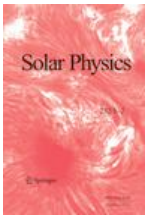
Journal Article



Weak-Field Magnetogram Calibration using Advanced Stokes Polarimeter Flux Density Maps – II. SOHO/MDI Full-Disk Mode Calibration

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Abstract Cotemporal Ni i 676.8 nm full-disk magnetograms from the Michelson Doppler Interferometer (MDI) instrument on SOHO and the Advanced Stokes Polarimeter (ASP) are quantitatively compared using observations of active region AR 8218, a large negative polarity sunspot group observed at S20 W22 on 13 May 1998. MDI produces flux density estimates based on a polarized line center-of-gravity algorithm using moderate spectral resolution filtergrams with approximately 4 arc sec angular resolution. The magnetograms are formed by an on-board image processor and sent to the ground where they are calibrated using an empirical model to produce flux density maps. The ASP uses high spectral resolution Stokes polarimetric observations to produce very high precision vector magnetic field maps at angular resolution values on the order of 1 arc sec in good seeing. We use ASP inversion results to create a reference ASP `longitudinal magnetic flux density map' with which to calibrate the MDI full-disk magnetograms. The magnetograms from each instrument are scaled to a common reference frame and co-aligned with an accuracy of about 1.6 arc sec. Regions of invalid data, poor field-of-view overlap, and sunspots are masked out in order to calibrate MDI predominately on the relatively vertical `weak-field' plage magnetic elements. Pixel-to-pixel statistical comparisons are used to determine an MDI magnetogram linear calibration relative to reference ASP flux density values. We find that the current Level-1.5 MDI full-disk calibration gives flux density values lower on average by a factor of 0.64±0.013 compared to the ASP reference in active region plage. In sunspot regions (penumbra and umbra) the factor is 0.69±0.007.