MIT SOLAR WIND PLASMA DATA FROM EXPLORER 33 AND EXPLORER 35: JULY 1966 TO SEPTEMBER 1970

by

H. Howe, J. Binsack
C. Wang, E. Clapp

CSR TR-71-4 December 1971

CENTER FOR SPACE RESEARCH
MASSACHUSETTS INSTITUTE OF TECHNOLOGY

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ACKNOWLEDGMENT

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Contents

1. General Introduction

The MIT Plasma Experiments on Explorer 33 and Explorer 35 have yielded large amounts of solar wind data. These data are now available from the National Space Science Data Center in the form of plots and on magnetic tape. This report gives a brief review of the method used to obtain the data, provides a description of the plasma parameters, and describes in detail the format of the plots and tapes which are available from the Data Center.

Hourly average plots of the data are included at the end of the report. From these plots, the availability and interest of the solar wind data for any period of time may be determined and the necessity of requesting more detailed data from the Data Center may be ascertained.

2. Times of Solar Wind Coverage

Solar wind plasma data are available from the MIT Plasma Experiments on Explorer 33 and Explorer 35 for selected times between July, 1966 and September, 1970. Explorer 33 was launched on July 1, 1966 into earth orbit. Due to the spin axis orientation of the spacecraft, data are available from this spacecraft during two roughly four month periods each year. The spacecraft orbit limits most solar wind observations to one of these four month periods, from January to April of 1967 to 1969, inclusive, although some data are available from the other period which extends from July to October of 1966 to 1970, inclusive.

Explorer 35 was launched on July 19, 1967 into lunar orbit and operated continuously for one year until the MIT instrument failed on about July 14, 1968. During each month of operation, solar wind coverage was interrupted for about one week by the passage of the moon through the magnetosheath and magnetotail. Also, no data are available during two daily one hour periods when the spacecraft was in lunar optical shadow and during two daily periods when the spacecraft was in lunar radio shadow. All data which were influenced by the presence of the moon have been deleted from the set of solar wind measurements.

Using the unreduced data from both spacecraft, the times of all magnetopause and bow shock crossings have been determined. These crossing times, in turn, were used to eliminate all magnetosheath data from the current data set. Therefore, both the hourly averages and the detailed data represent measurements made ahead of the bow shock.

It should be noted that, due to inherent limitations in the instruments and in the analysis program, plasma parameters cannot be derived when the solar wind velocity or thermal speed exceed certain limits. Parameters cannot be derived when the velocity is less than $\sim$280 km/sec or greater than $\sim$700 km/sec or when the thermal speed is less than $\sim$15 km/sec.

3. Plasma Parameter Derivation and Description

a. Parameter Derivation

The MIT instruments on Explorer 33 and Explorer 35 measure the total flux, differential energy spectrum, and information concerning the direction of the solar wind once every 2.7 minutes. Plasma parameters (velocity, flow direction, density, and thermal speed) are derived from the measured spectra by first assuming the velocity distribution function in the rest frame of the plasma is well represented by the function

$$f(\omega) = \frac{n}{(\pi \omega_o^2 \kappa)^{3/2}} \frac{\Gamma(\kappa+1)}{\Gamma(\kappa-1/2)} \left[\frac{1}{1 + \kappa^{-1}(\omega/\omega_o)^2} \right]^{\kappa+1}$$

where $\omega = |\vec{v}-\vec{v}_B|$, $\vec{v}$ is the particle velocity, $\vec{v}_B$ is the plasma bulk flow velocity, n is the number density, ω_o is the thermal speed, and $\kappa = 4$.

This function is similar to the Maxwellian distribution function but includes a high energy inverse power law tail.

This distribution function is next combined theoretically with the instrument response function to predict the response of the instrument to a wide variety of assumed incident flow conditions. By fitting the predicted currents to the three largest differential spectral measurements, the flow velocity, flow direction angles, and thermal speed are derived. The density is derived by scaling the calculated total flux to match the measured total flux. The general operation of the MIT type of plasma detector is given by Vasyliunas (1971) and the Explorer instruments are discussed in greater detail by Lyon et al. (1968) and by Howe (1971).

3b. Parameter Description

The flow direction is specified by two angles, ϕ and λ. (ϕ, λ) are the solar eliptic longitude and latitude of the direction from which the wind flows. Therefore, ϕ is positive (negative) for flow from the east (west) of the sun and λ is positive (negative) for flow from above (below) the solar eliptic plane. For example, flow from the typical aberration direction and in the ecliptic plane would have $\phi \simeq -4°$, $\lambda \doteq 0°$.

As described below, two sets of velocity vectors (speed and two angles) are supplied for the fine scale data. One velocity vector represents the actual measured velocity. The other is the true velocity vector with the aberration due to the earth's 30 km/sec orbital motion removed. For the hourly averages, the second (true) velocity magnitude and angles are used, thus aberration has been removed from the hourly averaged parameters prior to averaging.

The thermal speed (W_o) is the most probable speed of the distribution function in the plasma rest frame and is related to the temperature of the plasma through the relation

$$1/2 \; Mp \; W_o^2 = kT$$

where Mp is the proton mass and k is the Boltzman constant. If W_o is specified in km/sec and T in degrees Kelvin, then

$$T \, (°K) = 60.5 \; W_o^2 \; (km/sec)$$

Two important points should be noticed. First, since the energy spectrum of the solar wind is measured only once every 2.7 minutes, then the finest time scale data available from the Explorer 33 and 35 instruments is one point every 2.7 minutes. In particular, these data do not represent an average of finer time scale data. Second, large changes in the solar wind flow such as the passage of an interplanetary shock wave during the measurement of an individual energy spectrum usually leads to the derivation of grossly incorrect plasma parameters from the spectrum. Therefore, care should be taken when using the one or two measurements made adjacent to or during the passage of a shock or discontinuity past the spacecraft.

4. Hourly Averages

a. Data Description

The hourly averages are formed for the solar wind velocity, flow direction angles (with aberration removed), number density, and thermal speed. For each hour, the standard deviation of each of these five parameters is also formed, in order to represent the parameter value spread within each hour. The averages and deviations are available on magnetic tape and as plots. The tape and plot formats are given in the following two sections.

b. Tape Format

The hourly-average tapes are written in seven track 556 bpi, BCD, unlabeled, even parity, fixed block format. The block size is 1600 bytes and the logical record length is 80 bytes. Each logical record contains one set of averaged plasma parameters in the format described below. The DD parameters necessary to read the tapes are as follows:

```
UNIT=TAPE7, LABEL=(,NL),
DCB=(DEN=1, TRTCH=ET,RECFM=FB,LRECL=80,BLKSIZE=1600)
```

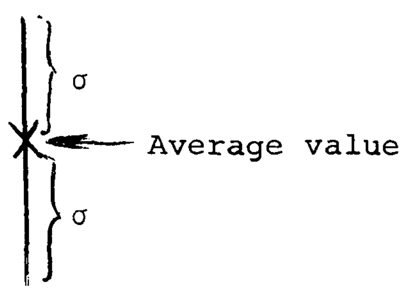
Hourly Average Data Record Format

BCD Character	Format	Description
1-2	I2	Spacecraft identification (33 or 35)
3-5	I3	Number of solar wind measurements in the hourly average
6-10	F5.0	Decimal day of the year (0.0 - 365.0, January 1 is day 0.0)
11-13	I3	Hour of the day (universal time) (1-24)
14-16	I3	Day of the month (1-31)
17-19	A3	Month name (JAN-DEC)
20-21	I2	Year (66-69)
22-26	F5.0	Average thermal speed (km/sec)
27-31	F5.1	Average number density (no./c.c.)
32-36	F5.0	Average flow speed with aberration removed (km/sec)
37-46	2F5.1	Average solar ecliptic longitude and latitude respectively, of the direction from which the unaberrated flow was coming. (degrees)
47-71	F5.0 F5.1 F5.0 2F5.1	Standard deviations of the above fine parameters, in the same order, units, and format
72-74	I3	Same as item 2
75-80	F6.0	Solar rotation number

4c. Plot Format

The labels across the top of the plot indicate, in order, the spacecraft from which the data came, the solar rotation (one solar rotation is plotted on each plot), the averaging interval (one hour), the date the plot was generated, and the region from which the data came (solar wind - all magnetosheath data were removed before averaging). The scale across the top of the plot indicates the day of the solar rotation.

For each plot, the hourly average is plotted as a symbol (+ for bulk velocity, $\underline{\bar{X}}$ for density, and x for thermal speed) and the standard deviation (σ) of the plotted parameter for the hour is indicated by the vertical line through the symbol.



The three plotted parameters, from the top plot to the bottom, are most probable thermal speed (km/sec), proton number density (no/cc), and bulk flow speed (km/sec). As mentioned above, if w_o is given in km/sec and T in degrees Kelvin, then

$$T\ (°K) = 60.5\ w_o^2\ (km/sec)$$

A temperature scale is plotted at the extreme right end of the thermal speed plot. Notice that the density scale is logarithmic and that the velocity scale does not start at zero.

The scale at the bottom of the plot gives the calender day. The month and year of the first and last days of the plot are given at the left and right ends of the bottom of the plot.

5. Detailed Data Tape Description

The detailed data are available on a time scale of approximately once every 2.7. minutes. The data tapes are written in seven track, 556 bpi, BCD, unlabeled, even parity, fixed block format. The block size is 1000 bytes and the logical record length is 100 bytes. Each logical record contains one solar wind measurement in the format shown below. There are two tapes available, one each for Explorer 33 and Explorer 35. The DD parameters necessary to read the tapes are as follows:

```
UNIT=TAPE7, LABEL=( ,NL),DCB=(DEN=1, TRTCH=ET,RECFM=FB, LRECL=100,
BLKSIZE=1000)
```

Detailed Data Record Format

BCD Character	Format	Description
1-2	I2	Year (66-69)
3-11	F9.5	Decimal day of year, including fractional part (0.0 - 365.0, January 1, 1200UT in decimal day 0.5)
12-15	A4	Name of month (JAN - DEC)
16-17	I2	Calendar day of month (1-31)
18-21	I4	Universal time of day (0000-2400)
22-27	I6	Sequence number, a satellite counter
28-32	F5.1	Density (no./cm^3)
33-35	I3	Aberrated bulk velocty (km/sec)
36-41	F6.1	Aberrated longitude of flow
42-47	F6.1	Aberrated latitude of flow

Note: items (9,10) give the solar ecliptic longitude and latitude of the direction from which the flow was coming.

BCD Character	Format	Description
48-50	I3	Thermal speed (km/sec)
51-56	F6-1	Spacecraft coordinate flow angles, not normally used
63-68	F6.1	True longitude of flow } 30 km/sec aberration removed
69-74	F6.1	True latitude of flow } 30 km/sec aberration removed
75-80	I6	True velocity of flow } 30 km/sec aberration removed
81-86	F6.1	Solar ecliptic longitude of spin axis
87-92	F6.1	Solar ecliptic latitude of spin axis
93-100	8X	

6. References

Howe, H., Explorer 33 and Explorer 35 plasma observations of the interaction region between the solar wind and the magnetic field of the earth, Ph.D. Thesis, MIT, June, 1971

Lyon, E., A. Egidi, G. Pizzella, H. Bridge, J. Binsack, R. Baker, and R. Butler, Plasma measurements on Explorer 33 (I) interplanetary region, Space Res., VII, 99, 1968.

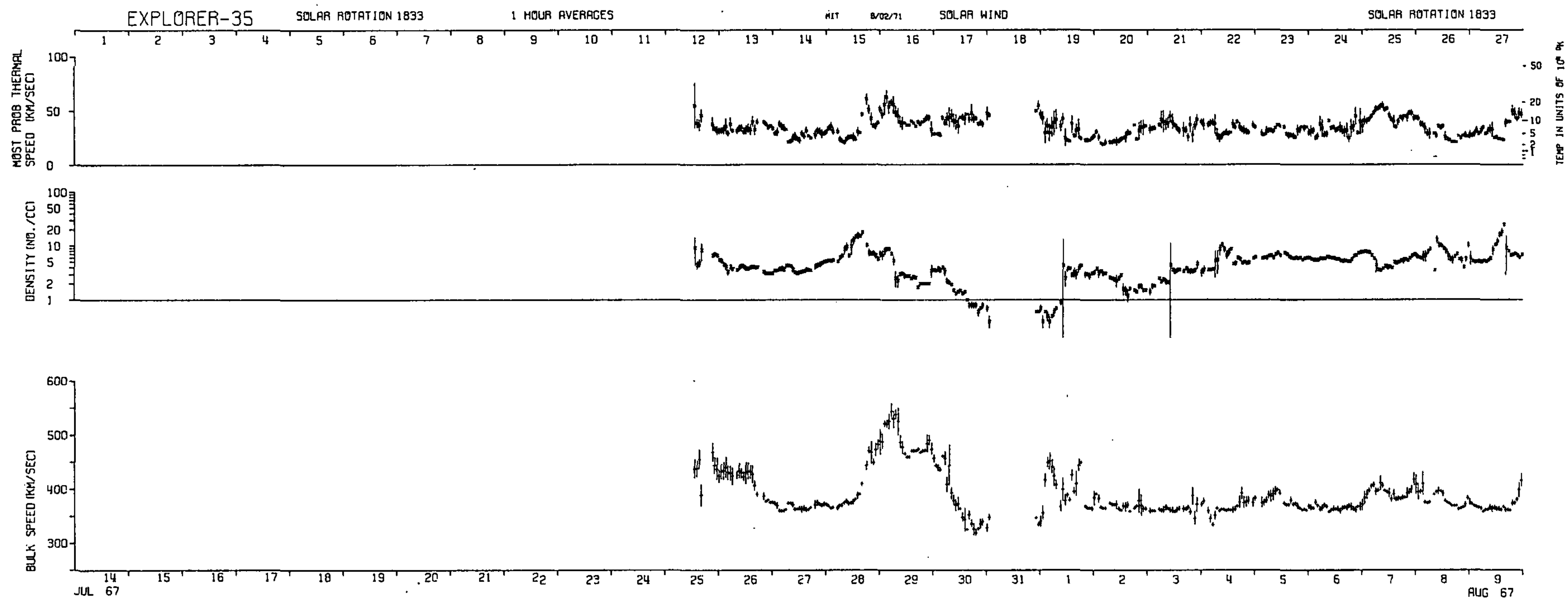
Vasyliunas, V.M., Deep space plasma measurements, in Methods of Experimental Physics, Volume 9B (Plasma Physics) ed. R.H. Lovberg, Academic Press, New York, 1971

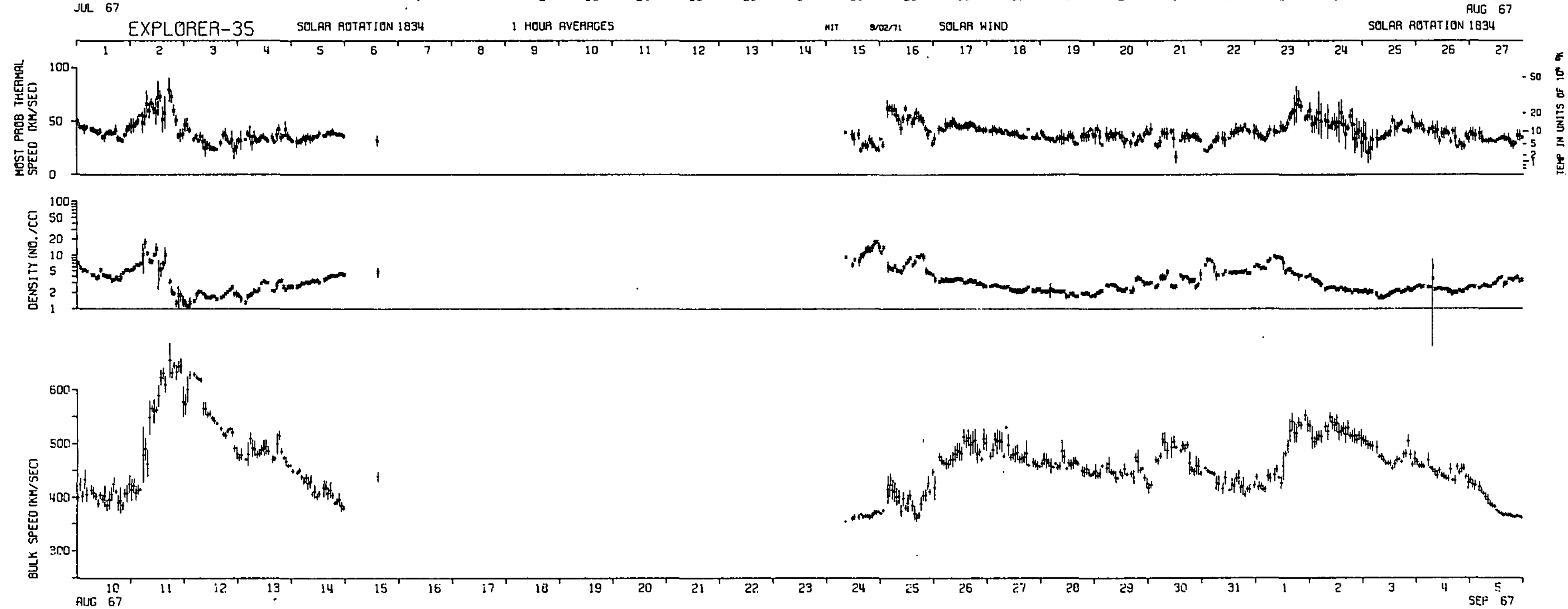
7. Hourly Average Data Plots

The hourly average data plots for Explorer 35 and Explorer 33, respectively, are included in this section. The plot format is described in section 4c. The solar rotations during which data are available and the satellites from which the measurements were made are as follows:

Solar Rotation #	First Day	Last Day	Satellite
1819	July 1, 1966	July 27, 1966	33
1820	July 28, 1966	August 23, 1966	33
1826	January 6, 1967	February 1, 1967	33
1827	February 2, 1967	February 28, 1967	33
1828	March 1, 1967	March 27, 1967	33
1833	July 14, 1967	August 9, 1967	35
1834	August 10, 1967	September 5, 1967	33,35
1835	September 6, 1967	October 2, 1967	33,35
1836	October 3, 1967	October 29, 1967	35
1837	October 30, 1967	November 25, 1967	35
1838	November 26, 1967	December 22, 1967	35
1839	December 23, 1967	January 18, 1968	33,35
1840	January 19, 1968	February 14, 1968	33,35
1841	February 15, 1968	March 12, 1968	33,35
1842	March 13, 1968	April 8, 1968	33,35
1843	April 9, 1968	May 5, 1968	35
1844	May 6, 1968	June 1, 1968	35
1845	June 2, 1968	June 28, 1968	35
1846	June 29, 1968	July 25, 1968	35
1847	July 26, 1968	August 21, 1968	33
1848	August 22, 1968	September 17, 1968	33
1849	September 18, 1968	October 14, 1968	33
1853	January 4, 1969	January 30, 1969	33
1854	January 31, 1969	February 26, 1969	33
1855	February 27, 1969	March 25, 1969	33
1856	March 26, 1969	April 21, 1969	33
1860	July 12, 1969	August 7, 1969	33

