Parker Solar Probe SWEAP-SPC
Data Release Notes

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Overview of Measurements: DCP-3a level 3

The SWEAP team is pleased to release the SPC level 3 ion data from Encounter 3. The files contain data from the time range July 20, 2019 - October 13, 2019. This includes all SPC data transmitted during Data Collection Period 3a (DCP-3a).

The derived measurements released here correspond in 1-to-1 fashion with the [level 2] measurement spectra that comprise the previous release. Each level 3 file corresponds uniquely to the level 2 file of the same date, and each time point therein to the same time point in the level 2 file.

This release comprises all measurements of suitable quality made by the SPC instrument from the end of the Release 1 period through October 13, 2019. These data have been processed with version 01 of the SPC data analysis pipeline. They are consistent and continuous with Release 1 in all respects, including format and calibration. No Release 1-2 data have been revised or replaced at this time. The Release 1-2 notes in the sections that follow therefore apply to this release as well.

The data are, as before, provided in daily files `psp_swpspc_l3i_YYYYMMDD_v01.cdf`. Files have only been created for dates where SPC observations were made and transmitted.

Overview of Measurements: DCP-3b level 2

The SWEAP team is pleased to release the SPC level 2 ion data from Encounter 3. The files contain data from the time range December 12, 2019 - January 10, 2020. This includes all SPC data transmitted during Data Collection Period 3b (DCP-3b).

This release comprises all measurements of suitable quality made by the SPC instrument from the end of the Release 2 period through January 14, 2020, excluding the date of the 2nd Venus encounter. These data have been processed with version 01 of the SPC data analysis pipeline. They are consistent and continuous with Release 1 in all respects, including format and calibration. No Release 1 data have been revised or replaced at this time. The Release 1-2 notes in the section that follows therefore apply to this release as well.

The data are, as before, provided in daily files `psp_swpspc_l2i_YYYYMMDD_v01.cdf`. Files have only been created for dates where SPC observations were made and transmitted.
SPC Encounter 3 remarks

Please refer to the Release 2 remarks, which apply to this release as well.
Overview of Measurements

The SWEAP team is pleased to release the SPC level 2 ion data from Encounter 3. The files contain data from the time range July 20, 2019 - October 13, 2019. This includes all SPC data transmitted during Data Collection Period 3a (DCP-3a).

This release comprises all measurements of suitable quality made by the SPC instrument from the end of the Release 1 period through October 13, 2019. These data have been processed with version 01 of the SPC data analysis pipeline. They are consistent and continuous with Release 1 in all respects, including format and calibration. No Release 1 data have been revised or replaced at this time. The Release 1 notes in the section that follows therefore apply to this release as well.

Data have been, as before, provided in daily files `psp_swp_spc_l2i_YYYYMMDD_v01.cdf`. Files have only been created for dates where SPC observations were made and transmitted.

SPC Encounter 3 remarks

Encounter 3 is officially defined as the period from August 27, 2019 at 02:18:40 UT to September 07, 2019 at 09:20:54 UT. It includes the third perihelion, which occurred on September 01, 2019 17:49:47 UT at a solar distance of 35.67 \( R_{\text{sun}} \).

The SPC instrument was halted on August 30, 2019, at approximately 17:30 UT. This stoppage has been attributed to a “red limit violation”-- an instance where a diagnostic of a component’s electrical current draw exceeded its predetermined safety threshold. It was later determined that the safety threshold itself was set erroneously low, leading to a violation during normal function.

As a result of this halt, no SPC measurements were recorded from August 30, 2019 at 17:30 UT to September 18, 2019 at 23:30 UT. The gap spans more than 70% of Encounter 3, and it includes the perihelion period.

Data quality up to the halt was very good. The full scan parameterization issue described in the Release 1 notes (see SPC Encounter 2 remarks) has been resolved and verified. Encounter 3 data are not affected by that issue.

The instrument was restarted on September 18, 2019, and normal function was verified. The incorrect limit was revised. Future encounters will not be affected.
Overview of Measurements

The SWEAP team is pleased to release the data from Encounter 1 and Encounter 2. The files contain data from the time range October 31, 2018 - June 18, 2019.

The prime mission of Parker Solar Probe is to take data when within 0.25AU of the Sun during its orbit. However, there has been some extended campaign measurements outside of this distance. The data are available for those days that are within 0.25AU as well as those days when the instruments were operational outside of 0.25AU.

Each SWEAP data file includes a set of a particular type of measurements over a single observing day. Measurements are provided in Common Data Format (CDF), a self-documenting data framework for which convenient open source tools exist across most scientific computing platforms. Users are strongly encouraged to consult the global metadata in each file, and the metadata that are linked to each variable. The metadata includes comprehensive listings of relevant information, including units, coordinate systems, qualitative descriptions, measurement uncertainties, methodologies, links to further documentation, and so forth.

