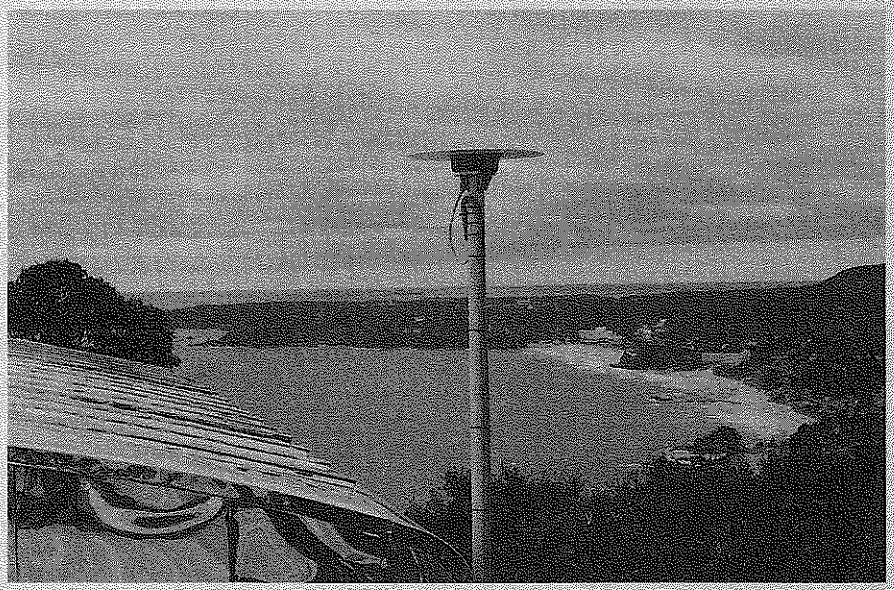
ISSN 0914-5753

水路部観測報告

衛星測地編

第 6 号

平成 5 年 3 月



海上保安庁

DATA REPORT
OF
HYDROGRAPHIC OBSERVATIONS

SERIES OF SATELLITE GEODESY

No. 6, March 1993

CONTENTS

Satellite laser ranging observations in 1991 1

Photographic direction observation of Ajisai in 1991 36

Positioning of the first order control points in the marine geodetic control network 45

Satellite Doppler positioning of off-lying Islands in 1991 60

GPS Observations around Sagami Bay in 1991 70

MARITIME SAFETY AGENCY
TŌKYŌ, JAPAN

Compiled by the Hydrographic Department of Japan (JHD).
Inquiries as to this publication should be addressed to:
Hydrographic Department
Tsukiji-5, Chuo-ku, Tōkyō,
104 Japan.

DATA REPORT

OF

HYDROGRAPHIC OBSERVATIONS

SERIES OF SATELLITE GEODESY

No.6, March 1993

SATELLITE LASER RANGING OBSERVATIONS IN 1991

Summary - Satellite laser ranging observations have been continued by a fixed type satellite laser ranging system at the Simosato Hydorographic Observatory (JHDLRS-1) and by a transportable one (HTLRS) at off-lying islands. The total numbers of returns obtained by the JHDLRS-1 in 1991 are 101,146 from 101 passes of Lageos, 41,739 from 91 passes of Starlette, 206,742 from 215 passes of Ajisai and 11,056 from 28 passes of ERS-1 (European Remote Sensing Satellite -1), respectively. Those obtained by the HTLRS at Minami Daito Sima in 1991 are 433 from 2 passes of Lageos, 79 from 2 passes of Starlette and 14,388 from 50 passes of Ajisai, respectively. The range precisions of the JHDLRS-1 are 6.5cm for Lageos, 5.8cm for Starlette, 6.0cm for Ajisai and 7.5cm for ERS-1, respectively. Those of the HTLRS are 3.6cm for Lageos, 2.5cm for Starllete and 4.6cm for Ajisai, respectively.

Key words: satellite laser ranging - global geodesy - Lageos - Ajisai - Starlette - JHDLRS-1 - HTLRS

This is a report of the satellite laser ranging (SLR) observations obtained by a fixed type satellite laser ranging station at the Simosato Hydrographic Observatory called JHDLRS-1, which is identical to SHOLAS which appears in the previous report, and a transportable one called HTLRS (Sasaki 1988) at off-lying islands. This report contains the lists of data obtained by these two stations in 1991. Previous data obtained by the JHDLRS-1 appear in the Series of Astronomy and Geodesy, Data Report of Hydrographic Observations for the period from 1982 to 1985, and in the Series of Satellite Geodesy from 1986 to 1990. Routine observation by the HTLRS started in December 1987, and previous data obtained by the HTLRS at off-lying islands appear in the Data Report of Hydrographic Observation, Series of Satellite Geodesy, No. 3, 4 and 5 (Sengoku *et al.* 1990, 1991, 1992)

1. Observation

The routine ranging observation for Lageos, Starlette, and Beacon (BE)-C started in April 1982 by using a fixed type SLR station at the Simosato Hydrographic Observatory (the JHDLRS-1) under the mutual cooperation between the Hydrographic Department(JHD) and the National Aeronautics and Space Administraion (NASA) of the United States of America. According to the launch of Japanese first Geodetic Satellite "Ajisai" in August 1986, observation of BE-C was terminated in July 1986. Lageos, Starlette and Ajisai were observed routinely from August 1986 to June 1992. European Remote Sensing Satellite "ERS-1" was

launched in July 1991, and the range observation started immediately after the launch. Lageos, Starlette, Ajisai and ERS-1 have been observed since then.

The range observation for Lageos, Starlette and Ajisai by the HTLRS started in December 1987. The range observation by the HTLRS at off-lying islands have been carried out as follows.

Jan. - Mar. 1988 : Titi sima
Jul. - Sep. 1988 : Isigaki sima
Jan. - Mar. 1989 : Minamitori Sima
Jul. - Sep. 1989 : Okinawa Sima
Oct. - Nov. 1989 : Tusima
Sep. - Oct. 1990 : Oki Shoto
Dec. 1990 - Feb. 1991 : Minami-Daito Sima
Aug. - Nov. 1991 : Tokati

The major specifications of the JHDLRS-1 and the HTLRS are listed in Table 1 and 2(Sasaki *et al.* 1983, Sasaki 1988). The locations of the system and fiducial stonemarkers set up near the system are shown in Table 3 (Takemura, 1983).

The observation schedule of the JHDLRS-1 was made by selecting those passes whose maximum elevation was over 30 degrees for Ajisai, nighttime passes of Lageos and Starlette, over 35 degrees for daytime passes of Lageos. The observation schedule of the HTLRS was made by selecting those passes whose maximum elevation was over 20 degrees at night. When the HTLRS was operational, the same criterion was applied to the JHDLRS-1. In principle, observation was not carried out on Saturday and Sunday. The priority of the selection for simultaneous transits was in the order of Ajisai, Lageos, Starlette and ERS-1.

The SAO-formatted orbital elements of the satellites for the use of scheduling and tracking were sent from the Goddard Space Flight Center(GSFC) of NASA through GE Mark III network. The orbital elements of Ajisai were also calculated in the Headquaters of the JHD by using quick-look data sent from Simosato and from GSFC via GE Mark III network since the launch of the satellite. For the satellite tracking, an analytical tracking program using the elements were used. The tracking was carried out when the elevation of satellites was above 20 degrees. The temperature, atmospheric pressure and relative humidity were measured once in a pass. Before and after ranging satellites, the ranging calibrations were made by using ground targets.

The total numbers of returns and passes obtained by the JHDLRS-1 and by the HTLRS at Minami-Daito Sima and Tokati in 1991 are listed in table 4, 5 and 6.

In order to improve ranging precision, the JHDLRS-1 have been upgraded several times. A micro channel plate photomultiplier was introduced in the JHDLRS-1 in Jan 1985. A GPS clock was introduced in the JHDLRS-1 in December 1988, and it has been available since April 1989. A GPS clock was also used in the HTLRS in order to check the Loran C clock. A laser subsystem of the JHDLRS-1 was upgraded to a Quantel YG 460-5 at the beginning of July 1990.

2. Polynomial fitting and preliminary analysis of range data

False range data were removed by a visual rejection system. The system works on CRT screens by applying a filter of polynomial fitting to difference of measured range and predicted range or measured range itself by use of the on-site computer. Preliminary values of standard deviation for each pass were estimated

in this process.

A part of obtained data, named quick-look (QL) data, were sent to the GSFCwithin two days through GE Mark Ⅲ network. QL data of ERS-1 were sent to theDeutsches Geodaetisches Forschungsinstitut (DGFI) within one day though GE Mark Ⅲ network. All the range data, after application of the correction of the internal time delay of the SLR systems obtained by the ground target ranging, named full rate (FR) data, were recorded on a magnetic tape in MERIT Ⅱ Format (CSTG,1987) together with the satellite ID, the station ID, the transmitted time corrected into UTC (USNO MC), the meteorological data, the preliminary measurement standard deviation and some preprocessing indications. The FR data on magnetic tapes for the above four satellites were sent to the GSFC and the Centre d'Etudes et de Recherches Geodynamic et Astronomiques(CERGA) of France. The FR data of ERS-1 were also sent to the DGFI.

The weighted mean range precisions estimated by using the polynomial fitting for all the data obtained by the JHDLRS-1 in 1991 are 6.5cm for Lageos, 5.8cm for Starlette, 6.0cm for Ajisai and 7.5cm for ERS-1, respectively, as shown in Table 4. The same for the HTLRS are 3.6cm for Lageos, 2.5cm for Starlette and 4.3cm for Ajisai, respectively.

The QL data sent to the GSFC were used to update orbital elements. These data were transferred from the GSFC to the CSR and were used for the estimation of the polar motion and the variation of the angular velocity of the earth rotation by processing with the SLR data from other sites in the world. All the FR data were also analyzed in the CSR, and more precise values for the earth rotation parameters have been estimated. The FR data sent to the Crustal Dynamics Project were used to detect crustal movements and global plate motions.

The JHD has been processing FR data obtained at Simosato and other SLR sites by using an orbital processor (Sasaki, 1984a). A result of the geodetic coordinates for the cross point of azimuth and elevation axes of the JHDLRS-1 is 33° 34' 39". 70N, 135° 56' 13". 34E, 101.6 m for latitude, longitude and height above the reference ellipsoid of 6 378 137 m semi-major axis and 1/298.257 flattening, respectively (Sasaki, 1990).

The observations of satellite laser ranging were made by K. Matsumoto, H. Nakagawa, A. Suzuki, H. Ito, M. Suzuki, K. Tomii, T. Kurokawa, K. Sawada, S. Yosida, Y. Narita and K. Maeji of the Simosato Hydorographic Observatory and T. Utiyama, E. Nisimura,

A. Sengoku, K. Fuchida, I. Sato, K. Kawai, S. Masai, S. Kurokawa, H. Noda and N. Ikeda of the JHD Headquaters.

Calculations and compilation for this report have been made by A. Sengoku, S. Murakami, N. Ikeda of the JHD Headquaters and K. Matsumoto of the Simosato Hydrographic Observatory.

References

Abshire, J. B., 1980: *NASA Report*, "Plan for Investigating Atmospheric Errors in Satellite Laser Ranging Systems".

CSTG, 1987: Satellite Laser Ranging Newsletter SLR subcommision of the CSTG (Inter national Coordi nation of Space Techniques for Geodesy and Geodynamics) vol. 2, No. 1, p. 5.

Marini, J. W., C. W. Murray, Jr., 1973: NASA *report*, X-591-73-351, GSFC, Maryland. Sasaki, M., Y. Ganeko, Y. Harada, 1983: *Data Report of Hydrogr. Obs., Series of Astronomy and Geodesy*, No. 17, 49.

Sasaki, M., 1984a: *Report of Hydrogr. Researches*, No. 19, p. 107.

Sasaki, M., 1984b: *Jour. Geod. Soc. Japan*, vol. 30, p. 29.

Sasaki, M., 1988: *Data Report of Hydrogr. Obs., Series of Satellite Geodesy*, No. 1, p. 59.

Sasaki, M., 1990: Study of the Earth's Dynamics by Means of Satellite Laser Ranging Techniques, *Report of Hydrogr Researches*, No. 26, p. 99.

Kanazawa, T., A. Sengoku, M. Nagaoka, E. Nisimura, 1987: *ibid.*, No. 21, p. 63 (for 1985).

Schutz, B. E., 1983: Satellite Laser Ranging Procedures Guide for Project MERIT, CSR, Univ.of Texas,Austin.

USNO, 1991, 1992: *Daily Time Differences and Relative Phase Values, Series 4*, No. 1248-1300.

The reports of the SLR observations for the preceding years were presented in the following numbers of the Data Report of Hydrographic Observations.

Sasaki, M., M. Nagaoka, 1984: *Data Report of Hydrogr. Obs., Series of Astronomy and Geodesy*, No. 18, p. 55 (for 1982).

Sasaki, M., A. Sengoku, E. Nisimura, M. Nagaoka, 1985: *ibid.*, No. 19, p. 50 (for 1983).

Sasaki, M., A. Sengoku, M. Nagaoka, E. Nisimura, 1986: *ibid.*, No. 20, p. 44 (for 1984).

Kanazawa, T., A. Sengoku, M. Nagaoka, E. Nisimura, 1988: *Data Report of Hydrogr. Obs., Series of Satellite Geodesy*, No. 1, p. 19 (for 1986).

Kanazawa, T., A. Sengoku, M. Nagaoka, H. Nakagawa, 1989: *ibid.*, No. 2, p. 1 (for 1987).

Sengoku, A., M. Nagaoka, K. Fuchida, S. Masai, T. Fujii, H. Nakagawa, 1990:*ibid.*, No. 3, p. 1 (for 1988).

Sengoku, A., S. Kurokawa, H. Nakagawa, 1991: *ibid.*, No. 4, p. 1(for 1989).

Sengoku, A., S. Kurokawa, N. Ikeda and K. Matsumoto, 1992: *ibid.*, No. 5, p. 1 (for 1990).

Table 1. Principal specifications of Satellite Laser Ranging Station of the Sinosato Hydrographic Observatory (SHOLAS)

Subsystem	Specification
Mount configuration	elevation over azimuth/Coude path
Angular resolution	20 bits (1.2 arcsec)
Transmitter diameter	17 cm
Receiver diameter	60 cm
Laser wave length	532 nm
Output energy	125 mJ
Laser pulse width	100 ps
Repetition rate	4 pps
Receiver detector	Micro-Channel-Plate PMT (9%Q. E. and 300 ps rise time)
Flight time counter	20 ps resolution
Frequency standard	Rubidium oscillator
Time comparison	GPS(TRIMBLE, 5000A), multi-Loran C wave (NW Pacific Chain)
Computer	PDP 11/60(64 kw) with two disks and a MT drive

Table 2. Principal specifications of the Hydrographic Department Transportable Satellite Laser Ranging Station (HTLRS)

Subsystem	Specification
Mount configuration	elevation over azimuth/Coude path
Angular resolution	20 bits (1.2 arcsec)
Transmitter diameter	10 cm
Receiver diameter	35 cm
Laser wave length	532 nm
Output energy	50 mJ
Laser pulse width	50 - 100 ps
Repetition rate	5 pps
Receiver detector	Micro-Channel-Plate PMT with 300 ps rise time
Flight time counter	20 ps resolution
Frequency standard	Rubidium oscillator (rate: 2×10^{-11})
Time comparison	multi-Loran C wave, GPS
Computer	two 16-bits personal computers with hard disks, 5 inch and 3.5 inch floppy disk drives, printer, CRTs and a modem

Table 3a. Geodetic coordinates of SHOLAS

Location	Site ID	Coordinates (Tokyo Datum)
Cross point of Az. and El. axes of SHOLAS	International 7838 Domestic SHO-L	33° 34' 27.″496 N* 135 56 23.537 E 62.44 m
Cross line, the fiducial stone marker at Simosato Hydrogr. Obs.	Domestic SHO-HO	33° 34' 28.″078 N** 135 56 23.236 E 58.36 m

* Surveyed in November 1988.
** Surveyed in January 1982.

Table 3b. Geodetic coordinates of HTLRS

Location	Site ID	Coordinates (Tokyo Datum)
Cross point of Az. and El. axes of HTLRS at Minami-Daito Sima	International 7304	25° 49' 38.″739 N 131 13 42.198 E 15.84 m
Cross point of AZ. and EL. axes of HTLRS at Tokati	International 7313	42° 18' 54.″528 N 143 19 55.684 E 24.22 m

Table 4. Data acquisition at the Sinosato Hydrographic Observatory in 1991

Satellite	No. of ranges	No. of passes	RMS
Lageos	101,146	101	6.5 cm
Starlette	41,739	91	5.8
Ajisai	206,742	215	6.0
ERS-1	11,056	28	7.5

Observers K.Matsumoto, H.Nakagawa, A.Suzuki, H.Ito, M.Suzuki, K.Kato', K.Tomii, K.Kawai', I.Sato', Y.Watanabe', S.Inaki', T.Kurokawa, K.Sawada, S.Yosida, Y.Narita and K.Maeji

'JHD headquarters

Table 5. Data acquisition at Minami-Daito Sima in 1991

Satellite	No. of ranges	No. of passes	RMS
Lageos	433	2	3.6 cm
Starlette	79	2	2.5
Ajisai	6,576	16	3.3

Observers T.Fukusima, A.Sengoku, S.Masai, I.Sato, K.Tomii', S.Inaki, S.Murakami and Y.Narita'

'the Sinosato Hydrographic Observatory

Table 6. Data acquisition at Tokati in 1991

Satellite	No. of ranges	No. of passes	RMS
Ajisai	7,812	34	5.7 cm

Observers T.Uchiyama, E.Nisimura, K.Fuchida, S.Murakami, K.Sawada', Y.Narita' H.Noda and N.Ikeda

'the Sinosato Hydrographic Observatory

Table 7. Observations and data fitting

Explanation

Column

1,8 Serial number of passes ranged successfully for each satellite.

2 Observation time (UTC) of the first return and the last return observed in the satellite pass.

3 Satellite identification (ID), LG:Lageos, ST:Starlette, AJ:Ajisai, ER:ERS-1.

4 Azimuth when the tracking of the satellite started at 20° of elevation.

5 Elevations at the maximum, at the first return obtained and at the last return obtaind in the satellite path. U means through the maximum elevation.

6 Number of successful returns from the satellite in the pass.

7 Order of the polynomials applied and the root mean square deviation of the curve fitting to the difference of measured range and predicted range. Before the fitting application, an atmospheric correction (Marini and Murray,1973) is added.

The range correction added to the measured range is

$$dR = -\frac{g(\lambda)}{f(\phi,H)} \cdot \frac{A+B}{\sin E + \frac{B/(A+B)}{\sin E + 0.01}},$$

where

$$g(\lambda) = 0.9650 + \frac{0.0164}{\lambda^2} + \frac{0.000228}{\lambda^4},$$

$$f(\phi,H) = 1 - 0.0026 \cos 2\phi - 0.00031\ H,$$

$$A = 0.002357\ P + 0.000141\ e,$$

$$e = 6.11 \cdot \frac{Rh}{100} \cdot 10^{7.5(T-273.15)/(237.3+(T-273.15))},$$

$$B = (1.084\times10^{-8})\ PTK + (4.734\times10^{-8})\ \frac{P^2}{T} \cdot \frac{2}{(3-1/K)},$$

$$K = 1.163 - 0.00968 \cos 2\phi - 0.00104\ T + 0.00001435\ P,$$

Here

dR : Range correction (meters),

E : True elevation of satellite,

P : Atmospheric pressure at the site (hecto pascal),

T : Atmospheric temperature at the site (degrees kelvin),

Rh : Relative humidity at the site (%),

λ : Wavelength of the laser (microns),

ϕ : Latitude of the site,

H : Altitude of the site (kilometers),

This term is not corrected for the measured range in the final MT file, that is FR data.

Column

9 Station ID,7838:Simosato Hydrographic Observatory,
7304:Minami-Daito Sima,
7313:Tokati.

10 Atmospheric temperature (degrees centigrade).

11 Atmospheric pressure (hecto pascal).

12 Relative humidity (%).

13 Calibrated internal delay time of the SLR system obtained by the ground tranget rannging. The light velocity change in the air (Abshire, 1980) is used for the atmospheric correction. This term is corrected for the range data in the final MT file, FR data.

The group velocity of light in the air is given by

$$v = c \cdot (1+10^{-6}N)^{-1},$$

where

$$N = 80.343\ (0.9650+\frac{0.0164}{\lambda^2}+\frac{0.00028}{\lambda^4})\ \frac{P}{T}-11.3\ \frac{e}{T},$$

$$e = 6.11 \cdot \frac{Rh}{100} \cdot 10^{7.5(T-273.15)/(237.3+(T-273.15))}.$$

Here

c : The speed of light in vacua,

P : Atmospheric pressure (hecto pascal),

T : Atmospheric temperature (degrees kelvin),

Rh : Relative humidity (%),

λ : Wavelength of the light (microns).

14 Time correction: Transmitting time of GPS minus time of the clock used in the SLR system. This term is corrected for the transmitted time in the final MT file.

15 Time correction:UTC (USNO MC) minus transmitting time of GPS (USNO, 1991, 1992). This term is corrected for the transmitted time in the final MT file.

16 Comments.

Table 7. Observations and data fitting

(1) No.	(2) Obs.Time(UTC) date			caught			lost			(3) SAT.	(4) Az. ST	(5) Elev. MX	CT		(6) RTN	(7) Fitting N	
	Y	M	D	h	m	s	h	m	s		°	°	°	°			cm
1	91	01	10	14	10	38	14	16	41	ST	-120R	71	30U	39	473	27	5.2
2	91	01	12	12	58	53	13	08	30	ST	220L	78	21U	21	589	27	4.3
3	91	01	13	13	18	40	13	27	58	ST	-115R	65	22U	20	868	31	3.9
4	91	01	16	10	39	28	10	46	52	ST	180L	34	20U	21	146	27	5.6
5	91	01	18	11	16	47	11	27	02	ST	-130R	86	21U	19	824	25	4.7
6	91	01	19	09	53	56	09	56	23	ST	190L	38	34	20	62	21	7.7
7	91	01	23	09	15	24	09	25	16	ST	215L	69	20U	23	399	27	5.4
8	91	01	23	11	06	29	11	14	21	ST	-85R	36	22U	20	585	25	4.5
9	91	01	26	08	24	43	08	34	48	ST	220L	75	23U	20	730	31	4.6
10	91	01	28	09	04	26	09	12	16	ST	-100R	45	23U	27	711	27	4.6
11	91	01	31	08	13	41	08	22	22	ST	-90R	43	23U	20	585	31	5.6
12	91	02	01	08	34	04	08	41	04	ST	-75R	31	21U	21	196	31	7.1
13	91	02	04	11	26	33	11	32	53	ST	-30R	32	24U	20	181	29	6.9
14	91	02	05	11	45	01	11	53	29	ST	-35R	45	22U	20	683	31	4.7
15	91	02	06	12	05	19	12	13	33	ST	-45R	69	31U	20	979	31	4.9
16	91	02	07	10	34	31	10	42	22	ST	-30R	34	20U	20	452	25	4.4
17	91	02	08	10	53	41	11	02	54	ST	-35R	49	21U	19	984	27	5.6
18	91	02	12	04	50	33	04	57	53	ST	-75R	33	21U	21	388	21	4.7
19	91	02	12	10	22	09	10	31	48	ST	-45R	83	22U	21	462	25	4.3
20	91	02	16	02	28	58	02	37	50	ST	-110R	59	27U	20	440	25	5.3
21	91	02	16	08	01	37	08	10	27	ST	-30R	43	22U	20	612	31	4.9
22	91	02	19	01	38	37	01	45	07	ST	-105R	54	30U	31	441	27	4.6
23	91	02	21	00	27	22	00	36	34	ST	-125R	74	25U	19	673	25	4.2
24	91	02	25	05	33	05	05	38	05	ST	-35R	54	54	20	106	31	3.4
25	91	02	26	00	21	21	00	23	39	ST	-75R	32	29	20	35	11	4.0
26	91	02	26	05	48	51	05	57	56	ST	-45R	79	31U	20	696	31	4.7
27	91	02	27	04	22	50	04	26	33	ST	-35R	39	39U	22	44	9	6.7
28	91	03	14	01	53	53	01	59	01	ST	-70L	38	26U	31	245	21	6.4
29	91	03	16	15	52	05	15	59	28	ST	200L	52	21U	20	338	21	5.1
30	91	04	05	09	38	20	09	39	22	ST	215L	65	36	52	76	29	2.6
31	91	04	15	07	26	26	07	31	26	ST	-110R	51	45U	20	137	15	5.7
32	91	04	16	13	18	17	13	22	35	ST	-35R	58	56U	20	350	29	8.7
33	91	04	20	12	43	32	12	51	15	ST	-55L	68	20U	20	1081	25	4.8
34	91	05	02	09	20	33	09	27	27	ST	-65L	43	20U	20	526	23	6.0
35	91	05	16	19	54	53	20	03	15	ST	215L	67	30U	24	403	31	6.8
36	91	05	17	20	15	36	20	23	02	ST	-125R	78	45U	22	790	27	5.8
37	91	05	18	01	49	60	01	54	04	ST	-30R	32	31U	20	271	20	4.8
38	91	06	05	13	38	25	13	47	31	ST	220L	78	28U	19	1079	25	6.4
39	91	06	07	14	19	35	14	25	09	ST	-95R	44	38U	24	495	25	4.6
40	91	06	11	12	01	25	12	04	51	ST	-130R	84	64	23	445	21	4.9
41	91	06	14	11	06	59	11	13	58	ST	-125R	77	42U	22	257	15	6.8
42	91	07	06	11	02	20	11	08	37	ST	-45R	82	39U	30	192	14	7.5
43	91	07	11	08	59	55	09	06	57	ST	-40R	60	24U	30	569	23	5.9
44	91	07	17	07	23	17	07	25	43	ST	-45R	72	54	25	52	7	7.5
45	91	08	16	13	57	45	14	04	20	ST	220L	76	21U	53	218	15	6.3
46	91	08	31	09	48	00	09	51	32	ST	-120R	67	67	29	152	23	4.3
47	91	09	03	08	53	18	08	59	36	ST	-115R	62	33U	37	421	21	6.7
48	91	09	03	14	26	21	14	31	26	ST	-30R	37	25U	30	262	12	7.0
49	91	09	04	14	49	57	14	53	06	ST	-40R	57	53	22	410	27	3.9
50	91	09	04	16	37	20	16	40	58	ST	-75L	31	30U	20	199	27	8.1
51	91	09	05	07	42	10	07	51	26	ST	-130R	86	29U	20	440	21	5.4
52	91	09	06	06	12	60	06	21	11	ST	185L	37	23U	18	520	25	5.5
53	91	09	06	08	05	27	08	10	42	ST	-110R	58	58U	20	463	25	5.3
54	91	09	09	05	22	48	05	29	58	ST	190L	41	30U	20	358	25	5.4
55	91	09	09	07	15	27	07	18	04	ST	-105R	54	52	31	50	7	8.2
56	91	09	09	12	45	08	12	52	07	ST	-35R	45	32U	19	767	29	12.7
57	91	09	10	05	41	48	05	46	13	ST	215L	69	38U	56	68	9	12.3
58	91	09	11	11	33	09	11	40	50	ST	-30R	34	21U	19	553	25	5.0
59	91	09	11	13	21	58	13	31	18	ST	-55L	73	21U	20	779	27	5.5
60	91	09	19	04	59	41	05	05	33	ST	-75R	31	27U	20	147	12	6

