Imperial College London

MAG Data Release Report 2209

25 April 2023 (report covers data release for 1-30 September 2022)

Report Version	1	L2 ground processing software version:	V2.22
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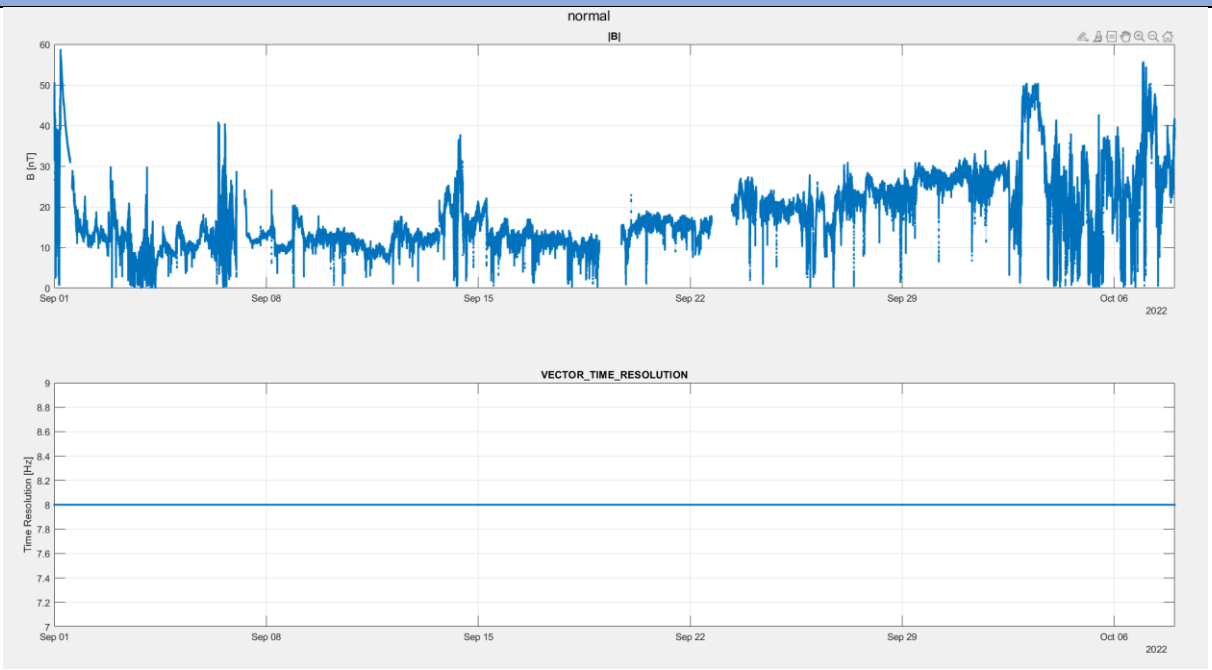
Data Summary

MAG was on for the period 1-30 September 2022. BM is available at 64 vectors/s for the whole period. The spacecraft flew past Venus on the 4th of September: data is also released in VSO coordinates for 3, 4, 5 September.

Spacecraft noise was observed particularly in IBS data for several periods (periods within the 02/09,05/09,06/09,07/09,11/09,12/09,18/09,19/09,22/09-26/09,30/09 for a total of 52 hours). This noise is very clear in IBS, the source has not been identified. We can see evidence for it being there in OBS as well, and do not have the algorithms to clean this from the data. The magnetic field data have been converted to NaNs when the noise in the data was particularly high. The full period of missing data is listed in the appendix of this report. If you have need for any data during these periods, please contact the MAG team and we see if the data maybe suitable for release for certain applications.

The spacecraft started the month at 0.75AU and at the end it was at 0.40AU from the Sun.

