

The SOLAR-1 Magnetometer and Space Weather Monitoring around L1

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The Space Weather Observations at L1 to Advance Readiness - 1 (SOLAR-1, formerly SWFO-L1) NOAA mission was launched in September 2025, as a successor to the DSCOVR mission. The satellite will be used to observe incoming solar wind particles and fields before they reach Earth, and the in situ magnetic field will serve as a "key parameter" for operational prediction of space weather events. As the spacecraft journeyed to the L1 Lagrange point, our magnetometer team began the process of in-flight instrument commissioning. In collaboration with the Southwest Research Institute and the University of New Hampshire, NOAA has applied algorithms to calculate the instrumental offsets and other parameters that must be determined in-flight. We also identified the stray magnetic fields originating from the spacecraft (thrusters, reaction wheels, etc.) and quantified the magnitude of the noise. To help end-users remove spurious signals from their analyses, we generated quality flags that will be incorporated with the public data. Finally, we compared the spacecraft's inboard and outboard sensors with each other, and also compared the primary (outboard) magnetometer with similar instruments on other spacecraft orbiting the L1 Lagrange point. We find that the L1 satellites' magnetic field measurements are highly correlated, but this correlation decreases with increased spatial separation. As such, the proximity of the SOLAR-1 and IMAP satellites, which were launched together in a rideshare configuration, has enabled an unprecedented level of cross-calibration between the two satellites' fluxgate magnetometers. Finally, we discuss the prospect of placing a magnetometer even further upstream from L1, on a spacecraft outfitted with a lightweight solar sail. We show that such a mission would be feasible from a magnetics perspective, as the interference would only become significant for very high frequencies, or for very large sails with side lengths comparable to the electron kinetic scales.