Table 7. Observations and data fitting

(8) No.	(9) STN	(10) TMP	(11) PRESS	(12) HUM	(13) IDT	(14) DTS	(15) DTG	(16) COMMENTS
		°C	hPa	%	ns	ms	ms	
1	7838	6.9	1007.0	64	6.6	0.5	0.0	
2	7838	6.5	1004.0	54	6.8	-0.5	0.0	
3	7838	2.8	1010.4	56	6.8	-1.1	0.1	
4	7838	5.5	1018.2	65	6.6	-0.7	0.0	
5	7838	2.8	1018.9	60	6.3	-0.9	0.0	
6	7838	5.5	1023.2	84	6.0	-0.2	-0.1	
7	7838	4.2	1017.8	56	6.1	-0.5	-0.1	
8	7838	3.2	1018.6	64	6.0	-0.5	-0.1	
9	7838	7.1	1013.0	52	6.0	-1.2	-0.1	
10	7838	4.3	1017.3	55	6.0	-0.4	-0.1	
11	7838	7.5	1010.1	58	6.1	-0.1	-0.1	DAYTIME
12	7838	8.1	1003.8	52	6.2	-0.6	-0.1	
13	7838	7.2	1002.9	65	5.8	-0.9	-0.1	
14	7838	2.4	1011.7	74	6.1	-1.2	-0.1	
15	7838	5.8	1008.4	59	5.8	-0.9	-0.1	
16	7838	6.1	1005.8	71	6.0	-0.4	-0.1	
17	7838	5.7	1013.2	64	5.8	-1.0	-0.1	
18	7838	13.3	1008.7	53	5.8	-0.1	0.0	DAYTIME
19	7838	6.9	1012.8	65	6.2	-0.2	0.0	
20	7838	10.7	987.5	65	6.4	-2.5	0.0	DAYTIME
21	7838	8.0	992.1	60	6.4	-1.0	0.0	DAYTIME
22	7838	7.3	998.8	53	6.3	-1.7	0.0	DAYTIME
23	7838	4.9	1006.6	61	6.2	-1.5	0.1	DAYTIME
24	7838	8.3	1016.7	44	6.3	-0.1	0.1	DAYTIME
25	7838	7.2	1022.8	48	6.3	-0.9	0.1	DAYTIME
26	7838	12.2	1019.3	43	6.3	-0.2	0.1	DAYTIME
27	7838	13.7	1017.5	59	6.3	-0.2	0.1	DAYTIME
28	7838	11.2	1006.2	83	6.3	-1.6	0.1	DAYTIME
29	7838	5.5	1006.9	90	6.2	-0.8	0.0	
30	7838	15.5	1011.5	88	6.1	-0.2	0.0	
31	7838	19.8	1005.6	80	6.2	-0.5	0.0	DAYTIME
32	7838	13.9	1010.6	91	6.2	-0.3	0.0	
33	7838	12.0	1003.6	79	6.0	-0.1	0.0	
34	7838	12.0	996.6	68	6.1	-0.4	0.0	DAYTIME
35	7838	16.3	990.7	73	5.7	-0.6	0.0	
36	7838	14.4	999.4	82	5.7	-0.2	0.0	DAYTIME
37	7838	24.9	1000.2	44	6.4	-0.4	0.0	DAYTIME
38	7838	18.8	1003.8	99	6.3	-0.3	0.0	
39	7838	19.8	1007.7	91	8.2	-0.4	0.0	
40	7838	24.0	1003.2	92	6.1	-0.8	0.0	
41	7838	18.1	998.8	61	6.1	-0.4	0.1	
42	7838	22.9	999.7	98	6.3	-0.4	0.0	
43	7838	28.6	1000.2	80	6.2	-0.4	0.0	DAYTIME
44	7838	29.7	999.7	85	7.0	-0.3	0.1	DAYTIME
45	7838	25.0	1002.3	82	5.9	-0.5	0.0	
46	7838	27.5	998.4	80	5.7	-0.1	0.0	
47	7838	27.4	1004.0	80	5.6	-0.2	0.0	DAYTIME
48	7838	25.0	1005.8	92	5.5	-0.5	0.0	
49	7838	25.0	1009.5	98	5.9	-0.6	0.0	
50	7838	25.0	1009.3	99	5.8	-0.7	0.0	
51	7838	29.1	1008.0	88	6.1	-0.1	0.0	DAYTIME
52	7838	29.0	1003.8	82	6.2	-0.1	0.0	DAYTIME
53	7838	28.3	1003.2	84	5.9	-0.2	0.0	DAYTIME
54	7838	32.2	991.8	60	5.2	-0.1	0.1	DAYTIME
55	7838	32.0	992.7	57	5.7	-0.2	0.1	DAYTIME
56	7838	25.4	996.6	73	6.3	-0.6	0.1	
57	7838	28.7	1000.5	78	5.6	-0.1	0.0	DAYTIME
58	7838	24.0	1000.8	84	5.9	-0.4	0.1	
59	7838	23.1	1001.0	86	5.6	-0.4	0.0	
60	7838	27.7	977.2	88	5.8	0.0	0.0	DAYTIME

Table 7. Observations and data fitting (continued)

(1) No.	(2) Obs.Time(UTC) date			caught			lost			(3) SAT.	(4) Az. ST	(5) Elev. MX	CT		(6) RTN	(7) Fitting N	
		M	D	h	m	s	h	m	s		°	°	°				cm
61	91	09	19	08	41	28	08	47	24	ST	-25R	31	24U	23	145	10	6.4
62	91	09	19	10	29	38	10	39	33	ST	-50R	81	23U	19	297	17	9.3
63	91	09	20	03	27	25	03	36	10	ST	-110R	59	28U	20	458	17	7.5
64	91	10	02	05	35	55	05	45	23	ST	-40R	57	24U	20	919	31	5.1
65	91	10	18	16	49	50	16	56	10	ST	205L	52	21U	29	607	25	5.8
66	91	10	21	15	58	52	16	02	23	ST	210L	57	21	59	136	10	7.3
67	91	11	07	10	34	37	10	41	20	ST	215L	66	23U	26	627	25	5.9
68	91	11	11	10	02	51	10	10	35	ST	-115R	62	21U	20	1047	31	7.3
69	91	11	12	08	33	41	08	39	11	ST	200L	45	22U	33	428	17	6.1
70	91	11	12	10	23	06	10	28	44	ST	-95R	38	21U	26	437	17	6.6
71	91	11	13	08	52	26	08	59	00	ST	225L	75	21U	35	773	27	5.2
72	91	11	15	07	43	30	07	48	09	ST	205L	51	29U	38	540	19	4.5
73	91	11	15	09	33	07	09	37	40	ST	-85R	35	26U	26	290	15	5.5
74	91	11	21	06	05	25	06	06	57	ST	215L	64	58	36	57	7	3.9
75	91	11	22	06	22	33	06	26	42	ST	-120R	72	55U	32	581	23	4.4
76	91	11	22	13	41	26	13	47	57	ST	-55L	71	25U	26	836	27	4.9
77	91	11	25	05	31	36	05	36	17	ST	-120R	66	52U	28	443	15	5.7
78	91	11	25	12	51	07	12	57	07	ST	-60L	64	29U	25	492	23	4.9
79	91	12	02	09	40	02	09	46	17	ST	-40R	56	31U	21	694	27	4.7
80	91	12	03	02	38	22	02	43	39	ST	130R	80	43U	36	482	22	5.4
81	91	12	03	09	59	40	10	04	50	ST	-50L	83	36U	31	593	24	7.4
82	91	12	04	08	31	06	08	34	03	ST	-30R	39	35U	31	200	13	6.9
83	91	12	04	10	18	06	10	23	36	ST	-65L	44	22U	29	417	21	6.9
84	91	12	05	01	27	11	01	33	25	ST	215L	66	33U	34	548	23	5.4
85	91	12	05	03	18	56	03	21	53	ST	-85R	35	33U	29	161	13	5.6
86	91	12	09	08	21	09	08	24	03	ST	-55L	65	58	21	275	16	5.3
87	91	12	10	06	48	27	06	54	22	ST	-35R	47	33U	20	821	29	5.2
88	91	12	12	07	28	36	07	29	29	ST	-60L	57	53	59	85	9	5.2
89	91	12	13	00	23	47	00	31	20	ST	-95R	42	25U	22	555	23	5.6
90	91	12	13	05	55	40	06	03	26	ST	-40R	52	20U	22	700	27	5.4
91	91	12	20	04	33	24	04	41	45	ST	-55L	73	24U	20	638	25	5.4

Table 7. Observations and data fitting (continued)

(8) No.	(9) STN	(10) TMP	(11) PRESS	(12) HUM	(13) IDT	(14) DTS	(15) DTG	(16) COMMENTS
		C	hPa	%	ns	ms	ms	
61	7838	28.0	980.5	86	5.9	-0.1	0.0	DAYTIME
62	7838	24.2	982.9	90	6.0	-0.3	0.0	
63	7838	28.4	996.4	67	5.8	0.0	0.0	DAYTIME
64	7838	27.0	1001.3	79	6.2	-0.1	0.0	DAYTIME
65	7838	11.8	1003.4	90	6.0	-0.6	0.0	
66	7838	12.8	1014.7	95	5.9	-0.4	0.1	
67	7838	15.6	1014.5	74	6.1	-0.2	0.0	
68	7838	11.2	1009.0	52	6.2	-0.8	0.1	
69	7838	12.0	1011.0	57	6.3	0.0	0.0	
70	7838	10.6	1012.3	60	6.4	-0.1	0.0	
71	7838	12.8	1012.5	66	6.3	-0.2	0.0	
72	7838	13.9	1015.2	55	6.2	-0.2	0.0	DAYTIME
73	7838	10.1	1016.7	65	6.2	-0.3	0.0	
74	7838	16.2	1016.9	53	6.3	-0.1	0.0	DAYTIME
75	7838	16.5	1017.1	61	6.5	-0.3	0.0	DAYTIME
76	7838	12.4	1017.8	70	6.4	-0.8	0.1	
77	7838	13.5	1024.1	54	6.3	-0.2	0.0	DAYTIME
78	7838	6.6	1026.3	73	6.3	-0.9	0.0	
79	7838	11.5	1010.1	57	6.5	-0.7	0.0	
80	7838	16.8	1011.5	67	6.6	-1.9	0.0	DAYTIME
81	7838	11.7	1011.2	95	6.4	-0.4	0.0	
82	7838	13.0	1015.0	55	6.4	-0.4	0.0	
83	7838	10.5	1016.5	54	6.3	-0.6	0.0	
84	7838	16.2	1020.9	61	6.3	-1.9	0.0	DAYTIME
85	7838	16.4	1019.2	63	6.4	0.0	0.0	DAYTIME
86	7838	9.4	1016.5	64	6.6	-0.2	0.1	
87	7838	13.4	1018.9	60	6.7	-0.3	0.0	DAYTIME
88	7838	5.9	1013.7	57	6.5	-0.3	0.0	DAYTIME
89	7838	6.9	1021.5	58	6.4	-1.8	0.0	DAYTIME
90	7838	10.5	1019.9	55	6.6	-0.3	0.0	DAYTIME
91	7838	12.6	1017.3	50	6.5	0.1	0.0	DAYTIME

Table 7. Observations and data fitting (continued)

(1) No.	(2) Obs.Time(UTC) date			caught			lost			(3) SAT.	(4) Az. ST	(5) Elev. MX	CT		(6) RTN	(7) Fitting N	
	Y	M	D	h	m	s	h	m	s		°	°	°	°			cm
1	91	01	04	01	51	46	01	56	23	LG	25L	76	75	64	66	19	2.6
2	91	01	07	01	22	27	01	28	50	LG	25L	84	68	48	134	31	6.4
3	91	01	13	09	57	24	10	40	39	LG	130L	74	28U	21	1125	27	5.1
4	91	01	13	13	44	28	14	05	13	LG	-140R	28	26U	20	137	31	4.9
5	91	01	14	09	02	05	09	17	39	LG	100L	49	47	20	302	21	5.2
6	91	01	14	12	14	36	12	49	59	LG	-180R	55	39U	21	1621	19	5.5
7	91	01	15	10	40	47	11	29	25	LG	-210R	85	20U	20	3265	23	4.5
8	91	01	16	09	33	30	10	03	51	LG	125L	64	48U	26	687	25	4.7
9	91	01	16	13	01	32	13	35	09	LG	-155R	36	24U	20	965	25	5.7
10	91	01	17	11	40	04	12	17	06	LG	-190R	64	43U	20	779	17	4.5
11	91	01	18	10	10	23	10	55	25	LG	140L	83	28U	20	1516	25	5.1
12	91	01	23	10	33	22	10	52	21	LG	-210R	85	52U	65	804	29	5.3
13	91	01	26	09	49	21	10	35	22	LG	140L	83	25U	20	1333	29	5.6
14	91	01	27	08	53	14	09	12	14	LG	115L	57	56	20	294	25	5.3
15	91	01	28	10	39	23	11	14	52	LG	-200R	74	30U	39	2282	27	5.1
16	91	01	29	09	14	06	10	01	06	LG	130L	74	21U	20	801	23	5.6
17	91	01	30	08	12	06	08	37	30	LG	105L	49	47U	21	150	29	6.7
18	91	01	30	11	46	30	12	10	24	LG	-180R	54	54U	20	1343	29	5.2
19	91	02	01	12	25	01	12	55	04	LG	-155R	36	28U	20	332	25	6.9
20	91	02	01	21	13	40	21	47	24	LG	50R	34	21U	20	174	31	7.0
21	91	02	02	11	05	53	11	37	07	LG	-190R	64	55U	20	2471	31	4.4
22	91	02	05	10	29	23	11	03	28	LG	-200R	74	55U	20	2396	31	4.2
23	91	02	07	11	10	16	11	49	41	LG	-180R	54	30U	21	1636	29	5.0
24	91	02	08	09	40	51	10	29	25	LG	-210R	84	20U	20	2670	21	5.2
25	91	02	12	11	26	47	12	03	55	LG	-170R	44	29U	19	1039	25	4.6
26	91	02	16	09	21	31	10	09	31	LG	-210R	84	22U	20	2972	21	4.8
27	91	02	21	09	50	09	10	23	25	LG	-200R	74	57U	20	2649	21	4.9
28	91	02	24	09	05	36	09	49	29	LG	-210R	84	31U	20	778	29	6.9
29	91	02	25	07	42	39	08	23	27	LG	125L	65	24U	27	555	31	5.8
30	91	02	25	11	25	51	11	55	01	LG	-155R	35	29U	20	598	31	7.2
31	91	02	26	09	56	01	10	37	17	LG	-190R	63	33U	20	3264	31	5.2
32	91	03	13	10	52	12	11	13	46	LG	-155R	35	33U	22	113	31	5.6
33	91	03	16	10	04	23	10	43	13	LG	-165R	43	24U	20	1316	31	5.8
34	91	04	09	05	59	39	06	11	18	LG	115L	58	47	23	62	9	8.1
35	91	04	22	05	36	52	05	42	51	LG	125L	67	57	67	33	9	9.4
36	91	05	09	19	37	52	19	42	42	LG	25R	86	73	87	109	9	6.6
37	91	05	17	03	29	49	03	41	24	LG	95L	45	42	24	40	6	8.7
38	91	05	17	18	58	55	19	38	02	LG	25R	86	21U	40	2116	31	5.4
39	91	05	28	18	34	49	18	52	10	LG	30R	76	65	20	255	10	7.4
40	91	06	06	16	33	57	17	06	10	LG	40R	46	35U	20	1088	25	6.5
41	91	07	16	18	28	42	18	47	59	LG	20L	54	45U	41	125	11	11.4
42	91	07	18	15	35	26	16	13	44	LG	35R	67	29U	29	1310	27	5.8
43	91	07	22	17	19	20	17	54	03	LG	20L	71	49U	19	984	31	7.2
44	91	07	23	15	45	28	16	32	12	LG	30R	78	21U	21	2009	31	7.3
45	91	08	01	14	04	47	14	45	34	LG	40R	47	20U	22	649	25	7.3
46	91	08	01	17	38	28	18	18	17	LG	20L	54	24U	20	1341	31	5.8
47	91	08	09	13	45	25	13	56	18	LG	40R	47	21	39	48	13	10.1
48	91	08	14	14	10	40	14	42	50	LG	35R	57	46U	20	1781	31	5.4
49	91	08	23	15	49	02	16	24	34	LG	20L	70	23U	41	1585	31	6.1
50	91	08	30	16	51	50	17	22	31	LG	20L	47	22U	34	1536	31	5.6
51	91	08	31	12	01	59	12	31	56	LG	55R	30	21U	20	471	27	10.0
52	91	09	03	15	05	09	15	30	18	LG	25L	79	49U	45	868	25	5.4
53	91	09	04	13	33	03	14	00	37	LG	30R	69	24U	61	922	31	7.8
54	91	09	04	17	20	11	17	38	57	LG	15L	41	40U	24	362	13	7.9
55	91	09	05	12	13	40	12	47	03	LG	45R	39	22U	25	292	17	5.8
56	91	09	05	15	59	03	16	00	47	LG	20L	61	57	59	69	11	6.6
57	91	09	06	14	19	40	15	06	49	LG	25R	86	21U	20	2514	31	5.3
58	91	09	09	13	48	54	14	14	23	LG	30R	79	28U	69	1873	31	5.3
59	91	09	09	17	33	21	17	48	03	LG	20L	36	35U	27	240	19	6.7
60	91	09	10	12	29	18	13	01	20	LG	40R	48	28U	30	199	21	11.1

Table 7. Observations and data fitting (continued)

(8) No.	(9) STN	(10) TMP	(11) PRESS	(12) HUM	(13) IDT	(14) DTS	(15) DTG	(16) COMMENTS
		°C	hPa	%	ns	ms	ms	
1	7838	9.9	1005.1	53	6.8	-3.1	0.0	DAYTIME
2	7838	8.2	1013.0	53	6.9	-1.6	0.0	DAYTIME
3	7838	3.3	1009.7	60	6.8	-1.0	0.0	
4	7838	2.8	1010.4	59	6.7	-1.2	0.1	
5	7838	4.2	1013.6	59	6.7	0.3	0.0	
6	7838	2.9	1014.5	66	6.7	0.2	0.0	
7	7838	2.7	1018.4	67	6.8	-0.2	0.0	
8	7838	7.1	1018.2	57	6.6	-0.7	0.0	
9	7838	4.2	1017.5	69	6.3	-0.7	0.0	
10	7838	6.9	1008.8	56	6.2	-0.2	0.0	
11	7838	3.0	1018.2	58	6.2	-0.8	0.0	
12	7838	3.5	1018.6	62	6.0	-0.5	-0.1	
13	7838	5.0	1014.1	65	6.0	-1.2	-0.1	
14	7838	6.5	1014.7	64	6.1	-1.8	-0.1	
15	7838	3.3	1018.2	57	6.0	-0.4	-0.1	
16	7838	4.5	1017.5	76	6.0	-0.9	-0.1	
17	7838	6.0	1014.3	57	6.1	-0.6	-0.1	DAYTIME
18	7838	2.8	1015.2	69	6.2	-0.7	-0.1	
19	7838	5.7	1005.3	62	6.1	-0.8	-0.1	
20	7838	3.7	1007.3	74	6.0	-0.9	-0.1	
21	7838	3.1	1011.7	67	6.1	-1.5	-0.1	
22	7838	3.1	1011.4	70	6.1	-1.1	-0.1	
23	7838	5.8	1006.2	73	6.0	-0.4	-0.1	
24	7838	6.0	1013.0	60	5.9	-0.9	-0.1	
25	7838	5.5	1013.8	79	6.0	-0.3	0.0	
26	7838	6.5	993.8	66	6.3	-0.9	0.0	
27	7838	4.6	1005.3	63	6.1	-2.1	0.1	
28	7838	2.0	1013.8	56	7.4	-4.5	0.1	
29	7838	5.6	1018.4	54	6.2	-0.2	0.1	DAYTIME
30	7838	0.9	1020.6	79	6.2	-0.4	0.1	
31	7838	5.3	1020.4	55	6.1	-0.4	0.1	
32	7838	11.5	1010.4	91	6.2	-1.1	0.1	
33	7838	6.3	1003.8	98	6.3	-0.4	0.0	
34	7838	22.8	1001.8	83	6.2	-0.2	0.0	DAYTIME
35	7838	17.8	1016.9	70	6.1	0.0	0.0	DAYTIME
36	7838	14.3	1007.1	94	6.1	-1.3	0.0	
37	7838	23.7	992.5	50	6.2	-0.8	0.0	DAYTIME
38	7838	14.7	999.2	82	6.0	-0.2	0.0	
39	7838	17.9	1008.4	64	6.0	-0.7	0.1	
40	7838	18.8	1001.4	98	6.3	-0.5	0.0	
41	7838	24.8	999.2	99	6.0	-0.5	0.1	
42	7838	23.8	1002.9	98	5.9	-0.6	0.1	
43	7838	26.0	1001.4	99	5.7	-0.8	0.1	
44	7838	27.2	1002.1	99	5.7	-0.7	0.0	
45	7838	27.4	1002.1	92	6.2	-0.5	0.0	
46	7838	29.1	1001.2	78	6.2	-0.6	0.0	
47	7838	22.8	999.2	95	6.1	-0.3	0.0	
48	7838	24.3	1003.2	97	6.1	0.0	0.0	
49	7838	26.1	992.5	95	5.5	-0.5	0.0	
50	7838	25.0	989.2	96	6.0	-0.4	0.0	
51	7838	24.6	999.9	87	5.8	-0.2	0.0	
52	7838	24.7	1005.8	92	5.9	-0.5	0.0	
53	7838	25.3	1009.5	99	6.1	-0.6	0.0	
54	7838	24.8	1009.3	99	5.8	-0.7	0.0	
55	7838	25.9	1009.0	96	6.2	-0.4	0.0	
56	7838	24.5	1008.2	99	5.9	-0.6	0.0	
57	7838	23.8	1003.4	99	6.2	-0.5	0.0	
58	7838	24.6	997.3	76	6.2	-0.7	0.1	
59	7838	22.9	997.9	78	6.1	-0.8	0.1	
60	7838	23.6	1002.1	97	5.9	-0.6	0.0	

Table 7. Observations and data fitting (continued)

(1) No.	(2) Obs.Time(UTC) date			caught			lost			(3) SAT.	(4) Az. ST	(5) Elev. MX		CT	(6) RTN	(7) Fitting N	
	Y	M	D	h	m	s	h	m	s		°	°	°	°			cm
61	91	09	11	18	15	09	18	32	26	LG	20L	29	27U	22	206	17	7.8
62	91	09	19	14	24	59	15	00	30	LG	25L	79	49U	20	778	23	7.5
63	91	09	20	13	22	56	13	33	07	LG	30R	69	56	31	253	17	5.0
64	91	10	02	14	29	29	14	52	02	LG	20L	69	69U	23	1038	28	6.1
65	91	10	03	12	48	26	13	09	41	LG	30R	79	27U	80	456	21	4.5
66	91	10	13	13	22	33	13	55	28	LG	25L	79	42U	31	1650	31	5.7
67	91	10	14	12	01	23	12	16	40	LG	30R	70	43U	69	743	22	7.8
68	91	10	18	13	41	44	14	10	31	LG	20L	69	53U	27	1664	31	6.5
69	91	10	19	12	12	21	12	29	33	LG	30R	80	36U	81	365	18	6.8
70	91	10	20	10	53	18	11	26	55	LG	40R	49	35U	21	1140	27	5.6
71	91	10	22	15	11	09	15	35	15	LG	20L	40	29U	30	102	10	11.3
72	91	10	23	10	35	15	10	48	20	LG	45R	40	39	24	69	8	6.2
73	91	10	23	13	54	13	14	12	07	LG	20L	60	46U	50	351	18	7.8
74	91	11	07	10	57	49	11	38	25	LG	30R	70	34U	20	2506	31	5.4
75	91	11	08	09	50	43	10	02	33	LG	45R	40	40U	33	150	12	14.5
76	91	11	08	13	08	42	13	29	33	LG	20L	59	33U	55	281	17	9.0
77	91	11	11	12	42	19	13	06	49	LG	20L	68	54U	35	519	23	7.1
78	91	11	12	11	26	00	11	49	43	LG	30R	81	76U	27	602	20	4.8
79	91	11	13	09	59	26	10	15	40	LG	40R	50	45U	42	388	21	4.6
80	91	11	15	10	42	19	11	07	18	LG	30R	71	45U	46	1064	28	7.0
81	91	11	18	13	46	48	14	02	26	LG	20L	45	44U	33	48	7	15.4
82	91	11	20	11	08	20	11	23	13	LG	30R	82	81U	44	160	13	6.0
83	91	11	22	11	41	31	12	16	30	LG	25L	77	38U	29	1973	31	5.7
84	91	11	25	11	13	05	11	44	24	LG	25R	87	55U	26	882	30	6.0
85	91	12	02	08	39	19	09	11	25	LG	45R	41	31U	20	145	13	5.7
86	91	12	02	12	14	28	12	40	12	LG	20L	59	46U	33	319	19	7.9
87	91	12	05	11	52	11	12	02	42	LG	20L	67	67	45	136	11	9.3
88	91	12	09	09	52	32	10	18	50	LG	30R	71	69U	20	544	24	6.2
89	91	12	10	08	12	09	08	51	55	LG	45R	41	20U	20	1983	31	5.9
90	91	12	10	11	42	57	12	16	31	LG	20L	59	21U	41	1988	31	5.9
91	91	12	11	10	23	05	11	04	08	LG	25R	87	28U	27	1206	31	6.8
92	91	12	12	08	59	29	09	41	50	LG	35R	61	23U	24	1556	31	5.6
93	91	12	12	12	32	11	13	03	03	LG	20L	45	21U	32	1631	31	6.5
94	91	12	13	07	43	31	08	10	28	LG	50R	33	24U	24	89	9	7.5
95	91	12	13	11	17	04	11	53	49	LG	20L	67	40U	20	1519	31	8.8
96	91	12	16	10	35	29	11	20	33	LG	25L	77	24U	20	996	31	6.3
97	91	12	18	11	22	37	12	06	37	LG	20L	59	20U	19	1973	31	6.8
98	91	12	19	10	06	07	10	47	17	LG	25R	87	35U	20	1124	31	5.5
99	91	12	20	08	39	13	09	23	48	LG	35R	61	23U	20	3100	31	6.3
100	91	12	20	12	12	22	12	40	03	LG	20L	45	22U	37	1349	31	6.3
101	91	12	26	11	03	50	11	41	41	LG	20L	59	22U	29	652	26	6.5

Table 7. Observations and data fitting (continued)

(8) No.	(9) STN	(10) TMP	(11) PRESS	(12) HUM	(13) IDT	(14) DTS	(15) DTG	(16) COMMENTS
		°C	hPa	%	ns	ms	ms	
61	7838	21.6	1001.0	95	6.1	-0.7	0.1	
62	7838	21.8	987.0	94	6.1	-0.5	0.0	
63	7838	20.1	1002.1	87	5.6	-0.6	0.0	
64	7838	19.3	1003.8	90	6.3	-0.6	0.0	
65	7838	20.2	1004.0	97	6.0	-0.1	0.0	
66	7838	19.6	993.6	75	5.6	-0.1	0.0	
67	7838	15.1	1000.8	91	5.8	-0.3	0.0	
68	7838	13.9	1003.6	85	6.0	-0.5	0.0	
69	7838	16.2	1005.3	90	6.1	-1.3	0.0	
70	7838	13.8	1010.3	89	5.9	-0.3	0.0	
71	7838	15.2	1013.0	92	6.2	-0.5	0.1	
72	7838	13.8	1013.6	76	6.3	-0.3	0.1	
73	7838	12.1	1013.8	80	6.2	-0.5	0.1	
74	7838	15.4	1014.1	73	6.2	-0.3	0.0	
75	7838	16.7	1000.3	99	6.3	-0.5	0.0	
76	7838	14.9	1000.5	95	6.3	-0.8	0.1	
77	7838	9.4	1009.7	59	6.0	-1.1	0.0	
78	7838	10.1	1012.5	59	6.4	-0.1	0.0	
79	7838	11.3	1013.4	73	6.3	-0.3	0.0	
80	7838	10.2	1017.1	61	6.1	-0.3	0.0	
81	7838	11.5	1011.4	75	6.4	-0.6	0.0	
82	7838	8.8	1014.7	67	6.4	-0.6	0.0	
83	7838	12.0	1018.0	72	6.4	-0.6	0.0	
84	7838	6.8	1026.3	80	6.3	-0.8	0.0	
85	7838	12.3	1009.3	59	6.4	-0.7	0.0	
86	7838	10.4	1010.8	62	6.4	-0.9	0.0	
87	7838	13.0	1020.4	80	6.2	-0.7	0.0	
88	7838	8.1	1017.8	72	6.6	-0.3	0.1	
89	7838	10.0	1019.3	77	6.6	-0.4	0.0	
90	7838	7.3	1018.9	87	6.5	-0.6	0.1	
91	7838	12.8	1004.5	67	6.6	-0.4	0.1	
92	7838	4.5	1015.6	62	6.4	-0.5	0.0	
93	7838	2.4	1017.5	68	6.6	-0.8	0.0	
94	7838	8.1	1020.2	61	6.5	-0.5	0.0	DAYTIME
95	7838	5.2	1021.7	75	6.4	-0.8	0.1	
96	7838	13.8	1021.9	64	6.5	-0.6	0.0	
97	7838	10.9	1005.6	94	5.8	-0.3	0.0	
98	7838	7.5	1012.5	65	6.4	-0.3	0.1	
99	7838	7.6	1018.9	74	6.5	-0.1	0.0	
100	7838	5.2	1019.7	84	7.3	-0.3	0.0	
101	7838	7.6	1008.4	74	6.5	-0.3	0.0	