1861	August 8, 1969	September 3, 1969	33
1862	September 4, 1969	September 30, 1969	33
1874	July 25, 1970	August 20, 1970	33
1875	August 21, 1970	September 16, 1970	33


EXPLORER-35
SOLAR ROTATION 1833
1 HOUR AVERAGES
MIT 8/02/71
SOLAR WIND
SOLAR ROTATION 1833
MOST PROB THERMAL SPEED (KM/SEC)
TEMP IN UNITS OF 10⁴ °K
DENSITY (NO./CC)
BULK SPEED (KM/SEC)
JUL 67
AUG 67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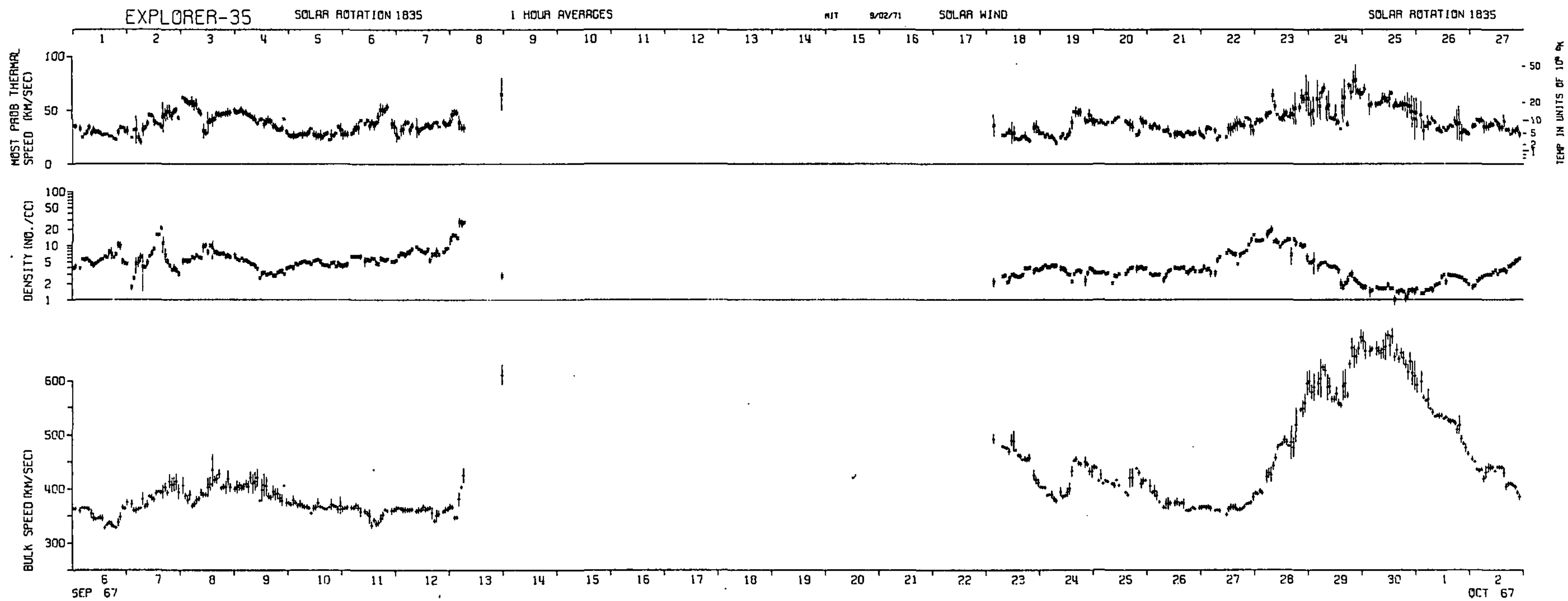
SOLAR ROTATION 1834
1 HOUR AVERAGES
MIT 9/02/71
SOLAR WIND
SOLAR ROTATION 1834
MOST PROB THERMAL SPEED (KM/SEC)
TEMP IN UNITS OF 10⁴ °K
DENSITY (NO./CC)
BULK SPEED (KM/SEC)
AUG 67
SEP 67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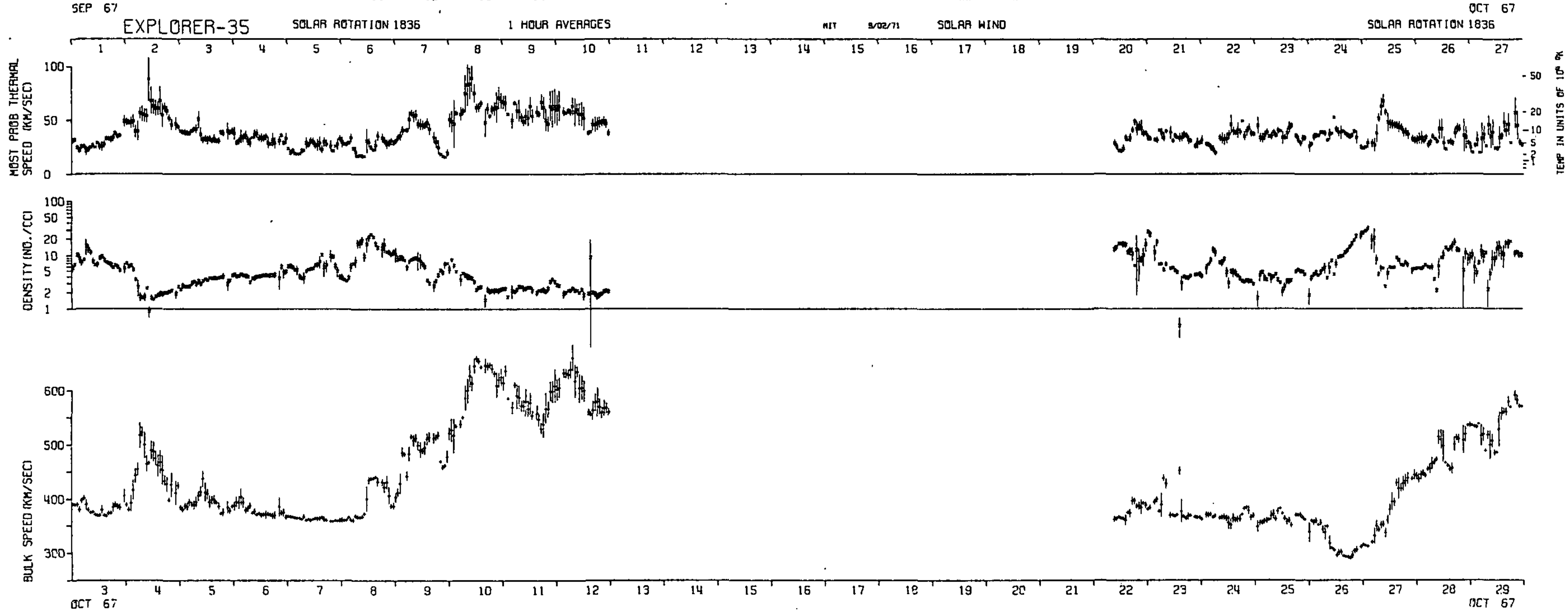
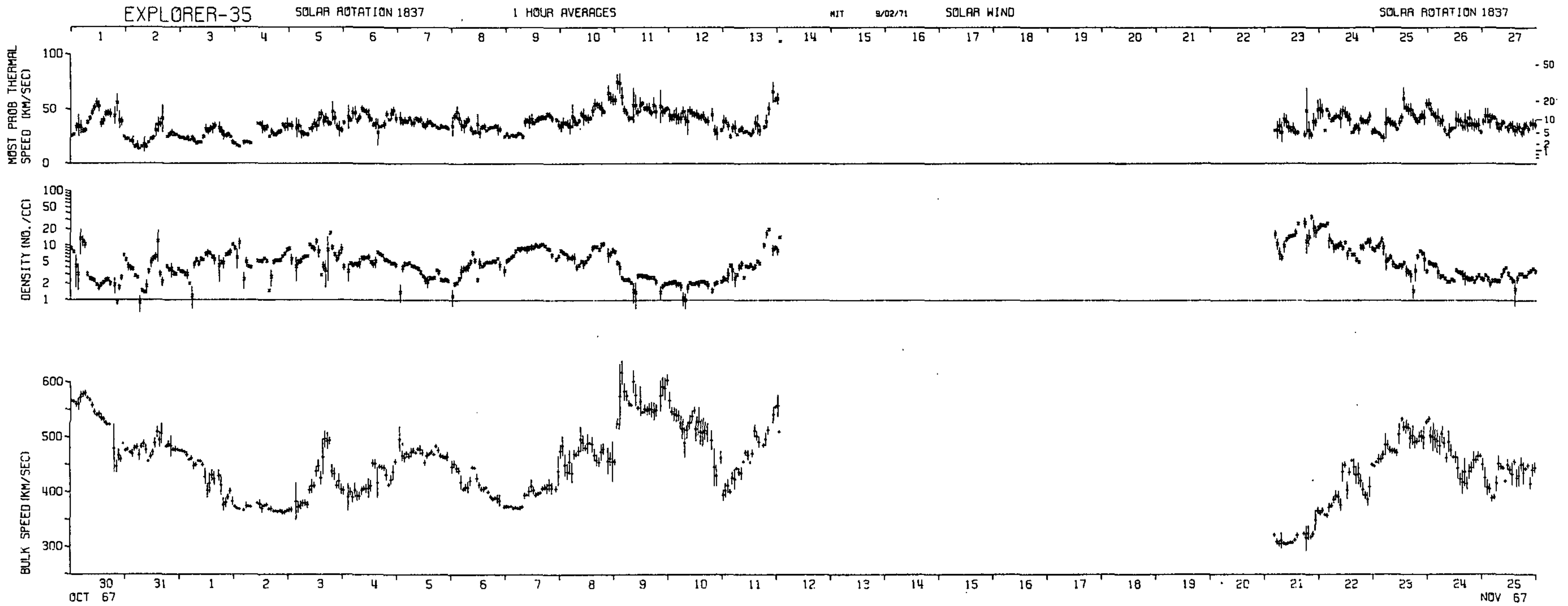
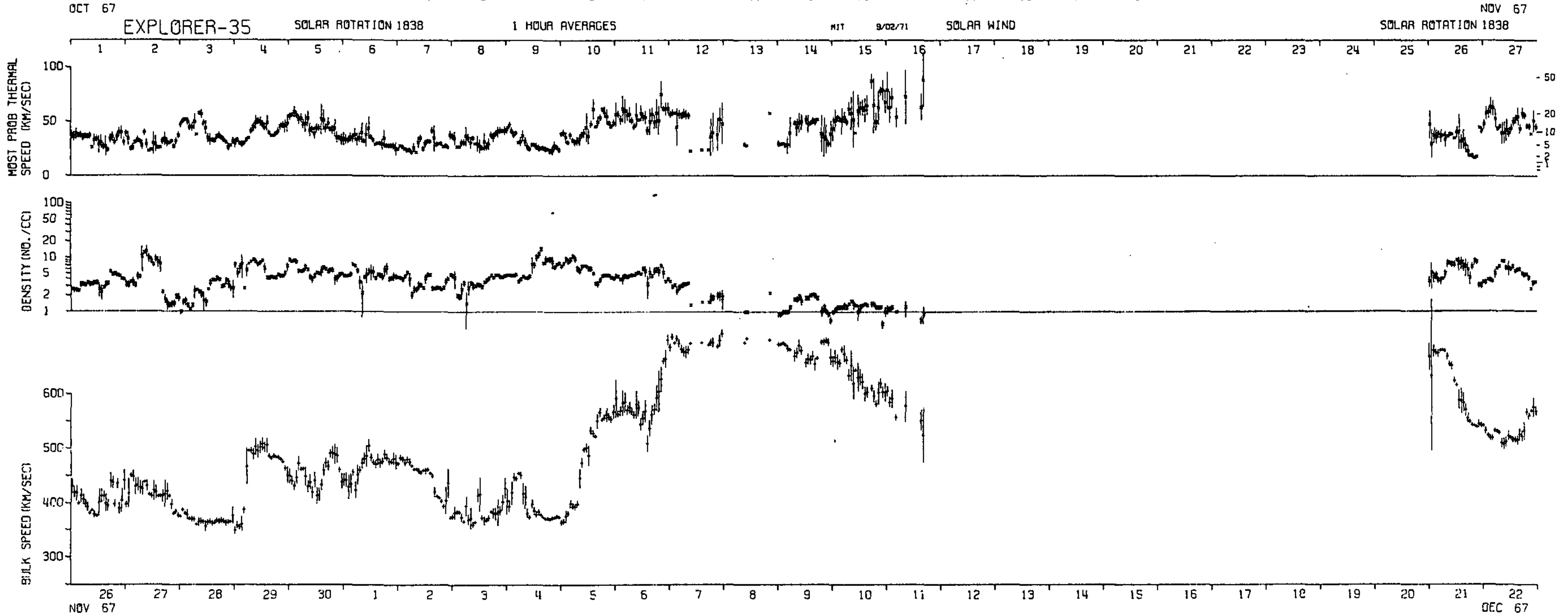
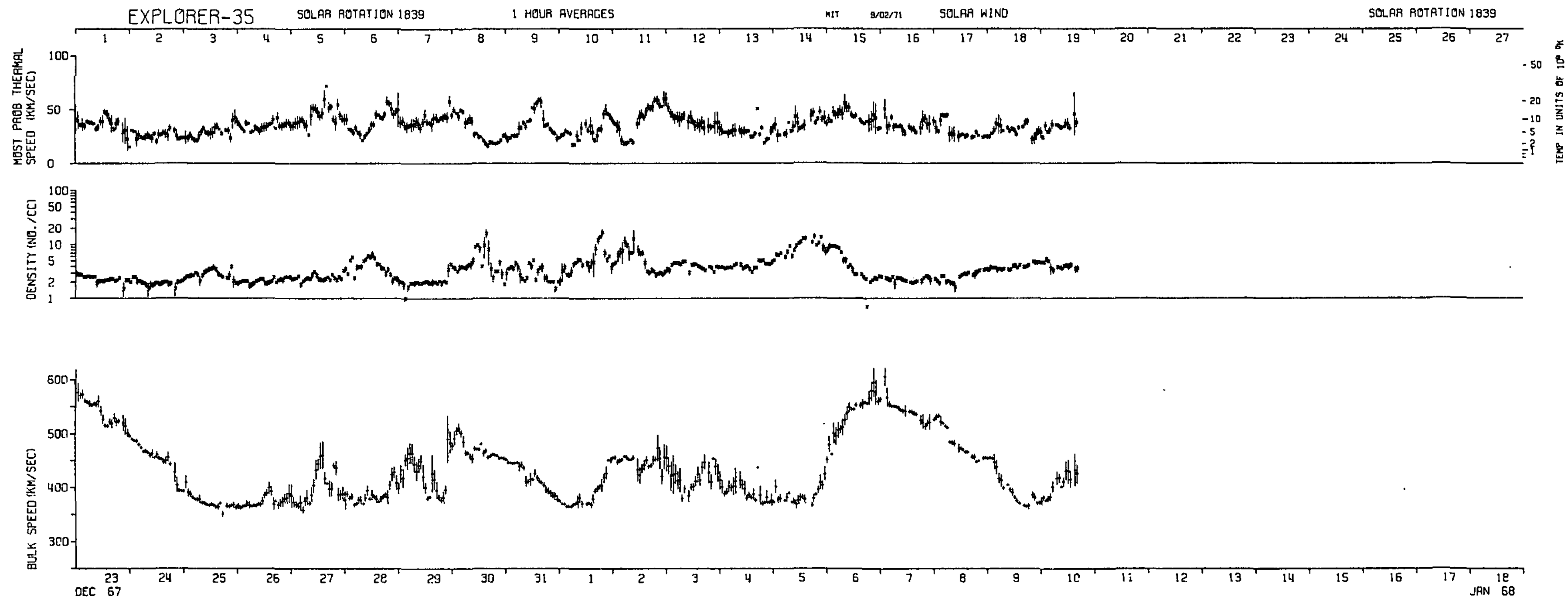
SOLAR ROTATION 1835
1 HOUR AVERAGES
MIT 9/02/71
SOLAR WIND
SOLAR ROTATION 1835
MOST PROB THERMAL SPEED (KM/SEC)
DENSITY (NO./CC)
BULK SPEED (KM/SEC)
TEMP IN UNITS OF 10⁴ °K
SEP 67
OCT 67

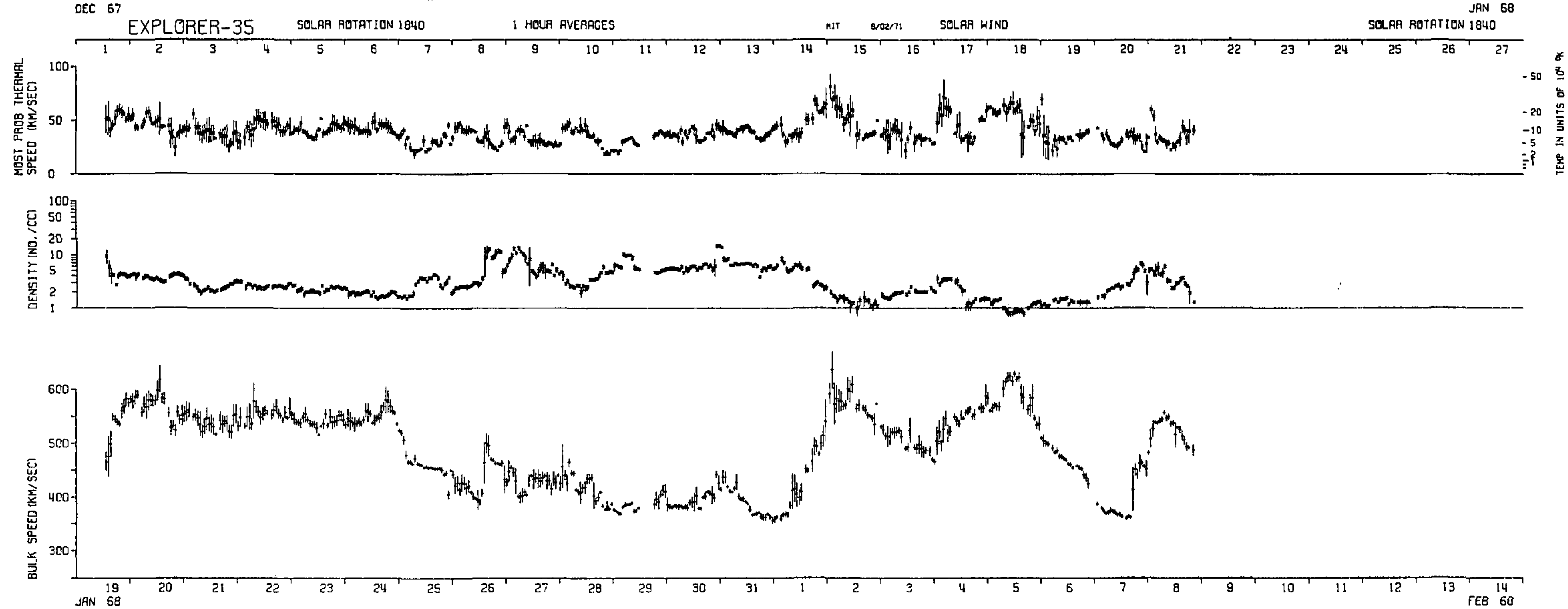

EXPLORER-35
SOLAR ROTATION 1836
1 HOUR AVERAGES
MIT 9/02/71
SOLAR WIND
SOLAR ROTATION 1836
MOST PROB THERMAL SPEED (KM/SEC)
DENSITY (NO./CC)
BULK SPEED (KM/SEC)
TEMP IN UNITS OF 10⁴ °K
OCT 67
OCT 67


