SPICE Data Release 3.0

SPICE consortium

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Access to data:

- For this release: https://spice.osups.universite-paris-saclay.fr/spice-data/release-3.0/.
- All SPICE data: through the ESA Solar Orbiter Archive.
- All releases: https://spice.osups.universite-paris-saclay.fr/spice-data/

This data pack contains Solar Orbiter/SPICE data recorded during:

- Cruise Phase: Short Term planning Period 100 (STP122) to 179. These data were acquired early in the mission, under variable instrument configurations.
- Nominal Mission Phase, from STP180.

We distribute both Level 2 (L2, calibrated) and Level 1 (L1, uncalibrated) files. However, scientists should use L2 and not L1 files for their research. L2 data take into account all the calibration parameters quantified at the time of the release. L1 files are only provided to investigate possible issues with the conversion from L1 to L2. The conversion software will eventually be released in SolarSoft. Users should contact the SPICE team in case they think they have a good reason to use L1 files.

Citation and acknowledgements

Scientific papers using SPICE data from this data release must:

- Cite the SPICE instrument paper "SPICE consortium et al, A&A, 2020 DOI:10.1051/0004-6361/201935574";
- Cite this data release: DOI:10.48326/idoc.medoc.spice.3.0. This can be done following the suggestions by DataCite;
- Include the following statement in the acknowledgements section:

> The development of SPICE has been funded by ESA member states and ESA. It was built and is operated by a multi-national consortium of research institutes supported by their respective funding agencies: STFC RAL (UKSA, hardware lead), IAS (CNES, operations lead), GSFC (NASA), MPS (DLR), PMOD/WRC (Swiss Space Office), SwRI (NASA), UiO (Norwegian Space Agency).

The usage of SPICE images as online web graphics or in printed materials must mention "Image Courtesy: ESA/Solar Orbiter/SPICE".

Documentation

- The SPICE instrument is described in: SPICE consortium et al 2020, A&A
- The processing steps applied to produce the L2 data are described in section 3.3.3 of the Data Product Description Document
- The SPICE data user's manual (preliminary version)
- IDL users: make sure you have an up-to-date SolarSoftWare distribution
- Python users: if you are using sunraster, make sure your version is >=0.4.3

Known limitations

- The wavelength calibration is the pre-flight one. In-flight wavelength calibration is ongoing. The wavelength calibration will be updated in subsequent releases.
- The time-dependent degradation of sensitivity is not taken into account at the moment.
- Burn-in of the detector (sensitivity degradation in the strongest lines) is not yet taken into account.
- The spatial resolution is lower than measured pre-flight: 5.4" from ground tests, 6.7" in flight.
- The spectral resolution is lower than measured pre-flight: (a) 2" slit, SW channel: ground test – 4.7 pixels, flight – 7.8 pixels; (b) 2" slit, LW channel: ground test – 5.3 pixels, flight – 9.4 pixels.
- There is a systematic bias in measurements of Doppler velocities correlated to the intensity gradients — an effect qualitatively similar to what was reported in SoHO/CDS (Haugan 1999) and Hinode/EIS (Young et al. 2012; Warren et al. 2018), although with a larger magnitude. The source of this bias appears to be a combination of anisotropic PSFs (i.e., astigmatism) in both the telescope and spectrometer sections. An effort is on-going to model the effect and to devise corrective actions. As of today, we recommend not to interpret Doppler velocities in SPICE data without contacting the instrument team for advice. A deconvolution software is being developed (Plowman et al. 2023), the method is currently under test prior to deployment.
- Some specific observations have been done during spacecraft "Wheel Off-Loading" (WOL) events for testing purposes, then the pointing was unstable: this concerns e.g. files with SPIOBSID 100663338 (STP184), 100663445 (STP187), 100663526 (STP189). The correct pointing information is however present in the WCSDVARR FITS file HDUs and the data can be rectified if needed.
- Observations made during commissioning and cruise-phase were mostly of engineering

type and are therefore not all suitable for scientific analysis. Caution is recommended when using these. STP134 for example if unfit for scientific analysis.

- Files built from incomplete telemetry (with header COMPLETE='I') are also unfit for scientific analysis.

Change log

New in Data Release 3.0

- L1 and L2: Wide-slit observations are no longer reversed in the wavelength dispersion dimension, i.e. Instrument-X is now increasing with increasing wavelength pixel.
- L1 and L2: Temperature dependent SPICE vs spacecraft pointing offset taken into account when calculating WCS keywords.
- L1 and L2: Information on pointing variations due to spacecraft pointing instabilities during the observation is put in two separate WCSDVARR image extensions (one per dimension).
- L2: Adjacent windows that are merged now occur only once in the FITS file.
- L2: Binary table extensions containing detailed information on lost telemetry have been removed.
- L1 and L2: Several changes to the metadata contents. See the Data Product Description Document for details.