Table 7. Observations and data fitting

(1) No.	(2) Obs.Time(UTC) date			caught			lost			(3) SAT.	(4) Az. ST	(5) Elev. MX	CT		(6) RTN	(7) Fitting N	
	Y	M	D	h	m	s	h	m	s		°	°	°	°			cm
1	91	01	09	08	00	44	08	13	27	AJ	205L	62	22U	20	407	25	4.2
2	91	01	09	16	13	13	16	26	59	AJ	-50L	84	21U	20	1499	25	4.0
3	91	01	09	18	19	26	18	22	14	AJ	270L	21	20U	20	239	25	6.7
4	91	01	10	17	22	09	17	32	22	AJ	-70L	34	20U	20	735	31	6.8
5	91	01	12	13	31	20	13	42	51	AJ	-40R	40	20U	20	1174	31	4.7
6	91	01	12	15	32	45	15	46	31	AJ	-50L	77	20U	20	1598	31	4.2
7	91	01	13	08	27	50	08	40	55	AJ	-110R	58	21U	20	1588	31	3.9
8	91	01	13	12	37	22	12	47	24	AJ	-40R	33	20U	20	757	27	5.5
9	91	01	13	14	38	38	14	52	23	AJ	-45R	74	20U	20	1490	31	4.2
10	91	01	13	16	42	07	16	51	26	AJ	-75L	31	20U	20	525	31	8.5
11	91	01	14	09	37	53	09	48	14	AJ	-70R	34	20U	20	1157	27	4.2
12	91	01	14	11	43	04	11	51	55	AJ	-40R	29	20U	20	910	29	3.9
13	91	01	14	13	44	47	13	57	22	AJ	-40R	55	21U	22	118	31	11.9
14	91	01	15	08	42	32	08	54	17	AJ	-85R	42	20U	20	1155	25	4.1
15	91	01	15	12	50	57	13	02	29	AJ	-35R	42	21U	21	822	27	5.0
16	91	01	15	14	52	19	15	05	56	AJ	-55L	73	20U	20	1413	29	4.2
17	91	01	16	11	56	52	12	07	15	AJ	-35R	34	20U	20	802	25	5.6
18	91	01	16	13	58	17	14	11	57	AJ	-45R	80	21U	20	1163	25	4.3
19	91	01	16	16	02	06	16	10	24	AJ	-80L	28	20U	20	341	31	7.0
20	91	01	17	08	57	46	09	07	47	AJ	-70R	33	20U	20	936	29	5.5
21	91	01	17	11	02	43	11	11	47	AJ	-35R	29	20U	20	478	27	5.7
22	91	01	17	13	04	16	13	17	31	AJ	-40R	58	20U	20	1424	29	3.7
23	91	01	17	15	06	38	15	14	36	AJ	-65L	44	21U	39	250	29	6.8
24	91	01	18	08	02	23	08	13	52	AJ	-85R	40	20U	20	1013	25	4.5
25	91	01	18	14	11	58	14	25	28	AJ	-55L	67	20U	20	1460	25	4.1
26	91	01	19	13	18	04	13	31	18	AJ	-50R	83	22U	21	803	25	5.3
27	91	01	19	15	22	04	15	29	15	AJ	-85L	25	20U	20	328	27	8.1
28	91	01	23	07	37	54	07	47	02	AJ	-65R	31	22U	20	589	27	4.9
29	91	01	23	11	44	28	11	56	48	AJ	-40R	66	26U	20	1036	29	4.8
30	91	01	23	13	46	08	13	56	57	AJ	-70L	37	20U	20	627	22	6.7
31	91	01	25	12	01	14	12	08	54	AJ	-50L	83	54U	31	313	31	7.6
32	91	01	26	09	01	37	09	11	22	AJ	-40R	32	20U	20	820	31	4.8
33	91	01	26	11	03	18	11	16	28	AJ	-45R	70	22U	20	1257	21	5.3
34	91	01	26	13	05	58	13	16	06	AJ	-75L	34	20U	20	582	27	7.3
35	91	01	27	10	09	05	10	21	47	AJ	-40R	52	21U	20	1246	21	4.2
36	91	01	27	12	15	03	12	17	41	AJ	-60L	53	44U	52	154	21	5.2
37	91	01	28	09	15	07	09	26	45	AJ	-40R	40	20U	20	972	29	4.7
38	91	01	28	11	19	42	11	30	12	AJ	-50L	77	42U	20	1097	31	4.8
39	91	01	29	08	21	14	08	31	13	AJ	-35R	33	21U	20	1081	29	4.4
40	91	01	29	10	22	24	10	36	11	AJ	-45R	75	20U	20	1050	31	5.3
41	91	01	29	12	25	53	12	35	08	AJ	-75L	31	20U	20	471	31	5.9
42	91	01	30	09	28	31	09	41	30	AJ	-40R	55	20U	20	1425	29	4.8
43	91	01	30	11	30	41	11	42	54	AJ	-65L	48	20U	20	1401	31	4.7
44	91	01	31	08	34	42	08	46	32	AJ	-35R	42	20U	20	1514	31	3.9
45	91	01	31	10	36	10	10	49	42	AJ	-55L	72	20U	20	1754	31	3.9
46	91	02	01	09	42	04	09	55	46	AJ	-45R	80	20U	20	1937	31	4.3
47	91	02	01	11	45	59	11	54	05	AJ	-80L	28	20U	20	357	31	6.7
48	91	02	02	08	48	10	09	01	14	AJ	-40R	58	21U	20	1510	25	4.3
49	91	02	02	10	50	32	11	02	15	AJ	-65L	44	21U	20	1265	23	5.0
50	91	02	04	09	02	25	09	15	15	AJ	-50R	82	25U	20	1589	31	4.2
51	91	02	05	06	06	42	06	15	26	AJ	-40R	30	22U	20	425	27	7.4
52	91	02	05	08	10	11	08	20	54	AJ	-40R	62	36U	20	857	31	4.2
53	91	02	06	01	03	59	01	15	48	AJ	225L	84	32U	20	1320	29	4.9
54	91	02	08	03	21	27	03	30	48	AJ	-65R	31	21U	20	572	21	6.7
55	91	02	12	05	52	49	06	05	34	AJ	-40R	52	20U	20	1453	21	5.1
56	91	02	12	07	54	49	08	07	47	AJ	-60L	52	20U	18	989	31	4.9
57	91	02	13	00	51	05	01	02	20	AJ	-90R	43	23U	20	1412	31	5.0
58	91	02	16	00	10	19	00	22	01	AJ	-90R	41	21U	19	1020	29	4.8
59	91	02	19	03	38	31	03	50	03	AJ	-40R	44	23U	20	1336	31	5.1
60	91	02	21	01	50	04	01	59	16	AJ	-35R	30	20U	20	721	21	6.1

Table 7. Observations and data fitting (continued)

(8) No.	(9) STN	(10) TMP	(11) PRESS	(12) HUM	(13) IDT	(14) DTS	(15) DTG	(16) COMMENTS
		°C	hPa	%	ns	ms	ms	
1	7838	5.9	1004.0	64	6.6	0.1	0.0	DAYTIME
2	7838	2.4	1008.6	78	6.6	-0.1	0.0	
3	7838	0.8	1008.8	85	6.8	-0.2	0.0	
4	7838	5.6	1006.4	64	6.8	0.4	0.0	
5	7838	6.2	1004.5	56	6.8	-0.5	0.0	
6	7838	4.8	1004.9	58	6.8	-0.6	0.0	
7	7838	4.4	1008.4	77	6.7	-1.0	0.0	
8	7838	3.3	1010.4	75	6.8	-1.1	0.0	
9	7838	1.9	1010.1	71	6.8	-1.2	0.1	
10	7838	1.3	1010.8	70	6.7	-1.2	0.1	
11	7838	3.8	1013.8	64	6.7	0.3	0.0	
12	7838	2.9	1014.5	66	6.7	0.3	0.0	
13	7838	3.0	1013.8	67	6.7	0.2	0.0	
14	7838	4.8	1016.5	60	6.2	-0.2	0.0	
15	7838	0.8	1018.9	80	6.8	-0.3	0.0	
16	7838	0.0	1018.9	98	6.7	-0.3	0.0	
17	7838	5.0	1018.0	77	6.1	-0.7	0.0	
18	7838	3.8	1016.9	71	6.3	-0.8	0.0	
19	7838	4.2	1015.6	69	6.3	-0.8	0.0	
20	7838	8.3	1006.6	64	6.1	-0.1	0.0	
21	7838	7.8	1007.7	53	6.3	-0.2	0.0	
22	7838	6.0	1009.9	56	6.1	-0.3	0.0	
23	7838	4.7	1010.8	65	6.2	-0.3	0.0	
24	7838	5.7	1014.9	57	6.1	-0.7	0.0	DAYTIME
25	7838	3.2	1019.5	63	6.3	-0.9	0.0	
26	7838	3.9	1022.8	91	6.3	-0.3	0.0	
27	7838	2.3	1022.1	91	6.2	-0.3	0.0	
28	7838	7.1	1016.2	47	6.0	-0.4	-0.1	DAYTIME
29	7838	2.7	1018.6	65	5.9	-0.5	-0.1	
30	7838	2.0	1019.1	67	5.9	-0.7	-0.1	
31	7838	7.9	1007.5	58	6.0	-0.7	-0.1	
32	7838	6.3	1013.4	59	6.1	-1.2	-0.1	
33	7838	3.9	1014.9	73	6.0	-1.2	-0.1	
34	7838	2.7	1015.8	80	5.9	-1.3	-0.1	
35	7838	4.3	1014.7	71	5.8	-1.8	-0.1	
36	7838	3.0	1015.2	80	7.0	-1.9	-0.1	
37	7838	4.0	1017.5	56	6.0	-0.4	-0.1	
38	7838	3.3	1018.2	58	5.8	-0.5	-0.1	
39	7838	5.8	1017.1	54	6.1	-0.9	-0.1	DAYTIME
40	7838	4.3	1017.8	76	6.0	-0.9	-0.1	
41	7838	2.9	1018.0	66	5.6	-1.1	-0.1	
42	7838	5.2	1015.2	60	6.2	-0.6	-0.1	
43	7838	3.2	1015.2	68	6.2	-0.6	-0.1	
44	7838	6.6	1010.1	61	6.1	-0.2	-0.1	
45	7838	4.7	1010.4	61	6.2	-0.2	-0.1	
46	7838	7.8	1004.2	51	6.0	-0.7	-0.1	
47	7838	6.3	1005.1	59	6.0	-0.8	-0.1	
48	7838	5.5	1009.9	56	5.6	-1.4	-0.1	
49	7838	3.5	1011.4	64	6.1	-1.5	-0.1	
50	7838	7.1	1003.1	63	6.2	-0.8	-0.1	
51	7838	9.4	1008.2	53	5.6	-0.9	-0.1	DAYTIME
52	7838	6.4	1009.9	62	6.2	-1.0	-0.1	DAYTIME
53	7838	7.7	1011.7	56	6.0	-0.6	-0.1	DAYTIME
54	7838	11.5	1005.8	53	6.0	-0.7	-0.1	DAYTIME
55	7838	13.5	1008.9	57	6.3	-0.1	0.0	DAYTIME
56	7838	10.7	1010.4	59	6.3	-0.2	0.0	DAYTIME
57	7838	10.0	1017.5	63	6.0	-0.7	0.0	DAYTIME
58	7838	13.0	985.7	67	6.2	-2.4	0.0	DAYTIME
59	7838	7.7	998.8	51	6.3	-1.0	0.0	DAYTIME
60	7838	6.7	1006.0	59	6.3	-1.6	0.1	DAYTIME

Table 7. Observations and data fitting (continued)

(1) No.	(2) Obs.Time(UTC) date			caught			lost			(3) SAT.	(4) Az. ST	(5) Elev. MX		CT	(6) RTN	(7) Fitting N	
	Y	M	D	h	m	s	h	m	s		°	°	°	°			cm
61	91	02	21	03	52	34	04	04	55	AJ	-40R	63	27U	19	1261	27	4.6
62	91	02	22	02	57	36	03	09	48	AJ	-35R	47	21U	20	1135	23	5.1
63	91	02	25	02	17	40	02	29	34	AJ	-40R	49	23U	20	695	27	6.3
64	91	02	26	01	24	42	01	34	23	AJ	-40R	38	27U	20	920	31	5.3
65	91	02	27	00	29	43	00	38	58	AJ	-35R	32	22U	20	638	31	6.4
66	91	02	27	02	35	14	02	43	58	AJ	-45R	71	56U	20	633	27	3.9
67	91	03	02	01	50	26	02	03	25	AJ	-45R	76	22U	21	1171	31	4.5
68	91	03	13	00	02	46	00	15	32	AJ	-60L	56	21U	20	704	25	5.6
69	91	03	13	14	55	50	15	07	52	AJ	210L	64	23U	24	1591	31	4.1
70	91	03	14	14	02	23	14	13	20	AJ	190L	42	20U	23	894	31	5.5
71	91	03	14	16	04	12	16	16	29	AJ	-110R	61	26U	20	1168	27	5.3
72	91	03	15	00	18	22	00	27	12	AJ	-75L	33	24U	20	657	27	5.4
73	91	03	16	14	15	14	14	28	25	AJ	215L	69	23U	20	1300	31	5.4
74	91	03	16	16	17	59	16	29	57	AJ	-90R	43	21U	20	1121	31	5.5
75	91	03	20	12	41	22	12	53	27	AJ	200L	50	22U	20	1196	31	4.7
76	91	04	09	06	51	39	07	01	56	AJ	185L	36	21U	20	318	21	5.9
77	91	04	15	05	29	60	05	41	22	AJ	190L	43	21U	21	864	27	6.0
78	91	04	16	08	42	18	08	51	21	AJ	-75R	35	26U	20	595	28	7.0
79	91	04	16	12	48	18	13	00	43	AJ	-40R	53	23U	20	1811	21	6.0
80	91	04	20	07	11	00	07	16	55	AJ	-90R	41	41	20	56	9	7.4
81	91	04	20	11	13	30	11	25	24	AJ	-35R	43	21U	20	1192	25	5.5
82	91	04	20	13	14	58	13	28	28	AJ	-55L	70	20U	20	1927	31	4.3
83	91	04	22	03	17	22	03	25	49	AJ	175L	33	25U	20	561	25	5.9
84	91	04	22	07	22	04	07	29	26	AJ	-70R	32	26U	23	467	29	6.4
85	91	04	22	11	26	50	11	39	43	AJ	-40R	60	20U	22	966	31	5.7
86	91	04	22	13	29	26	13	39	52	AJ	-65L	43	21U	25	232	21	7.1
87	91	04	30	04	09	28	04	21	26	AJ	-90R	45	21U	20	1037	31	5.1
88	91	04	30	08	22	10	08	29	34	AJ	-40R	39	37U	20	704	31	5.6
89	91	04	30	10	19	29	10	33	15	AJ	-50L	79	20U	20	1845	31	4.0
90	91	05	01	03	15	13	03	27	28	AJ	-110R	60	25U	21	320	31	7.6
91	91	05	02	08	31	44	08	44	27	AJ	-40R	54	22U	20	965	31	4.9
92	91	05	02	10	33	32	10	46	05	AJ	-65L	50	20U	20	1198	31	5.0
93	91	05	13	00	33	60	00	45	16	AJ	-100R	47	24U	22	34	11	5.4
94	91	05	17	03	08	11	03	17	59	AJ	-35R	32	22U	19	749	20	6.1
95	91	05	17	05	10	05	05	22	49	AJ	-45R	74	26U	20	894	25	7.9
96	91	05	18	00	08	45	00	18	41	AJ	-75R	34	22U	20	932	25	5.7
97	91	05	28	18	14	45	18	27	39	AJ	205L	61	21U	20	915	24	6.0
98	91	05	30	03	41	21	03	46	02	AJ	-70L	35	35	22	74	8	9.9
99	91	06	06	16	12	56	16	26	22	AJ	220L	76	20U	21	1499	28	5.3
100	91	06	07	15	28	24	15	30	60	AJ	200L	52	41	25	252	27	6.5
101	91	06	11	13	46	34	13	56	60	AJ	185L	36	22U	19	1251	31	5.5
102	91	06	26	10	32	54	10	34	52	AJ	205L	57	35	23	111	31	6.0
103	91	06	26	12	32	21	12	36	02	AJ	-100R	49	46	26	179	11	28.9
104	91	06	27	09	31	44	09	40	22	AJ	185L	37	28U	21	933	25	5.5
105	91	07	06	09	29	14	09	41	48	AJ	-105R	55	21U	21	325	17	6.0
106	91	07	11	07	04	51	07	13	31	AJ	225L	82	63U	20	392	21	5.9
107	91	07	16	12	44	33	12	57	53	AJ	-45R	70	21U	20	1277	31	5.9
108	91	07	18	10	57	05	11	08	05	AJ	-35R	40	22U	20	764	29	7.0
109	91	07	18	12	58	19	13	03	31	AJ	-50L	78	22	67	561	27	5.4
110	91	07	19	10	08	09	10	09	30	AJ	-35R	33	32	30	175	13	6.6
111	91	07	20	11	10	11	11	22	58	AJ	-40R	54	21U	20	2371	31	4.5
112	91	07	20	13	14	34	13	24	22	AJ	-60L	48	33U	20	1176	31	5.7
113	91	07	22	11	24	30	11	37	11	AJ	-45R	79	26U	20	2088	31	5.1
114	91	07	22	13	27	30	13	35	29	AJ	-80L	28	21U	20	629	27	9.5
115	91	07	23	10	31	20	10	42	35	AJ	-40R	58	30U	20	861	29	7.3
116	91	07	23	12	35	54	12	43	46	AJ	-65L	44	40U	19	1076	29	6.3
117	91	07	25	10	45	08	10	56	46	AJ	-50R	85	33U	20	604	20	5.8
118	91	07	31	09	26	38	09	30	15	AJ	-50L	83	55U	70	256	12	4.9
119	91	08	01	10	35	57	10	40	33	AJ	-70L	33	33	22	455	21	5.6
120	91	08	02	09	38	52	09	48	47	AJ	-65L	52	35U	20	1953	31	4.6

Table 7. Observations and data fitting (continued)

(8) No.	(9) STN	(10) TMP	(11) PRESS	(12) HUM	(13) IDT	(14) DTS	(15) DTG	(16) COMMENTS
		°C	hPa	%	ns	ms	ms	
61	7838	7.9	1004.5	53	6.4	-1.7	0.1	DAYTIME
62	7838	5.1	1012.3	59	6.4	-0.3	0.1	DAYTIME
63	7838	7.5	1018.0	43	6.3	-5.9	0.1	DAYTIME
64	7838	8.2	1021.9	45	6.3	-0.9	0.1	DAYTIME
65	7838	11.9	1020.4	53	6.3	-1.0	0.1	DAYTIME
66	7838	13.3	1019.5	59	6.3	-1.1	0.1	DAYTIME
67	7838	10.5	1012.8	65	6.3	-0.8	0.1	DAYTIME
68	7838	13.1	1013.1	65	6.3	-0.7	0.0	DAYTIME
69	7838	7.8	1010.1	98	6.3	-1.2	0.0	
70	7838	4.0	1014.9	66	6.3	-0.3	0.1	
71	7838	3.4	1016.7	65	6.2	-0.4	0.1	
72	7838	5.4	1018.6	61	6.3	-0.7	0.0	DAYTIME
73	7838	6.1	1006.0	88	6.3	-0.7	0.0	
74	7838	4.9	1006.9	92	6.2	-0.8	0.0	
75	7838	16.8	1004.7	94	6.1	-0.2	0.0	
76	7838	21.8	1001.8	87	6.2	-0.2	0.0	DAYTIME
77	7838	19.8	1006.0	79	6.1	-0.4	0.0	DAYTIME
78	7838	19.8	1008.6	73	6.3	-0.2	0.0	DAYTIME
79	7838	14.6	1010.4	88	6.2	-0.3	0.0	
80	7838	17.8	1000.3	76	6.1	0.0	0.0	DAYTIME
81	7838	13.5	1002.5	82	6.1	0.0	0.0	
82	7838	11.9	1003.4	77	6.0	-0.1	0.0	
83	7838	18.6	1016.9	54	6.2	0.0	0.0	DAYTIME
84	7838	17.3	1017.8	75	6.1	-0.1	0.0	DAYTIME
85	7838	15.6	1019.9	77	6.1	-0.2	0.0	
86	7838	15.2	1020.1	78	6.1	-0.3	0.0	
87	7838	18.9	994.6	55	6.1	-0.2	0.0	DAYTIME
88	7838	18.8	994.6	61	6.3	-0.4	0.0	DAYTIME
89	7838	14.7	995.7	76	6.1	-0.5	0.0	
90	7838	21.8	991.4	54	6.1	-0.1	0.0	DAYTIME
91	7838	13.7	995.7	61	6.1	-0.2	0.0	DAYTIME
92	7838	11.0	998.1	70	6.1	-0.5	0.0	
93	7838	19.0	1005.8	88	6.3	-1.7	0.0	DAYTIME
94	7838	23.8	992.5	52	6.2	-0.8	0.0	DAYTIME
95	7838	24.1	992.5	48	6.2	-0.9	0.0	DAYTIME
96	7838	21.8	1000.5	57	6.3	-0.3	0.0	DAYTIME
97	7838	17.7	1008.4	73	6.1	-0.7	0.1	
98	7838	23.1	1006.0	75	6.0	-0.7	0.0	DAYTIME
99	7838	18.7	1001.4	98	6.2	-0.5	0.0	
100	7838	19.6	1008.2	92	6.0	-0.5	0.0	
101	7838	24.1	1003.4	94	6.2	-0.9	0.0	
102	7838	27.0	1004.7	83	6.2	-0.3	0.0	
103	7838	27.0	1005.3	84	6.1	-0.3	0.0	
104	7838	29.2	1001.6	74	6.2	-0.3	0.0	DAYTIME
105	7838	24.7	998.6	95	6.4	-0.4	0.0	DAYTIME
106	7838	29.9	999.9	74	6.3	-0.3	0.0	DAYTIME
107	7838	25.6	999.7	99	5.9	-0.3	0.1	
108	7838	24.3	1002.7	99	5.7	-0.3	0.1	
109	7838	24.0	1002.4	98	5.8	-0.4	0.1	
110	7838	24.8	1005.3	90	5.6	-0.4	0.1	DAYTIME
111	7838	28.2	1001.4	83	5.7	-0.4	0.1	
112	7838	27.0	1002.7	90	5.6	-0.5	0.1	
113	7838	28.1	1001.4	82	5.6	-0.5	0.1	
114	7838	27.5	1001.6	90	5.2	-0.6	0.1	
115	7838	28.4	1001.2	84	5.8	-0.4	0.1	
116	7838	27.7	1002.9	97	5.8	-0.5	0.1	
117	7838	28.2	998.1	77	6.3	-0.5	0.1	
118	7838	28.1	1002.5	97	6.2	-0.2	0.0	DAYTIME
119	7838	28.6	1001.8	93	6.2	-0.3	0.0	
120	7838	29.7	999.0	77	6.1	-0.2	0.0	DAYTIME

Table 7. Observations and data fitting (continued)

(1) No.	(2) Obs.Time(UTC) date			caught			lost			(3) SAT.	(4) Az. ST	(5) Elev. MX	CT		(6) RTN	(7) Fitting N	
	Y	M	D	h	m	s	h	m	s		°	°	°	°			cm
121	91	08	08	00	02	33	00	12	22	AJ	-120R	73	25U	40	850	31	4.4
122	91	08	08	06	21	03	06	22	59	AJ	-40R	59	55	41	170	11	7.6
123	91	08	09	07	27	20	07	33	42	AJ	-55L	66	66U	23	468	26	7.1
124	91	08	16	03	04	30	03	15	46	AJ	-35R	38	20U	20	1063	31	6.6
125	91	08	23	17	48	14	17	55	34	AJ	175L	32	27U	21	121	13	11.2
126	91	08	26	00	09	11	00	19	49	AJ	-35R	35	21U	20	766	27	7.3
127	91	08	26	17	05	58	17	13	37	AJ	180L	35	23U	28	641	25	7.8
128	91	08	27	18	11	43	18	24	34	AJ	225L	82	26U	20	691	27	6.4
129	91	08	30	17	31	07	17	44	32	AJ	-135R	87	25U	18	1123	31	6.2
130	91	09	03	15	58	34	16	09	23	AJ	215L	69	36U	21	802	22	7.1
131	91	09	04	15	04	56	15	14	56	AJ	195L	46	31U	20	1071	31	6.3
132	91	09	04	17	04	49	17	17	19	AJ	-110R	57	24U	20	1952	31	5.5
133	91	09	05	01	19	47	01	27	36	AJ	-80L	30	24U	20	669	18	5.3
134	91	09	05	16	10	01	16	23	14	AJ	-125R	78	23U	20	1514	31	6.2
135	91	09	05	18	15	57	18	22	10	AJ	-75R	34	26U	29	54	5	5.7
136	91	09	06	00	23	25	00	35	31	AJ	-65L	47	21U	20	1063	30	6.8
137	91	09	06	15	15	36	15	28	02	AJ	215L	74	21U	26	1262	31	5.4
138	91	09	06	17	18	50	17	29	48	AJ	-85R	41	20U	24	1858	31	5.5
139	91	09	09	14	38	24	14	48	42	AJ	220L	79	45U	20	688	27	5.5
140	91	09	09	16	38	48	16	50	11	AJ	-85R	39	21U	20	898	29	7.6
141	91	09	09	18	44	25	18	52	59	AJ	-45R	28	20U	20	1062	31	5.6
142	91	09	10	13	42	43	13	51	35	AJ	200L	55	27U	35	896	31	5.8
143	91	09	10	17	49	20	17	58	10	AJ	-55R	28	20U	20	1190	31	4.7
144	91	09	11	14	48	40	15	02	23	AJ	-120R	68	20U	20	1735	31	5.6
145	91	09	11	16	54	30	17	03	43	AJ	-65R	32	22U	20	289	21	7.6
146	91	09	11	18	58	37	19	08	05	AJ	-40R	30	20U	20	1012	31	6.0
147	91	09	19	11	40	01	11	51	48	AJ	215L	69	22U	28	1384	28	6.0
148	91	09	19	13	42	51	13	54	44	AJ	-90R	43	21U	20	1259	27	7.2
149	91	09	20	10	46	33	10	58	36	AJ	190L	46	21U	20	1551	31	5.7
150	91	09	20	12	47	41	13	00	52	AJ	-105R	57	20U	20	2042	31	5.5
151	91	10	02	10	06	52	10	18	52	AJ	-95R	45	21U	20	1559	31	5.3
152	91	10	02	12	13	26	12	21	04	AJ	-50R	28	23U	20	870	25	5.1
153	91	10	02	14	16	40	14	26	33	AJ	-35R	39	26U	21	1260	27	5.6
154	91	10	02	16	21	33	16	30	36	AJ	-50L	81	58U	20	1440	31	4.9
155	91	10	03	13	21	39	13	31	30	AJ	-40R	32	21U	20	1133	31	4.0
156	91	10	03	15	22	57	15	36	27	AJ	-45R	72	21U	20	2214	31	3.8
157	91	10	04	08	17	35	08	28	50	AJ	-130R	83	22U	33	644	24	3.9
158	91	10	12	13	22	05	13	34	12	AJ	-50R	85	24U	26	1076	31	6.8
159	91	10	13	12	27	31	12	40	53	AJ	-40R	64	21U	20	1303	31	5.9
160	91	10	13	14	30	00	14	41	09	AJ	-70L	39	20U	20	1381	31	6.3
161	91	10	14	07	28	44	07	35	53	AJ	-80R	37	32U	24	677	25	6.5
162	91	10	14	09	32	03	09	39	47	AJ	-45R	28	22U	21	313	17	8.6
163	91	10	14	11	34	07	11	45	57	AJ	-35R	48	23U	20	1164	25	6.6
164	91	10	14	13	35	28	13	47	43	AJ	-60L	60	22U	23	1063	25	5.4
165	91	10	15	06	36	28	06	39	49	AJ	-95R	48	47U	36	164	13	9.2
166	91	10	18	05	51	07	06	00	50	AJ	-90R	45	24U	28	148	12	7.7
167	91	10	18	09	59	18	10	10	29	AJ	-40R	39	21U	20	1409	31	5.9
168	91	10	18	12	00	35	12	14	16	AJ	-50L	80	21U	20	1614	31	6.0
169	91	10	19	09	06	31	09	14	52	AJ	-35R	32	25U	21	701	23	6.2
170	91	10	20	06	08	52	06	14	11	AJ	-70R	34	32U	27	396	17	8.4
171	91	10	20	10	14	39	10	25	23	AJ	-40R	53	32U	20	1851	31	4.7
172	91	10	20	12	14	50	12	26	45	AJ	-65L	51	22U	21	1928	31	5.1
173	91	10	21	05	14	04	05	19	26	AJ	-90R	43	39U	32	575	21	6.5
174	91	10	21	11	24	26	11	32	52	AJ	-55L	76	54U	25	424	24	8.1
175	91	10	22	04	16	31	04	27	19	AJ	-110R	56	28U	24	400	20	8.6
176	91	10	22	10	26	40	10	39	08	AJ	-45R	77	24U	23	1726	31	5.7
177	91	10	23	03	21	03	03	32	59	AJ	-125R	77	23U	27	1256	31	5.4
178	91	10	23	05	25	36	05	33	06	AJ	-70R	33	21U	28	295	17	8.5
179	91	10	23	09	32	02	09	44	05	AJ	-40R	56	21U	25	1529	31	5.6
180	91	10	23	11	34	36	11	45	36	AJ	-65L	47	22U	23	866	30	6.4

Table 7. Observations and data fitting (continued)

