The solar data presented here have been reduced using version 3.2.0 of the ESPRESSO Data Reduction Software (DRS). Details about the reduction and the obtained data are given in the following paper: Dumusque et al. 2025. Please make reference to this paper and the data release DOI (10.83364/dace-h4s8lp7c) for any publication using those solar data

Data available in file harpn_sun_release_timeseries_2015-2025.csv and corresponding keywords returned from DACE-API

GROUP	NAME	DESCRIPTION	UNIT	TYPE	NAME FROM DACE API	UNIT FROM API
OBS	FILE_ROOT	Name and timestamp of the observation	-	STRING	FILE_ROOTPATH	-
	NIGHT	Day in which the data where taken, from 9am to 9am the next day	-	STRING	DATE_NIGHT	-
	BJD	Barycentric Julian Date minus 2400000	days	FLOAT	OBJ_DATE_BJD	days
	ALPHA	Right ascencion of the Sun at the time of the measurement photocenter	hms	STRING	-	
	DELTA	Declination of the Sun at the time of the measurement photocenter	dms	STRING	-	
	TEXP	Exposure time	sec	FLOAT	TEXP	sec
	AIRMASS	Airmass of the Sun at the time of the measurement photocenter	-	FLOAT	-	-
	PHOTOCENTER	Flux barycenter of the measurement (between 0 and 1)	-	FLOAT	-	-
	SN_ORDER_20	Signal to noise in order 20	-	FLOAT	SPECTRO_FLUX_SN20	-
	SN_ORDER_50	Signal to noise in order 50	-	FLOAT	SPECTRO_FLUX_SN50	-
	SN_ORDER_60	Signal to noise in order 60	-	FLOAT	SPECTRO_FLUX_SN60	-
	OBS_QUALITY	Quality flag to assess the observation's quality in term of RV precision. Values above 0.9 assure data are not significantly affected by clouds and calima. See section 2.3 in Collier-Cameron et al. (2019) for more information.	-	FLOAT	SPECTRO_ANALYSIS_QUALFLAG	-
	DATA_QUALITY	1.0 for data that passed all quality curations, 0.0 for rejected	-	FLOAT	SPECTRO_DRS_QC	-
RVs	RV_RAW	RV of the Sun in the Solar System barycenter rest frame, as extracted by the DRS	km/s	FLOAT	SPECTRO_CCF_RV	m/s
	RV	RV of the Sun in the heliocentric rest frame, corrected for differential extinction and optimized RV correction. This value is obtained by substracting BERV_BARY_TO_HELIO, RV_DIFF_EXTINCTION, RV_OPTIMISED_CORR and constant 0.16759939657 to RV_RAW	km/s	FLOAT	SPECTRO_CCF_RV_CORR	m/s
	RV_ERR	RV error	km/s	FLOAT	SPECTRO_CCF_RV_ERR	m/s
ACTIVITY	RHK	Log(R'hk) calcium activity index	dex	FLOAT	SPECTRO_ANALYSIS_RHK	dex
	RHK_ERR	Log(R'hk) calcium activity index error	dex	FLOAT	SPECTRO_ANALYSIS_RHK_ERR	dex
	SMW	S Mount Wilson calcium activity index	-	FLOAT	SPECTRO_ANALYSIS_SMW	-
	SMW_ERR	S Mount Wilson calcium activity index error	-	FLOAT	SPECTRO_ANALYSIS_SMW_ERR	-
	MG2	Bremen Composite Magnesium II activity index for the Sun interpolated to the HARPS-N time of measurements (see https://www.iup.uni-bremen.de/UVSAT/data/ for more info)	-	FLOAT	-	-
	BIS_SPAN_RAW	Bisector span of the CCF as extracted from the DRS	km/s	FLOAT	SPECTRO_CCF_BISPAN	m/s
	BIS_SPAN	Bisector span corrected for blaze variations (see Sect. 3.4 in Dumusque et al. 2025)	km/s	FLOAT	-	m/s
	BIS_SPAN_ERR	Bisector span error of the CCF as extracted from the DRS	km/s	FLOAT	SPECTRO_CCF_BISPAN_ERR	m/s
	FWHM_RAW	Raw FWHM of the CCF as extracted from the DRS	km/s	FLOAT	SPECTRO_CCF_FWHM	m/s
	FWHM	FWHM of the CCF, corrected for the solar ecliptic obliquity and Earth orbit eccentricity (See section 3.2 in Collier-Cameron et al. 2019 for more information) and blaze variations (see Sect. 3.4 in Dumusque et al. 2025)	km/s	FLOAT	SPECTRO_CCF_FWHM_CORR (no blaze variation correction)	m/s
	FWHM_ERR	FWHM error of the CCF as extracted from the DRS	km/s	FLOAT	SPECTRO_CCF_FWHM_ERR	m/s
	CONTRAST_RAW	Raw contrast of the CCF as extracted from the DRS	%	FLOAT	SPECTRO_CCF_CONTRAST	%
	CONTRAST	Contrast of the CCF corrected for the FWHM correction so that the equivalent width of the CCF is conserved (see section 3.2 in Collier-Cameron et al. 2019 for more information) and for blaze variations (see Sect. 3.4 in Dumusque et al. 2025)	%	FLOAT	SPECTRO_CCF_CONTRAST_CORR (no blaze variation correction)	%
	CONTRAST_ERR	Contrast error of the CCF as extracted from the DRS	%	FLOAT	SPECTRO_CCF_CONTRAST_ERR	%
CORRECTIONS	BERV	Barycentric Earth RV correction	km/s	FLOAT	SPECTRO_CAL_BERV	km/s
	BERV_BARY_TO_HELIO	Correction to change from the barycentric to heliocentric rest frame. To change from the heliocentric to barycentric rest frame, just add this term to the RV vector	km/s	FLOAT	SPECTRO_ANALYSIS_BERV_HELIO_BARY	m/s
	RV_DIFF_EXTINCTION	Estimation of the RV effect induced by differential extinction (see section 2.4 in Collier-Cameron et al. 2019 for more information). This correction is already applied to the RV vector. To remove it, simply add it.	km/s	FLOAT	SPECTRO_ANALYSIS_DIFF_EXTINCTION	m/s
	RV_OPTIMISED_CORR	RV effect due to the optimisation of the drift correction (see Sect. 3.3 in Dumusque et al. 2025) and the correction for the blaze variation (see Sect. 3.4 of the same paper). This correction is already applied to the RV vector. To remove it, simply add it.	km/s	FLOAT	SPECTRO_ANALYSIS_OPTIMIZED_RV_CORR	m/s