Normal Mode

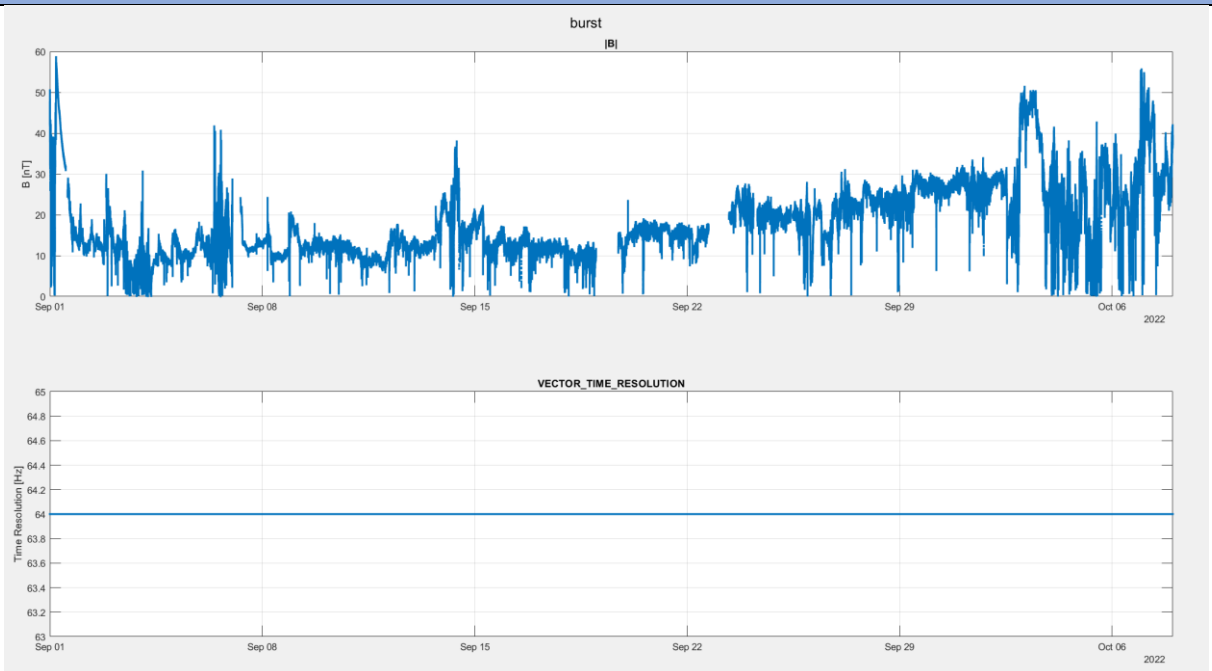


Operations	1-30 September	Science phase throughout period, normal data produced for exceptions see Appendix

Operational Events of Note	Venus Flyby 4/09 Battery Top up 01/09/2022 12:37-15:27 – MAG data not available

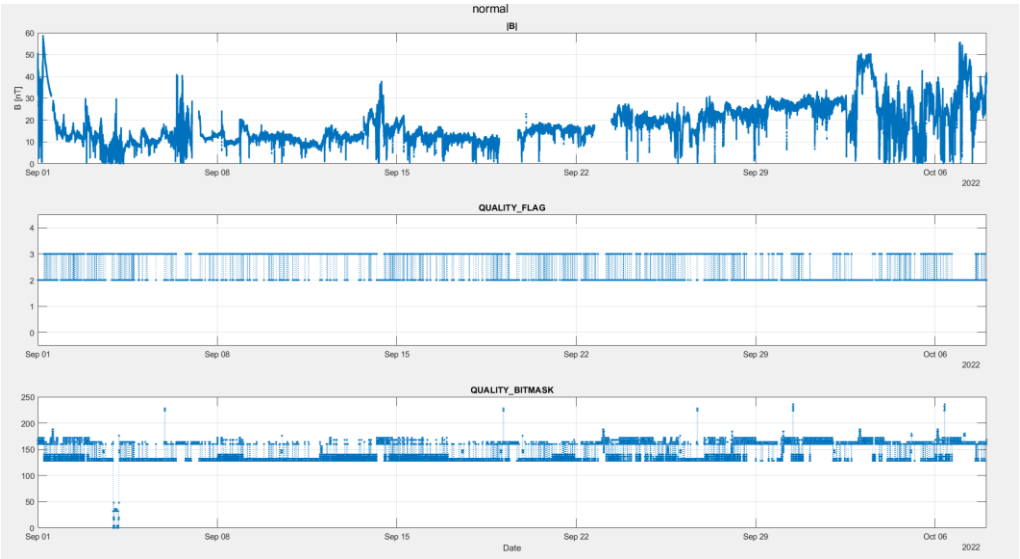
Data Gaps greater than one minute:
NaNs have been introduced during the noisiest periods because the data was highly disturbed. See Appendix for details.

