the photosphere at continuum optical depth  $\tau=1$ . We find that a quiet Sun setup with an unsigned vertical magnetic flux density of 69 G is about 0.7% brighter than a non-magnetic reference case. We find a linear dependence of the outgoing radiative energy flux on unsigned magnetic flux density (TSI sensitivity) of 0.017%/G. With this sensitivity, only a moderate change of the quiet Sun field strength by 10% would lead to a total solar irradiance variation comparable to the observed solar cycle variation. While this does provide strong indirect constraints on possible quiet Sun variations during a regular solar cycle, it also emphasizes that potential variability over longer time scales could make a significant contribution to longer-term solar irradiance variations.