(8) No.	(9) STN	(10) TMP	(11) PRESS	(12) HUM	(13) IDT	(14) DTS	(15) DTG	(16) COMMENTS
		°C	hPa	%	ns	ms	ms	
121	7838	26.4	994.6	81	6.1	-0.6	0.0	DAYTIME
122	7838	27.2	992.7	81	6.1	-0.8	0.0	DAYTIME
123	7838	27.2	996.6	77	6.0	-0.1	0.0	DAYTIME
124	7838	27.1	1002.7	80	5.8	-0.1	0.0	DAYTIME
125	7838	26.0	992.7	96	5.1	-0.5	0.0	
126	7838	26.5	998.6	78	5.9	-0.1	0.0	DAYTIME
127	7838	24.4	999.7	95	5.9	-0.2	0.0	
128	7838	24.0	1004.0	82	5.5	0.0	0.0	
129	7838	25.2	989.5	95	5.6	-0.4	0.0	
130	7838	24.3	1005.8	93	6.0	-0.5	0.0	
131	7838	25.1	1009.5	99	5.9	-0.6	0.0	
132	7838	25.0	1009.3	99	6.0	-0.7	0.0	
133	7838	29.7	1010.4	91	6.1	-1.1	0.0	DAYTIME
134	7838	24.5	1008.0	99	5.8	-0.6	0.0	
135	7838	24.8	1007.1	97	6.1	-0.7	0.1	
136	7838	28.9	1006.9	89	6.1	-1.0	0.0	DAYTIME
137	7838	23.5	1003.2	99	6.0	-0.6	0.0	
138	7838	23.3	1002.3	98	6.1	-0.7	0.0	
139	7838	24.1	997.3	77	6.2	-0.7	0.1	
140	7838	23.3	997.7	76	6.1	-0.8	0.1	
141	7838	22.7	998.1	79	5.8	-0.9	0.1	
142	7838	22.8	1002.1	99	5.6	-0.7	0.0	
143	7838	22.7	1001.2	97	6.2	-0.8	0.0	
144	7838	22.5	1001.2	90	6.3	-0.5	0.0	
145	7838	22.4	1001.2	90	5.7	-0.6	0.0	
146	7838	21.6	1001.2	98	6.1	-0.8	0.1	
147	7838	23.7	984.6	89	5.8	-0.3	0.0	
148	7838	22.0	986.6	95	6.0	-0.4	0.0	
149	7838	22.0	1000.5	77	5.9	-0.5	0.0	
150	7838	20.1	1001.8	88	5.6	-0.5	0.0	
151	7838	22.0	1002.9	86	6.3	-0.4	0.0	
152	7838	21.0	1004.0	85	6.2	-0.5	0.0	
153	7838	19.3	1003.8	91	6.2	-0.6	0.0	
154	7838	19.3	1004.0	88	6.3	-0.7	0.0	
155	7838	19.8	1004.0	99	6.1	-0.1	0.0	
156	7838	19.1	1003.6	99	5.9	-0.2	0.0	
157	7838	23.8	1002.0	87	6.1	-0.2	0.0	DAYTIME
158	7838	23.6	981.3	76	5.6	0.1	0.0	
159	7838	20.3	993.3	75	6.0	0.0	0.0	
160	7838	18.8	993.6	77	6.2	-0.2	0.0	
161	7838	22.2	998.1	70	5.5	-0.1	0.0	DAYTIME
162	7838	17.8	999.2	83	5.4	-0.3	0.0	
163	7838	16.5	1000.3	84	5.7	-0.3	0.0	
164	7838	16.9	1000.8	75	5.3	-0.4	0.0	
165	7838	19.6	1006.6	68	5.7	-0.1	0.0	DAYTIME
166	7838	22.4	1002.3	82	5.8	-0.1	0.0	DAYTIME
167	7838	16.6	1003.4	92	5.9	-0.2	0.0	
168	7838	15.0	1003.8	86	6.0	-0.4	0.0	
169	7838	18.0	1003.8	87	5.9	-1.2	0.0	
170	7838	19.8	1008.2	84	6.1	-0.1	0.0	DAYTIME
171	7838	14.8	1009.9	85	6.1	-0.3	0.0	
172	7838	12.9	1011.0	93	6.1	-0.4	0.0	
173	7838	19.9	1012.3	86	6.0	0.0	0.0	DAYTIME
174	7838	14.2	1014.9	90	5.7	-0.2	0.1	
175	7838	21.2	1012.3	69	5.9	-0.1	0.1	DAYTIME
176	7838	14.3	1012.5	82	6.0	-0.3	0.0	
177	7838	19.9	1012.5	53	6.2	0.0	0.1	DAYTIME
178	7838	20.3	1012.3	52	6.1	-0.1	0.1	DAYTIME
179	7838	14.1	1013.4	76	6.1	-0.3	0.1	
180	7838	12.6	1013.8	79	6.2	-0.3	0.1	

Table 7. Observations and data fitting (continued)

(1) No.	(2) Obs.Time(UTC) date			caught			lost			(3) SAT.	(4) Az. ST	(5) Elev. MX	CT		(6) RTN	(7) Fitting N	
	Y	M	D	h	m	s	h	m	s		°	°	°	°			cm
181	91	11	07	06	10	10	06	23	11	AJ	-45R	76	23U	20	1435	31	5.3
182	91	11	11	04	35	14	04	45	59	AJ	-45R	60	21U	34	1251	27	6.1
183	91	11	12	03	42	29	03	52	01	AJ	-35R	45	26U	27	823	29	6.7
184	91	11	12	05	42	59	05	54	37	AJ	-55L	64	21U	29	1318	31	5.1
185	91	11	13	02	48	05	02	57	42	AJ	-40R	36	23U	22	382	17	7.4
186	91	11	13	04	50	28	05	02	04	AJ	-50R	83	31U	22	1350	31	5.2
187	91	11	15	03	01	12	03	13	02	AJ	-40R	48	22U	21	1090	31	6.6
188	91	11	15	05	03	35	05	14	29	AJ	-60L	59	26U	26	1129	31	5.9
189	91	11	16	02	06	54	02	15	51	AJ	-35R	37	20U	29	764	25	6.9
190	91	11	18	02	23	00	02	31	41	AJ	-40R	50	35U	26	620	25	6.7
191	91	11	19	01	26	38	01	37	37	AJ	-35R	39	21U	21	281	15	7.5
192	91	11	19	03	29	58	03	39	38	AJ	-50L	79	34U	31	1196	31	6.2
193	91	11	20	00	35	22	00	39	05	AJ	-40R	32	30U	30	204	15	6.3
194	91	11	21	01	42	30	01	51	09	AJ	-40R	54	35U	28	1060	31	5.0
195	91	11	22	00	48	37	00	57	11	AJ	-35R	41	32U	21	328	16	9.1
196	91	11	25	00	06	53	00	16	35	AJ	-35R	43	27U	23	655	20	8.0
197	91	11	25	02	09	24	02	14	32	AJ	-55L	69	36U	66	207	13	5.6
198	91	11	28	16	21	52	16	32	00	AJ	205L	56	32U	23	959	29	5.9
199	91	11	28	18	22	25	18	34	24	AJ	-100R	50	23U	20	1116	31	6.1
200	91	11	29	00	32	59	00	41	59	AJ	-50R	87	24U	51	295	15	6.3
201	91	11	29	15	30	30	15	36	12	AJ	185L	36	33U	26	449	21	7.6
202	91	12	01	17	41	47	17	53	54	AJ	-95R	47	21U	20	997	25	5.7
203	91	12	02	14	46	11	14	55	38	AJ	190L	40	20U	28	574	23	9.2
204	91	12	03	01	04	23	01	08	22	AJ	-75L	35	33U	30	124	10	8.8
205	91	12	09	12	32	25	12	41	45	AJ	175L	30	20U	20	455	20	5.8
206	91	12	12	13	51	03	14	04	42	AJ	-120R	71	20U	20	1637	31	6.0
207	91	12	13	12	56	47	13	10	52	AJ	220L	81	20U	19	1942	31	6.2
208	91	12	16	12	16	56	12	30	07	AJ	225L	86	23U	20	1981	31	4.7
209	91	12	18	10	29	48	10	41	12	AJ	185L	40	20U	20	799	27	6.6
210	91	12	18	12	30	21	12	43	38	AJ	-110R	63	20U	20	1443	31	6.0
211	91	12	19	11	35	53	11	49	48	AJ	-130R	85	20U	20	1423	31	6.4
212	91	12	19	13	40	18	13	51	05	AJ	-80R	35	20U	20	1148	31	6.8
213	91	12	20	10	42	04	10	55	30	AJ	210L	66	20U	20	2066	31	4.6
214	91	12	20	12	44	55	12	57	14	AJ	-95R	44	20U	19	1874	31	6.1
215	91	12	26	09	21	24	09	34	41	AJ	220L	77	23U	20	179	13	8.7

Table 7. Observations and data fitting (continued)

(8) No.	(9) STN	(10) TMP	(11) PRESS	(12) HUM	(13) IDT	(14) DTS	(15) DTG	(16) COMMENTS
		°C	hPa	%	ns	ms	ms	
181	7838	15.4	1014.1	64	5.8	0.0	0.0	DAYTIME
182	7838	17.2	1006.2	42	6.2	-0.3	0.0	DAYTIME
183	7838	15.6	1009.7	48	6.3	0.1	0.0	DAYTIME
184	7838	15.5	1009.3	50	6.2	0.1	0.0	DAYTIME
185	7838	17.0	1012.8	49	6.3	-0.9	0.0	DAYTIME
186	7838	17.8	1011.2	50	6.3	-1.0	0.0	DAYTIME
187	7838	15.8	1014.7	48	6.3	0.0	0.0	DAYTIME
188	7838	16.0	1014.1	50	6.2	0.0	0.1	DAYTIME
189	7838	16.1	1019.1	51	6.1	-1.0	0.0	DAYTIME
190	7838	17.1	1012.1	47	6.2	0.0	0.0	DAYTIME
191	7838	17.1	1011.0	57	6.2	-1.2	0.1	DAYTIME
192	7838	19.1	1008.6	49	6.4	0.0	0.1	DAYTIME
193	7838	14.4	1009.7	49	6.3	-1.2	0.0	DAYTIME
194	7838	15.5	1019.1	55	6.5	-1.4	0.0	DAYTIME
195	7838	15.8	1019.1	61	6.4	-1.2	0.0	DAYTIME
196	7838	10.2	1025.6	53	6.3	0.0	0.0	DAYTIME
197	7838	12.6	1025.0	49	6.4	-0.1	0.0	DAYTIME
198	7838	14.7	1000.1	87	6.4	-0.4	0.0	
199	7838	12.8	1001.0	94	6.4	-0.5	0.0	
200	7838	16.5	1005.1	70	6.4	-0.7	0.0	DAYTIME
201	7838	16.4	1006.4	68	6.3	-1.0	0.0	
202	7838	12.9	1005.8	56	6.5	-1.9	0.0	
203	7838	9.2	1011.0	69	6.5	-1.2	0.0	
204	7838	16.0	1012.5	66	6.6	-1.8	0.0	DAYTIME
205	7838	6.7	1019.3	96	6.7	-0.5	0.1	
206	7838	2.2	1018.0	68	6.5	-0.9	0.0	
207	7838	6.1	1021.7	60	6.5	-0.9	0.1	
208	7838	13.6	1021.7	71	6.6	-0.7	0.0	
209	7838	11.6	1004.9	94	5.7	-0.3	0.0	
210	7838	11.1	1006.0	61	5.9	-0.4	0.0	
211	7838	6.9	1014.5	64	6.4	-0.3	0.1	
212	7838	6.6	1014.7	60	6.4	-0.4	0.1	
213	7838	5.9	1019.2	83	6.4	-0.2	0.0	
214	7838	4.8	1019.7	85	7.3	-0.3	0.0	
215	7838	8.3	1007.7	74	6.5	-0.1	0.0	

Table 7. Observations and data fitting (continued)

(1) No.	(2) Obs.Time(UTC) date			caught			lost			(3) SAT.	(4) Az. ST	(5) Elev. MX	CT		(6) RTN	(7) Fitting N	
	Y	M	D	h	m	s	h	m	s		°	°	°	°			cm
1	91	07	20	12	04	34	12	05	57	ER	100L	24	23U	23	13	7	17.6
2	91	07	20	13	42	20	13	47	09	ER	-150R	34	25U	20	357	19	6.1
3	91	07	24	13	13	27	13	15	30	ER	-190R	72	45	20	133	13	3.8
4	91	07	31	12	36	52	12	42	37	ER	135L	45	21U	27	275	15	8.0
5	91	08	01	02	35	06	02	36	38	ER	-20L	36	29	20	53	7	4.3
6	91	08	01	13	43	42	13	49	01	ER	-150R	32	21U	20	681	27	4.4
7	91	08	02	13	09	43	13	16	45	ER	-185R	72	22U	20	578	23	7.8
8	91	08	07	13	44	51	13	49	06	ER	-150R	32	28U	19	249	17	6.1
9	91	08	08	13	10	41	13	16	36	ER	-185R	72	32U	21	386	21	4.9
10	91	08	26	13	09	40	13	16	57	ER	-185R	68	22U	18	487	23	6.5
11	91	09	04	13	09	40	13	16	39	ER	-185R	72	22U	20	417	31	13.1
12	91	09	19	13	09	47	13	16	39	ER	-185R	69	23U	20	636	21	12.4
13	91	09	20	12	37	02	12	43	29	ER	140L	48	23U	19	476	22	7.2
14	91	10	02	12	37	13	12	43	26	ER	140L	49	25U	19	468	19	6.2
15	91	10	03	13	44	38	13	48	37	ER	-155R	32	27U	22	300	17	6.3
16	91	10	23	12	37	11	12	43	11	ER	135L	47	26U	21	674	24	5.7
17	91	11	15	02	02	19	02	02	42	ER	5L	67	45	39	50	7	8.3
18	91	11	15	13	10	14	13	15	37	ER	-185R	72	29U	28	238	14	14.9
19	91	11	28	12	37	46	12	43	20	ER	140L	48	32U	19	534	23	6.1
20	91	12	02	13	46	24	13	48	54	ER	-145R	32	32	19	127	10	7.7
21	91	12	03	01	58	49	02	00	06	ER	5L	64	37	60	95	10	4.2
22	91	12	03	13	09	33	13	14	54	ER	-185R	69	23U	36	634	26	10.2
23	91	12	04	12	37	18	12	42	54	ER	140L	50	28U	22	633	24	5.6
24	91	12	09	01	57	27	02	04	18	ER	5L	70	22U	20	344	19	4.8
25	91	12	09	13	09	11	13	16	24	ER	-185R	74	20U	20	372	20	9.6
26	91	12	13	12	36	38	12	43	15	ER	140L	49	22U	20	802	27	6.5
27	91	12	16	12	39	58	12	46	37	ER	145L	49	22U	21	771	27	6.0
28	91	12	26	13	51	04	13	55	33	ER	-155R	35	20U	20	273	16	6.4

Table 7. Observations and data fitting (continued)

(8) No.	(9) STN	(10) TMP	(11) PRESS	(12) HUM	(13) IDT	(14) DTS	(15) DTG	(16) COMMENTS
		°C	hPa	%	ns	ms	ms	
1	7838	27.9	1001.8	84	5.7	-0.5	0.1	
2	7838	26.3	1002.7	95	5.4	-0.6	0.1	
3	7838	26.8	999.9	85	5.8	-0.5	0.1	
4	7838	27.4	1003.6	98	6.1	-0.4	0.0	
5	7838	31.1	1002.7	83	6.2	-0.8	0.0	DAYTIME
6	7838	27.9	1002.2	93	6.1	-0.5	0.0	
7	7838	27.4	999.4	78	5.2	-0.4	0.0	
8	7838	22.5	994.0	99	7.2	-0.3	0.0	
9	7838	21.9	995.3	99	6.1	-0.1	0.0	
10	7838	25.0	999.4	93	5.8	-0.5	0.0	
11	7838	25.3	1009.5	98	5.7	-0.6	0.0	
12	7838	22.1	986.1	94	5.8	-0.4	0.0	
13	7838	21.2	1001.8	81	5.8	-0.5	0.0	
14	7838	21.0	1004.0	85	6.3	-0.5	0.0	
15	7838	19.5	1003.8	99	5.9	-0.1	0.0	
16	7838	11.9	1013.6	82	5.8	-0.4	0.1	
17	7838	15.4	1015.8	49	6.3	-2.4	0.0	DAYTIME
18	7838	9.4	1017.9	60	6.1	-0.4	0.1	
19	7838	16.4	997.0	91	6.4	-0.2	0.0	
20	7838	9.4	1011.0	68	6.6	-1.1	0.0	
21	7838	16.4	1011.9	68	6.4	-1.9	0.0	DAYTIME
22	7838	8.6	1012.5	76	6.5	-0.6	0.0	
23	7838	9.5	1017.5	58	6.4	-0.8	0.0	
24	7838	13.3	1013.3	59	6.6	-2.6	0.1	DAYTIME
25	7838	6.4	1019.5	96	6.6	-0.6	0.1	
26	7838	4.5	1021.7	75	6.4	-0.9	0.1	
27	7838	13.5	1021.7	73	6.5	-0.7	0.0	
28	7838	6.7	1008.8	72	6.5	-0.4	0.0	

Table 7. Observations and data fitting (continued)

(1) No.	(2) Obs.Time(UTC) date			caught			lost			(3) SAT.	(4) Az. ST	(5) Elev. MX	CT		(6) RTN	(7) Fitting N	
	Y	M	D	h	m	s	h	m	s		°	°	°	°			cm
1	91	01	13	16	43	45	16	48	03	AJ	300L	55	32U	55	349	21	3.2
2	91	01	16	14	05	14	14	11	26	AJ	340R	43	43U	21	51	15	3.4
3	91	01	16	16	01	37	16	13	34	AJ	300L	50	21U	21	992	31	3.4
4	91	01	17	15	06	58	15	17	36	AJ	310L	79	21U	39	434	25	3.5
5	91	01	18	14	13	53	14	17	35	AJ	320R	70	26	56	277	21	3.5
6	91	01	18	16	19	27	16	22	03	AJ	270L	27	26U	26	34	24	2.3
7	91	01	22	12	39	31	12	49	29	AJ	330R	51	24U	29	675	31	3.8
8	91	01	22	14	44	16	14	44	18	AJ	290L	41	35	36	7	3	1.7
9	91	01	23	13	50	02	13	58	47	AJ	310L	66	48U	23	756	31	3.2
10	91	01	24	13	00	50	13	05	13	AJ	320R	82	58	21	79	20	4.2
11	91	01	27	12	13	19	12	24	00	AJ	320R	88	31U	26	655	31	3.6
12	91	01	30	11	32	19	11	44	34	AJ	310L	85	27U	20	1487	31	3.6
13	91	01	31	10	38	14	10	50	18	AJ	330R	64	26U	20	604	31	3.3
14	91	01	31	12	42	23	12	45	36	AJ	280L	30	26U	30	39	12	2.9
15	91	02	03	10	05	42	10	09	51	AJ	320R	70	52	21	111	20	3.6
16	91	02	03	12	02	37	12	06	17	AJ	270L	27	25U	25	26	15	3.5

Table 7. Observations and data fitting (continued)

(8) No.	(9) STN	(10) TMP	(11) PRESS	(12) HUM	(13) IDT	(14') DTS	(15) DTL	(16) COMMENTS
		°C	hPa	%	ns	ms	ms	
1	7304	15.6	1021.7	53	51.0	1.9	-0.5	
2	7304	16.4	1022.6	79	50.7	1.9	-0.5	
3	7304	16.5	1020.9	72	50.7	1.9	-0.5	
4	7304	17.9	1019.2	75	50.8	1.9	-0.5	
5	7304	15.0	1022.6	75	50.7	1.9	-0.6	
6	7304	15.3	1021.6	79	50.8	1.9	-0.6	
7	7304	19.1	1017.2	81	50.7	2.8	-0.1	
8	7304	19.1	1017.2	75	50.8	2.8	-0.1	
9	7304	17.3	1020.9	78	50.9	2.8	-0.1	
10	7304	20.3	1017.8	80	50.8	2.8	-0.1	
11	7304	15.0	1021.5	87	50.6	2.8	0.1	
12	7304	16.4	1020.2	93	25.4	2.8	0.1	
13	7304	15.3	1017.7	93	25.4	2.8	0.1	
14	7304	14.6	1017.8	96	50.7	2.8	0.1	
15	7304	15.1	1018.1	87	50.6	2.8	0.1	
16	7304	13.8	1019.1	93	50.5	2.8	0.1	

Table 7. Observations and data fitting (continued)

(1) No.	(2) Obs.Time(UTC) date			caught			lost			(3) SAT.	(4) Az. ST	(5) Elev. MX	CT		(6) RTN	(7) Fitting N	
	Y	M	D	h	m	s	h	m	s		°	°	°	°			cm
1	91	01	18	10	15	13	10	24	05	LG	130L	68	42	63	122	15	3.8
2	91	01	30	11	47	33	11	55	30	LG	170R	66	63	47	311	31	3.5

Table 7. Observations and data fitting (continued)

(8) No.	(9) STN	(10) TMP	(11) PRESS	(12) HUM	(13) IDT	(14') DTS	(15) DTL	(16) COMMENTS
		°C	hPa	%	ns	ms	ms	
1	7304	16.6	1021.0	69	50.4	1.9	-0.6	
2	7304	15.9	1020.2	97	25.2	2.8	0.1	

Table 7. Observations and data fitting (continued)

(8) No.	(9) STN	(10) TMP	(11) PRESS	(12) HUM	(13) IDT	(14') DTS	(15) DTL	(16) COMMENTS
		°C	hPa	%	ns	ms	ms	
1	7304	18.9	1022.3	77	50.7	2.8	0.0	
2	7304	19.0	1016.8	76	50.8	2.8	-0.1	

Table 7. Observations and data fitting (continued)

(1) No.	(2) Obs.Time(UTC) date			caught			lost			(3) SAT.	(4) Az. ST	(5) Elev. MX	CT		(6) RTN	(7) Fitting N	
	Y	M	D	h	m	s	h	m	s		°	°	°	°			cm
1	91	01	19	11	40	50	11	43	02	ST	260R	40	33	20	53	15	1.8
2	91	01	22	10	49	40	10	50	41	ST	270R	36	32	27	26	12	3.1

Table 7. Observations and data fitting (continued)

(1) No.	(2) Obs.Time(UTC) date			caught			lost			(3) SAT.	(4) Az. ST	(5) Elev. MX	CT		(6) RTN	(7) Fitting N	
	Y	M	D	h	m	s	h	m	s			°	°	°			cm
1	91	08	26	19	13	08	19	20	03	AJ	240L	89	61U	32	253	15	4.7
2	91	08	28	17	22	51	17	32	58	AJ	200L	51	30U	22	289	31	5.0
3	91	08	28	19	25	53	19	28	34	AJ	260R	70	46	69	71	7	7.3
4	91	09	04	17	10	56	17	20	08	AJ	250R	78	49U	23	152	15	4.8
5	91	09	23	18	22	42	18	29	27	AJ	290L	49	44U	26	107	31	2.7
6	91	09	24	15	26	33	15	31	42	AJ	300R	61	51U	42	47	25	4.7
7	91	09	25	10	23	27	10	35	14	AJ	220L	67	27U	21	232	15	7.5
8	91	09	25	12	26	34	12	29	36	AJ	270R	61	33	56	123	31	5.7
9	91	09	25	14	29	22	14	38	26	AJ	300R	55	30U	31	499	31	4.6
10	91	09	25	16	32	19	16	42	21	AJ	300L	87	37U	26	238	31	5.2
11	91	09	25	18	35	59	18	40	58	AJ	280L	31	29U	24	78	31	9.2
12	91	09	26	09	31	44	09	39	06	AJ	200L	48	35U	30	118	21	7.5
13	91	09	30	09	56	50	10	07	43	AJ	240R	85	30U	26	141	31	7.8
14	91	09	30	11	59	46	12	10	25	AJ	280R	54	28U	23	263	31	8.2
15	91	09	30	14	05	11	14	06	56	AJ	300R	65	49	62	75	31	9.0
16	91	09	30	16	08	08	16	11	08	AJ	290L	60	54U	54	26	13	4.3
17	91	10	02	10	20	14	10	21	58	AJ	260R	67	34	23	20	7	6.9
18	91	10	03	11	22	47	11	26	15	AJ	290R	53	49U	46	195	15	5.1
19	91	10	03	13	21	53	13	25	19	AJ	300R	67	27	54	146	31	9.0
20	91	10	08	08	50	38	09	01	02	AJ	270R	63	33U	23	543	31	5.4
21	91	10	08	12	56	57	13	00	12	AJ	300L	88	41	82	155	31	8.0
22	91	10	16	11	52	42	11	57	59	AJ	290L	59	58U	30	441	21	4.4
23	91	10	18	08	02	25	08	08	25	AJ	290R	53	53U	22	221	31	3.7
24	91	10	18	09	58	43	10	11	36	AJ	300R	81	22U	22	488	31	3.9
25	91	10	18	12	03	18	12	06	23	AJ	280L	39	30	39	31	21	3.7
26	91	10	19	09	05	40	09	17	11	AJ	300R	67	28U	23	361	31	3.5
27	91	10	19	11	08	16	11	18	30	AJ	290L	55	30U	23	500	31	3.7
28	91	10	20	08	12	15	08	22	45	AJ	300R	58	33U	22	657	31	3.7
29	91	10	20	10	12	37	10	24	59	AJ	300L	75	23U	23	467	31	3.7
30	91	10	22	08	26	54	08	36	30	AJ	300R	69	40U	24	138	31	6.3
31	91	10	23	09	32	31	09	44	54	AJ	300L	71	25U	21	418	31	3.7
32	91	10	23	11	37	53	11	38	46	AJ	270L	21	21	21	17	9	10.6
33	91	10	24	08	41	22	08	49	05	AJ	300L	88	49U	33	288	31	4.1
34	91	10	24	10	42	46	10	43	11	AJ	280L	33	28	29	14	11	4.7

Table 7. Observations and data fitting (continued)

(8) No.	(9) STN	(10) TMP	(11) PRESS	(12) HUM	(13) IDT	(14') DTS	(15) DTG	(16) COMMENTS
		°C	hPa	%	ns	ms	ms	
1	7313	9.2	1008.3	100	50.7	1.8	0.0	
2	7313	11.2	1006.0	95	50.5	1.8	0.0	
3	7313	9.7	1005.3	100	50.5	1.8	0.0	
4	7313	18.4	1015.9	99	50.7	1.8	0.0	
5	7313	12.9	1011.0	100	51.0	1.8	0.0	
6	7313	17.1	1011.1	88	50.9	1.8	0.0	
7	7313	11.8	1010.0	91	50.9	1.8	0.0	
8	7313	9.3	1015.5	99	50.8	1.8	0.0	
9	7313	9.5	1017.7	85	51.1	1.8	0.0	
10	7313	7.5	1018.2	95	51.1	1.8	0.0	
11	7313	6.0	1019.3	100	51.1	1.8	0.0	
12	7313	13.1	1020.8	85	51.1	1.8	0.0	
13	7313	12.4	1022.2	97	51.1	1.8	0.0	
14	7313	12.2	1016.7	93	50.8	1.8	0.0	
15	7313	10.5	1018.2	100	50.8	1.8	0.0	
16	7313	9.6	1019.1	100	50.9	1.8	0.0	
17	7313	12.4	1020.0	100	50.9	1.8	0.0	
18	7313	14.2	1009.4	78	51.0	1.8	0.0	
19	7313	11.9	1004.1	92	50.9	1.8	0.0	
20	7313	10.9	1003.5	100	50.8	1.8	0.0	
21	7313	10.0	1015.6	100	50.9	1.8	0.0	
22	7313	12.6	1016.6	100	50.9	1.8	0.0	
23	7313	15.6	1021.1	49	51.0	1.8	0.0	
24	7313	12.1	1003.2	66	51.0	1.8	0.0	
25	7313	11.4	1004.3	72	51.0	1.8	0.0	
26	7313	13.2	1004.8	47	51.2	1.8	0.0	
27	7313	12.1	1002.2	51	51.1	1.8	0.0	
28	7313	10.5	1004.0	61	51.3	1.8	0.0	
29	7313	9.0	1012.2	69	51.2	1.8	0.0	
30	7313	13.9	1014.4	59	51.1	1.8	0.0	
31	7313	4.7	1014.4	78	51.2	1.8	0.1	
32	7313	5.8	1017.9	61	51.2	1.8	0.1	
33	7313	7.8	1018.6	90	51.3	1.8	0.0	
34	7313	5.0	1020.6	98	51.3	1.8	0.0	

PHOTOGRAPHIC DIRECTION OBSERVATIONS OF AJISAI IN 1991

Summary - Photographic direction observations of Ajisai by satellite cameras at Tokati and the Simosato Hydrographic Observatory(SHO) were made in 1991. 3 photographs were taken by the fixed satellite camera at SHO, while 13 were taken by the transportable camera at Tokati.

Key words: satellite camera-Ajisai-photographic direction observation

1. Observation

Photographic direction observations of Ajisai by satellite cameras at Tokati and the Simosato Hydrographic Observatory(SHO) were made in 1991. The fixed satellite camera at the SHO is an Astronomical telescopewith a plate holder controlled by a personal computer (Kanazawa, 1989). The transportable camera is an astronomical telescope with a manually controlled plate holder. The plates used in these observations were Kodak professional plates Type TMAX100.

The observation schedule was determined by considering the status of flashing, the elevation of the satellite, its distance from the Moon andthe possibility of common view. Each plate was exposed 10 seconds and about30 flashes of the satellite were taken together with the image of the stars.

2. Directional data of Ajisai's flash

The positions of images on the developed photographic plates were measured with a comparator by a contractor. The positional data of flashes and star images were converted into right ascension and declination by the Satellite Data Analysis Computer System (Nagamori, 1989). The star catalogue used for this computation is the SAO. This computation were based on J2000.

The observed and computed data are shown in Table 1.

The computer programs were made by K. Asai and the data analysis was made by K. Kawai and H. Noda of Satellite Geodesy Office. This report was written by K. Kawai and H. Noda.