Burst Mode



Coverage	From	To	Coverage
	01/09	30/09	24h of 64 vectors/s exceptions listed in Appendix

Quality bitmask

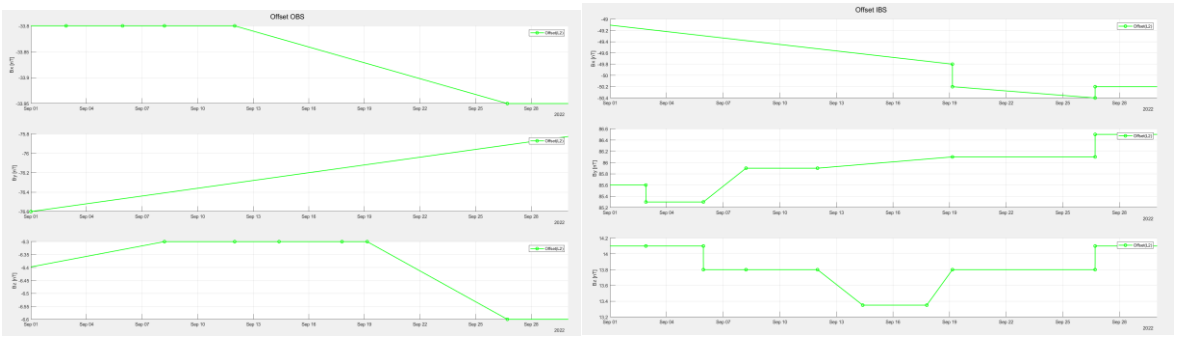


Quality bit mask events	
SC events which disturb the field	1. Solar array movements (solar array angle is changed, and then remains at new angle due to sun-SC distance thermal constraints) 2. High gain antenna movements

SC related issues

Time	Reason
05/09/2022 22:44 - 22:45	SA movement from 55.91 to 59.96 deg
02/09/2022 21:29 - 21:39	HGA movement -161.6 to -169.0 azimuth angle
04/09/2022 05:39 - 05:44	HGA movement -169.0 to -170.3 azimuth angle
08/09/2022 04:54 - 05:04	HGA movement -170.3 to 162.2 azimuth angle
19/09/2022 03:38 - 03:40	SA movement from 59.96 to 70.02
26/09/2022 17:11 - 17:12	SA movement from 70.02 to 72.98
30/09/2022 10:42 - 10:43	SA movement from 72.98 to 76.91

Offsets



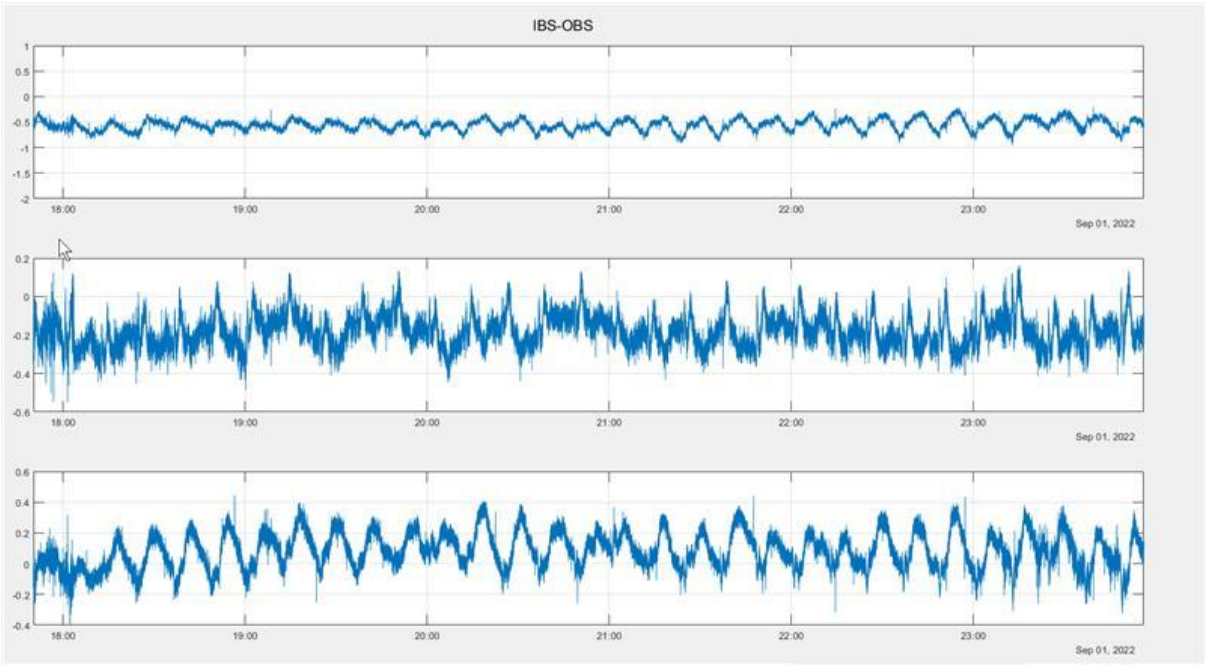
1-30 Sep:
The OBS offset in Z changed due to the HGA movement and a value was chosen to offset this. IBS offsets changed after the HGA movement on the 2nd and 8th of Sep and on the 5th and 26th due to the SA movement. Between these events, the offset linearly changed and the trend has been chosen accordingly.