Level 2 and 3, version 01 release notes

General remarks

Efforts have been made to distill all exceptional conditions that can affect normal data analysis into the “GENERAL_FLAG” variable, which can be found in all of the l3i files. In all data quality flags, a value of 0 signifies “good/no condition present”. In this version, all data are organized as time series such that the set of time points, EPOCH.DAT, is the same in l2i and l3i for a given date.

SPC Level 2 ion data

(“psp_swp_spc_l2i_YYYYMMDD_v01.cdf”)

This data product contains measurements of ion flux as a function of energy, organized into spectra. The SPC instrument measures one-dimensional distributions with a wide field of view. Please refer to the instrument paper for details.
This data set covers all periods for which the instrument was turned on and taking data in the solar wind in ion mode. This includes maneuvers affecting the spacecraft attitude and orientation.

The MODE_FLAG variable contains information about the type of spectrum being measured. “Ion full scan” spectra are marked with MODE_FLAG.DAT = 1. These spectra comprise a broad energy range, typically with lower signal-to-noise than the more frequent “ion peak tracking” spectra, which are marked with MODE_FLAG.DAT = 0. In the most frequent operating mode, Ion full scans are executed once every ~30 seconds or whenever the peak signal from the solar wind is poorly defined.

SPC Level 2 ion data quicklook plots
(“psp_swp_spc_l2i_YYYYMMDD_v01.png”)

These are browse-spectrogram plots showing the contents of the corresponding l2i data file. Ion full scan and ion peak tracking spectra are co-plotted, which can manifest as vertical bars or dashed lines.

SPC Level 3 ion data
(“psp_swp_spc_l3i_YYYYMMDD_v01.cdf”)

This data product contains derived measurements of ion properties in the solar wind, including density, temperature, velocity vector. These measurements correspond 1-to-1 with spectra in the psp_swp_spc_l2i file for the same date. It may be convenient for some applications to cross-reference the two — For example, the corresponding l3i file contains ephemeris and data quality flag information that may be useful for an investigator who is concerned only with l2i type measurements.

Conditions that impact measurement quality are documented in the “DQF” variable, which contains a 32 element flag array for each measurement time. Each element of the array is reserved to signify a specific condition. These conditions are described in the “DQF_FLAGNAMES” variable. In this version, for example, DQF_FLAGNAMES.DAT[23] is set to “spacecraft maneuver.” If measurement i was made during a spacecraft maneuver, it is thus flagged with DQF.DAT[23,i] = 1.

In version 01, measurements are not provided (i.e. variables are set to fill) during spacecraft maneuvers, under conditions of low signal-to-noise, and during certain observed transients. Such conditions are rare during encounters, but increasingly frequent in interplanetary cruise. These are documented in the “DQF” variable. Remarks are also provided in the “SPC Reduced Data Quality Periods” table.
In version 01, the solar wind alpha particle component is not measured (i.e. variables are set to fill).

**SPC Encounter 1 remarks**

Data quality is very good for the duration of the encounter. The solar wind flow was within the optimal field of view for the SPC instrument for nearly the entire encounter — See data flags for specific exceptions. As with all encounters, signal-to-noise is higher during approach than egress, which is reflected in the typically smaller uncertainties and less frequent “primary peak low signal” flag events.

**SPC Cruise phase remarks**

Measurements recorded during cruise phase are not all transmitted to Earth. The typical return is 1 spectrum out of every 32.

**SPC Encounter 2 remarks**

Due to an erroneous setting in the operating mode for this encounter, ion full scan spectra and certain spectra immediately following ion full scans are of reduced quality. In the affected full scan spectra, the energy steps over an initial portion of the measurement spectra have zero width (i.e. l2i variables MV_LO.DAT = MV_HI.DAT), and the corresponding measurements are purely noise. In some cases, this results in a poor determination of the proton “primary peak” energy, inducing additional subsequent full scans that are subject to the same incompleteness. In other cases, the energy range for the subsequent “ion peak tracking mode” scan is not ideal. The affected l3i measurements have been flagged with DQF.DAT[22] = 1 (“energy ranging/peak tracking error”) and/or set to fill.

The operating mode has been revised such that future encounters will not be so affected.
SWEAP Science Working Group Information

For a further discussion of the scientific uses of the data please join the Parker Solar Probe Working Group which will meet Tuesdays and run for 2 hours starting November 19. Call in information and times will be posted on the SWEAP and FIELDS website prior to the meeting. Announcements will also be made in SPA and Solar newsletters.