SO/PHI-HRT, third data release. L2 level, first version.

The third data release includes L2 SO/PHI-HRT datasets from RSW <u>7, 8, 10, 11, and 12</u> (version 1).

The on-ground processing pipeline includes correction for optical aberration. However, reconstruction for diffraction at the entrance pupil is not applied. The quality of the correction is variable, depending on the availability of suitable phase-diversity calibration files (not always available, mostly due to off-pointing) and on the status of the instrument across the orbit (see Kahil et al., 2023 and Bailén et al., 2024). Only the continuum is used for the flat field correction, while a cavity-map based wavelength correction is applied and a cross-talk correction which allows a variation of the cross-talk along the image (2D plane) to account for a gradient over the field of view (FoV). The RTE inversion is applied with different input parameters and polarimetric weights depending on whether the pixel is considered magnetically active or not.

visible. In a few cases, weak residual signatures of the prefilter and cavity map error remain at the edges of the FoV. Few SOOPs in RSW 7 and 8 are also affected by slightly higher noise due to a higher compression ratio, but the quality of the data is still excellent.

At this point in time almost all, but not quite all of the data is released to SOAR. The criteria for SOAR upload is that either data are properly calibrated, or it is not expected that the calibration will improve in the near future. Nevertheless, the data are in a state suitable for scientific exploitation. The datasets uploaded to SOAR belong to the following SOOPs:

- RSW 7: Full Disk Mosaic, Composition Mosaic, RS-burst, Slow Wind Connection
- RSW 8: Nanoflares (4 instances), Bright Points, Sunspot Oscillations, RS-burst (2 instances), Connection Mosaic
- RSW 10: RS-burst (2 instances), Connection Mosaic, Fast Wind
- RSW 11: AR_Long_Term, Polar Observation, Atmospheric Dynamics Structure, CH Boundary Expansion
- RSW 12: Fast Wind, Full Disk Mosaic, AR Heating (5 instances), Sunspot Oscillations, Bright Points, Polar Observation

The remaining data will be uploaded to SOAR as soon as better calibrations are attained. This includes the Polar Observation (RSW 7), Probe Quadrature (RSW 10), Earth Quadrature (RSW 10) SOOPs.

The datasets acquired in RSW 9 (Slow Wind Connection and Polar Observation) are not (and will not be) released because of an operational problem with the ISS that compromised the quality of the data.

All standard observables are released:

- *icnt*: continuum intensity computed by the RTE inversion;
- *vlos*: longitudinal velocity computed by the RTE inversion;
- *bmag*: magnetic field strength computed by the RTE inversion;
- *binc*: magnetic field inclination computed by the RTE inversion;
- *bazi*: ambiguous magnetic field azimuth computed by the RTE inversion;
- *blos*: longitudinal magnetic field computed from *bmag* and *binc* (note that *blos* is typically more robust than either *bmag* or *binc*);
- *stokes*: full Stokes vector (I, Q, U, V) measured in 5 points within the absorption line and in one point in the near continuum (measured continuum).

If any publications are produced to which SO/PHI data contribute in any way, we would request you to cite the relevant instrument papers:

- Solanki, S. K., del Toro Iniesta, J. C., Woch, J., et al. 2020, A&A, 642, A11, DOI: <u>10.1051/0004-6361/201935325;</u>
- Gandorfer, A. M., Grauf, B., Staub, J., et al. 2018, in Society of Photo-Optical Instrumentation Engineers (SPIE) Conference Series, Vol. 10698, Space Telescopes and Instrumentation 2022: Optical, Infrared, and Millimeter Wave,1403–1415, DOI: <u>10.1117/12.2311816</u>.

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We would appreciate receiving a copy of any publication you produce that profits from SO/PHI data at this email: sophi_support [at] mps.mpg.de

We would be glad if you can report to us about any problem or issue encountered in using SO/PHI data. Please contact sophi_support [at] mps.mpg.de

Further information is given at: <u>https://www.mps.mpg.de/solar-physics/solar-orbiter-phi</u>