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Title: Working with the photospheric magnetic field observations from Mount Wilson, Wilcox, and Kitt Solar Observatories

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Abstract

Routine full disk measurements of the Sun's photospheric field began at Mount Wilson Solar Observatory (MWO) in 1966, resulting in a near-continuous set of daily **magnetograms** over approximately the last three solar cycles. Similar measurements began both at the National Solar Observatory on Kitt Peak (NSO) and Wilcox Solar Observatory (WSO) roughly a solar cycle later in the mid-1970s. There are thus three solar observatories with near continuous daily observations of the global photospheric field that span approximately the last three decades. However, working with these data requires care and frequently a detailed understanding of important issues about the observations from each observatory. For instance, both MWO and NSO have had a number of major instrument changes over the years. MWO replaced its grating in 1982 and 1994 and NSO replaced its original magnetograph in 1992 and then again in 2003 with the recent installation of the new SOLIS instrument. At any given observatory, the data taken with new instruments are not necessarily well inter-**calibrated** with older ones nor is it necessarily true that all known **calibration** issues for a particular instrument have been fully addressed. This tends to be especially true in the older data. For example, it is well known that the observations made with the original magnetograph at NSO (i.e., pre 1992) frequently suffer from systematic biases in the zero point of the measurements [Arge et al., 2002]. In addition, the three observatories provide their line-of-sight (LOS) photospheric magnetic field observations using different file formats, spatial resolutions, and even units and frequently not with all known corrections applied to them. For example, MWO and WSO both make use of the Fe I 525.0 nm line to measure the LOS magnetic field strength. This line is well known to be especially prone to line saturation effects that require the application of an appropriate correction factor. Historically, neither observatory has routinely corrected their data for saturation effects, and in fact, each has advocated using a different correction factor for this same spectral line. In this paper, we highlight, from the perspective of someone that routinely uses them for space weather modeling purposes, some of the important issues that can make using these data less than straightforward.

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