EXPLØRER-35
SOLAR ROTATION 1837
1 HOUR AVERAGES
MIT 9/02/71
SOLAR WIND
SOLAR ROTATION 1837
MOST PROB THERMAL SPEED (KM/SEC)
DENSITY (NO./CC)
BULK SPEED (KM/SEC)
TEMP IN UNITS OF 10⁴ °K
OCT 67
NOV 67

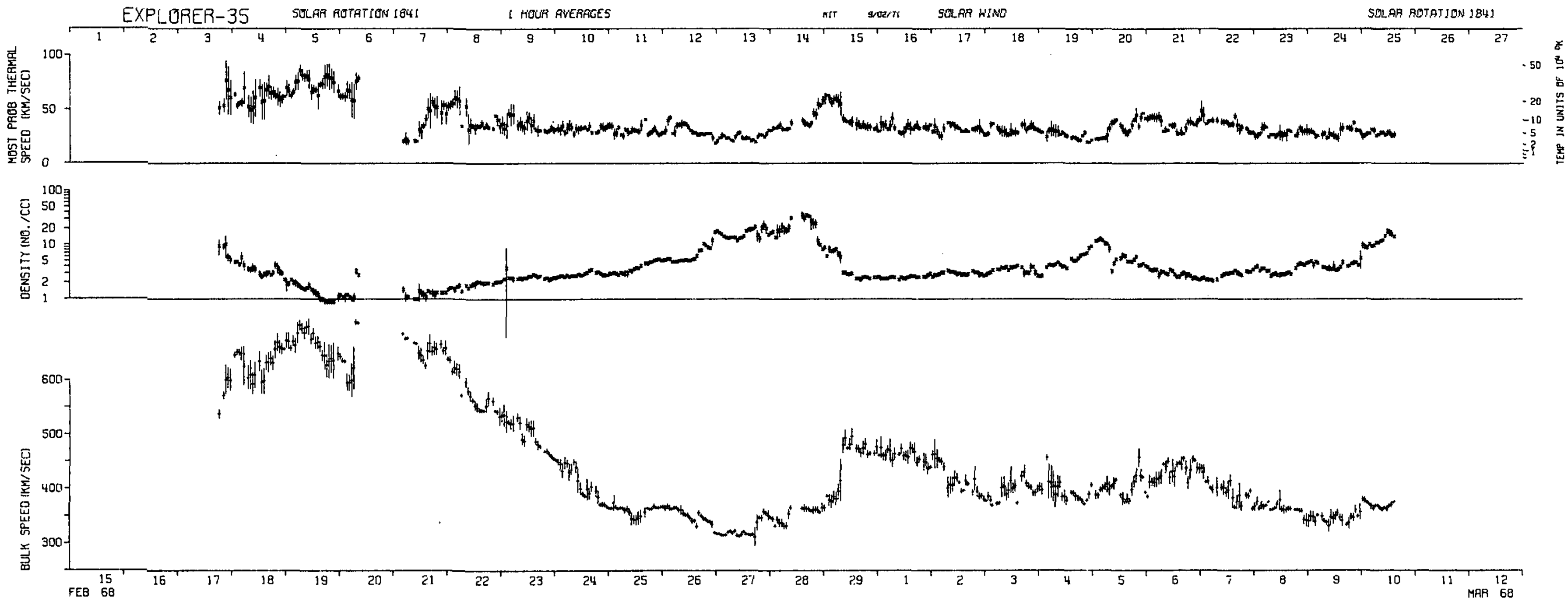

EXPLØRER-35
SOLAR ROTATION 1838
1 HOUR AVERAGES
MIT 9/02/71
SOLAR WIND
SOLAR ROTATION 1838
MOST PROB THERMAL SPEED (KM/SEC)
DENSITY (NO./CC)
BULK SPEED (KM/SEC)
TEMP IN UNITS OF 10⁴ °K
NOV 67
DEC 67



EXPLORER-35
SOLAR ROTATION 1839
1 HOUR AVERAGES
MIT 8/02/71
SOLAR WIND
SOLAR ROTATION 1839
MOST PROB THERMAL SPEED (KM/SEC)
DENSITY (NO./CC)
BULK SPEED (KM/SEC)
TEMP IN UNITS OF 10⁴ °K
DEC 67
JAN 68



EXPLORER-35
SOLAR ROTATION 1840
1 HOUR AVERAGES
MIT 8/02/71
SOLAR WIND
SOLAR ROTATION 1840
MOST PROB THERMAL SPEED (KM/SEC)
DENSITY (NO./CC)
BULK SPEED (KM/SEC)
TEMP IN UNITS OF 10⁴ °K
JAN 68
FEB 68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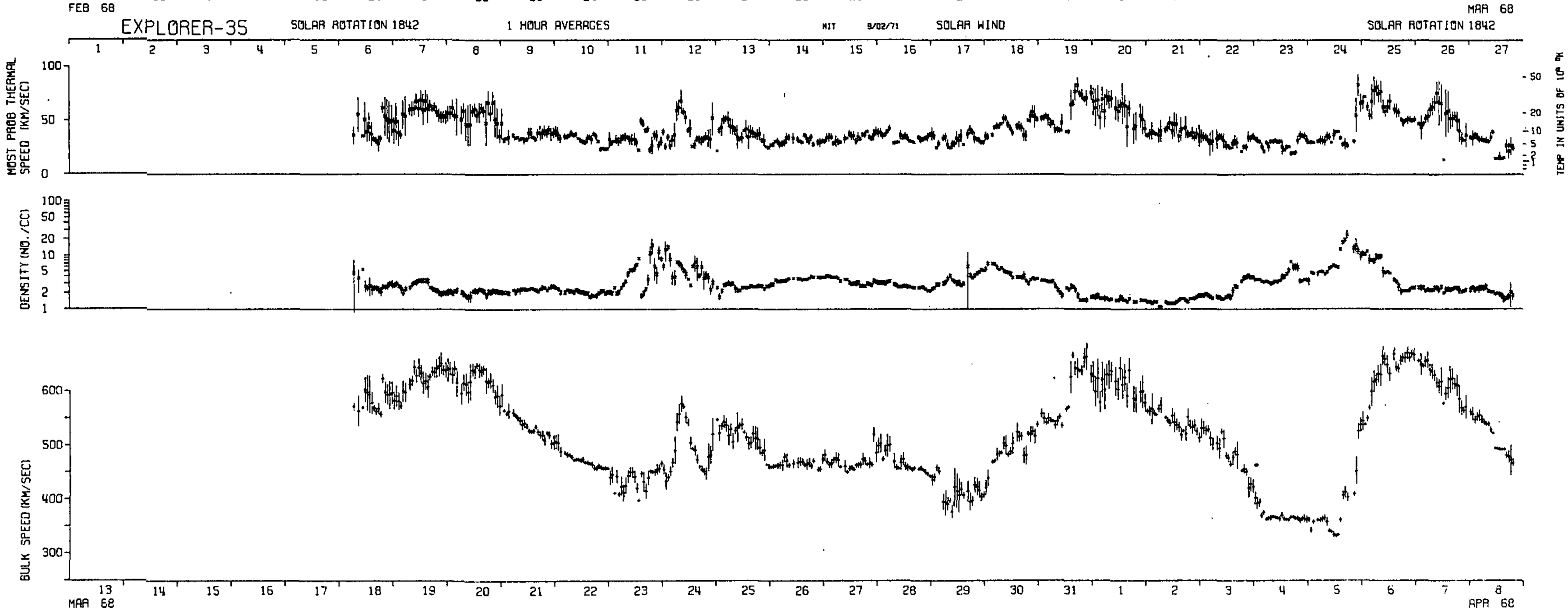
SOLAR ROTATION 1841
1 HOUR AVERAGES
MIT 8/02/71
SOLAR WIND
SOLAR ROTATION 1841
MOST PROB THERMAL SPEED (KM/SEC)
TEMP IN UNITS OF 10⁴ °K
DENSITY (NO./CC)
BULK SPEED (KM/SEC)
FEB 68
MAR 68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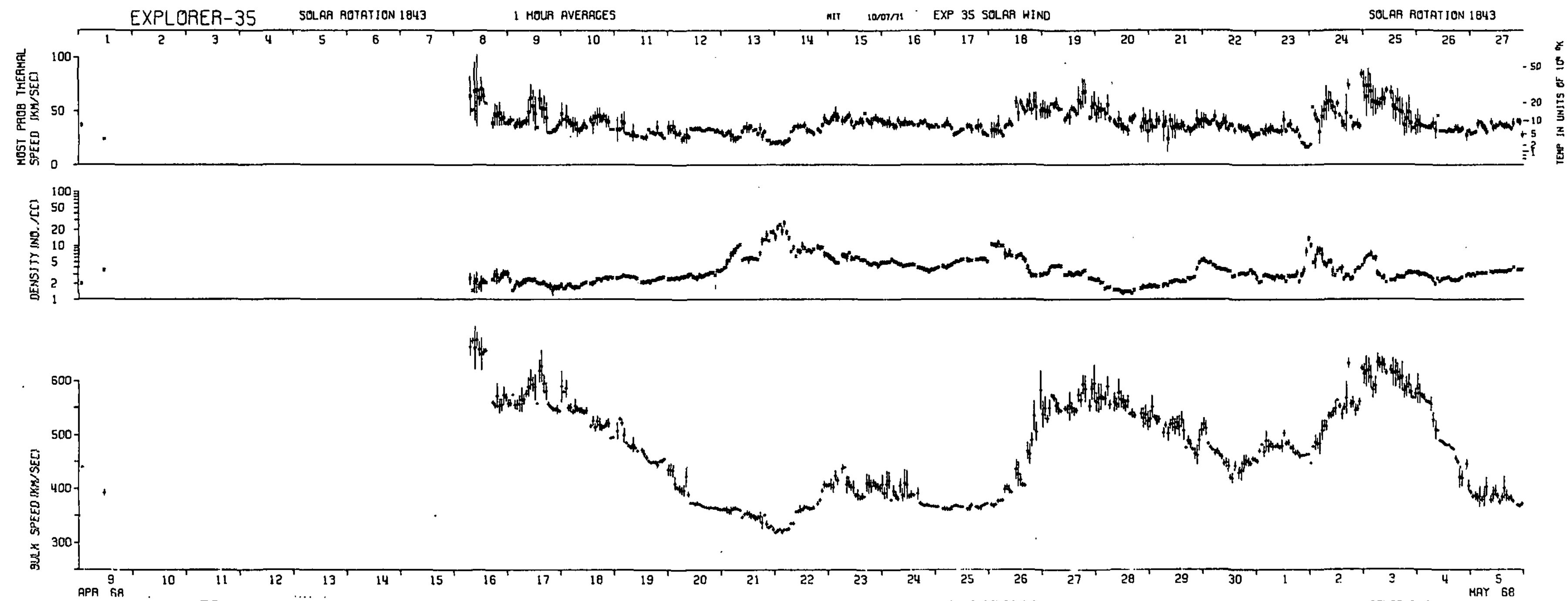
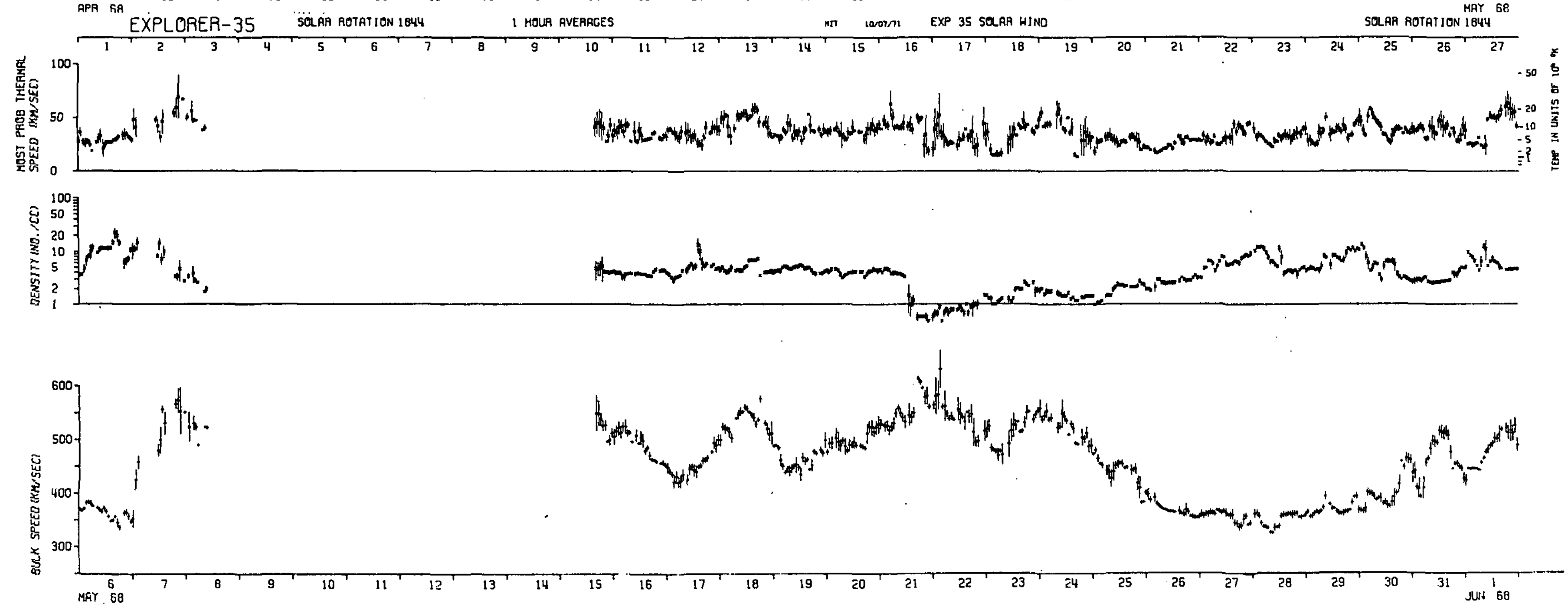
SOLAR ROTATION 1842
1 HOUR AVERAGES
MIT 8/02/71
SOLAR WIND
SOLAR ROTATION 1842
MOST PROB THERMAL SPEED (KM/SEC)
TEMP IN UNITS OF 10⁴ °K
DENSITY (NO./CC)
BULK SPEED (KM/SEC)
MAR 68
APR 68