OffsetNumber	Date	OBSX	OBSY	OBSZ	IBSX	IBSY	IBSZ	Comment
220902	31/08/2022 19:49	-33.80	76.6	-6.4	-49.1	86	14.1	Post SA movement from 30 to 56 deg
220903	31/08/2022 23:59		-77					Continuation
220904	02/09/2022 21:35	-33.80				86	14.1	Pre HGA movement
220905	02/09/2022 21:39	-33.80				85	14.1	Post HGA movement
220906	05/09/2022 22:45	-33.80				85	14.1	Pre SA movement from 56 to 60 deg

220907	05/09/2022 22:45	-33.80				85	13.8	Post SA movement from 56 to 60 deg
220908	08/09/2022 04:59	-33.80					13.8	Pre HGA movement
220909	08/09/2022 05:02	-33.80		-6.3		86	13.8	Post HGA movement
220910	12/09/2022 00:00	-33.80		-6.3		86	13.8	Change linear trend both
220911	14/09/2022 09:30			-6.3			13.35	Change linear trend IBS
220912	17/09/2022 19:00			-6.3			13.35	Change linear trend IBS
220913	19/09/2022 03:38			-6.3	-49.8	86	13.8	Pre SA movement from 60 to 70 deg
220914	19/09/2022 03:41				-50.2	86	13.8	Post SA movement from 60 to 70 deg
220915	26/09/2022 17:11	-33.95			-50.4	86	13.8	Pre SA movement from 70 to 73 deg
220916	26/09/2022 17:12			-6.6	-50.2	87	14.1	Post SA movement from 70 to 73 deg
220917	30/09/2022 10:42			-6.6	-50.2	87	14.1	Pre SA movement from 73 to 76 deg
220918	30/09/2022 10:44			-6.6	-49.8	87	14	Post SA movement from 73 to 76 deg
220919	01/10/2022 00:00	-33.95	-76	-6.6	-49.8	87	14	Linear Trend in Y