Available HARPS-N data reduction software products

S2D spectrum

File name	r.HARPN.XXXX-XX-XXTXX:XX:XX.XXX_S2D_A.fits (and S2D_BLAZE_A.fits)
Description	The extracted echelle-order 1d spectra, corrected from the instrumental blaze, in the Solar System barycenter rest-frame. These products are called S2D spectra due to their two dimensional shape but should not be confused with raw 2d frames. Note that when downloading a S2D spectrum using the Python API or file download via the DACE solar spectroscopy database, you will also get access to the S2D_BLAZE_A.fits file which include the instrument blaze. The first and second table in the S2D_A.fits file contain the blaze-corrected extracted flux per pixel and corresponding error for each spectral order. The error corresponds to the photon-noise plus read-out noise of the detector added in quadrature, and divided by the blaze, so that the corresponding error can be directly used with the flux given in the first table of the FITS file. We note that the blaze is not corrected in the S2D_BLAZE_A.fits file. The third table corresponds to the quality of the pixels for each order, zero being good, and anything else being bad. Hot and bad pixels are flagged that way. Tables four and five are the wavelength solution in the vacuum and in air, and tables six and seven are the width of pixels in wavelength in the vacuum and in air, respectively. The wavelengths of those spectra are in the Solar System barycenter rest-frame. Doppler shift them by the BERV_BARY_TO_HELIO plus RV_DIFF_EXTINCTION plus RV_OPTIMISED_CORR plus constant 0.16759939657 to obtain them in the heliocentric rest-frame while applying differential extinction correction and optimized RV correction. We note that all wavelengths are in Angstroms. Because of dispersion, the size of each pixel in Angstroms will change with wavelength, which implies that for a given order, the continuum of an S2D spectrum will show a significant slope. To correct for dispersion and thus get a flat continuum, the easiest is to divide the flux by the width of pixels in wavelength (divide table 1 by table six or seven, depending if you use the wavelength solution in the vacuum or the air).

S1D spectrum

File name	r.HARPN.XXXX-XX-XXTXX:XX:XX.XXX_S1D_A.fits
Description	The extracted merged-1d spectra, corrected from the instrumental blaze, in the Solar System barycenter rest-frame. These products are called S1D spectra. The only table in the FITS file includes the wavelength in the vacuum and in air for each point of the merged spectrum, its flux and the quality of the point, as defined in the first item above. We note that merged-1d spectra are interpolated on a grid constant in velocity space and not in wavelength space. The step between each point is 0.82 m/s, equivalent to the average width of a pixel in velocity space. The wavelengths of those spectra are in the Solar System barycenter rest-frame. Doppler shift them by the BERV_BARY_TO_HELIO plus RV_DIFF_EXTINCTION plus RV_OPTIMISED_CORR plus constant 0.16759939657 to obtain them in the heliocentric rest-frame while applying differential extinction correction and optimized RV correction.

CCF profile

File name	r.HARPN.XXXX-XX-XXTXX:XX:XX.XXX_CCF_A.fits
Description	The Cross Correlation Function (CCF) obtained by cross-correlating the S2D_BLAZE_A.fits spectra with the G2 synthetic mask available from the ESPRESSO DRS. The first table in the FITS file gives the CCF measured for each echelle order, with a step of 0.82 m/s, in addition to the photon-noise weighted average CCF over all orders. Therefore, the table has the shape N_{CCF} x N_{ORD}+1, where N_{CCF} is the number of points of the CCF and N_{ORD} is the number of echelle orders, 69 for HARPS-N. The grid in velocity of the CCF can be obtained by combining the following keywords from the FITS header: the starting velocity value (HIERARCH TNG RV START), the step size (HIERARCH TNG RV STEP) and the length of the CCF vector. The second table gives the photon noise errors, and the third table gives the quality of each point as defined in the description of the S1D spectrum.