EXPLORER-35
SOLAR ROTATION 1843
1 HOUR AVERAGES
MIT 10/07/71
EXP 35 SOLAR WIND
SOLAR ROTATION 1843
MOST PROB THERMAL SPEED (KM/SEC)
DENSITY (NO./CC)
BULK SPEED (KM/SEC)
TEMP IN UNITS OF 10⁴ °K
APR 68
MAY 68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SOLAR ROTATION 1844
1 HOUR AVERAGES
MIT 10/07/71
EXP 35 SOLAR WIND
SOLAR ROTATION 1844
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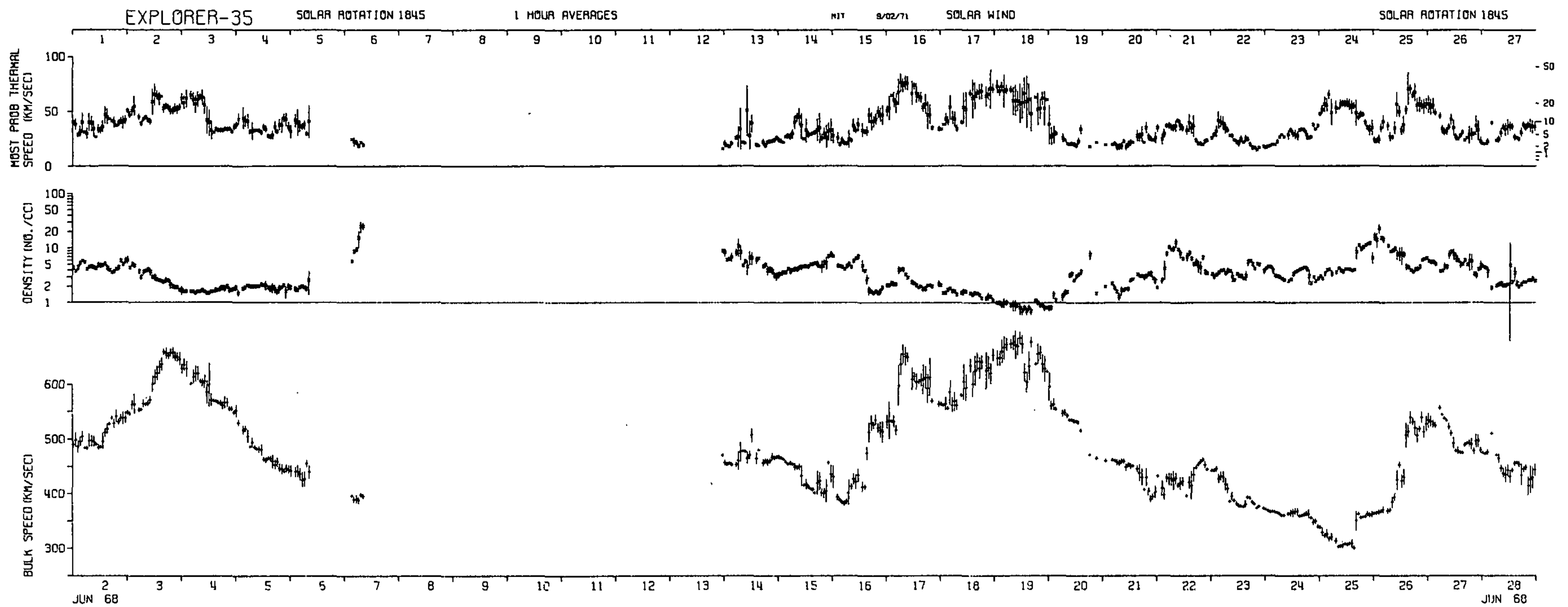
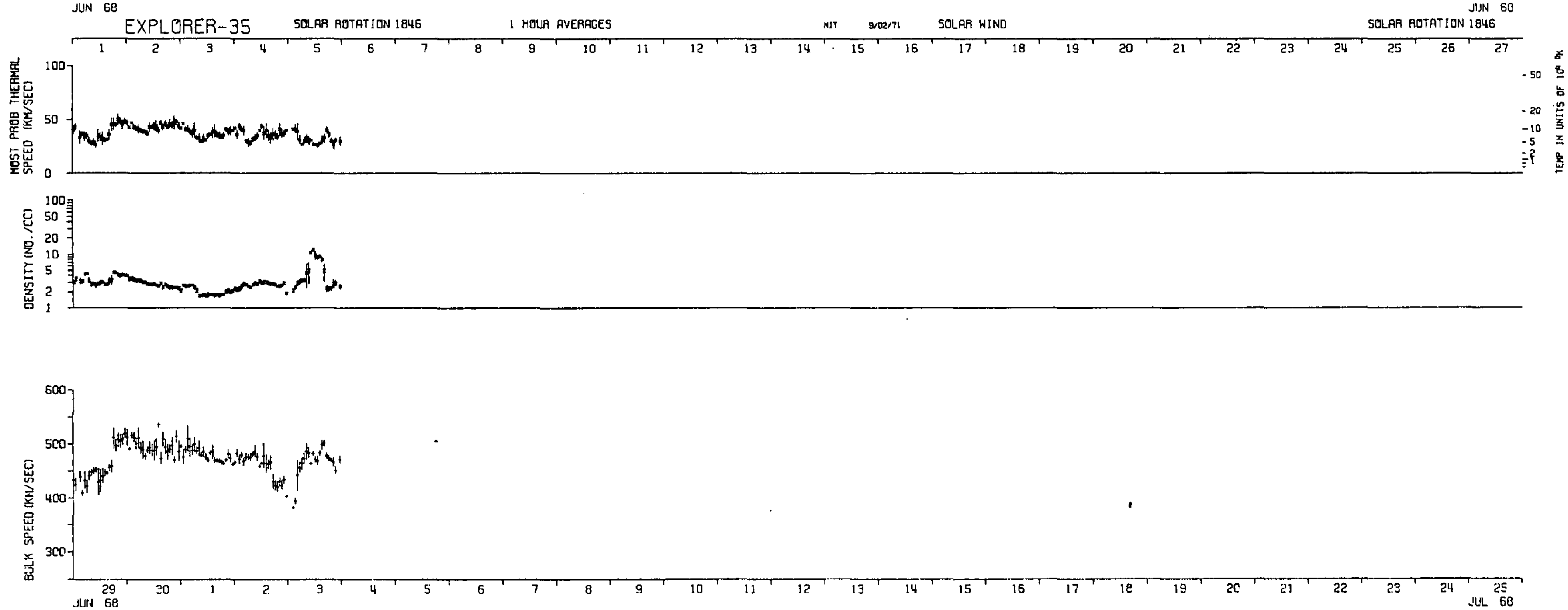
DENSITY (NO./CC)
BULK SPEED (KM/SEC)
TEMP IN UNITS OF 10⁴ °K
MAY 68
JUN 68


EXPLORER-35
SOLAR ROTATION 1845
1 HOUR AVERAGES
MIT 9/02/71
SOLAR WIND
SOLAR ROTATION 1845
MOST PROB THERMAL SPEED (KM/SEC)
TEMP IN UNITS OF 10⁴ °K
DENSITY (NO./CC)
BULK SPEED (KM/SEC)
JUN 68
JUN 68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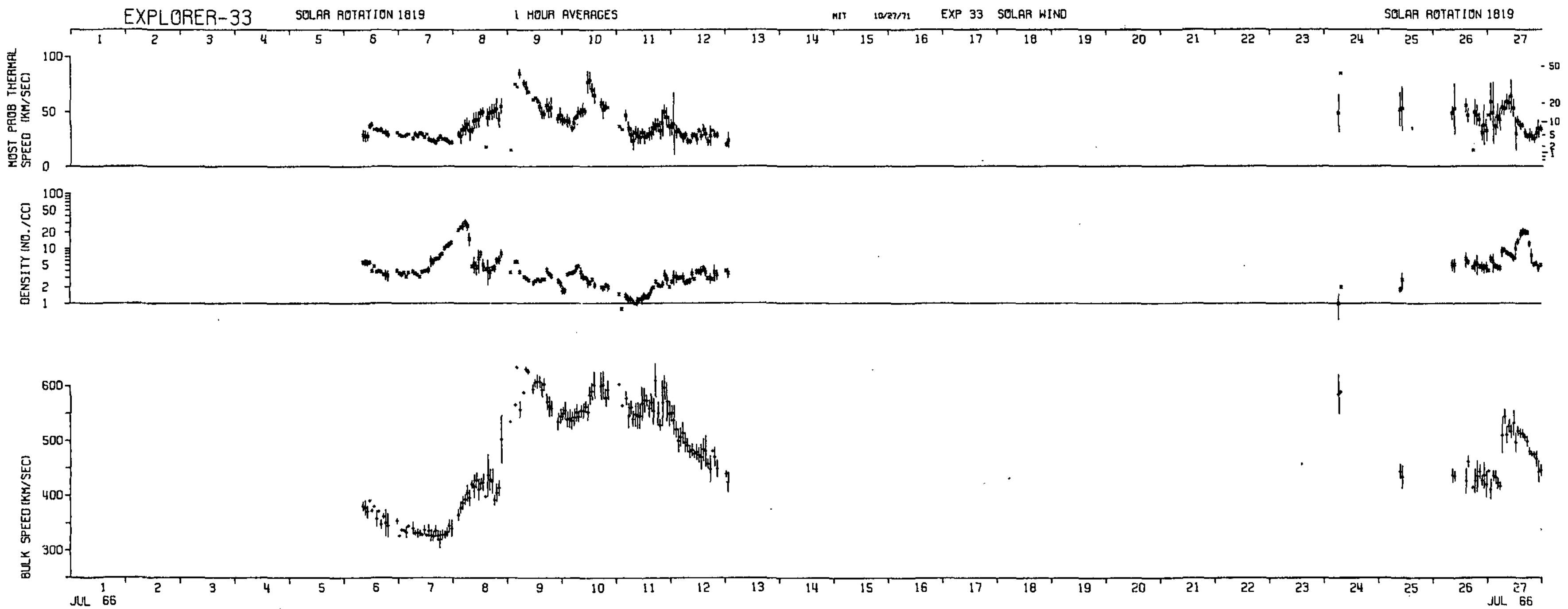
SOLAR ROTATION 1846
1 HOUR AVERAGES
MIT 9/02/71
SOLAR WIND
SOLAR ROTATION 1846
MOST PROB THERMAL SPEED (KM/SEC)
TEMP IN UNITS OF 10⁴ °K
DENSITY (NO./CC)
BULK SPEED (KM/SEC)
JUN 68
JUL 68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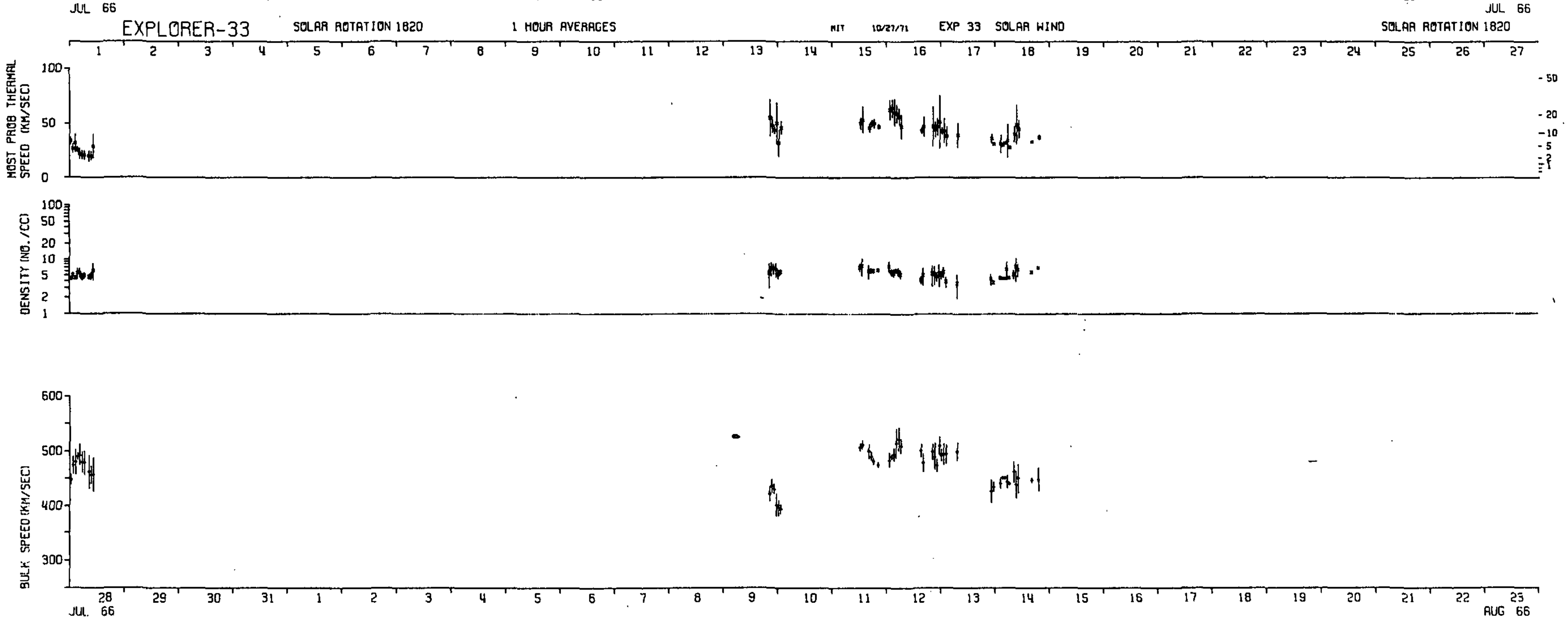
SOLAR ROTATION 1819
1 HOUR AVERAGES
MIT 10/27/71
EXP 33 SOLAR WIND
SOLAR ROTATION 1819
MOST PROB THERMAL SPEED (KM/SEC)
DENSITY (NO./CC)
BULK SPEED (KM/SEC)
TEMP IN UNITS OF 10⁴ °K
JUL 66
JUL 66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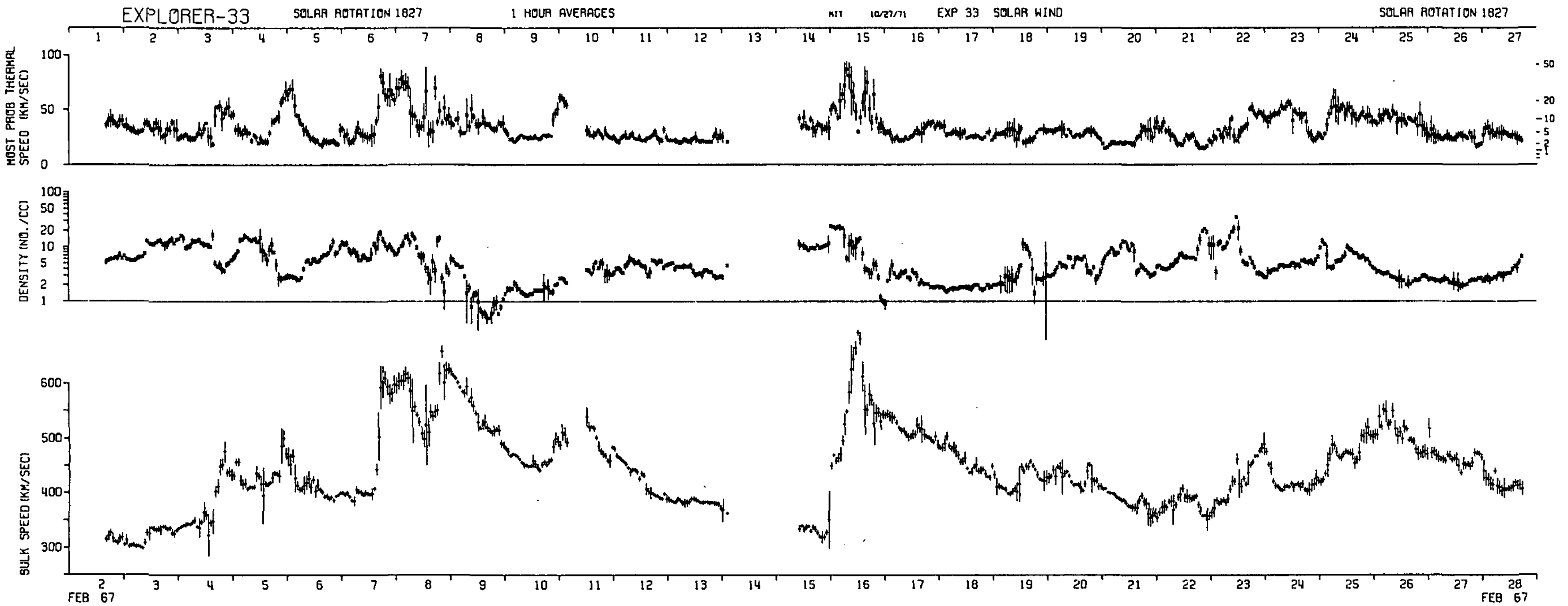
SOLAR ROTATION 1820
1 HOUR AVERAGES
MIT 10/27/71
EXP 33 SOLAR WIND
SOLAR ROTATION 1820
MOST PROB THERMAL SPEED (KM/SEC)
DENSITY (NO./CC)
BULK SPEED (KM/SEC)
TEMP IN UNITS OF 10⁴ °K
JUL 66
AUG 66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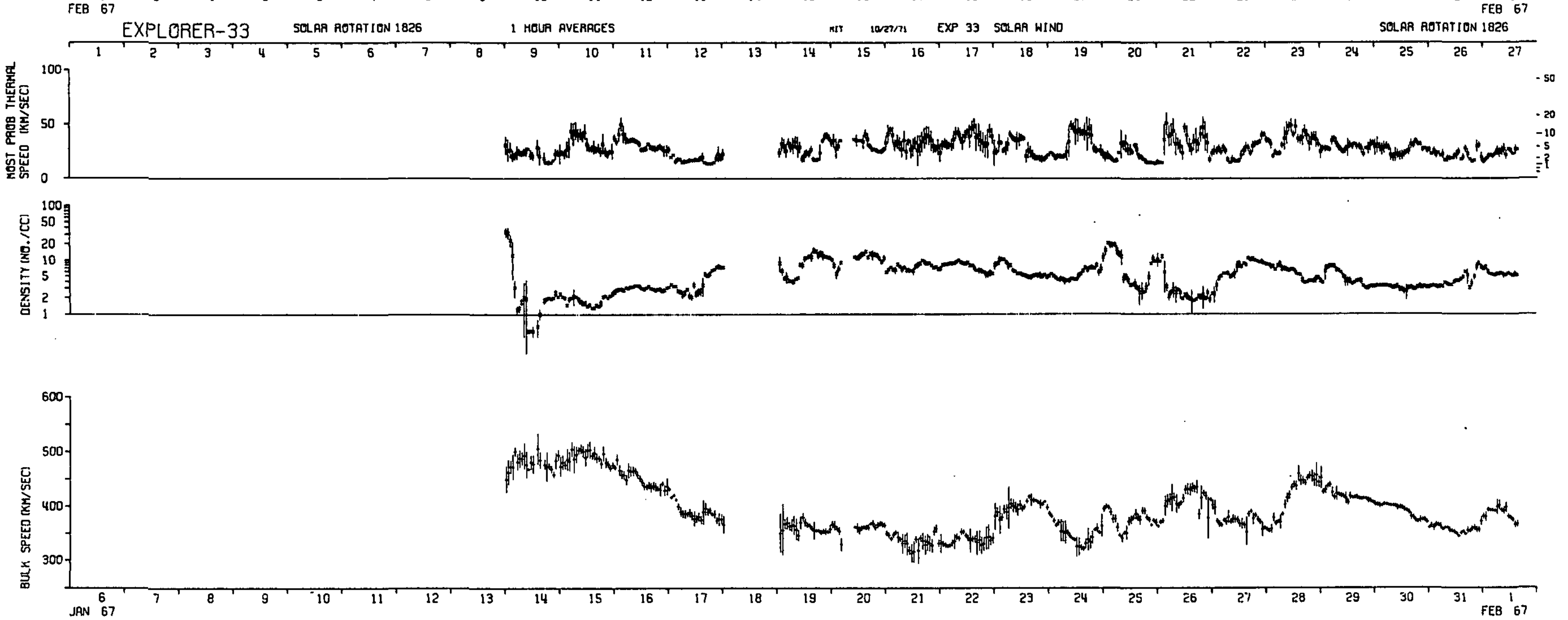
SOLAR ROTATION 1827
1 HOUR AVERAGES
MIT 10/27/71
EXP 33 SOLAR WIND
SOLAR ROTATION 1827
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27
MOST PROB THERMAL SPEED (KM/SEC)
100
50
0
50
20
10
5
2
1
TEMP IN UNITS OF 10⁴ °K
DENSITY (NO./CC)
100
50
20
10
5
2
1
BULK SPEED (KM/SEC)
600
500
400
300
2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28
FEB 67
FEB 67