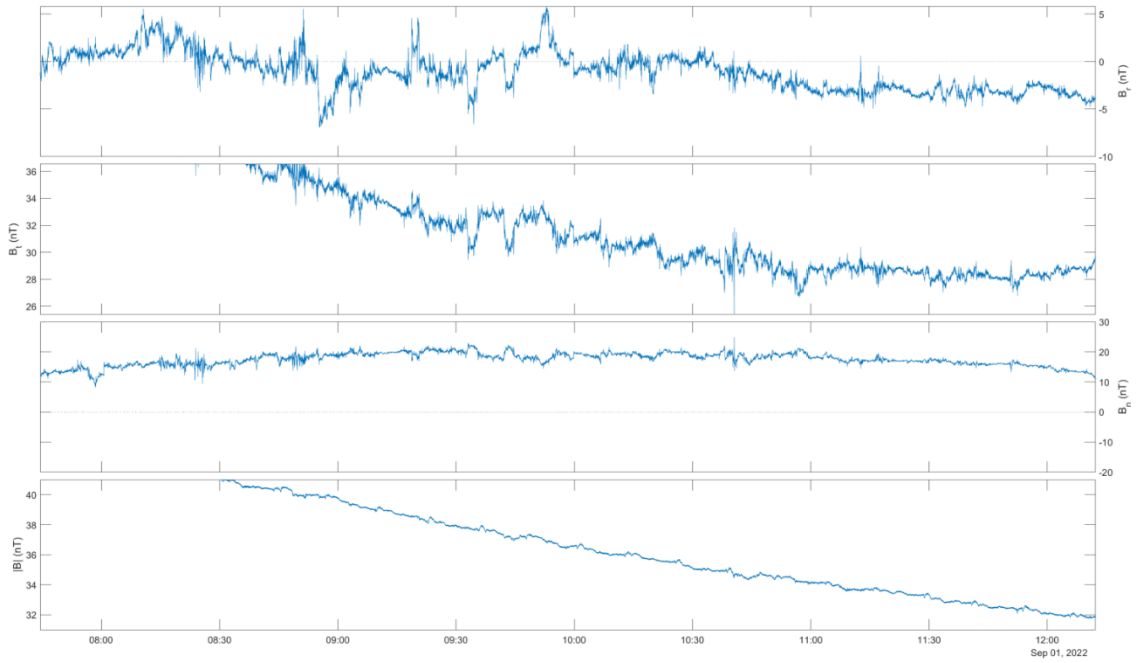
Residual MAG heater signal in data

Interference from the MAG heater is routinely characterised and removed from the data. This removal is not perfect, and there is evidence in the MAGIBS-MAGOBS data (shown below) that some residual level of signal is still present in the archive data. The magnitude of this error in the released archive data will be less than the error presented below in IBS-OBS. The heater cycle is ~15 minutes, and heater on/off status is reported in the quality bitmask.

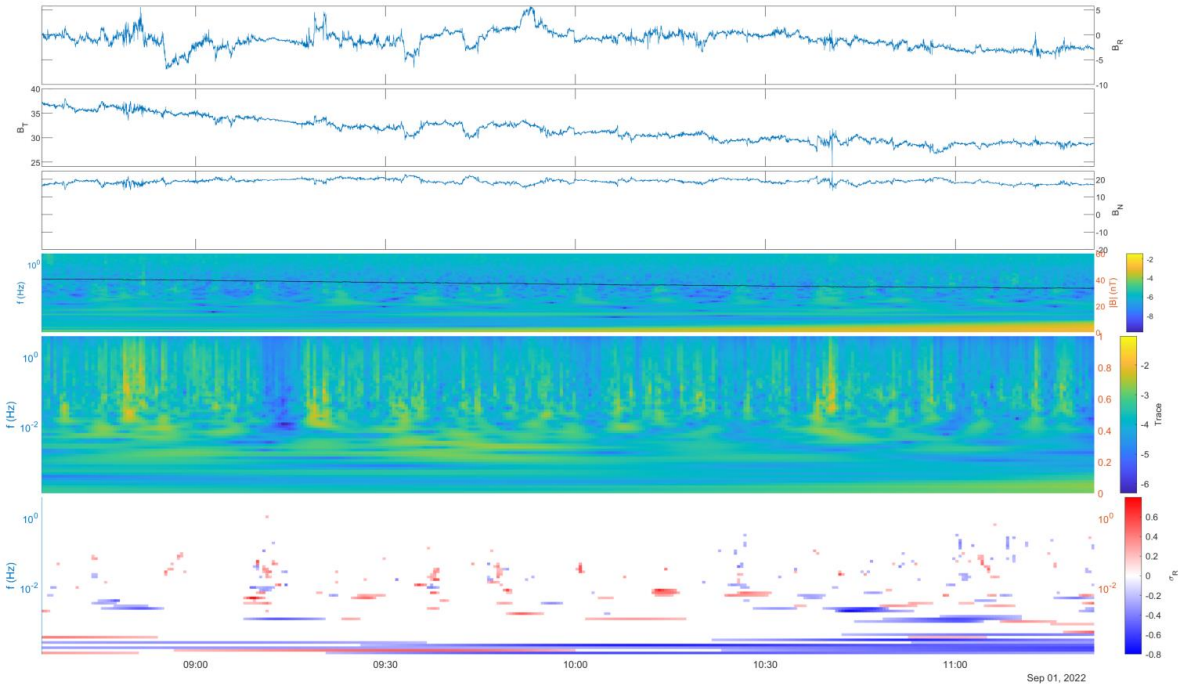


Example of heater generated interference as seen in the MAGIBS-MAGOBS time series for September 1 2022. Y axis is in nT for sensor coordinates X, Y Z (top middle bottom panels).