References

Kanazawa, T., 1989: *Data report of Hydrogr. Obs., Series of Satellite Geodesy,* No. 2, p. 50.
Kubo, Y., 1989: *Data report of Hydrogr. Obs., Series of Satellite Geodesy,* No. 2, p. 72.
Nagamori, K., 1989: *Data report of Hydrogr. Obs., Series of Satellite Geodesy,* No. 2, p. 59.
Kawai, K., 1990: *Data report of Hydrogr. Obs., Series of Satellite Geodesy,* No. 3, p. 36.
Kawai, K., 1991: *Data report of Hydrogr. Obs., Series of Satellite Geodesy,* No. 4, p. 38.
Kawai, K., 1992: *Data report of Hydrogr. Obs., Series of Satellite Geodesy,* No. 5, p. 30.

Table 1. Directional data of Ajisai's flashes

Explanation

Column 1 Serial number
2 Observation date
3 Observation time (UTC)
(Epoch of the exposure)
4 R. A. (Right-Ascension) of satellite flash
5 Decl. (Declination) of satellite flash
6 Station ID. 7838: The Simosato Hydrographic Observatory
7313: Tokati
7 Meteorological data;
TMP: Atmospheric temperature
(degree centigrade)
HUM: Relative humidity (%)
PRESS: Atmospheric Pressure
(hecto pascal)

Table 1. Directional data of Ajisai's flashes

(1) No.	(2) date			(3) time			(4) R.A.			(5) Decl.			(6) STN	(7) TMP	HUM	PRESS
	Y	M	D	h	m	s	h	m	s	°	'	"	ID	℃	%	hPa
1	91	8	27	9	23		7	11	50.3	+46	59	33.84	7838	24.0	82	1004
2	91	8	27	9	23		7	12	8.2	+46	58	46.38	7838	24.0	82	1004
3	91	8	27	9	23		7	12	39.0	+46	57	17.65	7838	24.0	82	1004
4	91	8	27	9	23		7	12	52.0	+46	56	38.99	7838	24.0	82	1004
5	91	8	27	9	23		7	13	10.7	+46	55	54.13	7838	24.0	82	1004
6	91	8	27	9	23		7	13	39.1	+46	54	23.00	7838	24.0	82	1004
7	91	8	27	9	23		7	13	53.5	+46	53	44.93	7838	24.0	82	1004
8	91	8	27	9	23		7	14	10.0	+46	52	57.16	7838	24.0	82	1004
9	91	8	27	9	23		7	14	40.6	+46	51	30.54	7838	24.0	82	1004
10	91	8	27	9	23		7	14	54.4	+46	50	48.47	7838	24.0	82	1004
11	91	8	27	9	23		7	15	11.1	+46	50	1.84	7838	24.0	82	1004
12	91	8	27	9	23		7	15	41.7	+46	48	33.19	7838	24.0	82	1004
13	91	8	27	9	23		7	15	55.4	+46	47	53.89	7838	24.0	82	1004
14	91	8	27	9	23		7	16	11.7	+46	47	3.67	7838	24.0	82	1004
15	91	8	27	9	23		7	16	41.8	+46	45	34.62	7838	24.0	82	1004
16	91	8	27	9	23		7	16	55.5	+46	44	54.13	7838	24.0	82	1004
17	91	8	27	9	23		7	17	11.8	+46	44	5.60	7838	24.0	82	1004
18	91	8	27	9	23		7	17	43.2	+46	42	34.56	7838	24.0	82	1004
19	91	8	27	9	23		7	17	56.3	+46	41	56.91	7838	24.0	82	1004
20	91	8	27	9	23		7	18	17.4	+46	41	5.59	7838	24.0	82	1004
21	91	8	30	8	40		4	22	53.1	+51	34	24.47	7838	25.2	95	990
22	91	8	30	8	40		4	23	15.7	+51	34	56.28	7838	25.2	95	990
23	91	8	30	8	40		4	23	54.4	+51	35	46.71	7838	25.2	95	990
24	91	8	30	8	40		4	24	48.8	+51	36	57.08	7838	25.2	95	990
25	91	8	30	8	40		4	25	11.3	+51	37	26.40	7838	25.2	95	990
26	91	8	30	8	40		4	25	49.8	+51	38	12.63	7838	25.2	95	990
27	91	8	30	8	40		4	26	44.2	+51	39	20.84	7838	25.2	95	990
28	91	8	30	8	40		4	27	6.8	+51	39	47.73	7838	25.2	95	990
29	91	8	30	8	40		4	27	45.0	+51	40	35.22	7838	25.2	95	990
30	91	8	30	8	40		4	28	39.1	+51	41	35.10	7838	25.2	95	990
31	91	8	30	8	40		4	29	1.7	+51	42	4.30	7838	25.2	95	990
32	91	8	30	8	40		4	29	39.9	+51	42	45.37	7838	25.2	95	990
33	91	8	30	8	40		4	30	33.8	+51	43	44.63	7838	25.2	95	990
34	91	8	30	8	40		4	30	56.4	+51	44	8.85	7838	25.2	95	990
35	91	8	30	8	40		4	31	34.2	+51	44	50.71	7838	25.2	95	990
36	91	8	30	8	40		4	32	27.9	+51	45	46.27	7838	25.2	95	990
37	91	8	30	8	40		4	32	50.5	+51	46	9.86	7838	25.2	95	990
38	91	8	30	8	40		4	33	28.2	+51	46	47.69	7838	25.2	95	990
39	91	8	30	8	40		4	34	21.7	+51	47	39.54	7838	25.2	95	990
40	91	9	16	16	35		1	27	44.9	+78	51	23.53	7313			
41	91	9	16	16	35		1	31	25.1	+78	51	37.15	7313			
42	91	9	16	16	35		1	33	22.5	+78	51	42.44	7313			
43	91	9	16	16	35		1	34	57.8	+78	51	41.33	7313			
44	91	9	16	16	35		1	38	39.0	+78	51	36.84	7313			
45	91	9	16	16	35		1	40	37.1	+78	51	32.36	7313			
46	91	9	16	16	35		1	42	12.5	+78	51	26.14	7313			
47	91	9	16	16	35		1	45	52.5	+78	51	2.15	7313			
48	91	9	16	16	35		1	47	50.5	+78	50	41.68	7313			
49	91	9	16	16	35		1	49	26.8	+78	50	29.94	7313			
50	91	9	16	16	35		1	53	4.8	+78	49	46.64	7313			

Table 1. Directional data of Ajisai's flashes (continued)

(1) No.	(2) date			(3) time			(4) R.A.			(5) Decl.			(6) STN	(7) TMP	HUM	PRESS
	Y	M	D	h	m	s	h	m	s	°	'	"	ID	℃	%	hPa
51	91	9	16	16	35		1	55	3.3	+78	49	21.48	7313			
52	91	9	16	16	35		1	56	37.6	+78	48	58.50	7313			
53	91	9	16	16	35		2	0	17.3	+78	47	55.95	7313			
54	91	9	16	16	35		2	2	13.8	+78	47	15.44	7313			
55	91	9	16	16	35		2	3	48.0	+78	46	43.10	7313			
56	91	9	16	16	35		2	7	25.1	+78	45	21.26	7313			
57	91	9	16	16	35		2	9	21.3	+78	44	40.72	7313			
58	91	9	16	16	35		2	10	55.0	+78	43	56.68	7313			
59	91	9	16	9	38		4	15	27.5	+50	12	3.13	7313			
60	91	9	16	9	38		4	16	5.2	+50	8	18.45	7313			
61	91	9	16	9	38		4	16	31.0	+50	5	40.72	7313			
62	91	9	16	9	38		4	17	38.0	+49	58	53.30	7313			
63	91	9	16	9	38		4	18	15.7	+49	54	59.87	7313			
64	91	9	16	9	38		4	18	41.3	+49	52	23.10	7313			
65	91	9	16	9	38		4	19	47.7	+49	45	31.21	7313			
66	91	9	16	9	38		4	20	24.8	+49	41	35.58	7313			
67	91	9	16	9	38		4	20	50.4	+49	38	55.67	7313			
68	91	9	16	9	38		4	21	56.1	+49	31	56.35	7313			
69	91	9	16	9	38		4	22	32.5	+49	28	2.43	7313			
70	91	9	16	9	38		4	22	58.1	+49	25	18.60	7313			
71	91	9	16	9	38		4	24	3.1	+49	18	16.89	7313			
72	91	9	16	9	38		4	24	39.4	+49	14	19.18	7313			
73	91	9	16	9	38		4	25	4.4	+49	11	34.53	7313			
74	91	9	16	9	38		4	26	9.2	+49	4	29.60	7313			
75	91	9	16	9	38		4	26	45.4	+49	0	29.39	7313			
76	91	9	16	9	38		4	27	9.8	+48	57	42.12	7313			
77	91	9	16	9	38		4	28	14.0	+48	50	32.88	7313			
78	91	9	17	15	42		4	36	53.5	+72	51	9.11	7313			
79	91	9	17	15	42		4	38	24.3	+72	43	35.75	7313			
80	91	9	17	15	42		4	39	12.3	+72	39	37.53	7313			
81	91	9	17	15	42		4	39	50.4	+72	36	15.78	7313			
82	91	9	17	15	42		4	41	19.9	+72	28	42.29	7313			
83	91	9	17	15	42		4	42	5.3	+72	24	43.56	7313			
84	91	9	17	15	42		4	42	43.2	+72	21	22.64	7313			
85	91	9	17	15	42		4	44	9.7	+72	13	45.69	7313			
86	91	9	17	15	42		4	44	54.7	+72	9	41.36	7313			
87	91	9	17	15	42		4	45	31.4	+72	6	20.49	7313			
88	91	9	17	15	42		4	46	54.7	+71	58	37.59	7313			
89	91	9	17	15	42		4	47	39.2	+71	54	31.97	7313			
90	91	9	17	15	42		4	48	14.0	+71	51	14.99	7313			
91	91	9	17	15	42		4	49	36.1	+71	43	31.32	7313			
92	91	9	17	15	42		4	50	18.0	+71	39	22.28	7313			
93	91	9	17	15	42		4	50	53.1	+71	35	57.88	7313			
94	91	9	17	15	42		4	52	11.0	+71	28	15.93	7313			
95	91	9	17	15	42		4	52	52.6	+71	24	7.10	7313			
96	91	9	17	15	42		4	53	26.6	+71	20	47.19	7313			
97	91	9	17	17	44		4	34	55.6	+60	28	28.47	7313			
98	91	9	17	17	44		4	35	28.0	+60	25	7.90	7313			
99	91	9	17	17	44		4	35	59.9	+60	21	51.55	7313			
100	91	9	17	17	44		4	37	19.9	+60	13	30.56	7313			

Table 1. Directional data of Ajisai's flashes (continued)

(1) No.	(2) date			(3) time			(4) R.A.			(5) Decl.			(6) STN	(7) TMP	HUM	PRESS
	Y	M	D	h	m	s	h	m	s	°	'	"	ID	℃	%	hPa
101	91	9	17	17	44		4	37	51.9	+60	10	5.47	7313			
102	91	9	17	17	44		4	38	23.9	+60	6	43.23	7313			
103	91	9	17	17	44		4	39	42.2	+59	58	23.57	7313			
104	91	9	17	17	44		4	40	14.4	+59	55	0.35	7313			
105	91	9	17	17	44		4	40	45.1	+59	51	35.87	7313			
106	91	9	17	17	44		4	42	2.4	+59	43	6.18	7313			
107	91	9	17	17	44		4	42	33.8	+59	39	41.57	7313			
108	91	9	17	17	44		4	43	4.1	+59	36	18.25	7313			
109	91	9	17	17	44		4	44	20.9	+59	27	44.32	7313			
110	91	9	17	17	44		4	44	51.0	+59	24	18.36	7313			
111	91	9	17	17	44		4	45	21.4	+59	20	51.07	7313			
112	91	9	17	17	44		4	46	36.7	+59	12	12.28	7313			
113	91	9	17	17	44		4	47	6.9	+59	8	44.04	7313			
114	91	9	17	17	44		4	47	36.2	+59	5	17.58	7313			
115	91	9	17	17	44		4	48	50.6	+58	56	31.88	7313			
116	91	9	18	16	52		6	28	14.6	+44	55	17.26	7313			
117	91	9	18	16	52		6	28	30.4	+44	49	3.31	7313			
118	91	9	18	16	52		6	28	40.9	+44	44	39.74	7313			
119	91	9	18	16	52		6	28	54.3	+44	39	27.54	7313			
120	91	9	18	16	52		6	29	9.6	+44	33	18.70	7313			
121	91	9	18	16	52		6	29	20.6	+44	28	56.98	7313			
122	91	9	18	16	52		6	29	33.4	+44	23	43.23	7313			
123	91	9	18	16	52		6	29	48.9	+44	17	34.82	7313			
124	91	9	18	16	52		6	29	59.5	+44	13	16.43	7313			
125	91	9	18	16	52		6	30	12.6	+44	8	0.38	7313			
126	91	9	18	16	52		6	30	27.7	+44	1	51.92	7313			
127	91	9	18	16	52		6	30	34.0	+43	59	22.30	7313			
128	91	9	18	16	52		6	30	38.0	+43	57	38.79	7313			
129	91	9	18	16	52		6	30	42.5	+43	55	53.16	7313			
130	91	9	18	16	52		6	30	51.0	+43	52	26.80	7313			
131	91	9	18	16	52		6	30	57.6	+43	49	42.30	7313			
132	91	9	18	16	52		6	31	12.0	+43	43	43.63	7313			
133	91	9	18	16	52		6	31	20.5	+43	40	17.87	7313			
134	91	9	18	16	52		6	31	35.5	+43	34	9.04	7313			
135	91	9	18	16	52		6	31	50.1	+43	28	14.43	7313			
136	91	9	18	16	52		6	31	58.5	+43	24	45.61	7313			
137	91	9	18	18	52		3	54	47.4	+28	20	7.85	7313			
138	91	9	18	18	52		3	55	14.2	+28	16	21.62	7313			
139	91	9	18	18	52		3	55	35.2	+28	13	21.60	7313			
140	91	9	18	18	52		3	56	20.4	+28	6	53.84	7313			
141	91	9	18	18	52		3	56	47.2	+28	3	5.19	7313			
142	91	9	18	18	52		3	57	8.2	+28	0	2.50	7313			
143	91	9	18	18	52		3	57	53.0	+27	53	34.87	7313			
144	91	9	18	18	52		3	58	19.6	+27	49	42.94	7313			
145	91	9	18	18	52		3	58	40.5	+27	46	39.63	7313			
146	91	9	18	18	52		3	59	25.4	+27	40	11.51	7313			
147	91	9	18	18	52		3	59	51.7	+27	36	19.18	7313			
148	91	9	18	18	52		4	0	12.6	+27	33	16.28	7313			
149	91	9	18	18	52		4	0	56.9	+27	26	42.92	7313			
150	91	9	18	18	52		4	1	23.3	+27	22	51.95	7313			

Table 1. Directional data of Ajisai's flashes (continued)

(1) No.	(2) date			(3) time			(4) R.A.			(5) Decl.			(6) STN	(7) TMP	HUM	PRESS
	Y	M	D	h	m	s	h	m	s	°	'	"	ID	℃	%	hPa
151	91	9	18	18	52		4	1	43.8	+27	19	46.39	7313			
152	91	9	18	18	52		4	2	28.3	+27	13	13.27	7313			
153	91	9	18	18	52		4	2	54.5	+27	9	21.19	7313			
154	91	9	18	18	52		4	3	14.9	+27	6	18.02	7313			
155	91	9	18	18	52		4	3	58.8	+26	59	42.04	7313			
156	91	9	25	10	29		21	23	14.8	+24	22	23.57	7313	9.3	99	1018
157	91	9	25	10	29		21	23	39.9	+24	25	34.02	7313	9.3	99	1018
158	91	9	25	10	29		21	24	26.4	+24	31	38.32	7313	9.3	99	1018
159	91	9	25	10	29		21	24	45.7	+24	34	3.42	7313	9.3	99	1018
160	91	9	25	10	29		21	25	10.4	+24	37	15.48	7313	9.3	99	1018
161	91	9	25	10	29		21	25	57.4	+24	43	16.15	7313	9.3	99	1018
162	91	9	25	10	29		21	26	16.8	+24	45	43.84	7313	9.3	99	1018
163	91	9	25	10	29		21	26	41.6	+24	48	55.09	7313	9.3	99	1018
164	91	9	25	10	29		21	27	28.6	+24	54	51.25	7313	9.3	99	1018
165	91	9	25	10	29		21	27	48.1	+24	57	18.87	7313	9.3	99	1018
166	91	9	25	10	29		21	28	13.1	+25	0	24.66	7313	9.3	99	1018
167	91	9	25	10	29		21	29	0.1	+25	6	20.23	7313	9.3	99	1018
168	91	9	25	10	29		21	29	19.4	+25	8	44.49	7313	9.3	99	1018
169	91	9	25	10	29		21	29	44.6	+25	11	51.02	7313	9.3	99	1018
170	91	9	25	10	29		21	30	31.7	+25	17	46.42	7313	9.3	99	1018
171	91	9	25	10	29		21	30	51.3	+25	20	7.08	7313	9.3	99	1018
172	91	9	25	10	29		21	31	16.5	+25	23	17.53	7313	9.3	99	1018
173	91	9	25	10	29		21	32	4.0	+25	29	4.65	7313	9.3	99	1018
174	91	9	25	10	29		21	32	23.4	+25	31	28.81	7313	9.3	99	1018
175	91	10	2	10	13		16	45	23.7	+69	57	58.44	7838	22.0	86	1003
176	91	10	2	10	13		16	45	5.5	+69	54	15.72	7838	22.0	86	1003
177	91	10	2	10	13		16	44	25.9	+69	46	6.70	7838	22.0	86	1003
178	91	10	2	10	13		16	43	57.8	+69	40	14.20	7838	22.0	86	1003
179	91	10	2	10	13		16	43	39.8	+69	36	29.32	7838	22.0	86	1003
180	91	10	2	10	13		16	43	0.6	+69	28	20.59	7838	22.0	86	1003
181	91	10	2	10	13		16	42	33.1	+69	22	26.59	7838	22.0	86	1003
182	91	10	2	10	13		16	42	15.6	+69	18	39.77	7838	22.0	86	1003
183	91	10	2	10	13		16	41	37.6	+69	10	28.53	7838	22.0	86	1003
184	91	10	2	10	13		16	41	10.4	+69	4	35.20	7838	22.0	86	1003
185	91	10	2	10	13		16	40	53.2	+69	0	51.01	7838	22.0	86	1003
186	91	10	2	10	13		16	40	16.3	+68	52	37.66	7838	22.0	86	1003
187	91	10	2	10	13		16	39	49.9	+68	46	40.92	7838	22.0	86	1003
188	91	10	2	10	13		16	39	33.1	+68	42	58.05	7838	22.0	86	1003
189	91	10	2	10	13		16	38	56.8	+68	34	42.61	7838	22.0	86	1003
190	91	10	2	10	13		16	38	31.5	+68	28	47.62	7838	22.0	86	1003
191	91	10	2	10	13		16	38	15.0	+68	25	0.95	7838	22.0	86	1003
192	91	10	2	10	13		16	37	39.8	+68	16	46.27	7838	22.0	86	1003
193	91	10	2	10	13		16	37	14.4	+68	10	49.27	7838	22.0	86	1003
194	91	10	2	10	13		16	52	20.8	+32	59	14.38	7313	12.4	100	1009
195	91	10	2	10	13		16	52	36.6	+33	5	16.37	7313	12.4	100	1009
196	91	10	2	10	13		16	52	47.9	+33	9	26.02	7313	12.4	100	1009
197	91	10	2	10	13		16	53	0.9	+33	14	27.18	7313	12.4	100	1009
198	91	10	2	10	13		16	53	17.2	+33	20	27.78	7313	12.4	100	1009
199	91	10	2	10	13		16	53	28.4	+33	24	35.67	7313	12.4	100	1009
200	91	10	2	10	13		16	53	42.1	+33	29	41.42	7313	12.4	100	1009

Table 1. Directional data of Ajisai's flashes (continued)

(1) No.	(2) date			(3) time			(4) R.A.			(5) Decl.			(6) STN	(7) TMP	HUM	PRESS
	Y	M	D	h	m	s	h	m	s	°	'	"	ID	℃	%	hPa
201	91	10	2	10	13		16	53	58.4	+33	35	45.04	7313	12.4	100	1009
202	91	10	2	10	13		16	54	9.6	+33	39	57.71	7313	12.4	100	1009
203	91	10	2	10	13		16	54	23.6	+33	45	1.45	7313	12.4	100	1009
204	91	10	2	10	13		16	54	39.7	+33	51	3.86	7313	12.4	100	1009
205	91	10	2	10	13		16	54	51.1	+33	55	16.52	7313	12.4	100	1009
206	91	10	2	10	13		16	55	5.0	+34	0	21.99	7313	12.4	100	1009
207	91	10	2	10	13		16	55	21.7	+34	6	27.32	7313	12.4	100	1009
208	91	10	2	10	13		16	55	33.1	+34	10	40.50	7313	12.4	100	1009
209	91	10	2	10	13		16	55	47.2	+34	15	49.42	7313	12.4	100	1009
210	91	10	2	10	13		16	56	3.7	+34	21	56.18	7313	12.4	100	1009
211	91	10	2	10	13		16	56	15.5	+34	26	10.34	7313	12.4	100	1009
212	91	10	2	10	13		16	56	29.6	+34	31	19.36	7313	12.4	100	1009
213	91	10	18	10	5		21	25	52.6	+51	37	26.46	7313	12.1	66	1004
214	91	10	18	10	5		21	26	23.7	+51	34	49.73	7313	12.1	66	1004
215	91	10	18	10	5		21	27	11.2	+51	30	53.44	7313	12.1	66	1004
216	91	10	18	10	5		21	28	12.8	+51	25	37.26	7313	12.1	66	1004
217	91	10	18	10	5		21	28	44.1	+51	22	59.27	7313	12.1	66	1004
218	91	10	18	10	5		21	29	30.8	+51	18	59.20	7313	12.1	66	1004
219	91	10	18	10	5		21	30	32.6	+51	13	40.05	7313	12.1	66	1004
220	91	10	18	10	5		21	31	3.2	+51	10	54.01	7313	12.1	66	1004
221	91	10	18	10	5		21	31	34.2	+51	8	16.97	7313	12.1	66	1004
222	91	10	18	10	5		21	31	49.9	+51	6	51.95	7313	12.1	66	1004
223	91	10	18	10	5		21	32	5.3	+51	5	29.55	7313	12.1	66	1004
224	91	10	18	10	5		21	32	35.9	+51	2	48.65	7313	12.1	66	1004
225	91	10	18	10	5		21	33	52.1	+50	55	57.06	7313	12.1	66	1004
226	91	10	18	10	5		21	34	23.0	+50	53	14.51	7313	12.1	66	1004
227	91	10	18	10	5		21	34	53.3	+50	50	24.11	7313	12.1	66	1004
228	91	10	18	10	5		21	36	9.2	+50	43	31.48	7313	12.1	66	1004
229	91	10	18	10	5		21	36	39.2	+50	40	42.61	7313	12.1	66	1004
230	91	10	18	10	5		21	37	9.7	+50	37	53.24	7313	12.1	66	1004
231	91	10	18	10	5		21	38	24.6	+50	30	54.07	7313	12.1	66	1004
232	91	10	18	10	5		21	38	54.6	+50	28	5.46	7313	12.1	66	1004
233	91	10	18	10	5		21	39	24.7	+50	25	13.52	7313	12.1	66	1004
234	91	10	19	9	10		19	32	23.4	+67	36	43.98	7313	13.2	47	1002
235	91	10	19	9	10		19	33	50.5	+67	35	44.82	7313	13.2	47	1002
236	91	10	19	9	10		19	35	8.7	+67	34	59.12	7313	13.2	47	1002
237	91	10	19	9	10		19	36	18.7	+67	34	11.98	7313	13.2	47	1002
238	91	10	19	9	10		19	37	45.4	+67	33	8.59	7313	13.2	47	1002
239	91	10	19	9	10		19	39	2.8	+67	32	9.20	7313	13.2	47	1002
240	91	10	19	9	10		19	40	13.6	+67	31	12.13	7313	13.2	47	1002
241	91	10	19	9	10		19	41	39.7	+67	30	6.36	7313	13.2	47	1002
242	91	10	19	9	10		19	42	58.1	+67	29	0.26	7313	13.2	47	1002
243	91	10	19	9	10		19	44	7.5	+67	27	56.79	7313	13.2	47	1002
244	91	10	19	9	10		19	45	34.7	+67	26	41.44	7313	13.2	47	1002
245	91	10	19	9	10		19	46	52.4	+67	25	29.17	7313	13.2	47	1002
246	91	10	19	9	10		19	48	2.3	+67	24	21.11	7313	13.2	47	1002
247	91	10	19	9	10		19	49	27.9	+67	22	57.10	7313	13.2	47	1002
248	91	10	19	9	10		19	50	45.0	+67	21	38.42	7313	13.2	47	1002
249	91	10	19	9	10		19	51	54.5	+67	20	19.40	7313	13.2	47	1002
250	91	10	19	11	11		19	29	54.4	+25	14	4.56	7313	12.1	51	1004

Table 1. Directional data of Ajisai's flashes (continued)

(1) No.	(2) date			(3) time			(4) R.A.			(5) Decl.			(6) STN	(7) TMP	HUM	PRESS
	Y	M	D	h	m	s	h	m	s	°	'	"	ID	℃	%	hPa
251	91	10	19	11	11		19	30	8.9	+25	12	54.47	7313	12.1	51	1004
252	91	10	19	11	11		19	30	56.3	+25	8	59.74	7313	12.1	51	1004
253	91	10	19	11	11		19	31	14.9	+25	7	28.07	7313	12.1	51	1004
254	91	10	19	11	11		19	31	29.2	+25	6	15.84	7313	12.1	51	1004
255	91	10	19	11	11		19	32	16.6	+25	2	19.33	7313	12.1	51	1004
256	91	10	19	11	11		19	32	26.4	+25	1	30.30	7313	12.1	51	1004
257	91	10	19	11	11		19	32	34.7	+25	0	49.22	7313	12.1	51	1004
258	91	10	19	11	11		19	32	49.5	+24	59	37.13	7313	12.1	51	1004
259	91	10	19	11	11		19	33	9.9	+24	57	52.78	7313	12.1	51	1004
260	91	10	19	11	11		19	33	24.9	+24	56	35.81	7313	12.1	51	1004
261	91	10	19	11	11		19	33	37.1	+24	55	35.79	7313	12.1	51	1004
262	91	10	19	11	11		19	33	55.3	+24	54	2.27	7313	12.1	51	1004
263	91	10	19	11	11		19	34	9.8	+24	52	47.41	7313	12.1	51	1004
264	91	10	19	11	11		19	34	30.6	+24	51	2.04	7313	12.1	51	1004
265	91	10	19	11	11		19	34	45.4	+24	49	51.35	7313	12.1	51	1004
266	91	10	19	11	11		19	35	7.3	+24	47	58.65	7313	12.1	51	1004
267	91	10	19	11	11		19	35	51.1	+24	44	11.32	7313	12.1	51	1004
268	91	10	19	11	11		19	36	5.7	+24	43	0.77	7313	12.1	51	1004
269	91	10	19	11	11		19	36	27.8	+24	41	4.62	7313	12.1	51	1004
270	91	10	23	9	40		21	45	12.0	+14	14	9.07	7313	4.7	78	1018
271	91	10	23	9	40		21	45	41.3	+14	9	23.61	7313	4.7	78	1018
272	91	10	23	9	40		21	46	6.8	+14	4	28.81	7313	4.7	78	1018
273	91	10	23	9	40		21	46	28.0	+14	0	19.65	7313	4.7	78	1018
274	91	10	23	9	40		21	46	51.3	+13	55	48.58	7313	4.7	78	1018
275	91	10	23	9	40		21	47	16.7	+13	50	53.45	7313	4.7	78	1018
276	91	10	23	9	40		21	47	37.7	+13	46	50.96	7313	4.7	78	1018
277	91	10	23	9	40		21	47	45.1	+13	45	23.91	7313	4.7	78	1018
278	91	10	23	9	40		21	48	18.7	+13	38	52.95	7313	4.7	78	1018
279	91	10	23	9	40		21	48	38.7	+13	35	0.04	7313	4.7	78	1018
280	91	10	23	9	40		21	48	54.3	+13	31	55.64	7313	4.7	78	1018
281	91	10	23	9	40		21	49	27.9	+13	25	23.60	7313	4.7	78	1018
282	91	10	23	9	40		21	49	47.4	+13	21	31.23	7313	4.7	78	1018
283	91	10	23	9	40		21	50	3.0	+13	18	28.70	7313	4.7	78	1018
284	91	10	23	9	40		21	50	36.2	+13	11	54.71	7313	4.7	78	1018
285	91	10	23	9	40		21	50	55.8	+13	8	3.53	7313	4.7	78	1018
286	91	10	23	9	40		21	51	11.4	+13	5	2.54	7313	4.7	78	1018
287	91	10	23	9	40		21	51	44.2	+12	58	32.45	7313	4.7	78	1018
288	91	10	23	9	40		21	52	4.0	+12	54	36.06	7313	4.7	78	1018
289	91	10	23	9	40		21	52	19.5	+12	51	37.37	7313	4.7	78	1018
290	91	10	24	8	43		18	31	30.3	+51	3	13.00	7313	7.8	90	1021
291	91	10	24	8	43		18	32	23.2	+51	1	49.76	7313	7.8	90	1021
292	91	10	24	8	43		18	33	11.0	+51	0	32.68	7313	7.8	90	1021
293	91	10	24	8	43		18	33	54.0	+50	59	20.95	7313	7.8	90	1021
294	91	10	24	8	43		18	34	46.9	+50	57	53.87	7313	7.8	90	1021
295	91	10	24	8	43		18	35	34.4	+50	56	34.34	7313	7.8	90	1021
296	91	10	24	8	43		18	36	17.7	+50	55	18.77	7313	7.8	90	1021
297	91	10	24	8	43		18	36	35.5	+50	54	49.44	7313	7.8	90	1021
298	91	10	24	8	43		18	37	10.6	+50	53	47.20	7313	7.8	90	1021
299	91	10	24	8	43		18	37	41.1	+50	52	51.72	7313	7.8	90	1021
300	91	10	24	8	43		18	38	28.6	+50	51	26.87	7313	7.8	90	1021

Table 1. Directional data of Ajisai's flashes (continued)

(1) No.	(2) date			(3) time			(4) R.A.			(5) Decl.			(6) STN	(7) TMP	HUM	PRESS
	Y	M	D	h	m	s	h	m	s	°	'	"	ID	℃	%	hPa
301	91	10	24	8	43		18	38	59.0	+50	50	29.64	7313	7.8	90	1021
302	91	10	24	8	43		18	40	4.6	+50	48	29.85	7313	7.8	90	1021
303	91	10	24	8	43		18	40	52.3	+50	47	0.33	7313	7.8	90	1021
304	91	10	24	8	43		18	41	22.7	+50	46	2.21	7313	7.8	90	1021
305	91	10	24	8	43		18	42	28.4	+50	43	53.35	7313	7.8	90	1021
306	91	10	24	8	43		18	43	15.9	+50	42	22.11	7313	7.8	90	1021
307	91	10	24	8	43		18	43	46.6	+50	41	23.08	7313	7.8	90	1021
308	91	10	24	8	43		18	44	52.1	+50	39	8.67	7313	7.8	90	1021
309	91	10	24	8	43		18	45	39.6	+50	37	31.45	7313	7.8	90	1021
310	91	10	24	8	43		18	46	47.5	+50	35	35.73	7313	7.8	90	1021

海洋測地網一次基準点の位置決定
隠岐諸島，南大東島

POSITIONING OF THE FIRST ORDER CONTROL POINTS
(Oki Syoto and Minami Daito Sima)
IN THE MARINE GEODETIC CONTROL NETWORK

Summary - As a step to establish the marine geodetic control network around Japan, we performed a simultaneous observation program of Ajisai and Lageos at Oki Syoto, Minami Daito Sima and the Simosato Hydrographic Observatory (SHO) in 1990 and 1991. The position of two islands are connected to the fiducial point, Simosato located at SHO.