EXPLORER-33
SOLAR ROTATION 1826
1 HOUR AVERAGES
MIT 10/27/71
EXP 33 SOLAR WIND
SOLAR ROTATION 1826
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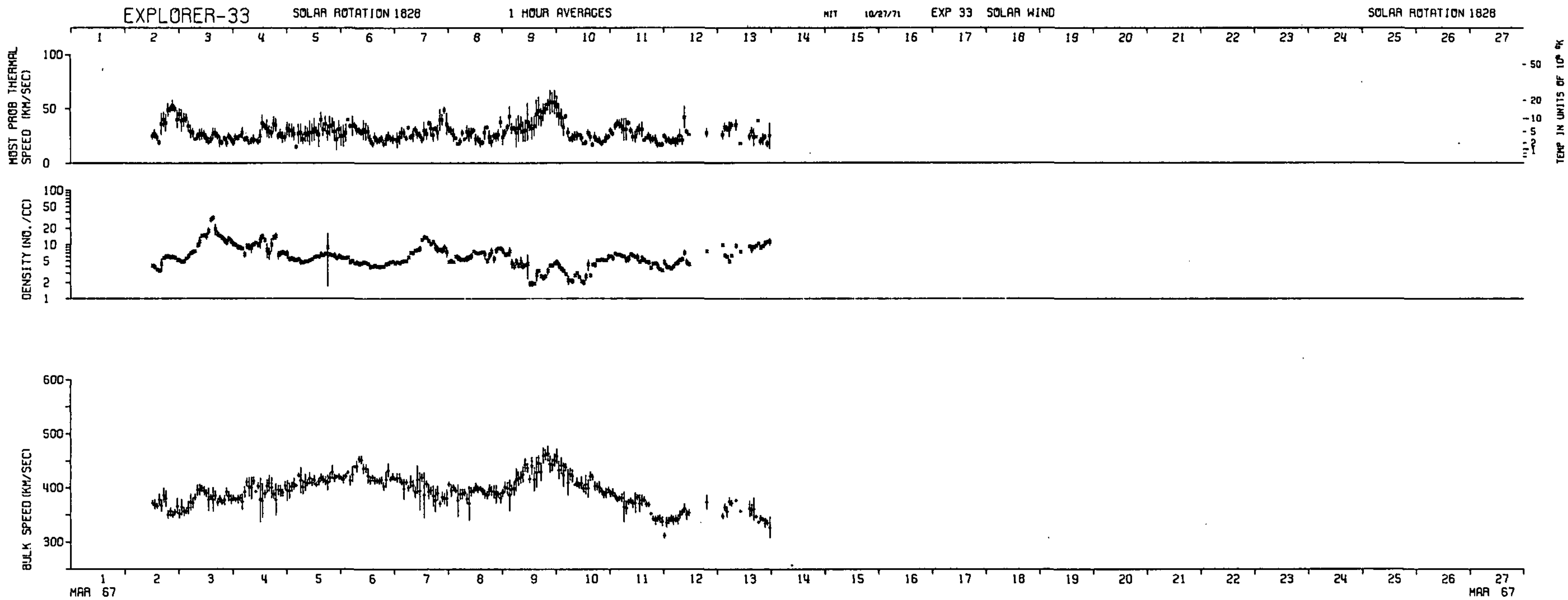
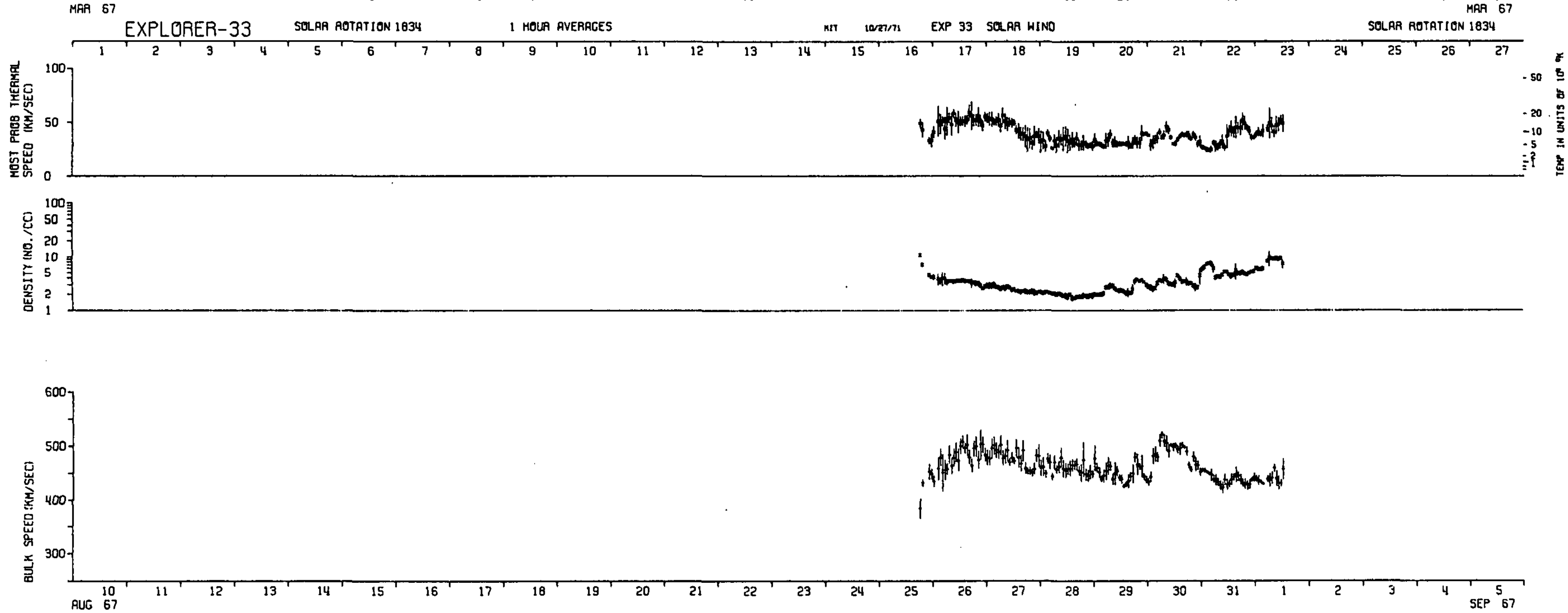
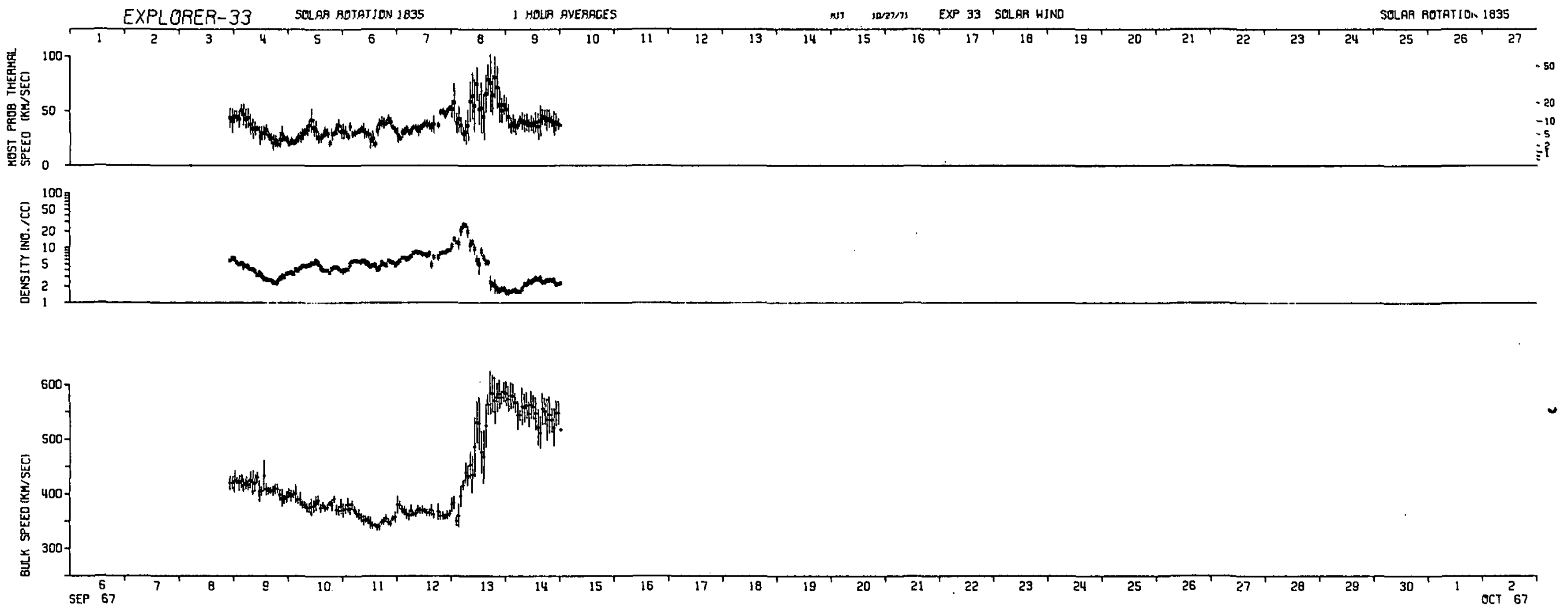
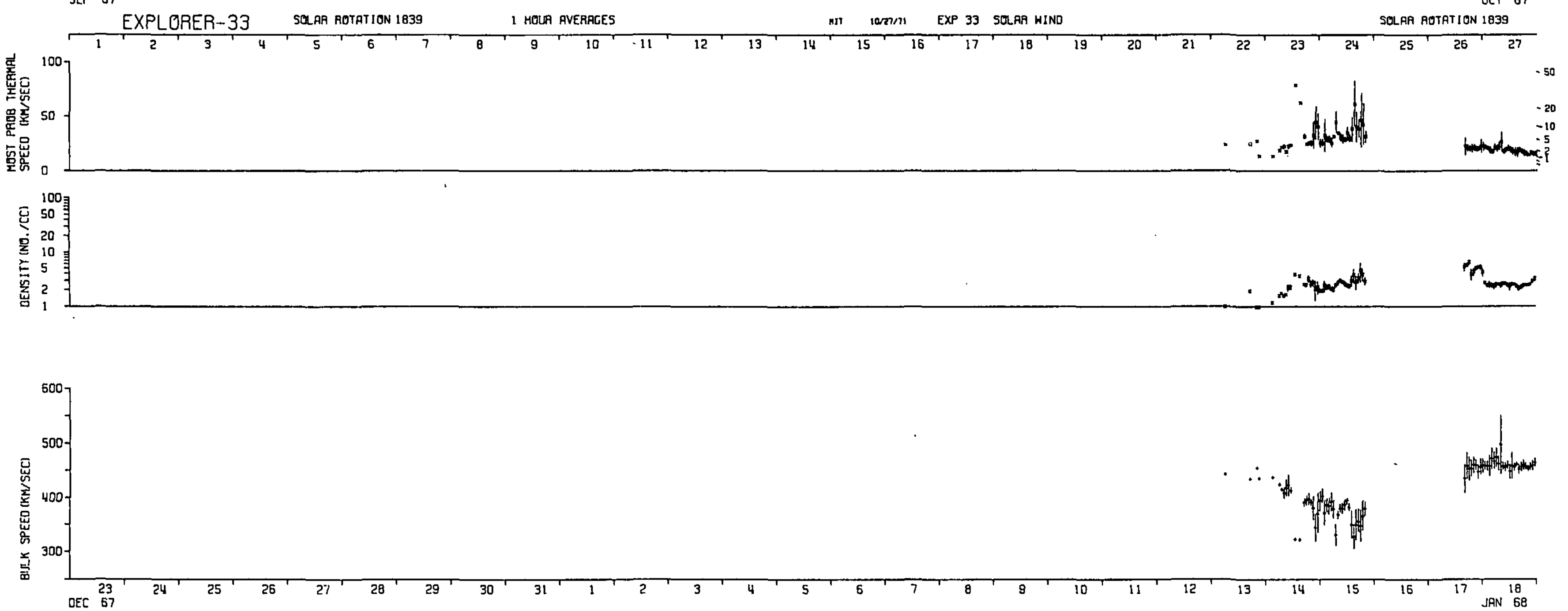
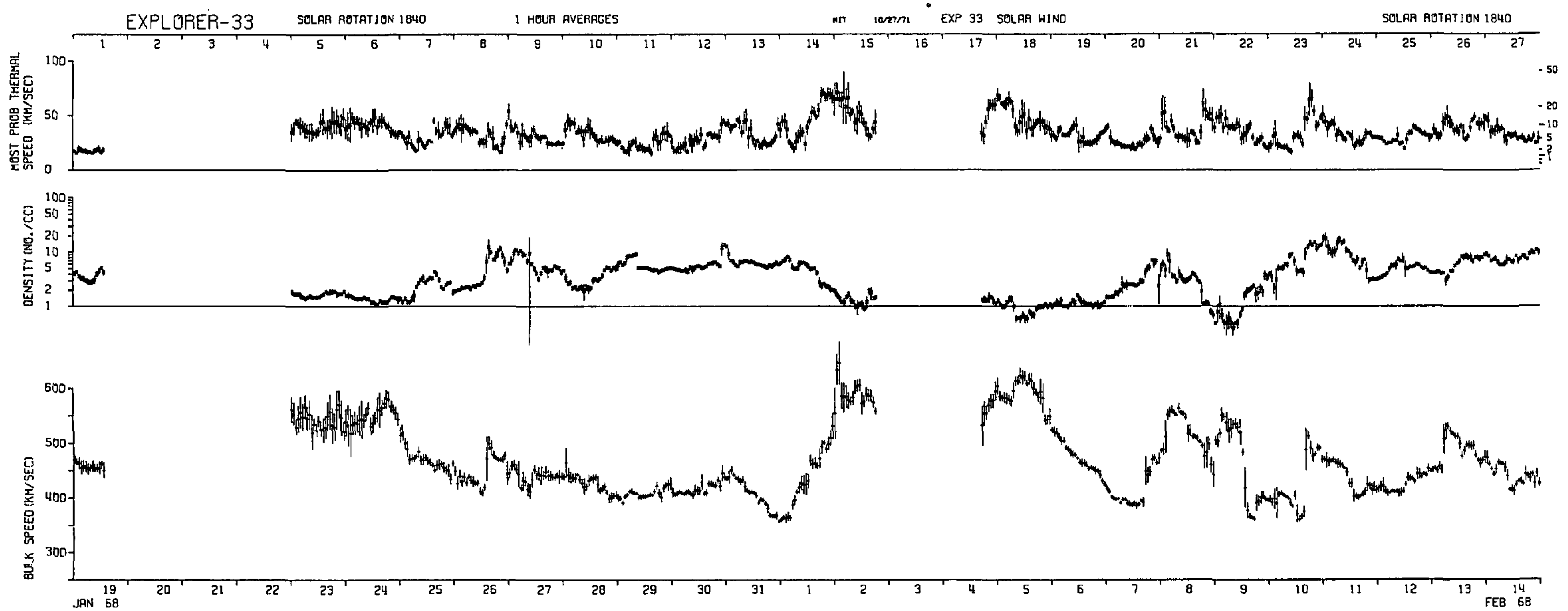
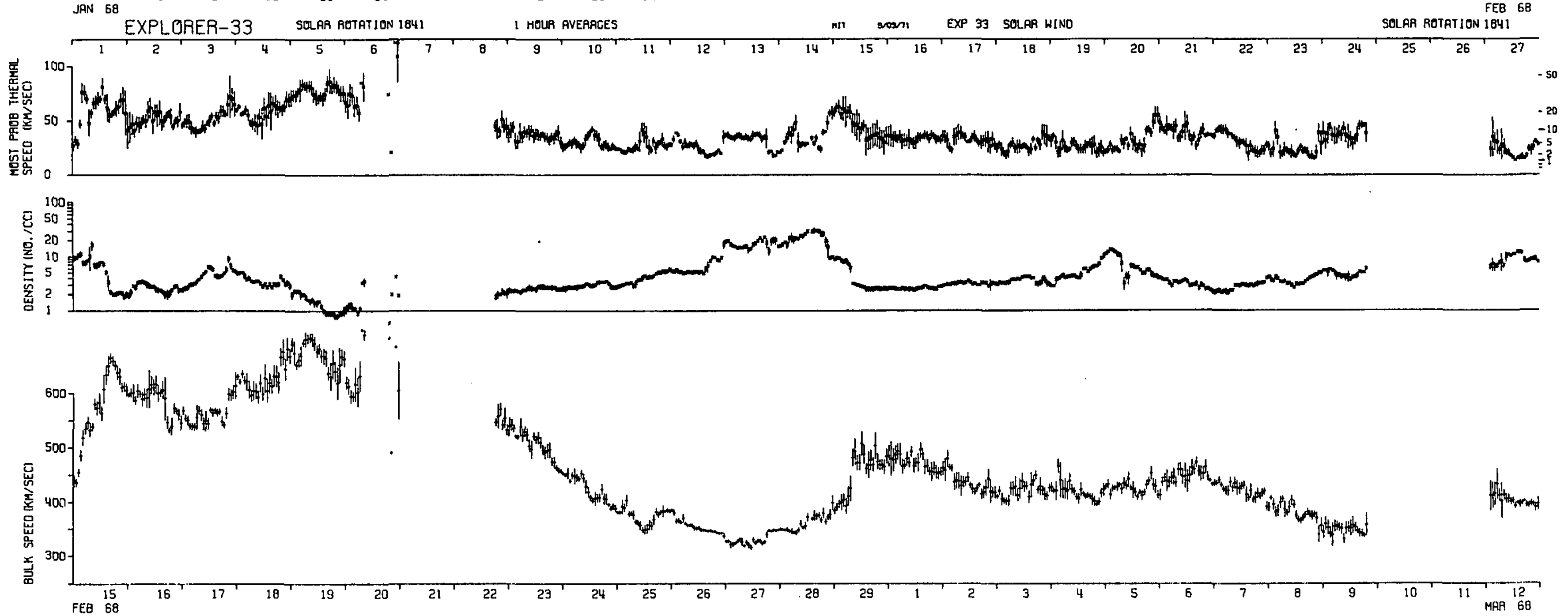
MOST PROB THERMAL SPEED (KM/SEC)
100
50
0
50
20
10
5
2
1
TEMP IN UNITS OF 10⁴ °K
DENSITY (NO./CC)
100
50
20
10
5
2
1
BULK SPEED (KM/SEC)
600
500
400
300
6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 1
JAN 67
FEB 67