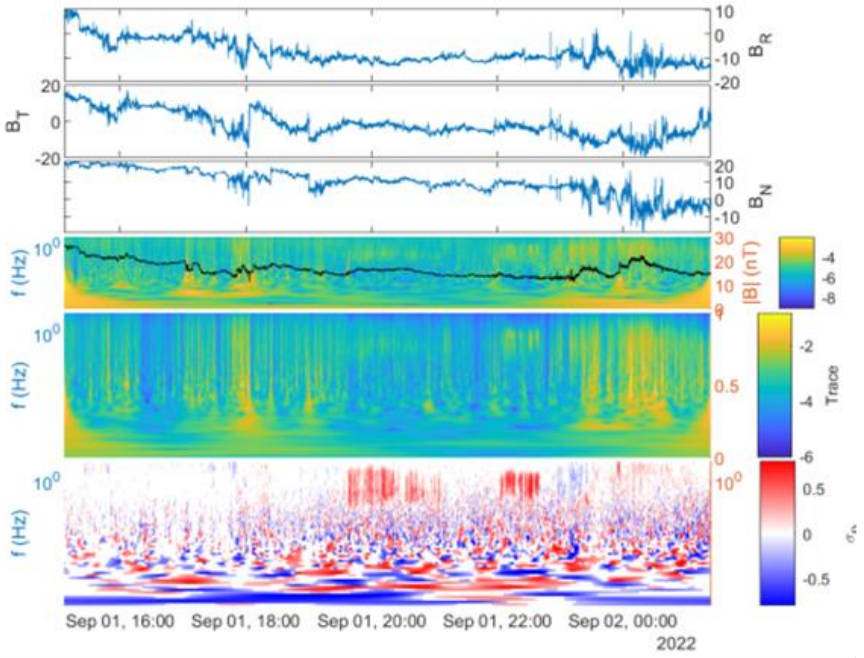
However, analysis was undertaken to look at the magnitude of the natural signal against the heater interference signature, and usually the natural signal is much higher than the error profile from the heater. At very quiet times (especially during the CME flux rope on 1 September) there is some evidence of the heater operation in the field magnitude:



When looking at the components, the heater signal is much less than the natural magnetic field, as seen in the figure below.



Especially for later periods, for example towards the end of 01/09 to 02/09, the heater interference is no longer visible.



Therefore, the data has been released.

Appendix

Appendix A: NANs periods of the month

This table shows the NaN periods which have been introduced in the data due to SC interference. The disturbance observed in the IBS-OBS data set is large that we cannot quantify the impact on OBS, therefore we have set this data to NaN. If you have a need to see this data, please get in contact with the MAG team and we can discuss this with you.

StartTime	EndTime	Comment
01/09/2022 12:35	01/09/2022 14:00	Battery top up
02/09/2022 20:00	02/09/2022 20:30	SC interference
05/09/2022 22:27	05/09/2022 23:23	SC interference
05/09/2022 22:45	05/09/2022 22:45	SA movement from 56 to 60 deg
06/09/2022 10:45	06/09/2022 11:30	SC interference
06/09/2022 16:30	06/09/2022 17:30	SC interference
07/09/2022 00:25	07/09/2022 06:45	SC interference
11/09/2022 01:37	11/09/2022 02:54	SC interference
12/09/2022 09:50	12/09/2022 10:01	SC interference
18/09/2022 12:09	18/09/2022 13:00	SC interference
19/09/2022 00:00	19/09/2022 17:30	SC interference
19/09/2022 03:38	19/09/2022 03:41	SA movement from 60 to 70 deg
22/09/2022 05:05	22/09/2022 06:10	SC interference
22/09/2022 17:00	23/09/2022 09:00	SC interference
23/09/2022 18:30	23/09/2022 19:30	SC interference
24/09/2022 04:30	24/09/2022 07:30	SC interference
25/09/2022 10:00	25/09/2022 11:30	SC interference
26/09/2022 17:11	26/09/2022 17:13	SA movement from 70 to 73 deg
30/09/2022 10:42	30/09/2022 10:43	SA movement from 73 to 76 deg

Appendix B: Files within this release

Filename
solo_L2_mag-rtn-burst_20220901_V01.cdf
solo_L2_mag-rtn-burst_20220902_V01.cdf
solo_L2_mag-rtn-burst_20220903_V01.cdf
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