Key words : satellite laser ranging - satellite photography - Ajisai - Lageos - marine geodetic controls

1. はじめに

水路部では，領海等我が国の管轄海域の確定と，海洋における測位精度の向上を目的として，1980年より，海洋測地網の整備を推進している（Kubo, 1988）．この中で，一次基準点は本土基準点（下里水路観測所）と主要な島を結合して，海洋測地網の骨格を形成する役割を担っており，1988年から観測が行われている．1989年以前に行われた一次基準点観測の成果は，父島，石垣島については水路部観測報告衛星測地編第4号（福島他，1991）を，南鳥島，沖縄，対馬については同第5号（仙石他，1992）をそれぞれ参照していただきたい．本報告では，1990年と1991年に実施したあじさい（Sasaki, 1987），ラジオスによる隠岐諸島，南大東島（Fig. 1）の一次基準点の観測およびその成果について報告する．1991年には十勝の一次基準点観測も行われたが，その成果については次号に報告する．観測方法，解析手法等については，同第4号（福島他，1991）を参照されたい．

2. 隠岐諸島一次基準点観測

2.1. 概要

2.1.1. 作業経過

1990年，9月中旬から10月下旬にかけて，下里および隠岐諸島（島後）において「あじさい」等の同時観測を実施した．なお，この同時観測前の1990年7月下旬に，下里において比較観測を実施した．

2.1.2. 主な作業

(1) 基準点標識等の設置

一次基準点標石（22cm角）　標識名：隠岐諸島．

(2) 「あじさい」等の同時観測による位置決定

隠岐諸島を決定．

(3) 地上測量

隠岐諸島で実施．

2.1.3. 使用装置等

(1) 一次基準点

可搬式レーザー測距装置（Sasaki, 1988），可搬式衛星方位測定装置.

(2) 本土基準点

固定式レーザー測距装置（Sasaki *et al.*, 1983），固定式衛星方位測定装置（Kanazawa,1989）.

2.1.4. 観測データ

隠岐諸島と下里の同時観測において得られたレーザー測距データは，水路部観測報告衛星測地編第5号（Sengoku *et al.*, 1992）に，また写真観測については同号(Kawai, 1992）に，報告されている.

2.2. 観測

2.2.1. 観測地点

(1) 一次基準点「隠岐諸島」

島根県隠岐郡西郷町大字岬町字風の松2121番地（Fig. 2, 3）.

(2) 本土基準点

和歌山県東牟婁郡那智勝浦町下里　第五管区海上保安本部下里水路観測所.

2.2.2. 観測班

(1) 一次基準点

前半：内山　丈夫，淵田　晃一，今木　滋（衛星測地室）
　　澤田　剛一（下里水路観測所）
後半：西村　英樹，佐藤　勲，河合　晃司（衛星測地室）
　　黒川　隆司（下里水路観測所）.

(2) 本土基準点

第五管区海上保安本部下里水路観測所職員.

2.2.3. 作業期間

1990年9月11日～10月30日（うち設営 9月12日～18日，撤収10月27～29日）.

2.2.4. 観測数

(1) レーザー測距観測

	衛星	パス数	リターン数
一次基準点	あじさい	32	5028
	ラジオス	5	339
本土基準点	あじさい	41	24262
	ラジオス	15	2360.

(2) 写真観測

	衛星	パス数	枚数
一次基準点	あじさい	4	4
本土基準点	あじさい	3	3.

2.2.5. 観測状況

(1) 一次基準点

観測地点は隠岐空港に選定し，隠岐空港管理所前の駐車場のアスファルト面上に，観測機器を設置した．視界は良好であった．

「あじさい」のレーザー測距と衛星方位観測，および「ラジオス」のレーザー測距観測を実施した．

(2) 本土基準点

「あじさい」のレーザー測距と衛星方位観測，および「ラジオス」のレーザー測距観測を実施した．

2.2.6. 基準点標識等の設置

隠岐空港管理所前の駐車場に近い緑地の中に，基準点標石「隠岐諸島」を設置した．

2.2.7. 地上測量

(1) 基準点標石「隠岐諸島」

基準点標石「隠岐諸島」Hの位置は，二等三角点「西郷岬」を測量原点，四等三角点「小浜谷」を方位基準として，経緯儀T2,光波測距儀Geoidmeterを用いて測定した（Fig.4）．

(2) 観測点

可搬式レーザー測距装置の不動点T，衛星方位測定位置の不動点Kの位置は，基準点標石「隠岐諸島」を測量原点，二等三角点「西郷岬」を方位基準として，経緯儀T2，光波測距儀を用いて測定した．

2.3. 解析成果

隠岐諸島と下里水路観測所において同時に観測された「あじさい」のレーザー測距データをＳＰＯＲＴ法により解析を行った．用いたプログラムは，人工衛星レーザー測距データ解析プログラムHydrangea である．1990年10月2日11h～13h，10月9日11h～13h，10月9日13h～15h，10月23日10h～12h，10月23日12h～14hの5セットについて解析を行った．ＳＰＯＲＴ法では，未知点である隠岐の座標とあじさいの元期における位置と速度の初期値を未知量として推定する．下里の座標は，現時点で最も信頼できる世界測地系のひとつであるITRF89（Boucher, 1991）を Minster &Jordan（1978）のプレート運動モデル（AM0-2）によって1989.1年の座標に変換したものを採用した．下里水路観測所の固定式レーザー測距装置の不動点の地心直交座標は，

$$\begin{aligned} U_s &= -3822388.380\,\mathrm{m} \\ V_s &= 3699363.491\,\mathrm{m} \qquad \text{....(1)} \\ W_s &= 3507573.084\,\mathrm{m} \end{aligned}$$

である．

解析の結果，隠岐諸島における可搬式レーザー測距装置の送受信望遠鏡の不動点Tの位置は，

$$\begin{aligned} U_T &= -3536204.460 \pm .012\,\mathrm{m} \\ V_T &= 3749974.110 \pm .036\,\mathrm{m} \qquad \text{.....(2)} \\ W_T &= 3744418.369 \pm .023\,\mathrm{m} \end{aligned}$$

となった．これは，世界測地系（ITRF89）に基づく位置である．

2.4. 座標変換

上記の解析によって得られる成果は，世界測地系（ITRF89）で表示した一次基準点の本土基準

点に対する相対位置である．この相対位置から日本測地系における一次基準点の絶対位置を求めるには，まず，下里において世界測地系（ITRF89）と日本測地系の変換パラメーターを求め，次にこのパラメーターを用いて一次基準点の座標を世界測地系（ITRF89）から日本測地系へと変換する必要がある．

下里水路観測所の固定式レーザー測距装置の日本測地系における位置（経度ϕ，緯度λ，標高h）は測量から，

$$\phi_S = 33^\circ\ 34'\ 27.4963''$$
$$\lambda_S = 135^\circ\ 56'\ 23.5368'' \quad \text{.....(3)}$$
$$h_S = 62.443\text{m}$$

と求められている（竹村，1983）．ベッセル楕円体の諸元（a=6377397.155m および1/f=299.152813）を用いて直交座標系（u,v,w）に変換すると，

$$u_S = -3822242.043\ \text{m}$$
$$v_S = 3698856.017\ \text{m} \quad \text{.....(4)}$$
$$w_S = 3506891.329\ \text{m}$$

ただし，ここではGaneko(1977)の結果を用いて，下里における日本測地系の準拠楕円体からのジオイド高を0mと推定している．(1)と(4)から，世界測地系（ITRF89）から日本測地系への原点変換量は，

$$\triangle u = u_S - U_S = 146.337\ \text{m}$$
$$\triangle v = v_S - U_S = -507.474\ \text{m} \quad \text{.....(5)}$$
$$\triangle w = w_S - W_S = -681.755\ \text{m}$$

となる．

一次基準点の位置を日本測地系で求めるためには，世界測地系（ITRF89）で求められた地心直交座標に原点変換量（(5)式）を加え，さらにベッセル楕円体の諸元を用いて緯度ϕ，経度λ，楕円体高Hに直せばよい．

隠岐諸島の可搬式レーザー測距装置の不動点Tの位置は，日本測地系に変換すると，

$$\phi_T = 36^\circ\ 10'\ 37.6411''$$
$$\lambda_T = 133^\circ\ 19'\ 19.7924'' \quad \text{.....(6)}$$
$$H_T = 58.741\ \text{m}$$

となる．ただし，楕円体高については，日本測地系の準拠楕円体からのジオイド高hgと標高hの和になることに注意する必要がある．

地上測量により，三角点成果に基づいた局所測地系における各点の位置をTable 1に示す．Table 1と(6)の比較から，隠岐諸島の三角点成果に加えるべき補正量は，

$$\Delta\phi = \phi_T\ (\text{一次基準点観測}) - \phi_T\ (\text{地上測量}) = 0.096''$$
$$\Delta\lambda = \lambda_T\ (\text{一次基準点観測}) - \lambda_T\ (\text{地上測量}) = 0.101'' \quad \text{.....(7)}$$
$$hg = H_T\ (\text{一次基準点観測}) - h_T\ (\text{地上測量}) = -30.74\ \text{m}$$

となる．ただし，hgは隠岐諸島における日本測地系の準拠楕円体からのジオイド高である．

これを用いて一次基準点標石「隠岐諸島」Hの日本測地系における位置は，

$$\phi_H = 36^\circ\ 10'\ 37.426''$$
$$\lambda_H = 133^\circ\ 19'\ 19.251'' \quad \text{.....(8)}$$
$$h_H = 87.81\ \text{m}$$

となる．ただし，h_Hは標高である．ベッセル楕円体からの楕円体高H_Hは，

$$H_H = 57.07\ \text{m} \quad \text{.....(9)}$$

である．

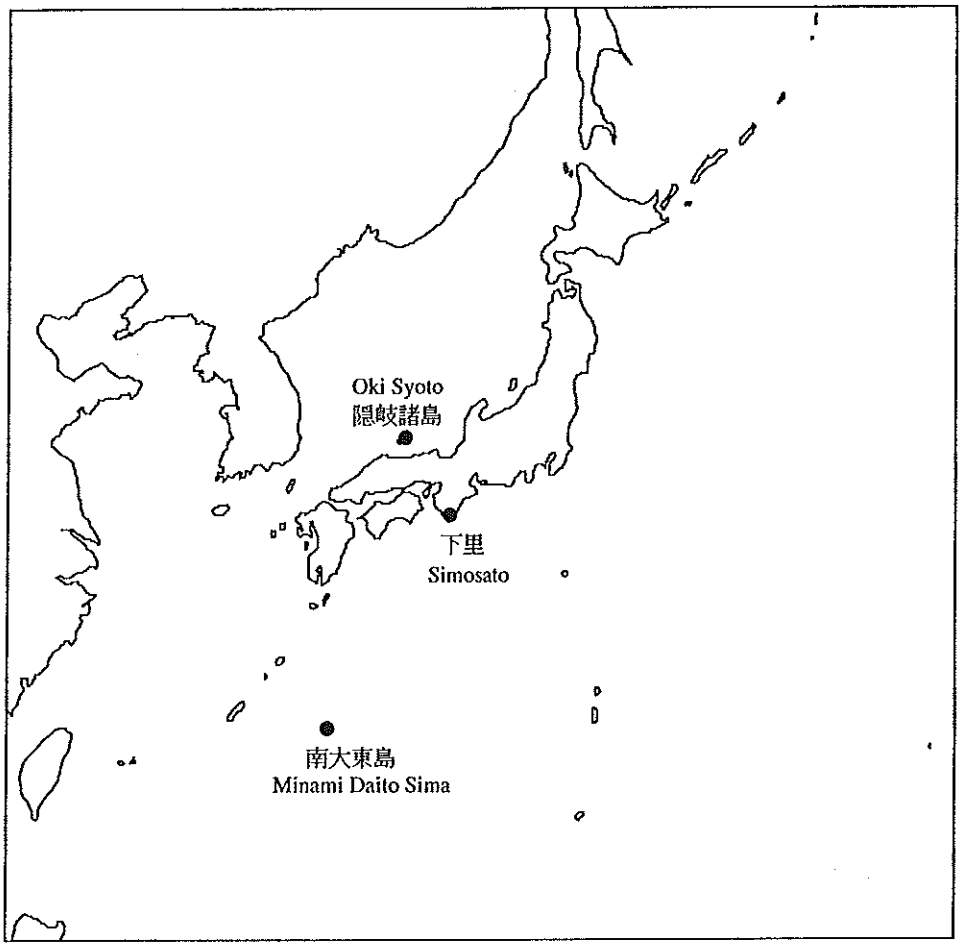


Figure 1. Satellite Laser Ranging observations in 1990.

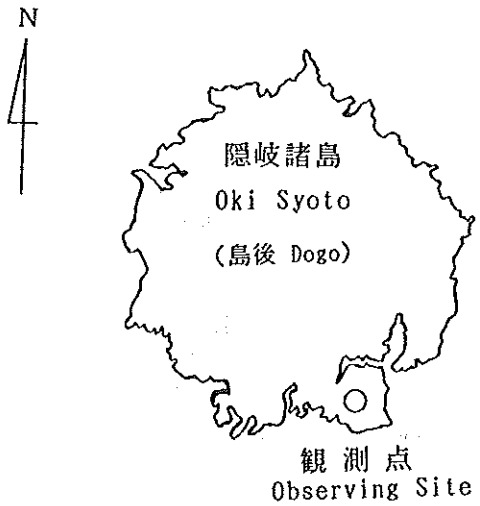


Figure 2. Oki Syoto.

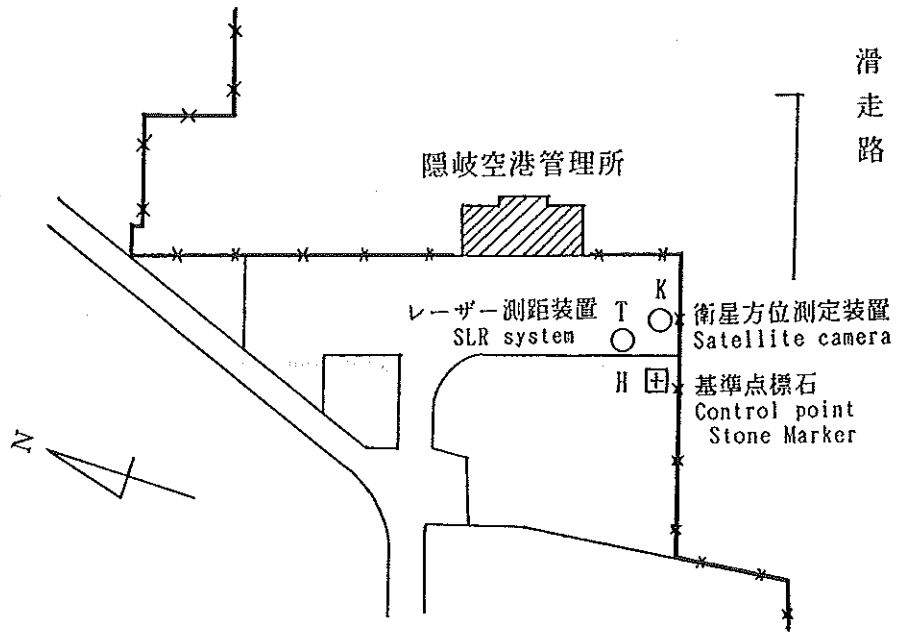


Figure 3. Observing site at Oki Syoto.

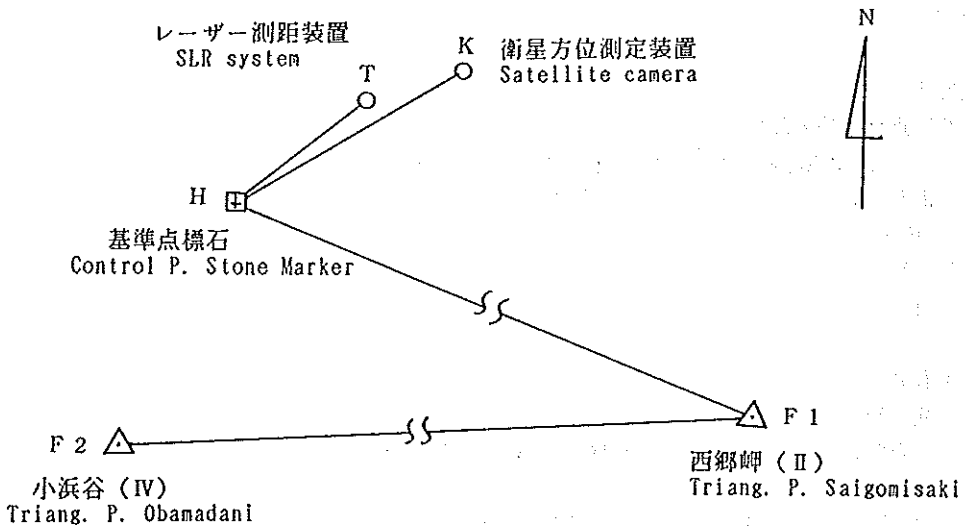


Figure 4. Survey map (Oki Syoto).

3. 南大東島一次基準点観測

3.1. 概要

3.1.1. 作業経過

1990年12月上旬から1991年2月上旬にかけて，下里および南大東島において，「あじさい」等の同時観測を実施した．なお，この同時観測後の1991年3月中旬に，下里において比較観測を実施した．

3.1.2. 主な作業

(1) 基準点標識等の設置

一次基準点標石（22cm角）　標識名：南大東島．

(2) 「あじさい」等の同時観測による位置決定

南大東島を決定．

(3) 地上測量

南大東島で実施．

3.1.3. 使用装置等

(1) 一次基準点

可搬式レーザー測距装置，可搬式衛星方位測定装置．

(2) 本土基準点

固定式レーザー測距装置，固定式衛星方位測定装置．

3.1.4. 観測データ

南大東島と下里の同時観測において得られたレーザー測距データについては，水路部観測報告衛星測地編第6号（Sengoku *et al.*, 1993）に，また写真観測については，同第5号（Kawai, 1992）に報告されている．

3.2. 観測

3.2.1. 観測地点

(1) 一次基準点「南大東島」

沖縄県島尻郡南大東村字南163-3番地 南大東村村民グラウンド構内（Fig. 5, 6）．

(2) 本土基準点

和歌山県東牟婁郡那智勝浦町下里 第五管区海上保安本部下里水路観測所．

3.2.2. 観測班

(1) 一次基準点

前半：福島　登志夫，佐藤　勲，今木　滋（衛星測地室）
　　成田　誉孝（下里水路観測所）
後半：仙石　新，政井　悟，黒川　修司（衛星測地室）
　　富井　清文（下里水路観測所）．

(2) 本土基準点

第五管区海上保安本部下里水路観測所職員．

3.2.3. 作業期間

1990年12月2日～1991年2月7日（うち設営1990年12月4日～10日，撤収1991年2月4日～6日）．

3.2.4. 観測数

(1) レーザー測距観測

	衛星	パス数	リターン数
一次基準点	あじさい	18	6637
	ラジオス	2	433
本土基準点	あじさい	61	61236
	ラジオス	32	28969.

(2) 写真観測

	衛星	パス数	枚数
一次基準点	あじさい	3	3
本土基準点	あじさい	4	4.

3.2.5. 観測状況

(1) 一次基準点

観測地点は，南大東島の南西部にある，南大東村の村民グラウンド構内に選定し，グラウンドの上に観測機器を設置した．視界は良好であった．雨が降ると水が溜まり，ぬかるむことがあった．「あじさい」のレーザー測距，衛星方位観測，および「ラジオス」のレーザー測距観測を実施した．

(2) 本土基準点

「あじさい」のレーザー測距，衛星方位観測，および「ラジオス」のレーザー測距観測を実施した．

3.2.6. 基準点標識等の設置

沖縄県島尻郡南大東村字南163-3番地にある南大東村村民グラウンド構内に，基準点標石「南大東島」を設置した．

3.2.7. 地上測量

(1) 測点標識の設置

給水塔の屋上に，測点標識Q（水路部測点標識：金属標）を設置した．測点標識Qを測量原点，無線塔Rを方位基準にして，大神宮山，北幕上，旧東北，旧東南，見張台，亀池の各四等三角点の方向角，高度角と距離を測定した．測角および測距には，Geodimeter 400 ｼﾘｰｽﾞ の「ﾄｰﾀﾙ ｽﾃｰｼｮﾝ」を使用した．

(2) 基準点標石「南大東島」

基準点標石「南大東島」の位置は，測点標識Qを測量原点，無線塔Rを方位基準として，方向角と高度角を測定した．測角および測距には「ﾄｰﾀﾙ ｽﾃｰｼｮﾝ」を使用した．

(3) 観測点

可搬式レーザー測距装置の不動点T，衛星方位測定装置の不動点Cの位置は，測点標識Qを測量原点，無線塔Rを方位基準として，方向角と高度角を測定した（Fig. 7）．

3.3. 解析成果

南大東島と下里水路観測所において同時に観測された「あじさい」のレーザー測距データをＳＰＯＲＴ法によって解析を行った．用いたのは，1991年1月16日14h～16hのデータである．下里の採用座標値は，隠岐諸島と同様である．

解析の結果，可搬式レーザー測距装置の送受信望遠鏡の不動点の位置は，

$$U_T = -3786331.412$$
$$V_T = 4320316.146 \quad \text{.....(10)}$$
$$W_T = 2761963.846$$

となった．これは，世界測地系（ITRF89）に基づく位置である．原点変換量(5)によって日本測地系に変換すると，

$$\phi_T = 25^\circ\ 49'\ 26.6075''$$
$$\lambda_T = 131^\circ\ 14'\ 0.9986'' \quad \text{....(11)}$$
$$H_T = 51.758\ \text{m}$$

となる．

地上測量により，三角点成果に基づいた局所測地系における各点の位置をTable 2に示す．Table 2と(11)の比較から，南大東島の三角点成果に加えるべき補正量は，

$$\Delta\phi = \phi_T\ (\text{一次基準点観測}) - \phi_T\ (\text{地上測量}) = -12.131''$$
$$\Delta\lambda = \lambda_T\ (\text{一次基準点観測}) - \lambda_T\ (\text{地上測量}) = 18.801'' \quad \text{.....(12)}$$
$$h_g = H_T\ (\text{一次基準点観測}) - h_T\ (\text{地上測量}) = 35.93\ \text{m}$$

となる．ただし，h_gは南大東島における日本測地系の準拠楕円体からのジオイド高である．

これを用いて一次基準点標石「南大東島」Hの日本測地系における位置は，

$$\phi_H = 25^\circ\ 49'\ 25.905''$$
$$\lambda_H = 131^\circ\ 14'\ 0.620'' \quad \text{.....(13)}$$
$$h_H = 14.21\ \text{m}$$

となる．また，ベッセル楕円体からの楕円体高H_Hは，

$$H_H = 50.14\ \text{m} \quad \text{.....(14)}$$

である．

本報告は，仙石 新，内山 丈夫，西村 英樹が作成した．

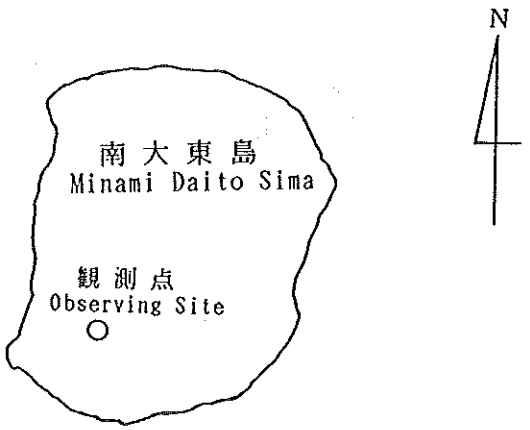


Figure 5. Minami Daito Sima.

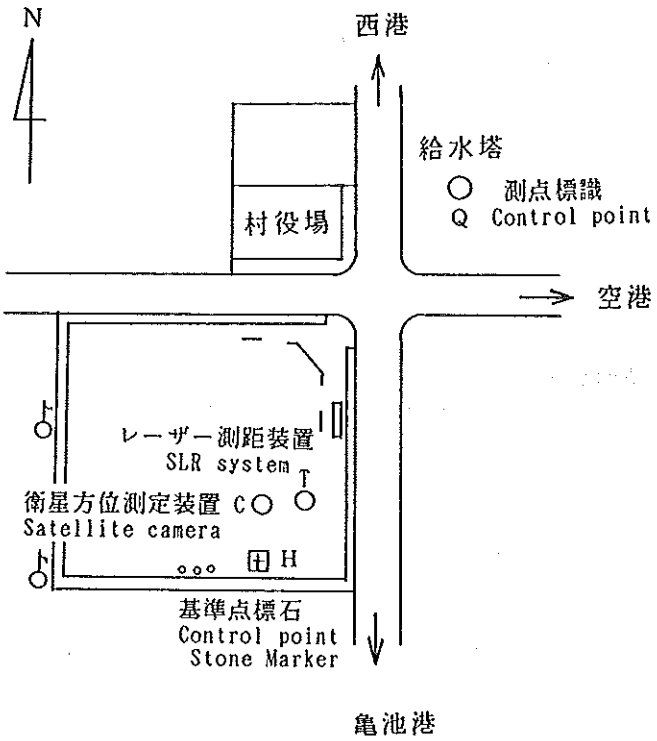


Figure 6. Observing site at Minami Daito Sima.