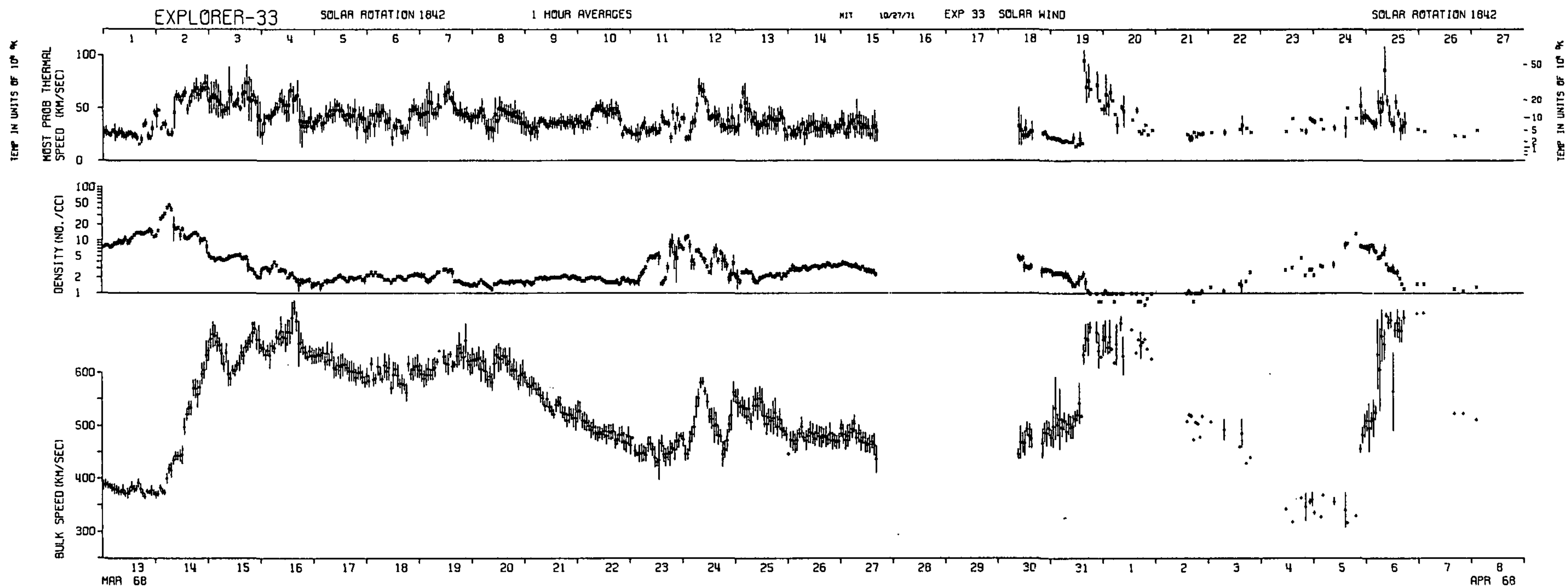

EXPLORER-33
SOLAR ROTATION 1828
1 HOUR AVERAGES
EXP 33 SOLAR WIND
SOLAR ROTATION 1828
MOST PROB THERMAL SPEED (KM/SEC)
DENSITY (NO./CC)
BULK SPEED (KM/SEC)
TEMP IN UNITS OF 10⁴ °K
MAR 67

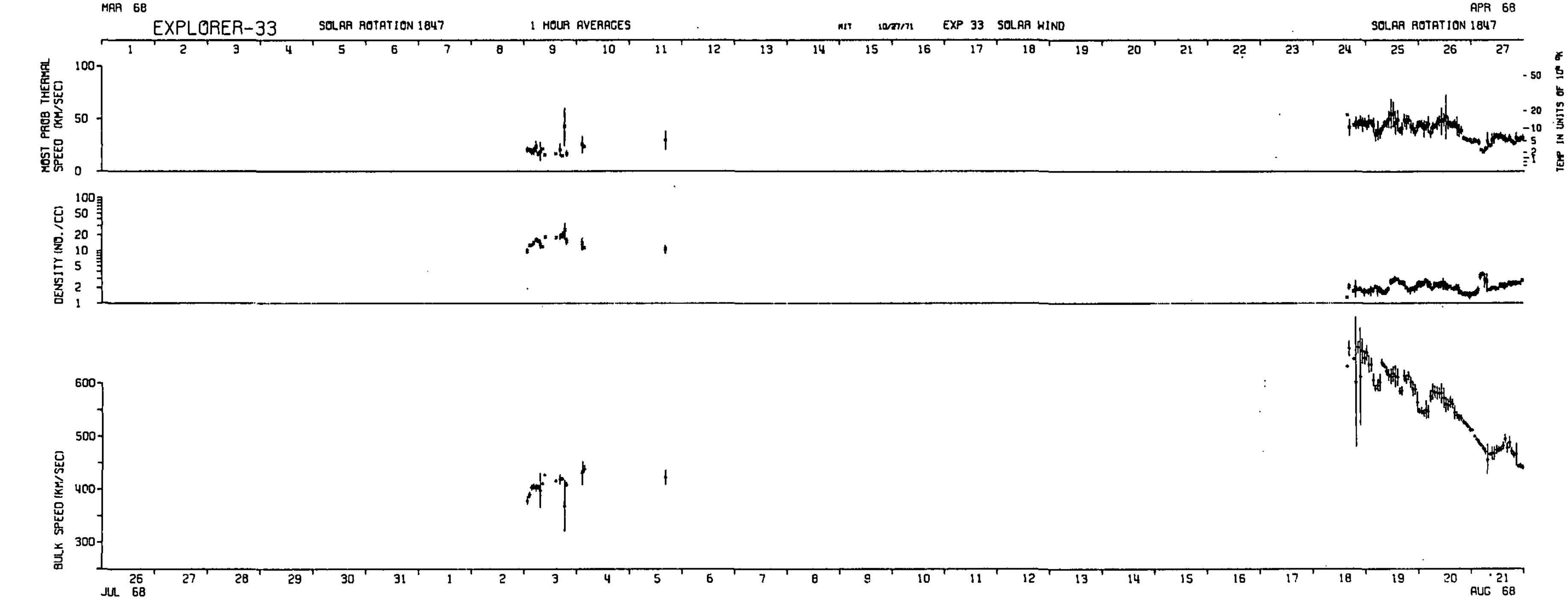

EXPLORER-33
SOLAR ROTATION 1834
1 HOUR AVERAGES
EXP 33 SOLAR WIND
SOLAR ROTATION 1834
MOST PROB THERMAL SPEED (KM/SEC)
DENSITY (NO./CC)
BULK SPEED (KM/SEC)
TEMP IN UNITS OF 10⁴ °K
AUG 67
SEP 67

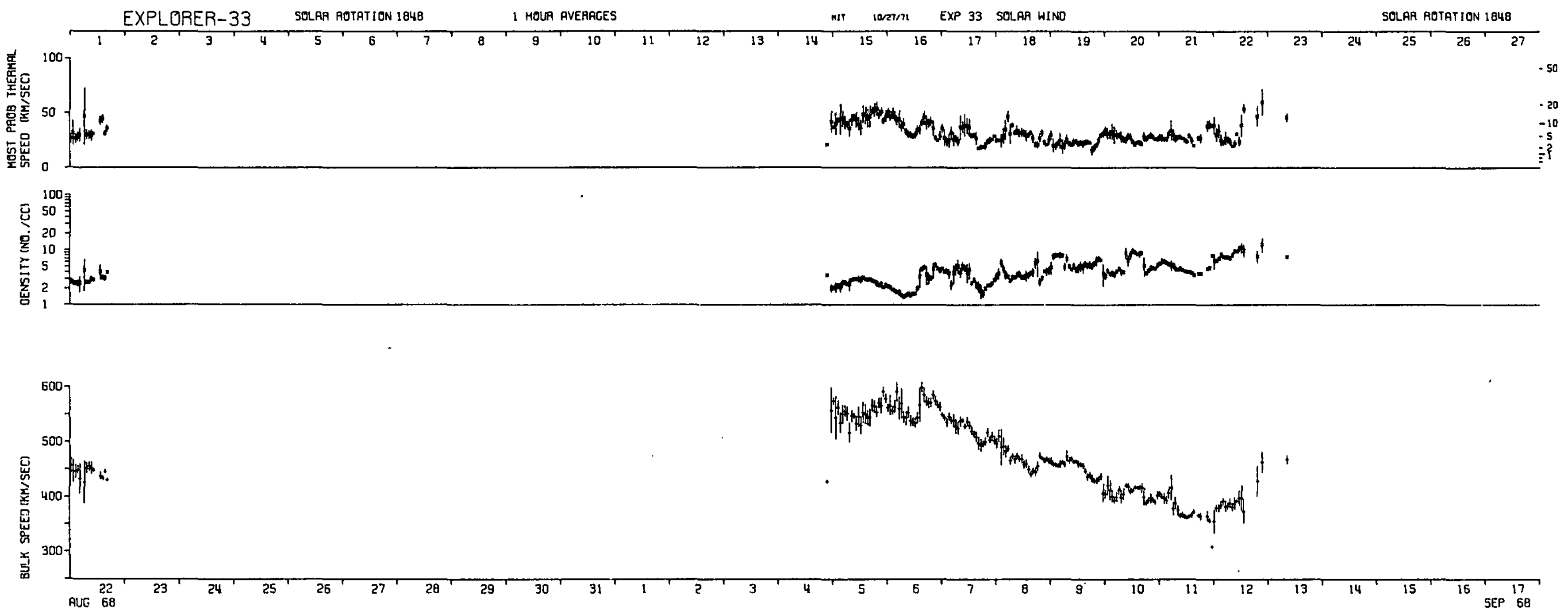

EXPLORER-33
SOLAR ROTATION 1835
1 HOUR AVERAGES
EXP 33 SOLAR WIND
SOLAR ROTATION 1835
MOST PROB THERMAL SPEED (KM/SEC)
DENSITY (NO./CC)
BULK SPEED (KM/SEC)
TEMP IN UNITS OF 10⁴ °K
SEP 67
OCT 67

EXPLORER-33
SOLAR ROTATION 1839
1 HOUR AVERAGES
EXP 33 SOLAR WIND
SOLAR ROTATION 1839
MOST PROB THERMAL SPEED (KM/SEC)
DENSITY (NO./CC)
BULK SPEED (KM/SEC)
TEMP IN UNITS OF 10⁴ °K
DEC 67
JAN 68

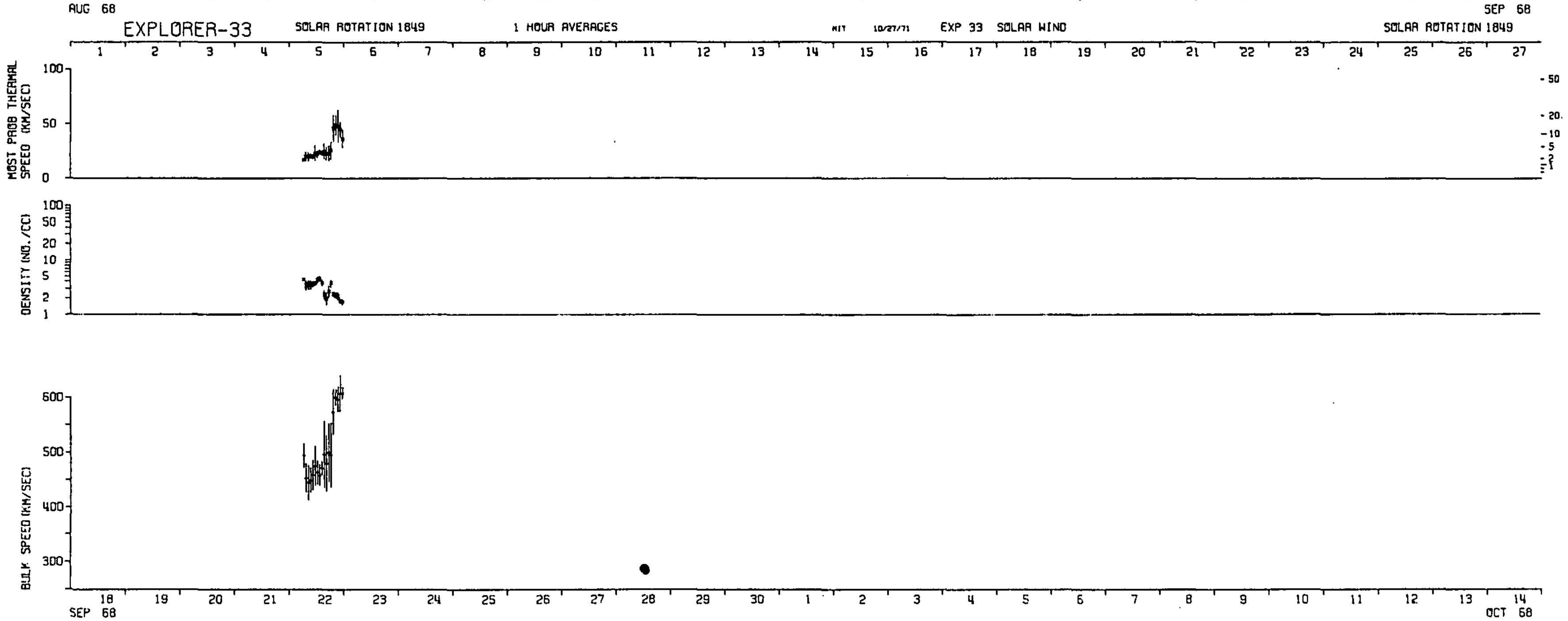

EXPLORER-33
SOLAR ROTATION 1840
1 HOUR AVERAGES
EXP 33 SOLAR WIND
SOLAR ROTATION 1840
MOST PROB THERMAL SPEED (KM/SEC)
DENSITY (NO./CC)
BULK SPEED (KM/SEC)
TEMP IN UNITS OF 10⁴ °K
JAN 68
FEB 68

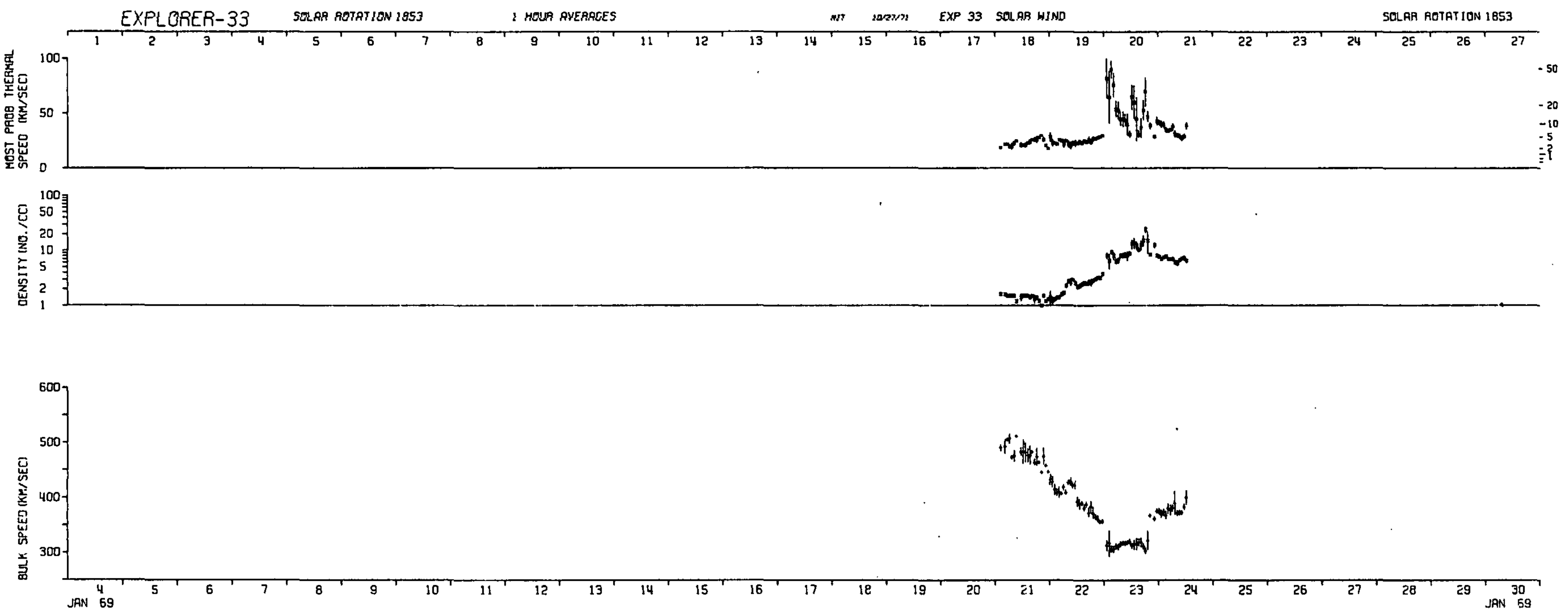

EXPLORER-33
SOLAR ROTATION 1841
1 HOUR AVERAGES
EXP 33 SOLAR WIND
SOLAR ROTATION 1841
MOST PROB THERMAL SPEED (KM/SEC)
DENSITY (NO./CC)
BULK SPEED (KM/SEC)
TEMP IN UNITS OF 10⁴ °K
FEB 68
MAR 68

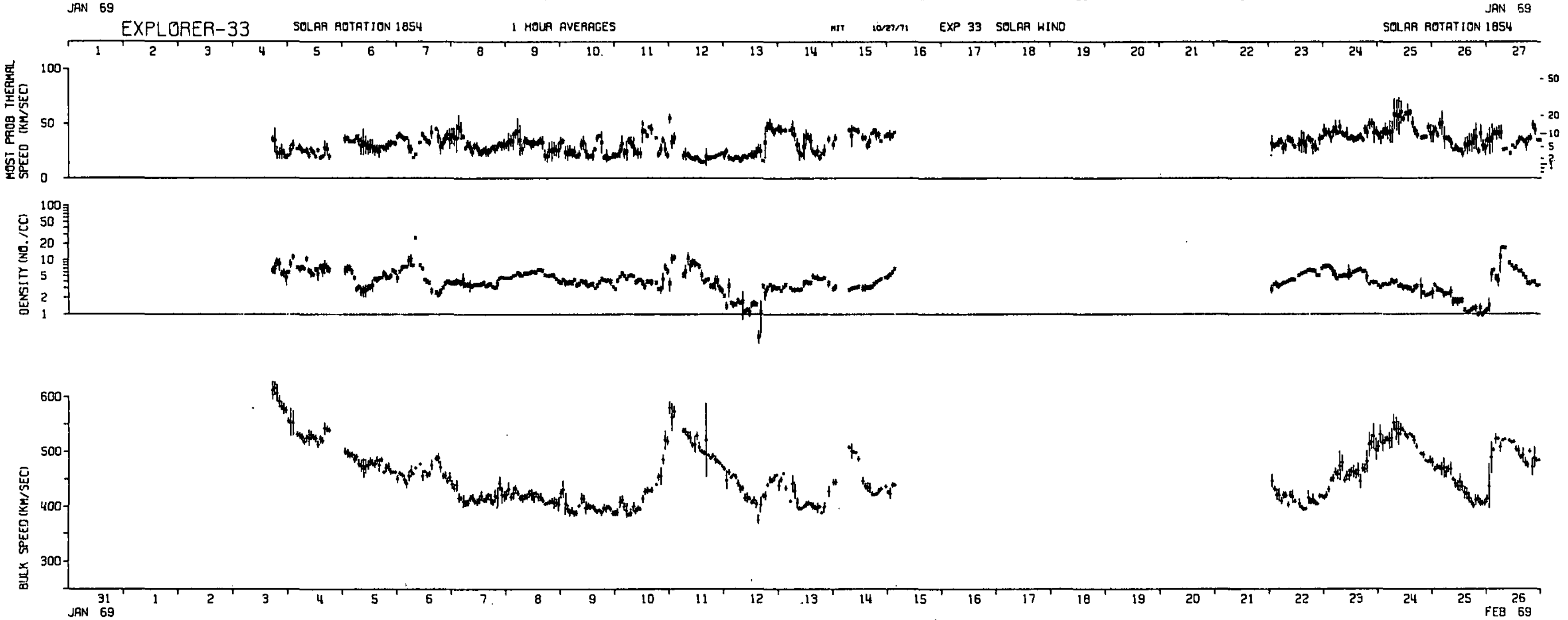

EXPLORER-33
SOLAR ROTATION 1842
1 HOUR AVERAGES
MIT 10/27/71
EXP 33 SOLAR WIND
SOLAR ROTATION 1842
MOST PROB THERMAL SPEED (KM/SEC)
TEMP IN UNITS OF 10⁴ °K
DENSITY (NO./CC)
BULK SPEED (KM/SEC)
MAR 68
APR 68

