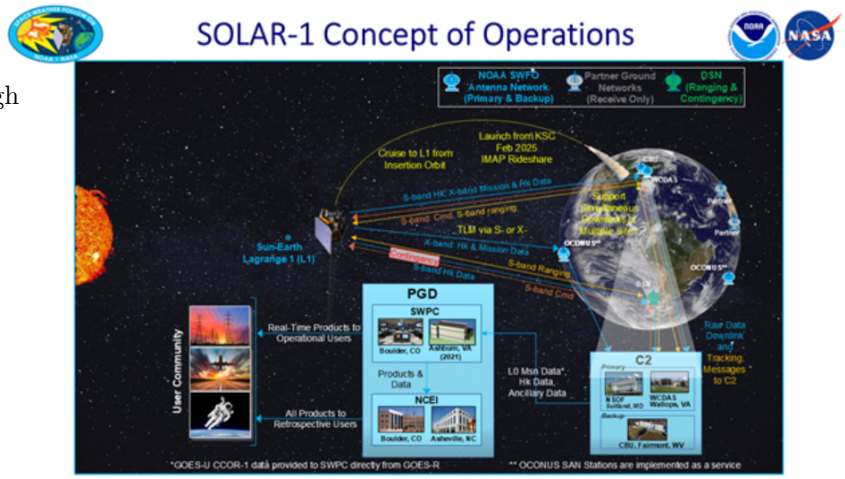
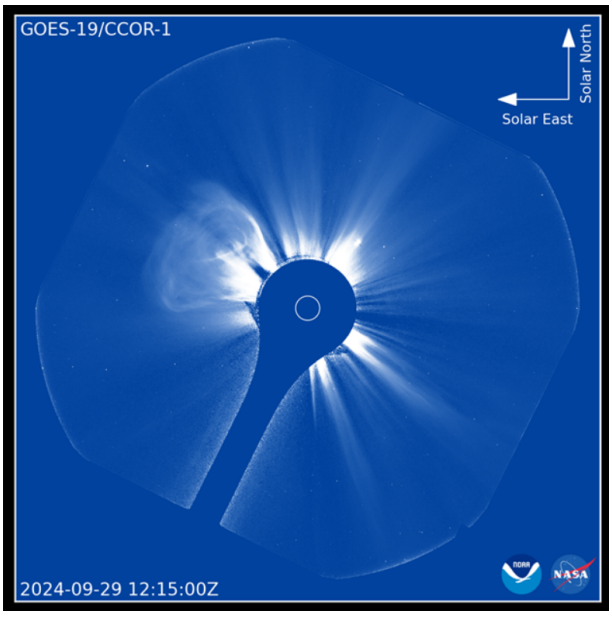
NOAA's SWFO Program: CCOR-1 and the SOLAR-1 Observatory

Dimitrios Vassiliadis[1]

[1]NOAA / NESDIS / Space Weather Observations (SWO), Lanham, United States



NOAA has recently upgraded its observations of the solar atmosphere and the near-Earth space environment through the Space Weather Follow On (SWFO) program developed in close collaboration with NASA. First, the Compact Coronagraph 1 (CCOR-1) was built by NRL to detect and track coronal mass ejections (CMEs), based on the lab's heritage of developing solar imagers, and was launched to geostationary orbit onboard NOAA's GOES-19 satellite on June 25, 2024. It is superior to legacy coronagraphs in terms of spatial resolution, dynamic range, S/N ratio, dynamic SEP-effect removal, and latency among other parameters. It is used at NOAA's SWPC (see https://www.swpc.noaa.gov/products/coronagraph), NASA's M2M, and international forecast centers, while several tools like jHelioviewer have been adapted to process its images. There is ongoing work on intercalibration and joint observations with LASCO/C3, METIS, DKIST, and other instruments, and plans to contribute to CME catalogs and other solar-science resources.



Then, on September 24, 2025, the Space Weather Observations at L1 to Advance Readiness (SOLAR-1, formerly SWFO-L1) mission was launched as a rideshare with NASA's IMAP and CGO, and traveled to the Sun–Earth Lagrange 1 point (L1). SOLAR-1 carries a nearly identical coronagraph, CCOR-2, as well as three in situ instruments to measure the solar wind plasmas, interplanetary magnetic field (IMF), and suprathermal-particle flux. After commissioning, NASA handed over the spacecraft to NOAA on April 21. SOLAR-1 is currently in the final stage of product validation with the magnetic-field data accessible at NOAA's Space Weather Portal (SPOT; https://www.ncei.noaa.gov/cloud-access/space-weather-portal/). SOLAR-1 will soon replace NOAA's legacy DSCOVR mission and the operational use of SOHO's LASCO/C3 coronal images and ACE solar wind measurements.

The new plasma, IMF, and particle measurements have provided a glimpse into the turbulent environment that is the solar wind at 1 AU, and will be used to extend the decades-long datasets of interplanetary missions. The space-science and statistical-physics communities have used a wide range of nonlinear dynamical and complex-systems approaches to model and in some cases predict these fascinating heliospheric plasma systems.