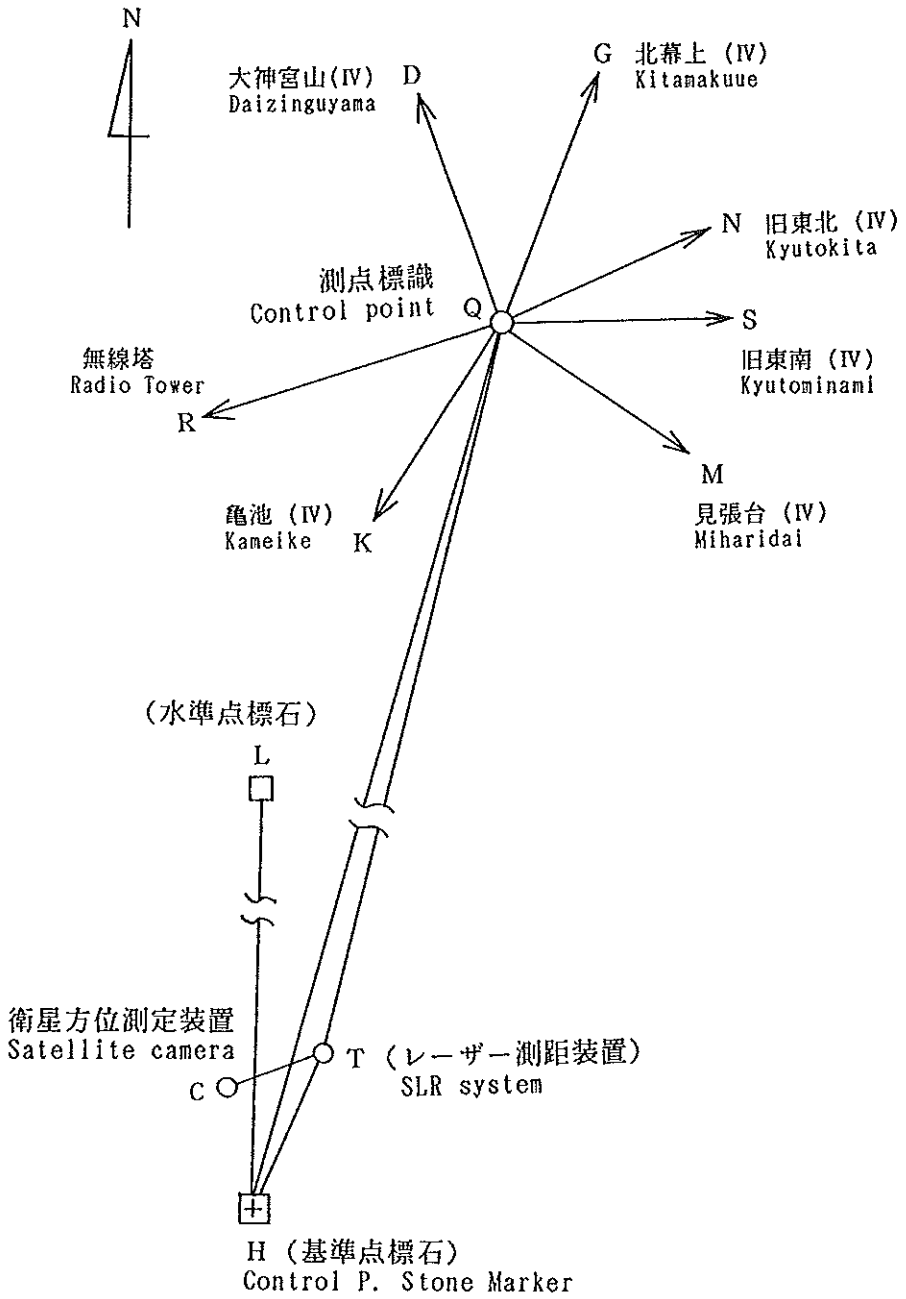


Figure 7. Survey map (Minami Daito Sima).

Table 1. Positions of the markers at Oki Syoto:the ground survey results in Tokyo datum

Station	φ	λ	h	Note
	° ′ ″	° ′ ″	m	
二等三角点「西郷岬」 Triang. P. Saigomisaki	36 10 18.067	133 20 17.097	150.753	GSI result
四等三角点「小浜谷」 Triang. P. Obamadani	36 10 16.035	133 19 18.737	49.350	ibid.
基準点標石「隠岐諸島」H Control P. Stone Marker	36 10 37.330	133 19 19.352	87.81	
レーザー測距装置 T SLR systen	36 10 37.545	133 19 19.691	89.48	Fixed point
衛星方位測定装置 K Satellite camera	36 10 37.626	133 19 19.951	88.72	Fixed point
H － T	-0.2148	-0.3393	-1.67	Relative

Table 2. Positions of the markers at Minami Daito Sima:the ground survey results in local datum

Station	φ	λ	h	Note
四等三角点「大神宮山」 Triang. P. Daizinguyama	° ′ ″ 25 50 30.670	° ′ ″ 131 13 24.037	m 31.42	GSI result
四等三角点「北幕上」 Triang. P. Kitanakuue	25 51 53.926	131 14 35.209	53.52	ibid.
四等三角点「旧東北」 Triang. P. Kyutokita	25 50 26.935	131 15 23.598	60.17	ibid.
四等三角点「旧東南」 Triang. P. Kyutominami	25 49 46.119	131 15 22.154	58.73	ibid.
四等三角点「見張台」 Triang. P. Miharidai	25 49 08.085	131 14 42.375	75.24	ibid.
四等三角点「亀池」 Triang. P. Kameike	25 49 06.626	131 13 18.281	53.79	ibid.
二等水準点「20155」 Bench Mark	—	—	14.639	ibid.
測点標識 Q Control P. Q	25 49 43.429	131 13 43.441	38.66	
基準点標石「南大東島」H Control P. Stone Marker	25 49 38.036	131 13 41.819	14.21	
レーザー測距装置 T SLR systen	25 49 38.739	131 13 42.198	15.83	Fixed point
衛星方位測定装置 C Satellite camera	25 49 38.596	131 13 41.704	14.99	Fixed point
H − T	-0.7032	-0.3788	-1.62	Relative

参考文献

Boucher, C., Altamimi, Z., 1991: *IERS Tech. Note* No.6, Observatoire de Paris.

福島 登志夫・内山 丈夫・西村 英樹・仙石 新，1991:水路部観測報告衛星測地編，第4号，p.60.

Ganeko, Y., 1977:*J. Geophys. Res.*, Vol.82, p.2490.

Kanazawa, T., 1989: *Data Report of Hydrogr. Obs., Series of Satellite Geodesy*, No.2, p.50.

Kawai, K., 1992: *Data Report of Hydrogr. Obs., Series of Satellite Geodesy*, No.5, p.30.

Kubo, Y. 1988: *Data Report of Hydrogr. Obs., Series of Satellite Geodesy*, No.1, p.1.

Minster, J.B., Jordan, T.H., 1978:*J. Geophys. Res.*, Vol.83, p.5331.

Sasaki, M., Ganeko, Y., Harada, Y., 1983: *Data Report of Hydrogr. Obs., Series of Astronomy and Geodesy*, No.17, p.49.

Sasaki, M., 1987: *Data Report of Hydrogr. Obs., Series of Astronomy and Geodesy*, No.21, p.90.

Sasaki, M., 1988: *Data Report of Hydrogr. Obs., Series of Satellite Geodesy*, No.1, p.59. p.42.

Sengoku, A., S., Kurokawa, N., Ikeda, K. Matsumoto, 1992: *Data Report of Hydrogr. Obs., Series of Satellite Geodesy*, No.5, p.1.

仙石　新，内山　丈夫，西村　英樹，1992:水路部観測報告衛星測地編，第５号，p.43.

Sengoku, A., S., Kurokawa, N., Ikeda, K. Matsumoto, 1993: *Data Report of Hydrogr. Obs., Series of Satellite Geodesy*, No.6, p.1.

竹村 武彦，1983:水路部観測報告天文測地編，第17号，p.44.

人工衛星のドップラー観測による離島の位置決定
1991

SATELLITE DOPPLER POSITIONING OF OFF-LYING ISLANDS IN 1991

Summary - This paper is a continuation of the series of the report on the satellite Doppler positioning of the off-lying islands around Japan. The provisional results of the observations made by the JHD in 1991 are given in this report.

Key words : satellite Doppler positioning - marine geodetic controls

水路部では，1980年以降海洋測地網の整備として，人工衛星を利用して本土から遠隔地にある島嶼の経緯度の測定を行っている．本稿では，1991年に実施した米海軍航行衛星による離島の経緯度観測の暫定的な成果について報告する．観測方法，整約方法等については水路部観測報告天文測地編第17号（竹村・金沢，1983）を参照されたい．

米海軍航行衛星の観測から求めた各測点の位置の成果をTable 1に示す．経緯度は，礼文島および十勝においては1990年に行ったドップラー観測による小樽の成果に（河合他，1992），その他の地点においては下里の本土基準点にそれぞれ基づいている．また，高さは標高である．

Table 1. Summary of the positions of the fiducial markers expressed in the Tokyo Datum by means of the satellite Doppler observations

Station	Marker	ϕ	λ	h
宇　治　島 (Uzi Sima)	G1	31° 11′ 57.″182	129° 28′ 39.″007	94.m95
津　倉　瀬 (Tukura Se)	H1	31 18 17.829	129 44 32.640	—
見　　島 (MI Sima)	G1	34 46 14.324	131 09 45.579	88.89
対　　馬 (Tusima)	H0	34 11 35.949	129 17 45.255	2.86
礼　文　島 (Rebun Tō)	G1	45 25 56.038	141 03 24.722	166.98
十　　勝 (Tokati)	H0	42 18 54.866	143 19 56.500	22.37

h: The height above the (local) mean sea level.

1. 1991年作業経過及び暫定成果

1. 概要

1.1. 作業経過

1991年に実施した全観測地の配置をFig.1に示す.

4月下旬～5月下旬にかけて，対馬，下里，宇治島，津倉瀬，見島において同時観測を実施した.

8月中旬～8月下旬にかけて，小樽，十勝，礼文島において同時観測を実施した.

1.2. 主な作業

(1) 測点標識の設置

津倉瀬（水路部金属標）

(2) 航行衛星の同時観測による経緯度の決定

宇治島，津倉瀬，見島，礼文島

(3) 経緯度測量

宇治島（水路部金属標）

1.3. 使用機器等

(1) 航行衛星受信機　4台

機種　マグナボックス社MX－1502

機械番号　HD1，HD2，HD3，HD4

(2) テープ変換器　MFE5000，№01219

(3) 整約プログラム　MAGNET

2. 観測

2.1. 宇治島，津倉瀬，見島観測

本観測には，測量船海洋を使用した.

観測地点と担当者

下　里	：下里水路観測所庁舎屋上（Fig.2）	第五管区海上保安本部下里水路観測所職員
対　馬	：厳原海上保安部巡視船基地建物屋上	淵田 晃一（本庁）
宇治島	：一等三角点（宇治島）(Fig.3)	西村英樹，河合晃司，池田信広(本庁)
津倉瀬	：水路部金属標識(Fig.4)	〃
見　島	：三等三角点(木ノ上)(Fig.5)	〃

観測期間と観測数

	受信機	期　間	受信パス数
下　里	HD4	1991年4月30日～5月15日	240
対　馬	HD1	1991年4月30日～5月14日	249
宇治島	HD3	1991年5月1日～5月6日	69
津倉瀬	HD2	1991年5月4日～5月5日	15
見　島	HD3	1991年5月10日～5月14日	67

観測状況と地上測量

下　里：下里水路観測所庁舎屋上のNNSS受信点において観測を行った.

対　馬：厳原海上保安部巡視船基地建物屋上に受信アンテナを設置して観測した．受信アン

テナ位置は有明山（Ⅲ），権現山（Ⅳ）の各三角点および北極星の真方位測量によって求め，受信アンテナ高は標高12.00mであった．

宇　治　島：一等三角点（宇治島）直上にアンテナを設置し観測を行った．受信アンテナ高は三角点上3.74mであった．

津　倉　瀬：水路部金属標直上にアンテナを設置し観測を行った．受信アンテナ高は金属標上方1.38mであった．

見　　島：三等三角点(木ノ上)直上にアンテナを設置し観測を行った．受信アンテナ高は三角点上3.76mであった．

2.2　礼文島観測

観測地点と担当者

小　　樽：小樽港湾合同庁舎屋上　第一管区海上保安本部水路部職員，河合晃司（本庁）

十　　勝：広尾町シーサイドパーク広尾構内　十勝一次基準点観測班　内山丈夫，淵田晃一，野田秀樹（本庁），澤田剛一（下里水路観測所）

礼　文　島：一等三角点（高山）（Fig.6）小野房吉，河合晃司，池田信広（本庁）

観測期間と観測数

	受信機	期　　間	受信パス数
小　樽	HD2	1991年8月24日～8月31日	149
十　勝	HD4	1991年8月22日～9月1日	194
礼文島	HD3	1991年8月24日～8月30日	84

観測状況と地上測量

小　　樽：小樽港湾合同庁舎屋上の水路部測点標識直上にアンテナを設置し観測を行なった．受信アンテナ高は1.35mであった．

十　　勝：広尾町シーサイドパーク広尾構内に設置した可搬式レーザー測距装置制御シェルター屋上に設置し観測を行なった．アンテナの位置は一次基準点標石と平尾取（Ⅳ）三角点より測量して求めた．

礼　文　島：一等三角点（高山）の直上にアンテナを設置し観測を行った．受信アンテナ高は三角点上1.58mであった．

3. 成果

受信データをMAGNETプログラムにより整約し，受信アンテナ位置をWGS－84の楕円体上で求めた結果をTable2に示す．これらの観測成果を日本測地系に変換したものがTable3で，それぞれの同時観測結果に対し，変換に使用したパラメータの値も掲げた．高さは何れも楕円体上の高さを表す．

Table 2. Positions of the NNSS antennas (1991) :the solutions of the translocation of the Doppler obserbations in the reference system of NNSS

Station	φ	λ	H	Note
下里(Simosato)	33°34'39.″178	135°56'12.″792	106.m60	宇治島・津倉瀬・
対馬(Tusima)	34 11 46.266	129 17 37.602	42.61	見島観測
宇治島(Uzi Sima)	31 12 09.751	129 28 31.042	130.59	
津倉瀬(Tukura Se)	31 18 30.372	129 44 24.581	56.35	
見島(Mi Sima)	34 46 25.541	131 09 36.727	124.95	
小樽(Otaru)	43 11 58.827	141 00 12.064	66.22	礼文島観測
十勝(Tokati)	42 19 03.857	143 19 42.041	46.21	
礼文島(Rebun Tō)	45 26 03.524	141 03 10.748	194.37	

H:The height above the WGS-84 ellipsoid(a=6378137m, f=1/298.257).

Table 3. Positions of the NNSS antennas (1991) :the transformed results of Table 2 into the Tokyo Datum

Station	φ	λ	H	Translation parameters	Note
下里(Simosato)☆	33°34'27.″098	135°56'23.″041	67.m61	ΔU= 146.755	宇治島・
対馬(Tusima)	34 11 34.937	129 17 45.777	-23.09	ΔV=-509.831	津倉瀬・
津倉瀬(Tukura Se)	31 18 17.829	129 44 32.640	10.57	ΔW=-678.575	見島観測
宇治島(Uzi Sima)	31 11 57.182	129 28 39.007	84.68		
見島(Mi Sima)	34 46 14.324	131 09 45.579	61.58		
小樽(Otaru)☆	43 11 50.360	141 00 25.501	-3.19	ΔU= 146.288	礼文島
十勝(Tokati)	42 18 54.730	143 19 56.046	-9.72	ΔV=-508.753	観測
礼文島(Rebun Tō)	45 25 56.038	141 03 24.722	115.55	ΔW=-674.749	

H:The height above the reference ellipsoid of the Tokyo Datum.

☆:The fixed stations to derive the corresponding translation parameters.
The coordinates of these stations were obtained by the previous Doppler observations and the ground surveys (Takemura, 1983, Mori, 1976, Kawai et al. 1992).

初めに掲げたTable 1は，Table 3に示した受信アンテナの位置に基づく測点標識等の位置である．地上測量による成果をTable4に示す．Table5はドップラー観測による成果（Table3）と地上測量による成果
（Table4）の差である．地上測量に用いた三角点の座標をTable 6に示した．

Table 4. Positions of the NNSS antennas (1991) :the ground survey results in the Tokyo Datum

Station	φ	λ	h	Note
下里(Simosato)	33°34'27.″098	135°56'23.″041	67.m61	津倉瀬・宇治島・
対馬(Tusima)	34 11 34.515	129 17 45.828	12.00	見島観測
宇治島(Uzi Sima)	31 11 57.282	129 28 38.910	98.69	
見島(Mi Sima)	34 46 14.203	131 09 45.497	92.65	
小樽(Otaru)	43 11 50.252	141 00 25.215	36.07	礼文島観測
十勝(Tokati)	42 18 54.655	143 19 55.755	25.95	
礼文島(Rebun Tō)	45 25 55.800	141 03 24.409	168.56	

H:The height above the (local) mean sea level.

Table 5. Differences between the Doppler results and the survey results (1991)
:Doppler(Table 3) minus survey(Table 4)

Station	Δφ	Δλ	hg
下里(Simosato)	0.″000	0.″000	0.m00
対馬(Tusima)	+0.422	-0.051	-35.09
宇治島(Uzi Sima)	-0.100	+0.097	-14.01
見島(Mi Sima)	+0.121	+0.082	-31.07
小樽(Otaru)	+0.108	+0.286	-39.26
十勝(Tokati)	+0.075	+0.291	-35.67
礼文島(Rebun Tō)	+0.238	+0.313	-53.01

hg:Geoidal height referred to the reference ellipsoid of the Tokyo Datum.

Table 6. Positions of the reference triangulation points used for the survey in 1991
(expressed in the Tokyo Datum)

Station		φ	λ	h
下里	高芝(Ⅲ)	33°34'36.″058N	135°54'58.″502E	123.m35
〃	太地(Ⅱ)	33 34 51.295	135 56 37.380	79.57
対馬	有明山(Ⅲ)	34 12 3.999	129 16 2.224	558.17
〃	権現山(Ⅳ)	34 13 57.372	129 16 48.851	419.44
宇治島	宇治島(Ⅰ)	31 11 57.282	129 28 38.910	94.95
見島	木ノ上(Ⅲ)	34 46 14.203	131 9 45.497	88.89
十勝	地蔵堂(Ⅲ)	42 20 8.153	143 18 41.115	41.94
〃	平尾取(Ⅳ)	42 19 6.768	143 18 10.686	168.70
礼文島	高山(Ⅰ)	45 25 55.800	141 3 24.409	166.98

本報告は，高梨泰宏が作成した．また電子計算機による観測成果の算出は河合晃司及び池田信広が担当した．

参 考 文 献

竹村武彦・金沢輝雄,1983：水路部観測報告天文測地編,第17号,P61.
竹村武彦,1983：水路部観測報告天文測地編,第17号,P44.
森　巧,1976：水路部観測報告天文測地編,第10号,P42.

ドップラー観測による離島の位置決定に関する従前の報告は以下の水路部観測報告に収録してある．
竹村武彦・金沢輝雄,1983：水路部観測報告天文測地編,第17号,P61.
竹村武彦・金沢輝雄,1984：水路部観測報告天文測地編,第18号,P42.
竹村武彦,1985：水路部観測報告天文測地編,第19号,P85.
竹村武彦,1986：水路部観測報告天文測地編,第20号,P72.
竹村武彦,1988：水路部観測報告衛星測地編,第1号,P46.
仙石新・浅井光一,1990：水路部観測報告衛星測地室編,第3号,P77.
河合晃司・浅井光一・政井悟,1992：水路部観測報告衛星測地室編,第5号,P65.

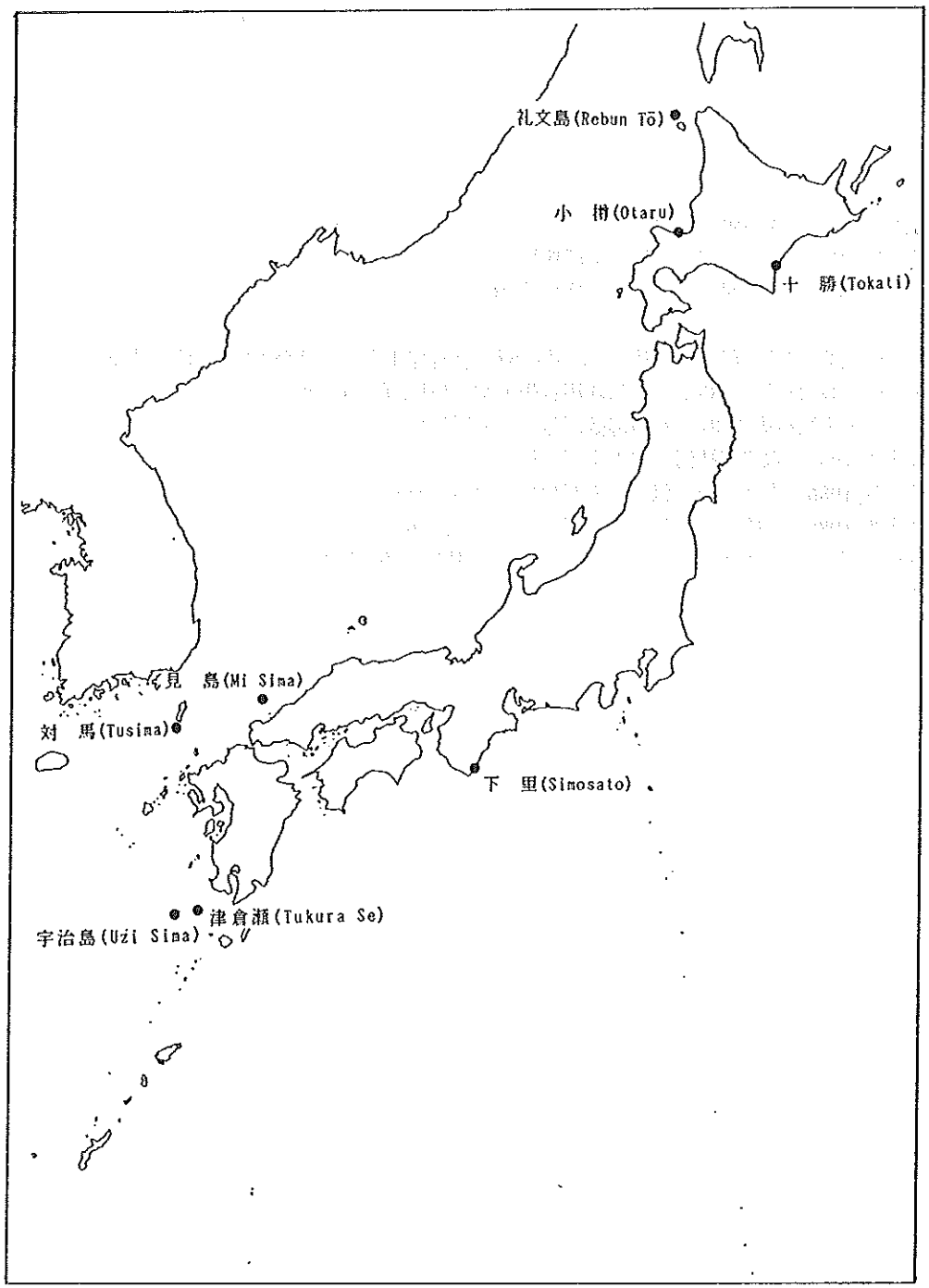


Figure 1. Doppler positioning in 1991.

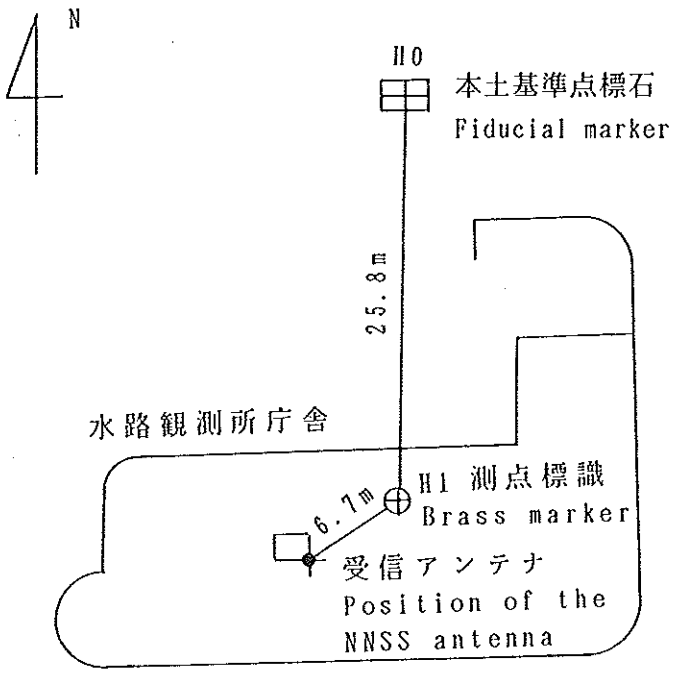


Figure 2. Site sketch for Simosato.

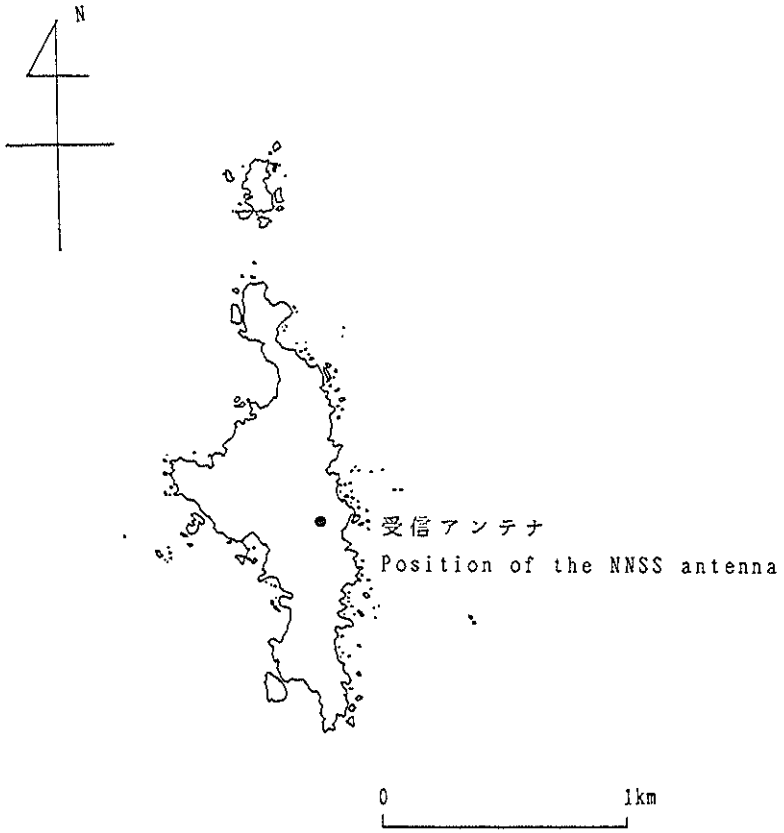


Figure 3. Site sketch for Uzi Sima.

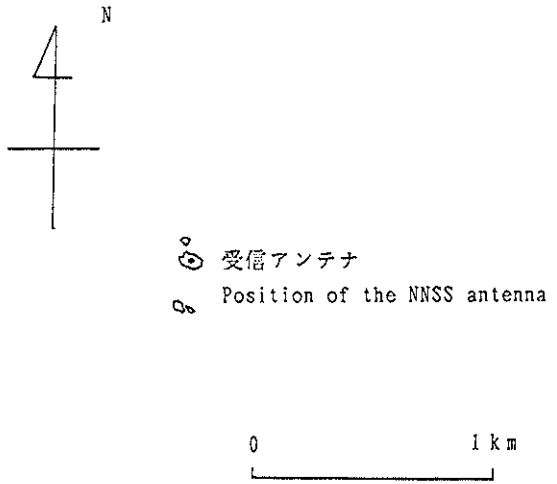


Figure 4. Site sketch for Tukura Se.

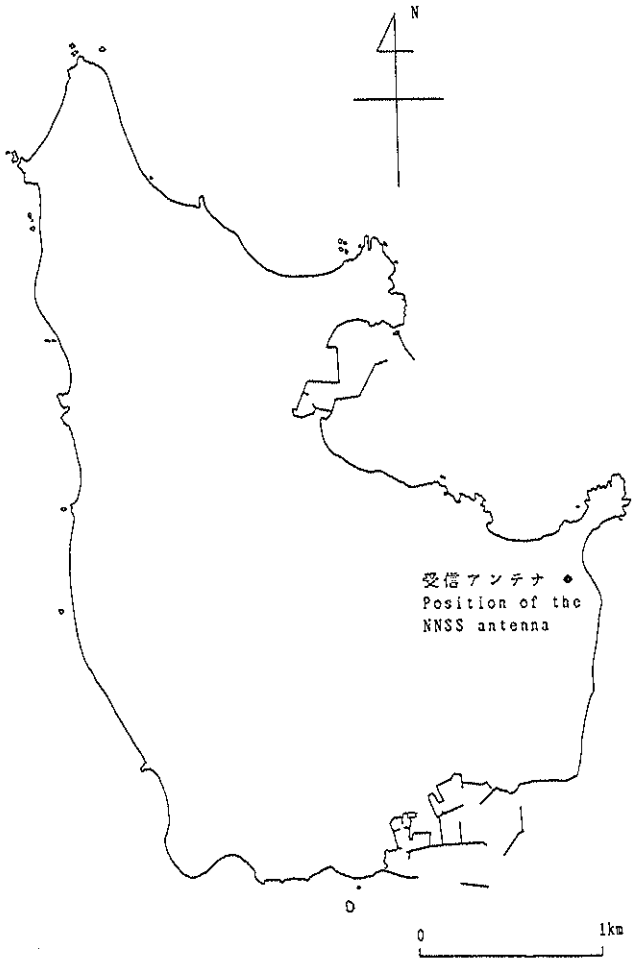


Figure 5. Site sketch for Mi Sima.