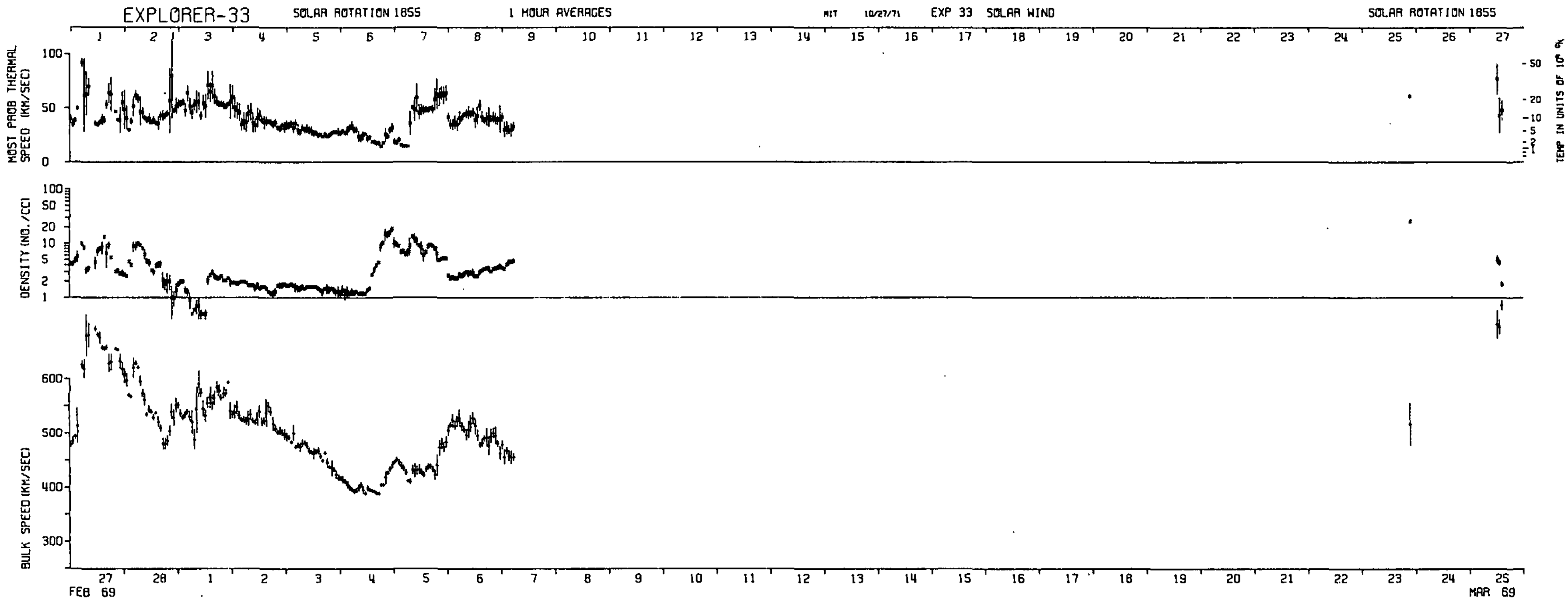

EXPLORER-33
SOLAR ROTATION 1847
1 HOUR AVERAGES
MIT 10/27/71
EXP 33 SOLAR WIND
SOLAR ROTATION 1847
MOST PROB THERMAL SPEED (KM/SEC)
TEMP IN UNITS OF 10⁴ °K
DENSITY (NO./CC)
BULK SPEED (KM/SEC)
JUL 68
AUG 68


EXPLORER-33
SOLAR ROTATION 1848
1 HOUR AVERAGES
MIT 10/27/71
EXP 33 SOLAR WIND
SOLAR ROTATION 1848
MOST PROB THERMAL SPEED (KM/SEC)
DENSITY (NO./CC)
BULK SPEED (KM/SEC)
TEMP IN UNITS OF 10^4 °K
AUG 68
SEP 68

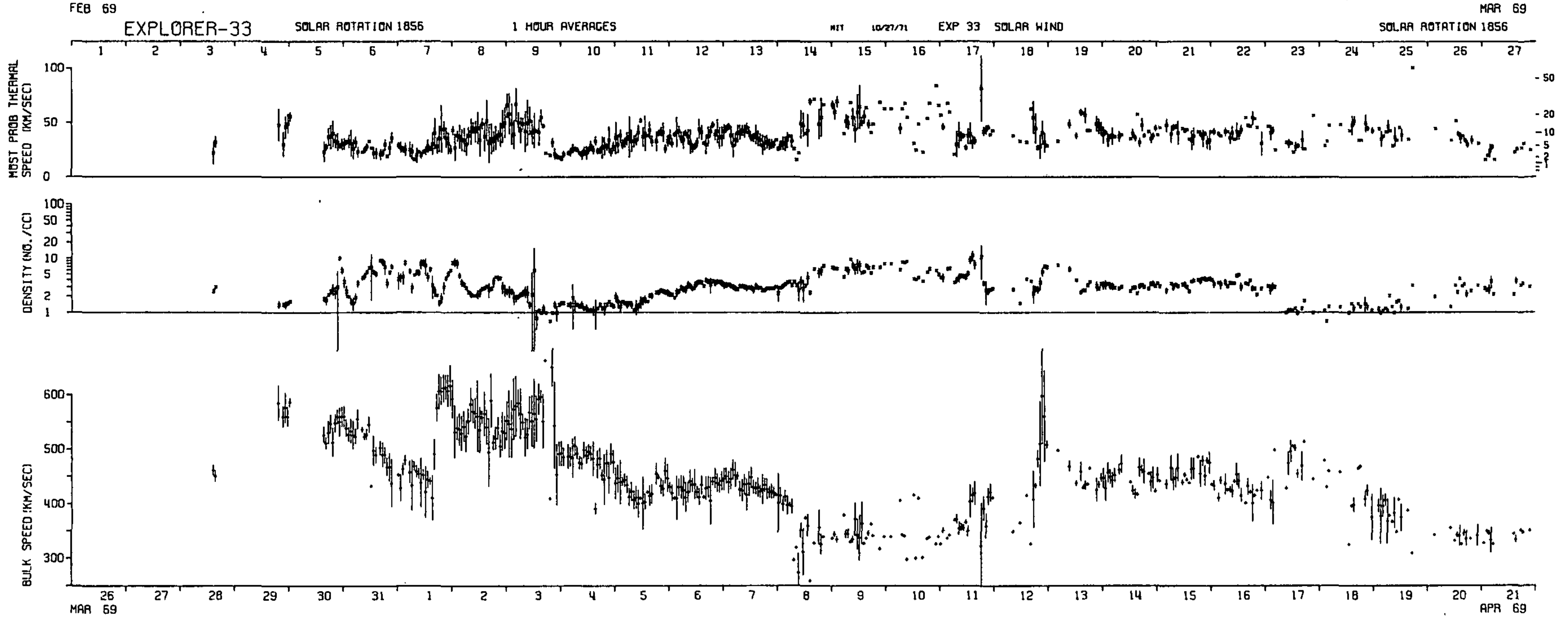

EXPLORER-33
SOLAR ROTATION 1849
1 HOUR AVERAGES
MIT 10/27/71
EXP 33 SOLAR WIND
SOLAR ROTATION 1849
MOST PROB THERMAL SPEED (KM/SEC)
DENSITY (NO./CC)
BULK SPEED (KM/SEC)
TEMP IN UNITS OF 10^4 °K
SEP 68
OCT 68


EXPLORER-33
SOLAR ROTATION 1853
1 HOUR AVERAGES
EXP 33 SOLAR WIND
SOLAR ROTATION 1853
MOST PROB THERMAL SPEED (KM/SEC)
TEMP IN UNITS OF 10⁴ °K
DENSITY (NO./CC)
BULK SPEED (KM/SEC)
JAN 69
JAN 69

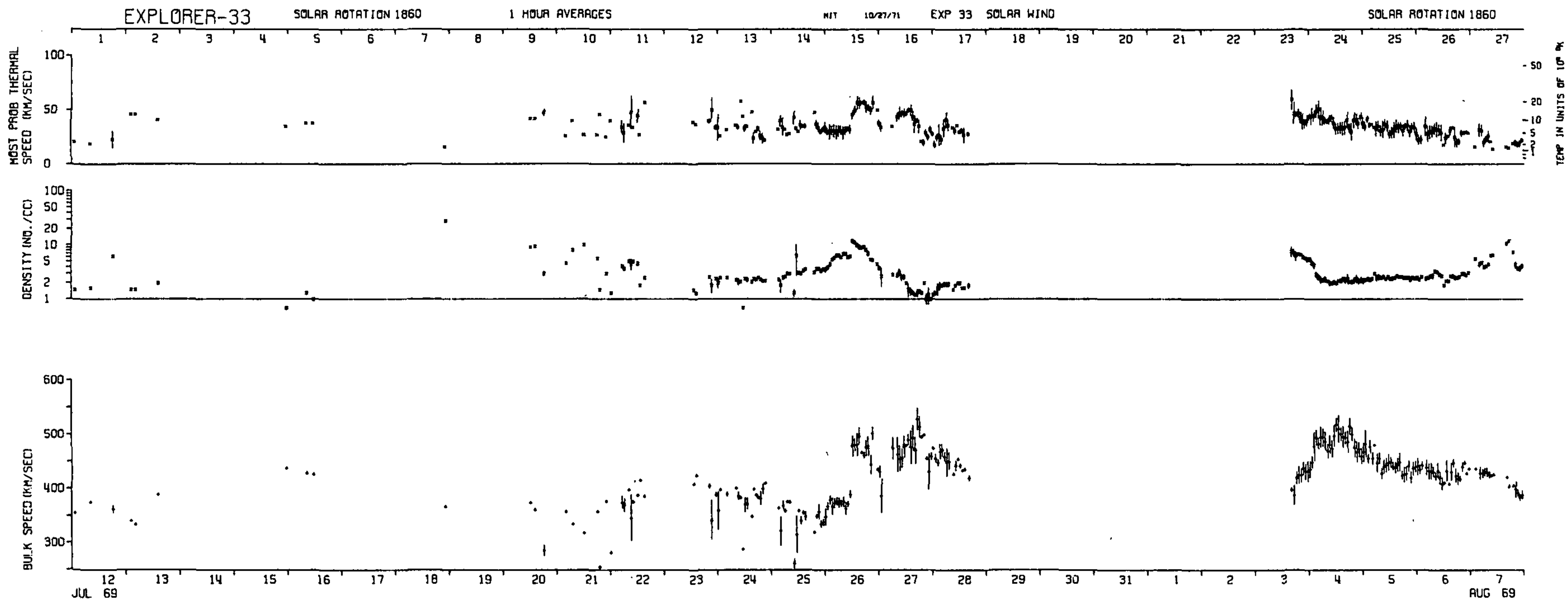

EXPLORER-33
SOLAR ROTATION 1854
1 HOUR AVERAGES
EXP 33 SOLAR WIND
SOLAR ROTATION 1854
MOST PROB THERMAL SPEED (KM/SEC)
TEMP IN UNITS OF 10⁴ °K
DENSITY (NO./CC)
BULK SPEED (KM/SEC)
JAN 69
FEB 69

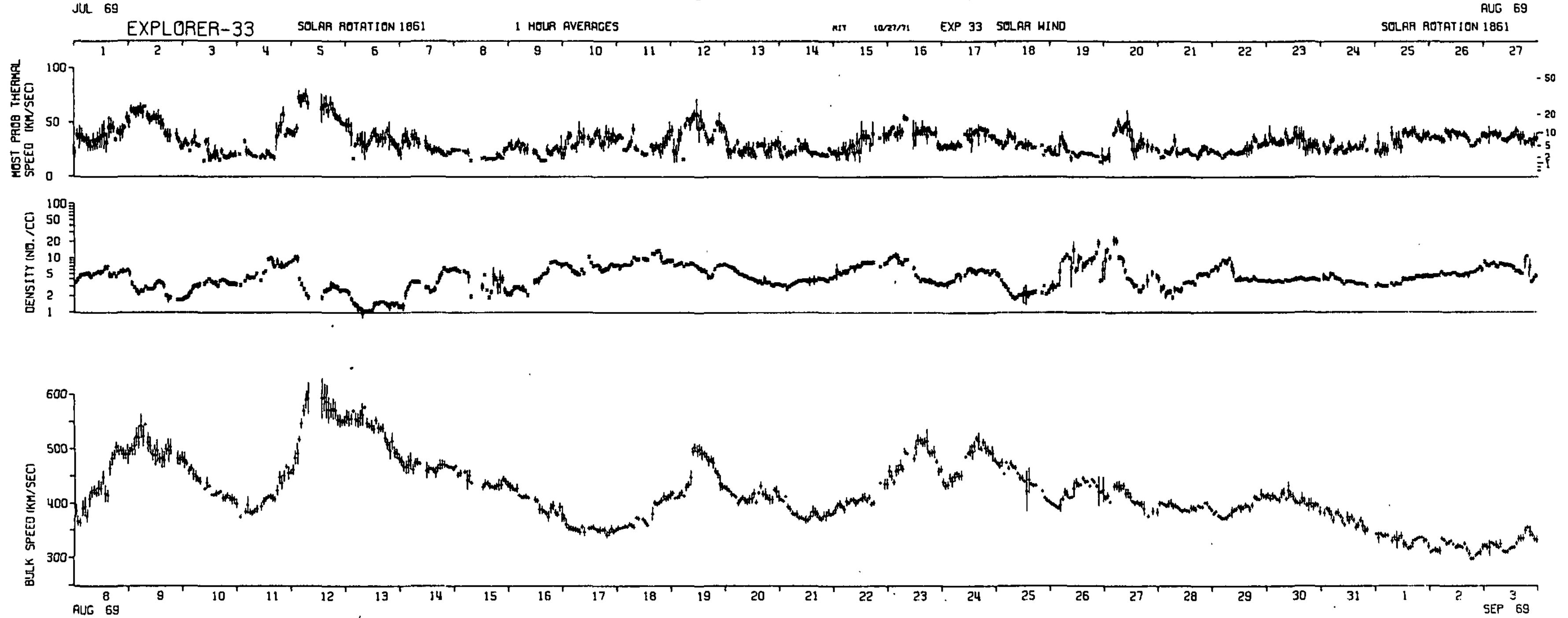


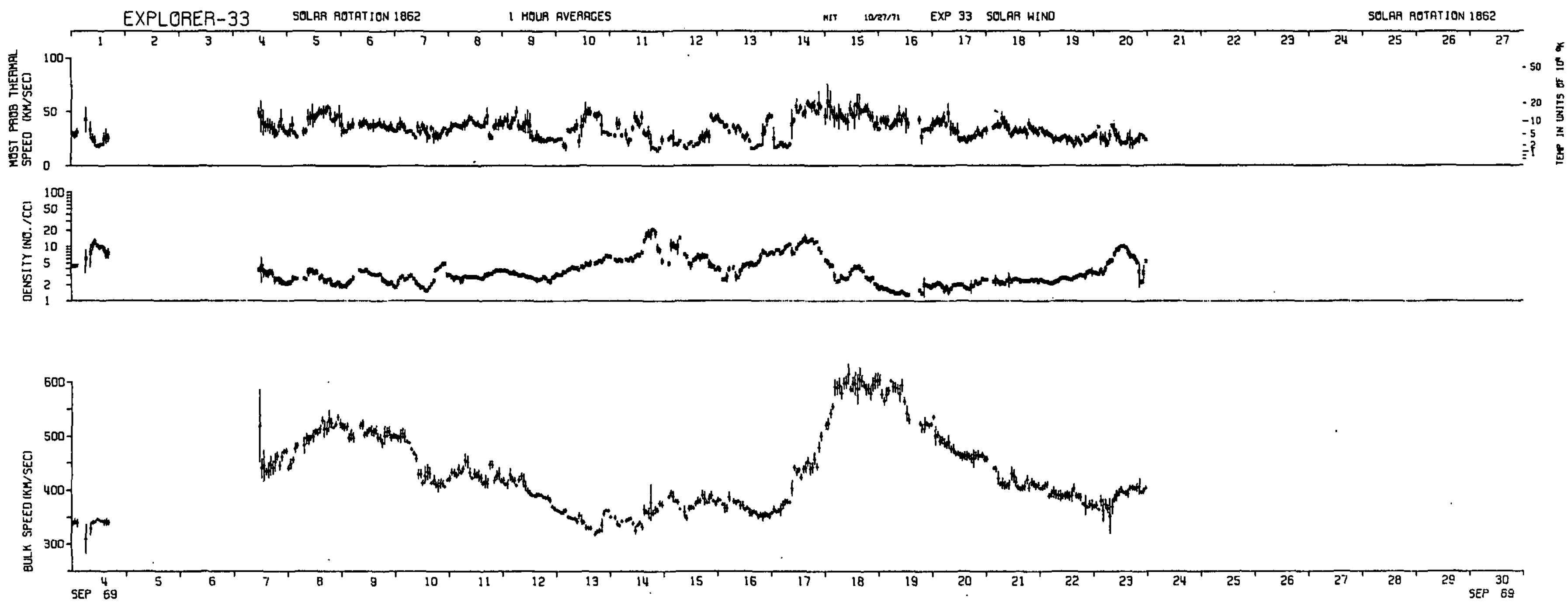
EXPLORER-33
SOLAR ROTATION 1855
1 HOUR AVERAGES
MIT 10/27/71
EXP 33 SOLAR WIND
SOLAR ROTATION 1855
MOST PROB THERMAL SPEED (KM/SEC)
DENSITY (NO./CC)
BULK SPEED (KM/SEC)
TEMP IN UNITS OF 10⁴ °K
FEB 69
MAR 69



