HOURLY AVERAGE

Voyager hourly average tapes contain averages of all the currently available interplanetary data for an individual spacecraft. They are FORTRAN readable. The tape contains data from L, M, E1, and E2 modes and also trajectory information.

The record begins with a header section which is followed by data arranged in triplets. If q is the quantity measured, the triplet is q_{ave}, σ_q, and N_q. where

$$q_{ave} = \sum \frac{q_i}{N_q}$$

$$\sigma_q = \sqrt{\sum \frac{(q_i - q_{ave})^2}{N_q - 1}}$$

N_q = number of data points contributing to q_{ave}.

Note carefully that any parameter may be filled (there is no unique fill value); if the parameter is filled, the value of N_q is set to 0. Be sure to check that $N_q > 0$ before using an average (the fill value is not predictable).

A detailed description of the tape follows. The source of most of the parameters is the "ANSWER" array (ANS) from the Voyager analysis program VGRANL. [1]

The default values follow.

HEADER

WORD	MEANING	TYPE
0	The number of words following in record	I4
1,2	Source of data (tape label)	A8
3	Type of source: ('EDR ', 'SUM ' or 'SPL ')	A4
4	Spare	
5	Spare	
6	SC ID: ('VOY1' or 'VOY2')	A8
7	Time of data: Year (e.g. 1977 = 77)	I4
8	Time of data: Day (Jan 1 = 1)	I4
9	Time of data: Hour (0 - 23)	I4

Unless otherwise specified, the data triplet variables have the following types: q_{ave} and σ_q *are R4;* N_q is I4.

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[1] (For M.I.T. people only) The position of any variable in the hourly average array is controlled by the common block, CDOCP, and can be changed using the namelist &RUNNT. Changes should be made only with extreme care, as mixing such files can result in an unreadable data set. The TRIPLET # refers to the index of the proto HA array produced by DOCP. The IFACT effects the number of samples reported when the data is poor. (m-mode only)

IFACT == 1 ==> not effected by poor data.
IFACT == 2 ==> report number off best samples used.
IFACT == 3 ==> do not report filled data.
IFACT == 4 ==> do not report questionable proton data.
IFACT == 5 ==> do not report questionable alpha data.

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M MODE VARIABLES, from moment analysis, protons and alphas

WORD	MEANING	SOURCE	[TRIPLET #]	IFACT
	Proton Main cups			
10-12	Density (#/cc)	ANS(38)	[1]	2
13-15	V_r (km/s)	ANS(99)	[2]	2
16-18	V_t (km/s)	ANS(100)	[3]	3
19-21	V_n (km/s)	ANS(101)	[4]	3
22-24	Thermal width [2] (km/s)	ANS(133)	[5]	2
25-27	Spare		[6]	0
	Alpha Main cups			
28-30	Density (#/cc)	ANS(117)	[7]	5
34-36	Thermal width [3] (km/s)	ANS(118)	[9]	5
31-33	$\lvert\delta(V_\alpha - V_p)\rvert$	ANS(139)	[8]	5
37-39	Spare		[10]	0

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[2]

$$W_i = \left(\frac{2KT}{M}\right)^{\frac{1}{2}} \quad \text{for i = A, B, C cups.}$$

$$W = \frac{W_A + W_B + W_C}{3}$$

[3]

$$W_i = \left(\frac{2KT}{M}\right)^{\frac{1}{2}} \quad \text{for i = A, B, C, cups.}$$

$$W = \left(\frac{W_A^2 + W_B^2 + W_C^2}{3}\right)^{\frac{1}{2}}$$

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L MODE VARIABLES, from moment analysis, long integration time