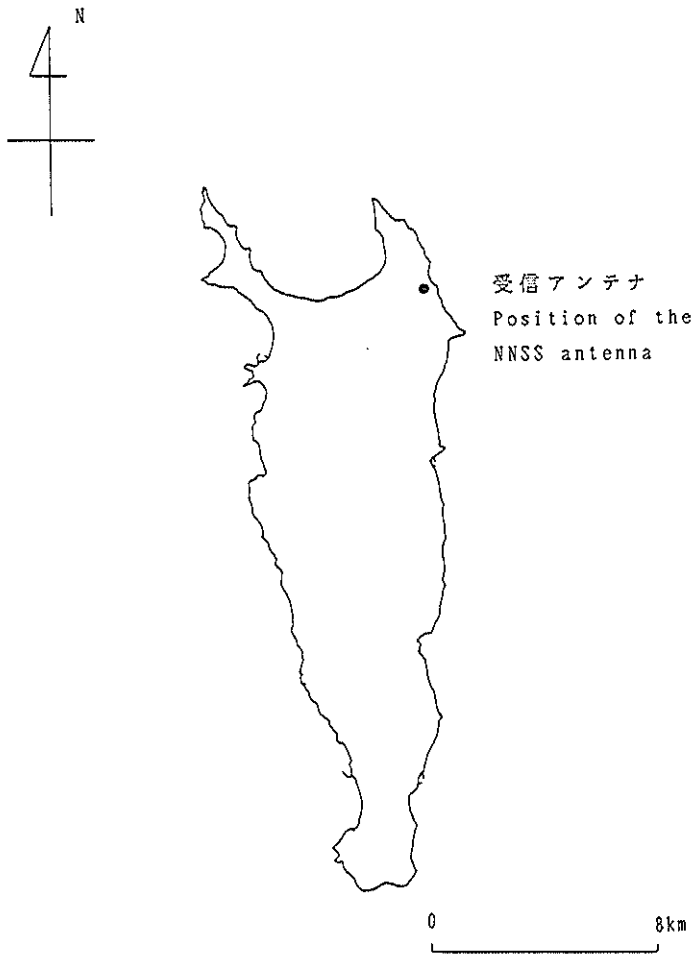


Figure 6. Site sketch for Rebun Tō.

GPS OBSERVATIONS AROUND SAGAMI BAY IN 1991

Summary - Hydrographic Department has been monitoring crustal movements around Sagami Bay by using GPS since the beginning of 1990. Dual frequency GPS receivers were installed at O Sima, Manazuru and Turugi Saki. These receivers are controlled through telephone line from the head office of the Hydrographic Department in Tokyo. Observations have been carried out about once a week with some intensive observations. Triple difference analysis has been made for each baseline fixing the position of O Sima or Manazuru.

Key words: GPS - Sagami Bay - crustal movements

This is a report of GPS (Global Positioning System) observations obtained at O Sima, Manazuru and Turugi Saki in 1991. This report contains the list of the data obtained at these three stations and the analyzed results. Previous data and results appear in the Data Report of Hydrographic Observations, Series of Satellite Geodesy, No. 5 (Sengoku and Kawai, 1992).

1. Observation

Crustal movements are active around Sagami Bay since there is a triple junction point of three plates, the North American plate, the Eurasian plate and the Philippine sea plate near this region. It is a generally accepted idea that there is an active fault in Sagami Bay off Odawara. The detection of crustal movements might offer valuable information for prediction of future earthquakes and volcanic activities in this area. The purpose of our observation is to monitor velocity field around Sagami Bay in relatively large scale (several tens of kilometers) and abrupt changes between stations, and to clarify the characteristics of crustal movements in plate boundary region.

The Hydrographic Department has been monitoring crustal movements around Sagami Bay by using GPS since Feb., 1990. Test observations in this area were carried out in 1989 (Sengoku *et al.*, 1991), and it was shown that repeatability of baseline length was about 1ppm or less.

Dual frequency GPS receivers (4000SLD, TRIMBLE NAV. ltd.) were set at O Sima (the Izu O Sima Aids to Navigation Office, Fig. 1), Manazuru (the Fire Service Office of Manazuru Town) and Turugi Saki (the Yokosuka Aids to Navigation Office). Distances between stations ranges from 47km to 49km. The control system, DS/7400 (Nippon Data General Inc.) and Quarter-L (Sony k.k.), was installed at the head office of the Hydrographic Department in Tokyo. Observation schedules of the three GPS receivers have been controlled by this system though NTT telephone line.

The control program is 4000 (TRIMBLE NAV. ltd., rev. D). Each baseline is analyzed by TRIMVEC (TRIMBLE NAV. ltd., rev. D) with triple difference analysis mode at the control system. Broadcast ephemerides and standard atmospheric model are used in the analysis.

The observation has been continued since Feb., 1990 and the analyzed results have been reported to the Coordinating Committee for Earthquake Prediction (Hydrographic Department, 1991-a, 1991-b, 1992).

After a test period for evaluating repeatability of baselines (from Feb. to Mar., 1990), 6 hour observations have been made once a week with some intensive observation periods. Table 1 shows observation schedules in 1991.

Some GPS data were lacking because of technical problems. There were a few troubles in every GPS

receivers in 1991. In order to improve system security and to lower receiver troubles, we introduced uninterruptive power supplies(UPS) in the three sites.

2. Baseline analysis aseline by using

TRIMVEC. In order to avoid systematic errors which might be introduced by inaccuracy of the coordinate of the fixed station, in the analyses of Manazuru-O Sima line and Turugi Saki-O Sima line, the position of O Sima is fixed to the value derived by the test GPS observations (Sengoku, 1991). So is the position of Manazuru in the analysis of Turugi Saki-Manazuru line. The estimation errors of geocentric rectangular coordinates are estimated by TRIMVEC. The estimation errors of latitude, longitude and height difference are also calculated by transforming covariance matrix from geocentric coordinates to topocentric coordinates (Sengoku *et al.*, 1990).

Analyzed results of baseline length, latitude difference, longitude difference, height difference and difference in geocentric rectangular coordinates (u, v, w) are listed in Table 2, 3 and 4. In 1991, 16 sets of baselines are obtained for O Sima - Manazuru line, 10 sets for O Sima - Turugi Saki line and 35 sets for Manazuru - Turugi Saki line. From Jul. 1, 1991, S/A (Selective Availability) was declared to block II GPS satellites and accuracy of point positioning seemed to be degraded to about 100m.

Authors would like to greatly appreciate the kind assistance of Manazuru Town, the Izu O Sima Aids to Navigation Office and the Yokosuka Aids to Navigation Office.

This report is written by A. Sengoku, K. Kouji and H. Noda.

References

Hydrographic Department 1991-a: *GPS observations around Sagami Bay* (February - November, 1990), *Report of the Coordinating Committee for Earthquake Prediction,* vol.45, 122-126. (in Japanese)

Hydrographic Department 1991-b: *GPS observations around Sagami Bay* (April, 1990 - April, 1991), *Report of the Coordinating Committee for Earthquake Prediction,* vol.46, 108-113. (in Japanese)

Hydrographic Department 1992: *GPS observations around Sagami Bay* (April, 1990 - November, 1991), *Report of the Coordinating Committee for Earthquake Prediction,* vol.47, 144-149. (in Japanese)

Sengoku, A., T. Fukushima, K. Kawai, K. Asai, T. Kawai and T. Fujii, 1990: *GPS observation around Sagami Bay,* Jour. Japan Soc. Mar. Surv. Tech., vol.2, 17-23. (in Japanese)

Sengoku, A., 1991: *GPS test observations around Sagami Bay in 1989, Data Report of Hydrographic Observation, series of Satellite Geodesy,* No.4, 6-108.

Sengoku, A., K. Kawai, 1990: *GPS observation around Sagami Bay in 1990, Data Report of Hydrographic Observation, series of Satellite Geodesy,* No.5, 95-114.

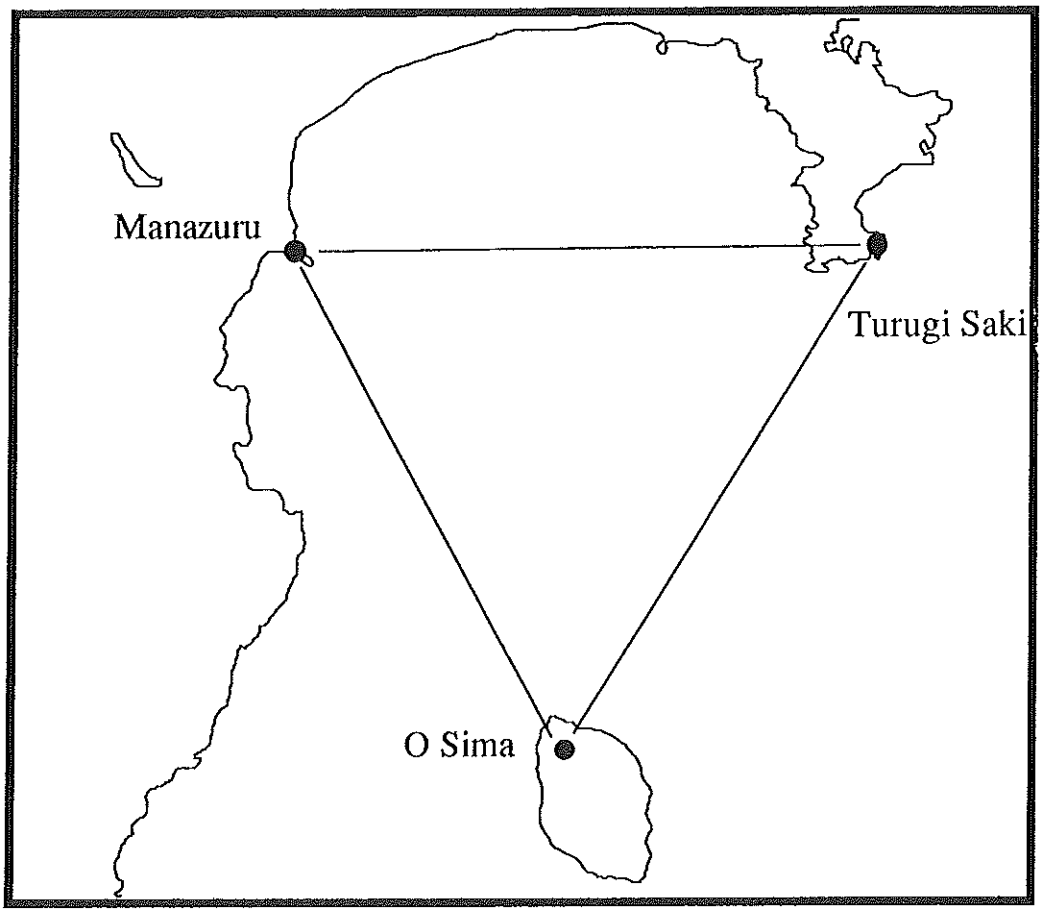


Figure 1. Observation sites.

Table 1. Observation data

Explanation

Column 1 Serial number
2 Session number
3 Observation date
4 Observation time (UT)
5 Observed satellites in PRN number
6 Acquired data size in byte.
4001: O Sima
4002: Manazuru
4003: Turugi Saki

Table 1. Observation data

No.	session	year	month	day	time		observed PRN#	data size		
					h m	h m		4001	4002	4003
1	008-1	1991	Jan.	8	00:38	05:38	3 6 9 12 13 16 17 18 19	514990	454638	
2	026-1	1991		26	16:44	21:48	2 6 11 13 14 15 18 19	644268		
3	029-1	1991		29	16:32	21:36	2 6 11 13 14 15 18 19	658062	581514	
4	036-1	1991	Feb.	5	16:04	21:08	2 6 11 13 14 15 18 19	655400	613850	
5	038-1	1991		7	15:54	21:00	2 6 11 13 14 15 18 19	659862	627912	
6	043-1	1991		12	15:36	20:40	2 6 11 13 14 15 18 19	650542	624838	
7	046-1	1991		15	15:24	20:28	2 6 11 13 14 15 18 19	656414	622276	
8	049-1	1991		18	15:12	20:16	2 6 11 13 14 15 18 19	650948	625256	
9	053-1	1991		22	14:56	20:00	2 6 11 13 14 15 18 19	637398	619566	
10	056-1	1991		25	14:44	19:48	2 6 11 13 14 15 18 19	639312		652904
11	063-1	1991	Mar.	4	14:16	19:20	2 6 11 13 14 15 18 19	635690		648702
12	070-1	1991		11	13:48	18:52	2 6 11 13 14 15 18 19	654352	621746	659982
13	077-1	1991		18	13:20	18:24	2 6 11 13 14 15 18 19	652698	617462	
14	084-1	1991		25	12:52	17:56	2 6 11 13 14 15 18 19	654968	617002	511274
15	092-1	1991	Apr.	2	12:20	17:24	2 6 11 13 14 15 18 19	651394	617864	651498
16	098-1	1991		8	12:00	17:00	2 6 11 13 14 15 18 19	644002	608766	643922
17	105-1	1991		15	11:22	16:22	2 6 11 13 14 15 18 19	645822	616122	653170
18	112-1	1991		22	10:54	15:54	2 6 11 13 14 15 18 19	647686	614404	643966
19	120-1	1991		30	10:22	15:22	2 6 11 13 14 15 18 19	644904	612506	645976
20	127-1	1991	May	7	09:54	14:54	2 6 11 13 14 15 18 19	206054	612610	639192
21	133-1	1991		13	09:30	14:30	2 6 11 13 14 15 18 19	628340	613680	640674
22	141-1	1991		21	08:58	13:58	2 6 11 13 14 15 18 19	648406	609224	648240
23	147-1	1991		27	08:34	13:34	2 6 11 13 14 15 18 19	443026	616106	644386
24	155-1	1991	Jun.	4	08:02	13:02	2 6 11 13 14 15 18 19		615860	642588
25	161-1	1991		10	07:38	12:38	2 6 11 13 14 15 18 19		607556	613240
26	168-1	1991		17	07:10	12:10	2 6 11 13 14 15 18 19		610228	619782
27	189-1	1991	Jul.	8	05:46	11:46	2 6 11 13 14 15 18 19		664166	653316
28	197-1	1991		16	05:14	11:14	2 6 11 13 14 15 18 19		662146	678984
29	204-1	1991		23	04:46	10:46	2 6 11 13 14 15 18 19		617092	628366
30	210-1	1991		29	02:46	08:46	2 6 11 13 14 15 18 19 21		688918	706406
31	218-1	1991	Aug.	6	02:12	08:12	2 6 11 13 14 15 18 19 21		710394	741728
32	226-1	1991		14	01:40	07:40	2 6 11 13 14 15 18 19 21		708874	732038
33	231-1	1991		19	01:20	07:20	2 6 11 13 14 15 18 19 21		708246	735356
34	238-1	1991		26	00:52	06:52	2 6 11 13 14 15 18 19 21		707394	716546
35	245-1	1991	Sep.	2	00:48	06:48	2 6 11 13 14 15 18 19 21		693300	706990
36	246-1	1991		3	08:00	11:00	6 13 14 18			382596
37	253-1	1991		10	00:16	06:16	2 6 11 13 14 15 18 19 21		699750	737306
38	261-1	1991		18	23:44	05:44	2 6 11 13 14 15 18 19 21		692290	736262
39	264-1	1991		21	23:32	05:32	2 6 11 13 14 15 18 19 21		701704	736640
40	274-1	1991	Oct.	1	22:52	04:52	2 6 11 13 14 15 18 19 21		696520	723756

Table 1. Observation data (continued)

No.	session	year	month	day	time		observed PRN#	data size		
					h m	h m		4001	4002	4003
41	280-1	1991		7	22:28	04:28	2 6 11 13 14 15 18 19 21		696032	727330
42	288-1	1991		15	21:56	03:56	2 6 11 13 14 15 18 19 21		682426	735416
43	295-1	1991		22	21:28	03:28	2 6 11 13 14 15 18 19 21		682324	735238
44	302-1	1991		29	21:00	03:00	2 6 11 13 14 15 18 19 21		693950	729594
45	312-1	1991	Nov.	8	20:20	02:20	2 6 11 13 14 15 18 19 21		683464	730312
46	316-1	1991		12	20:04	02:04	2 6 11 13 14 15 18 19 21		678548	731248
47	322-3	1991		18	19:02	01:02	2 6 11 13 14 15 18 19 21 24		707656	768214
48	324-3	1991		20	18:54	00:54	2 6 11 13 14 15 18 19 21 24		712538	760162
49	325-3	1991		21	18:50	00:50	2 6 11 13 14 15 18 19 21 24		714736	765478
50	329-1	1991		25	19:12	01:12	2 6 11 13 14 15 18 19 21 24		644450	689254
51	342-1	1991	Dec.	8	01:02	07:12	3 6 12 13 16 17 18 19 23 24			782438
52	346-1	1991		12	00:46	06:56	3 6 12 13 16 17 18 19 23 24			787412
53	349-2	1991		15	02:00	06:10	3 6 13 16 17 19 24			
54	350-1	1991		16	00:06	06:06	3 6 13 16 17 18 19 24			
55	351-1	1991		17	00:02	06:02	3 6 13 16 17 18 19 24			
56	352-1	1991		18	23:58	05:58	3 6 13 16 17 18 19 24			

Table 2, 3, 4. Analyzed results

Explanation

Column	1	Serial number
	2	Session number
	3	Slope distance between two stations with estimated RMS (unit: m)
	4	Latitude difference with estimated RMS (unit: arc sec.)
	5	Longitude difference with estimated RMS (unit: arc sec.)
	6	Height difference with estimated RMS (unit: m)
	7,8,9	Difference in Earth-fixed rectangular coordinate with estimated RMS (unit: m)
	10	RMS of residuals (unit: cycle)

Table 2. Analyzed results (Manazuru - O Sima)

No.	Session	slope distance	d ϕ	d λ	d h	dx	dy	dz	rms
1	029-1	47123.7772 .0118	1347.9586 .0002	-877.0884 .0007	393.798 -64.364	32599.469 .017	1286.649 .011	34003.964 .009	.091
2	036-1	47123.7570 .0115	1347.9587 .0002	-877.0865 .0007	401.782 -64.363	32599.438 .016	1286.612 .012	34003.967 .009	.095
3	038-1	47123.7471 .0112	1347.9585 .0002	-877.0861 .0007	403.773 -64.341	32599.416 .016	1286.619 .012	34003.974 .009	.092
4	043-1	47123.7639 .0110	1347.9590 .0002	-877.0862 .0006	408.757 -64.355	32599.434 .015	1286.607 .011	34003.980 .009	.085
5	046-1	47123.7645 .0112	1347.9584 .0002	-877.0876 .0007	411.751 -64.378	32599.463 .016	1286.629 .012	34003.953 .008	.085
6	049-1	47123.7203 .0103	1347.9579 .0002	-877.0851 .0006	414.746 -64.347	32599.395 .015	1286.602 .011	34003.958 .008	.079
7	053-1	47123.7106 .0126	1347.9585 .0003	-877.0831 .0009	418.728 -64.408	32599.407 .017	1286.526 .019	34003.936 .010	.094
8	070-1	47123.7457 .0100	1347.9579 .0002	-877.0872 .0006	435.688 -64.371	32599.445 .014	1286.630 .011	34003.944 .008	.080
9	077-1	47123.7361 .0110	1347.9586 .0002	-877.0850 .0007	442.662 -64.351	32599.404 .015	1286.591 .013	34003.971 .008	.085
10	084-1	47123.7606 .0101	1347.9584 .0002	-877.0874 .0006	449.646 -64.361	32599.448 .014	1286.633 .011	34003.961 .008	.079
11	092-1	47123.7581 .0112	1347.9586 .0002	-877.0868 .0007	457.624 -64.326	32599.419 .016	1286.638 .013	34003.986 .008	.091
12	098-1	47123.7580 .0098	1347.9585 .0002	-877.0869 .0006	463.608 -64.325	32599.419 .014	1286.642 .011	34003.985 .007	.074
13	105-1	47123.7371 .0109	1347.9578 .0002	-877.0867 .0006	470.582 -64.323	32599.406 .015	1286.648 .011	34003.968 .009	.087
14	120-1	47123.7686 .0098	1347.9584 .0002	-877.0880 .0006	485.540 -64.308	32599.426 .014	1286.674 .010	34003.992 .008	.080
15	133-1	47123.7427 .0106	1347.9589 .0002	-877.0848 .0007	498.507 -64.310	32599.381 .015	1286.607 .014	34004.002 .009	.086
16	141-1	47123.7324 .0122	1347.9582 .0002	-877.0854 .0007	506.482 -64.350	32599.406 .017	1286.604 .013	34003.963 .009	.096

Table 3. Analyzed results (Turugi Saki - O Sima)

No.	Session	slope distance	d ϕ	d λ	d h	dx	dy	dz	rms
1	056-1	48132.1821 .0093	1296.2502 .0002	1058.3691 .0007	421.723 -78.540	34.999 .016	-35325.419 .012	32692.820 .009	.079
2	063-1	48132.1496 .0133	1296.2502 .0003	1058.3667 .0008	428.704 -78.553	35.047 .016	-35325.380 .016	32692.814 .010	.097
3	070-1	48132.1874 .0080	1296.2505 .0002	1058.3689 .0006	435.688 -78.501	34.981 .013	-35325.399 .010	32692.850 .007	.077
4	084-1	48132.1967 .0090	1296.2506 .0002	1058.3693 .0007	449.646 -78.518	34.989 .020	-35325.416 .012	32692.845 .009	.083
5	092-1	48132.1940 .0082	1296.2504 .0002	1058.3695 .0006	457.624 -78.500	34.970 .014	-35325.408 .011	32692.849 .008	.077
6	098-1	48132.1853 .0089	1296.2506 .0002	1058.3685 .0007	463.608 -78.512	34.998 .015	-35325.397 .012	32692.849 .008	.087
7	105-1	48132.1570 .0097	1296.2504 .0002	1058.3669 .0007	470.582 -78.460	34.987 .016	-35325.337 .012	32692.872 .010	.096
8	120-1	48132.1750 .0085	1296.2505 .0002	1058.3679 .0006	485.540 -78.455	34.969 .014	-35325.355 .011	32692.879 .008	.083
9	133-1	48132.2395 .0132	1296.2512 .0003	1058.3712 .0008	498.507 -78.492	34.948 .016	-35325.447 .016	32692.875 .009	.098
10	141-1	48132.2441 .0089	1296.2521 .0002	1058.3699 .0007	506.482 -78.447	34.954 .015	-35325.408 .012	32692.923 .008	.088

Table 4. Analyzed results (Turugi Saki - Manazuru)

No.	Session	slope distance	d ϕ	d λ	d h	dx	dy	dz	rms
1	070-1	49016.3269 .0188	-51.7081 .0002	1935.4527 .0007	435.688 -14.128	-32564.430 .017	-36612.009 .013	-1311.110 .009	.100
2	084-1	49016.3735 .0269	-51.7081 .0003	1935.4545 .0011	449.646 -14.075	-32564.493 .029	-36612.017 .016	-1311.078 .012	.105
3	092-1	49016.3091 .0191	-51.7083 .0002	1935.4520 .0008	457.624 -14.167	-32564.396 .017	-36612.014 .014	-1311.136 .009	.098
4	098-1	49016.3060 .0194	-51.7077 .0002	1935.4519 .0008	463.608 -14.164	-32564.389 .018	-36612.017 .014	-1311.120 .010	.099
5	105-1	49016.2860 .0194	-51.7082 .0002	1935.4511 .0008	470.582 -14.170	-32564.378 .018	-36611.999 .014	-1311.135 .010	.098
6	112-1	49016.3018 .0169	-51.7077 .0002	1935.4517 .0007	477.565 -14.177	-32564.379 .016	-36612.020 .012	-1311.128 .008	.083
7	120-1	49016.3099 .0184	-51.7075 .0002	1935.4520 .0007	485.540 -14.131	-32564.409 .017	-36612.005 .013	-1311.096 .009	.095
8	127-1	49016.3023 .0193	-51.7079 .0003	1935.4517 .0008	492.518 -14.113	-32564.421 .019	-36611.985 .013	-1311.095 .011	.102
9	133-1	49016.3079 .0190	-51.7081 .0003	1935.4519 .0007	498.507 -14.167	-32564.394 .018	-36612.015 .013	-1311.132 .011	.108
10	141-1	49016.3562 .0211	-51.7074 .0002	1935.4539 .0008	506.482 -14.122	-32564.443 .020	-36612.037 .014	-1311.088 .010	.105
11	147-1	49016.3029 .0178	-51.7081 .0002	1935.4517 .0007	512.465 -14.125	-32564.416 .016	-36611.989 .013	-1311.106 .009	.096
12	155-1	49016.2887 .0171	-51.7075 .0002	1935.4512 .0007	520.443 -14.161	-32564.376 .016	-36612.005 .012	-1311.112 .009	.093
13	161-1	49016.2937 .0226	-51.7082 .0003	1935.4513 .0009	526.426 -14.089	-32564.434 .022	-36611.962 .015	-1311.089 .012	.109
14	168-1	49016.3125 .0197	-51.7082 .0003	1935.4521 .0008	533.410 -14.128	-32564.422 .020	-36611.997 .012	-1311.112 .011	.092
15	189-1	49016.2980 .0237	-51.7077 .0002	1935.4515 .0009	554.369 -14.089	-32564.430 .024	-36611.971 .015	-1311.076 .012	.096
16	197-1	49016.3671 .0240	-51.7084 .0003	1935.4542 .0009	562.347 -14.060	-32564.501 .023	-36612.001 .016	-1311.077 .012	.110
17	204-1	49016.3549 .0264	-51.7080 .0002	1935.4538 .0010	569.324 -14.099	-32564.465 .023	-36612.016 .017	-1311.089 .010	.080
18	210-1	49016.3677 .0212	-51.7094 .0002	1935.4542 .0008	575.244 -14.155	-32564.457 .020	-36612.038 .014	-1311.159 .008	.083
19	218-1	49016.2799 .0170	-51.7083 .0002	1935.4508 .0007	583.217 -14.160	-32564.382 .018	-36611.988 .011	-1311.133 .008	.092
20	226-1	49016.2799 .0170	-51.7083 .0002	1935.4508 .0007	583.217 -14.160	-32564.382 .018	-36611.988 .011	-1311.133 .008	.092

Table 4. Analyzed results (Turugi Saki - Manazuru, continued)

No.	Session	slope distance	d ϕ	d λ	d h	dx	dy	dz	rms
21	231-1	49016.2691 .0232	-51.7085 .0003	1935.4504 .0009	596.184 -14.174	-32564.369 .024	-36611.984 .015	-1311.147 .010	.120
22	238-1	49016.2767 .0206	-51.7088 .0002	1935.4507 .0008	603.168 -14.250	-32564.330 .022	-36612.027 .013	-1311.196 .009	.103
23	245-1	49016.3549 .0203	-51.7086 .0002	1935.4537 .0008	610.162 -14.095	-32564.475 .020	-36612.007 .014	-1311.102 .009	.093
24	253-1	49016.2659 .0227	-51.7088 .0003	1935.4502 .0009	618.137 -14.150	-32564.386 .022	-36611.965 .016	-1311.140 .011	.118
25	261-1	49016.2712 .0191	-51.7079 .0002	1935.4505 .0008	626.115 -14.113	-32564.401 .019	-36611.960 .013	-1311.095 .009	.094
26	264-1	49016.2954 .0176	-51.7086 .0002	1935.4514 .0007	629.109 -14.083	-32564.445 .017	-36611.954 .012	-1311.097 .008	.095
27	274-1	49016.2645 .0176	-51.7085 .0002	1935.4502 .0007	639.078 -14.136	-32564.389 .017	-36611.961 .012	-1311.123 .008	.092
28	280-1	49016.3360 .0193	-51.7084 .0002	1935.4530 .0008	646.062 -14.051	-32564.487 .018	-36611.972 .014	-1311.072 .008	.097
29	288-1	49016.2825 .0186	-51.7079 .0002	1935.4509 .0007	653.043 -14.136	-32564.393 .018	-36611.982 .013	-1311.108 .008	.089
30	295-1	49016.2938 .0172	-51.7078 .0002	1935.4514 .0007	660.023 -14.113	-32564.414 .018	-36611.980 .011	-1311.092 .008	.081
31	302-1	49016.3203 .0188	-51.7077 .0002	1935.4524 .0007	667.004 -14.099	-32564.439 .018	-36611.993 .013	-1311.082 .008	.091
32	312-1	49016.3748 .0209	-51.7084 .0002	1935.4545 .0008	676.976 -14.041	-32564.520 .020	-36611.995 .015	-1311.068 .009	.103
33	316-1	49016.4061 .0188	-51.7088 .0002	1935.4558 .0007	680.965 -14.058	-32564.534 .018	-36612.023 .013	-1311.087 .008	.089
34	322-3	49016.3384 .0219	-51.7091 .0002	1935.4531 .0009	687.925 -14.072	-32564.485 .022	-36611.976 .015	-1311.101 .009	.108
35	325-3	49016.4030 .0205	-51.7091 .0002	1935.4556 .0008	690.914 -13.959	-32564.598 .021	-36611.964 .013	-1311.038 .009	.099

平成５年３月21日印刷
平成５年３月31日発行

発行者　海上保安庁
東京都千代田区霞が関２丁目１番３号
(郵便番号 100)
電話 東京 (03)3951−6361 (代)

編集者　海上保安庁水路部
東京都中央区築地５丁目３番１号
(郵便番号 104)
電話 東京 (03)3541−3811 (代)

印刷者　株式会社 文秀社
東京都千代田区内神田３丁目10番７号
(郵便番号 101)
電話 東京 (03)3254−5311 (代)