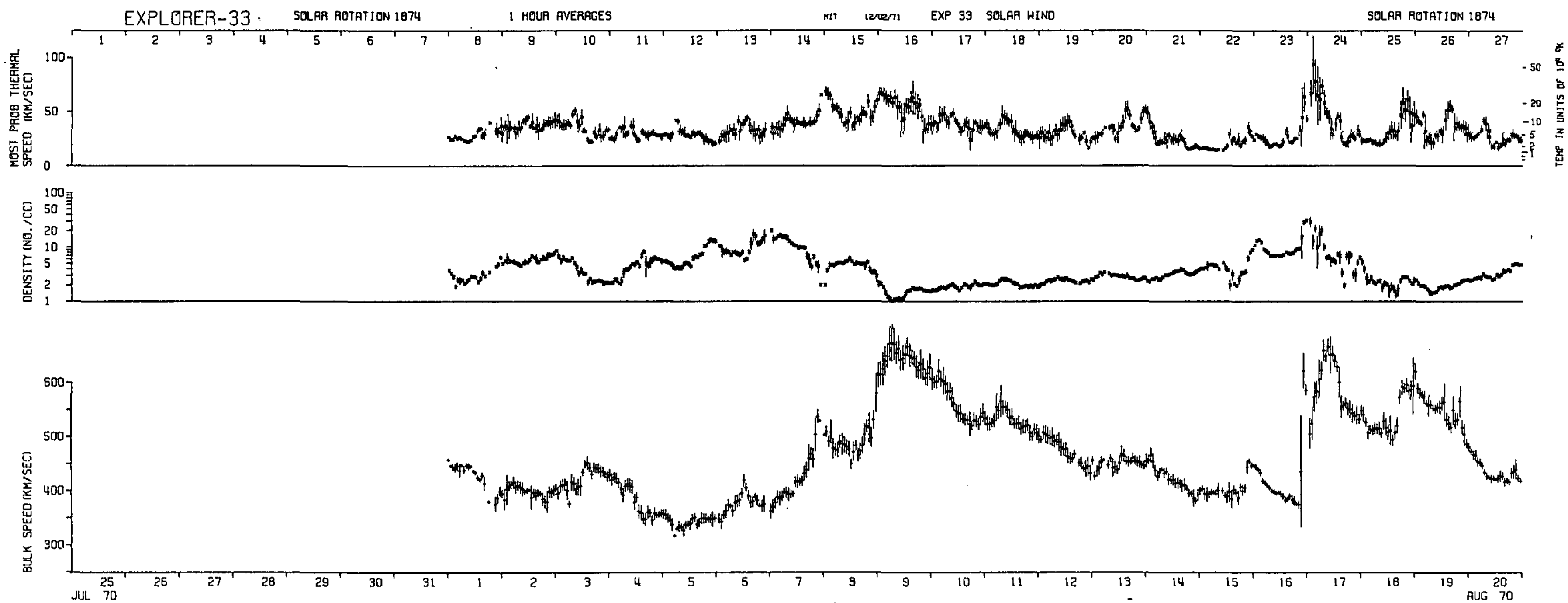
EXPLORER-33
SOLAR ROTATION 1856
1 HOUR AVERAGES
MIT 10/27/71
EXP 33 SOLAR WIND
SOLAR ROTATION 1856
MOST PROB THERMAL SPEED (KM/SEC)
DENSITY (NO./CC)
BULK SPEED (KM/SEC)
TEMP IN UNITS OF 10⁴ °K
MAR 69
APR 69

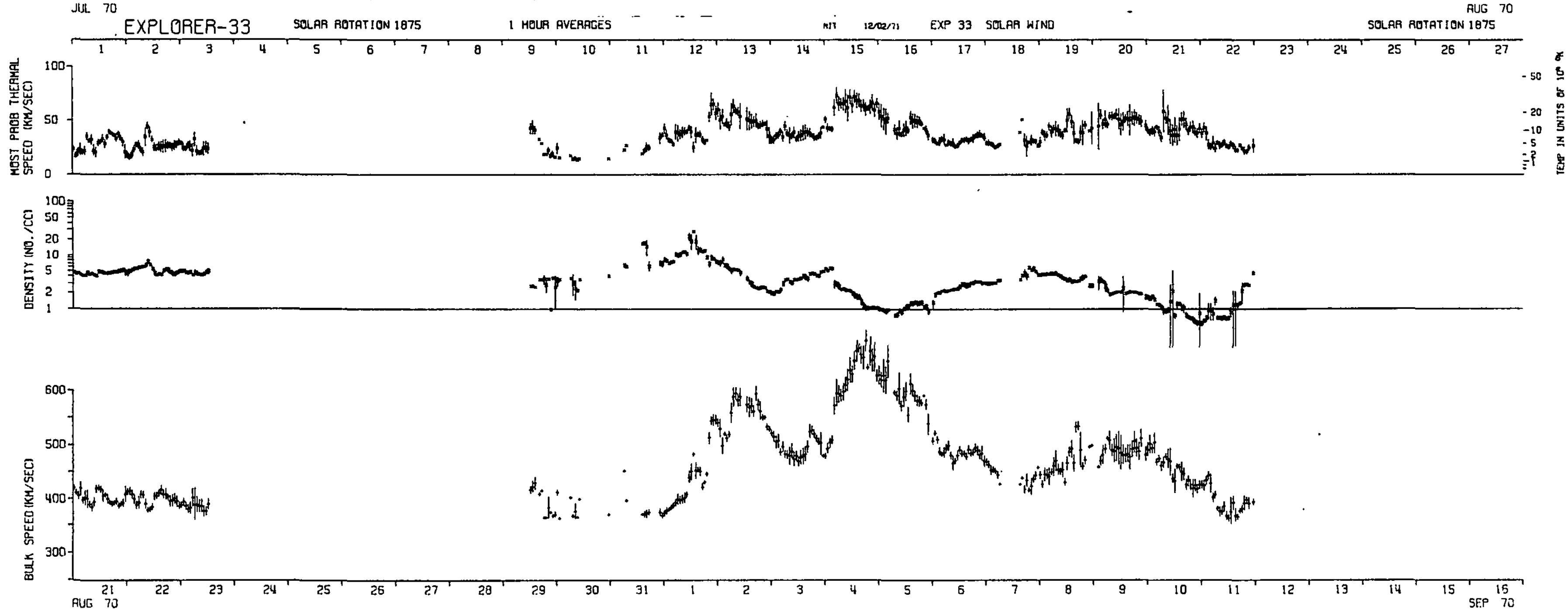

EXPLORER-33
SOLAR ROTATION 1860
1 HOUR AVERAGES
EXP 33 SOLAR WIND
SOLAR ROTATION 1860
MOST PROB THERMAL SPEED (KM/SEC)
TEMP IN UNITS OF 10^4 °K
DENSITY (NO./CC)
BULK SPEED (KM/SEC)
JUL 69
AUG 69


EXPLORER-33
SOLAR ROTATION 1861
1 HOUR AVERAGES
EXP 33 SOLAR WIND
SOLAR ROTATION 1861
MOST PROB THERMAL SPEED (KM/SEC)
TEMP IN UNITS OF 10^4 °K
DENSITY (NO./CC)
BULK SPEED (KM/SEC)
AUG 69
SEP 69

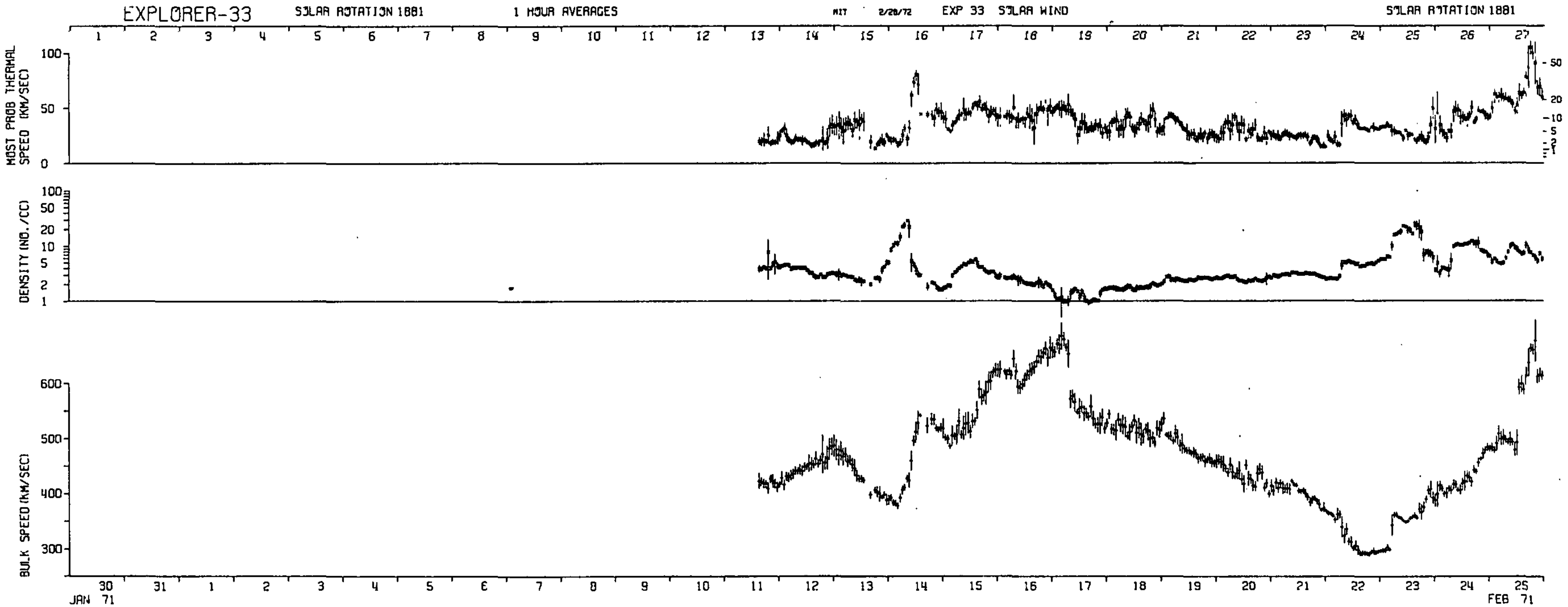


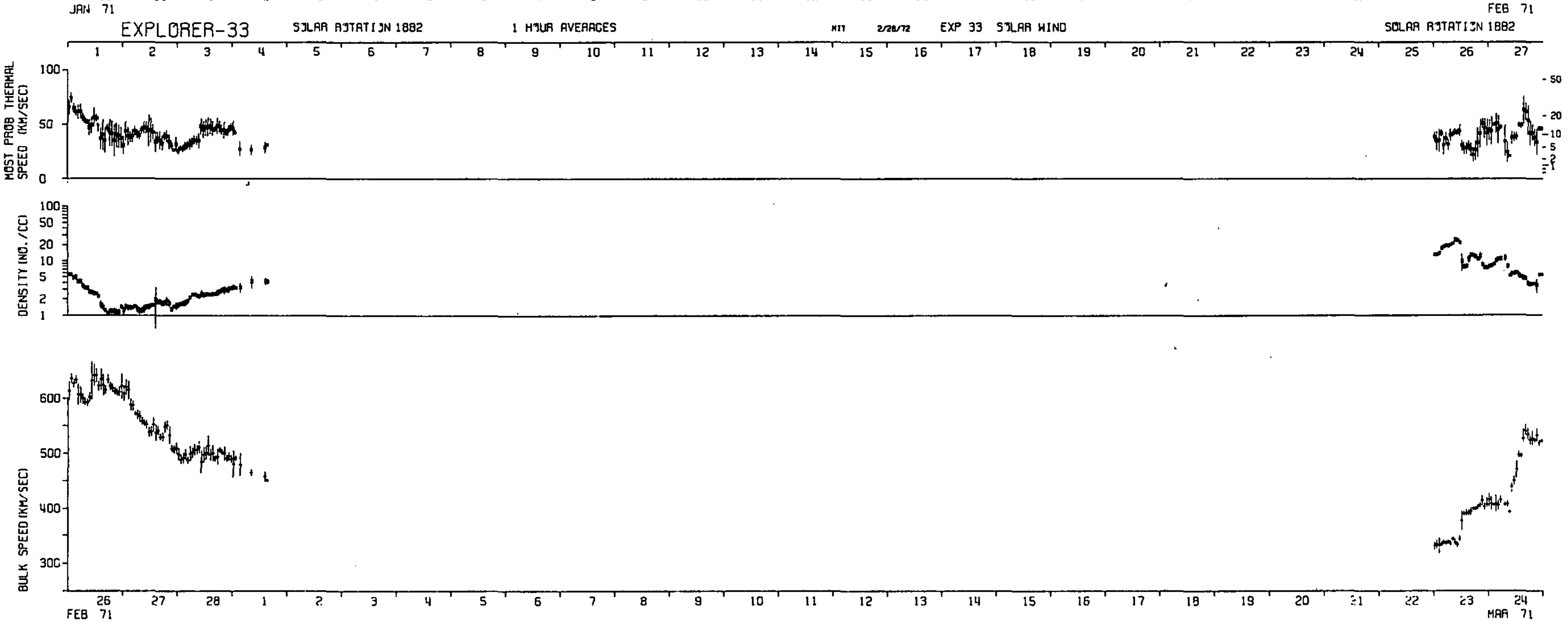
EXPLORER-33
SOLAR ROTATION 1862
1 HOUR AVERAGES
MIT 10/27/71
EXP 33 SOLAR WIND
SOLAR ROTATION 1862
MOST PROB THERMAL SPEED (KM/SEC)
TEMP IN UNITS OF 10⁴ °K
DENSITY (NO./CC)
BULK SPEED (KM/SEC)
SEP 69
SEP 69

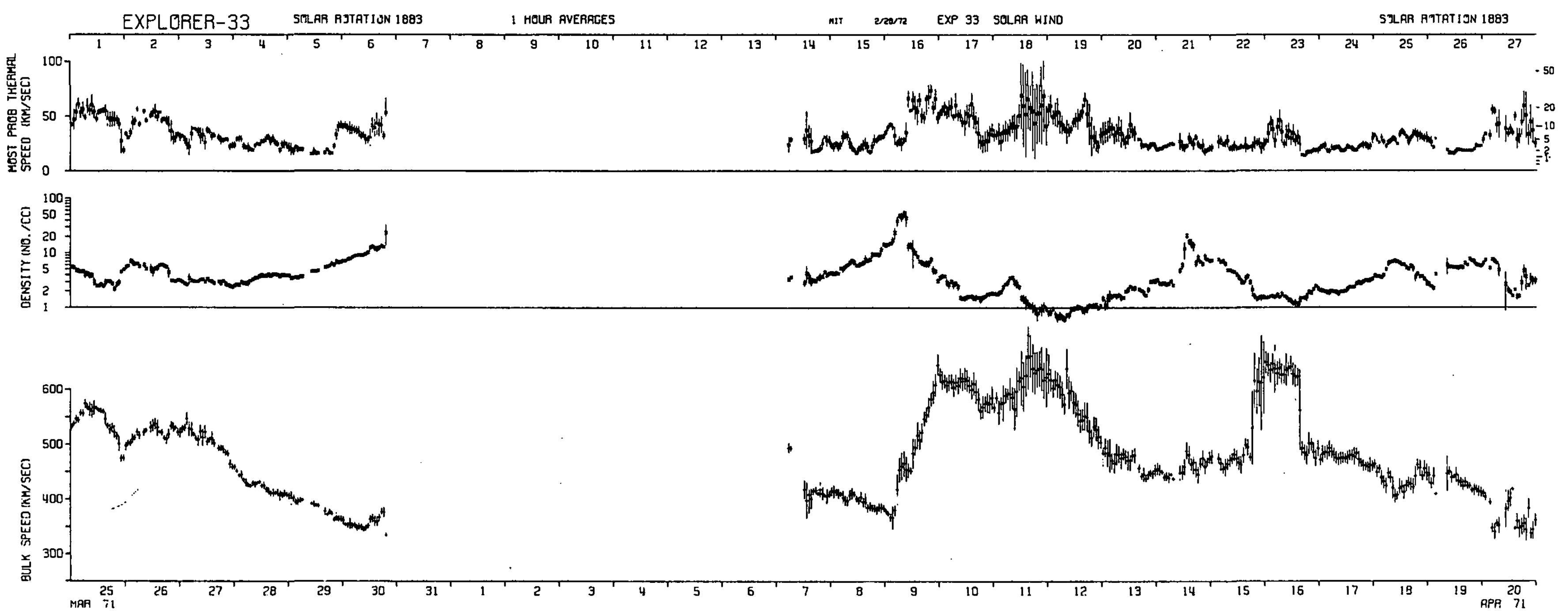

EXPLORER-33
SOLAR ROTATION 1874
1 HOUR AVERAGES
MIT 12/02/71
EXP 33 SOLAR WIND
SOLAR ROTATION 1874
MOST PROB THERMAL SPEED (KM/SEC)
TEMP IN UNITS OF 10⁴ °K
DENSITY (NO./CC)
BULK SPEED (KM/SEC)
JUL 70
AUG 70


EXPLORER-33
SOLAR ROTATION 1875
1 HOUR AVERAGES
MIT 12/02/71
EXP 33 SOLAR WIND
SOLAR ROTATION 1875
MOST PROB THERMAL SPEED (KM/SEC)
TEMP IN UNITS OF 10⁴ °K
DENSITY (NO./CC)
BULK SPEED (KM/SEC)
AUG 70
SEP 70

Data for solar rotations 1881 - 1883 are not yet available at the National Space Science Data Center on magnetic tape.


EXPLORER-33
SOLAR ROTATION 1881
1 HOUR AVERAGES
MIT 2/28/72
EXP 33 SOLAR WIND
SOLAR ROTATION 1881
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27
MOST PROB THERMAL SPEED (KM/SEC)
100
50
0
50
20
10
5
2
1
TEMP IN UNITS OF 10⁴ °K
DENSITY (NO./CC)
100
50
20
10
5
2
1
BULK SPEED (KM/SEC)
600
500
400
300
30 31 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25
JAN 71
FEB 71


EXPLORER-33
SOLAR ROTATION 1882
1 HOUR AVERAGES
MIT 2/28/72
EXP 33 SOLAR WIND
SOLAR ROTATION 1882
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27
MOST PROB THERMAL SPEED (KM/SEC)
100
50
0
50
20
10
5
2
1
TEMP IN UNITS OF 10⁴ °K
DENSITY (NO./CC)
100
50
20
10
5
2
1
BULK SPEED (KM/SEC)
600
500
400
300
26 27 28 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24
FEB 71
MAR 71



EXPLØRER-33
SOLAR ROTATION 1883
1 HOUR AVERAGES
MIT 2/28/72
EXP 33 SOLAR WIND
SOLAR ROTATION 1883
MOST PROB THERMAL SPEED (KM/SEC)
DENSITY (NO./CC)
BULK SPEED (KM/SEC)
TEMP IN UNITS OF 10⁴ °K
MAR 71
APR 71