WORD	MEANING	SOURCE	[TRIPLET #]	IFACT
	Proton Main cups			
40-42	Density (#/cc)	ANS(38)	[11]	2
43-45	V_r (km/s)	ANS(99)	[12]	2
46-48	V_t (km/s)	ANS(100)	[13]	3
49-51	V_n (km/s)	ANS(101)	[14]	3
52-54	Thermal width ^{2} (km/s)	ANS(133)	[15]	2
55-57	Spare		[16]	0
	Proton D cup			
58-60	Density (#/cc)	ANS(23)	[17]	2
61-63	Velocity (km/s)	ANS(27)	[18]	2
64-66	Thermal width (km/s)	ANS(37)	[19]	2
67-69	Spare		[20]	0
	E1 and E2 VARIABLES			
70-72	E1 flux $\frac{\#}{cm^2 \sec}$	ANS(16)	[21]	1
73-75	E1 temperature (K)	ANS(17)	[22]	1
76-78	E2 flux (#/cm^2 /sec)	ANS(16)	[23]	1
79-81	E2 temperature (K)	ANS(17)	[24]	1
	MAGNETIC FIELD			
82-84	B_r (nT)	ANS(96)	[25]	1
85-87	B_t (nT)	ANS(97)	[26]	1
88-90	B_n (nT)	ANS(98)	[27]	1
91-93	$\|B\|$ (nT)	ANS(8)	[28]	1
	TRAJECTORY VARIABLES, HG coordinates			
94-96	Range from Sun (AU)	SEDR(11)	[29]	1
97-99	Longitude (radians)	SEDR(12)	[30]	1
100-102	Latitude (radians)	SEDR(13)	[31]	1

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M MODE VARIABLES, fit, protons and alphas

	Proton Main cup			
103-105	Density (#/cc)	ANS(52)	[32]	2
106-108	V_r (km/s)	ANS(105)	[33]	2
109-111	V_t (km/s)	ANS(106)	[34]	3
112-114	V_n (km/s)	ANS(107)	[35]	3
115-117	Thermal width [4] (km/s)	ANS(53)	[36]	2
118-120	Anisotropy: $\frac{W_{\|\|}}{W_{\perp}}$	ANS(54)	[37]	3
	Alpha Main cup			
121-123	Density (#/cc)	ANS(59)	[38]	5
124-126	$\delta_{\alpha-p}$	ANS(63)	[39]	5
127-129	Thermal width (km/s)	ANS(60)	[40]	5
130-132	W_{fit} [5] (Protons)		[41]	3
	Key Parameters (isotropic fit only)			
133-135	Density (fit)	ANS(52)	[42]	2
136-138	speed first protons	ANS(49)	[43]	2
139-141	Thermal Speed (fit)	ANS(53)	[44]	2
142-144	Percent Alpha	100*ANS(59)/ANS(52)	[45]	5
145-147	Sum of E1 currents	ANS(34)	[46]	1
148-150	MinPeak/AvePeak(current)[6]	ANS(140)	[47]	1
151-153	iflag=((iflagf*100+iflagp)*100+iflaga	ANS(135)	[48]	1

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[4] $W_{fit} = \left(\frac{1}{3}W_{\|}^2 + \frac{2}{3}W_{\perp}^2\right)^{\frac{1}{2}}$

[5]

$W_{\|}^2 = ANS(68)^2$

$W_{\perp}^2 = ANS(69)^2$

$W_A^2 = W_{\|}^2\, ANS(130)^2 + W_{\perp}^2\, (1 - ANS(130)^2)$

$W_B^2 = W_{\|}^2\, ANS(131)^2 + W_{\perp}^2\, (1 - ANS(131)^2)$

$W_C^2 = W_{\|}^2\, ANS(132)^2 + W_{\perp}^2\, (1 - ANS(132)^2)$

$W_{fit} = (W_A^2 + W_B^2 + W_C^2)^{\frac{1}{2}}$

[6] Not a Key Parameter. The minimum peak current in any cup divided by the average of the peak currents in the three main cups. in place of the standard deviation for this last entry is
nflag=min0(nflaga,99)+100*(min0(nflagp,99)+100*min0(nflagf,99))

The first word of each record (Header word 0) indicates the number of words which follow. A FORTRAN READ statement might be of the form:

```
        READ (XX) N, (A(I), I = 1,N)
```

With an EQUIVALENCE statement

```
        EQUIVALENCE (A(1), IA(1))
```

With the DD card,

```
//FTXXF001 DD UNIT=T6250,LABEL=(,BLP),
// DCB=(RECFM=VBS,LRECL=17596,BLKSIZE=17600,
// VOL=SER=ABCD
```