THE NOBEYAMA RADIOHELIOGRAPH DATA USE

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1. Open Use of the Nobeyama Radioheliograph Data

Nobeyama Radioheliograph has started routine observations in late June 1992. Various interesting new phenomena have already been observed and the analyses of these phenomena are in progress. During this period, it was proved that Nobeyama Radioheliograph is a powerful instrument for solar research, more than what we have expected. We open this instrument to outside users for solar research. Nobeyama Radioheliograph is a dedicated instrument for solar observation and has only one mode of observation. So, we would like to propose not to open the instrument but to open the observed data. This is not a usual way of open use of telescopes, such as 45m Telescope at Nobeyama, but is more efficient for the case of the Radioheliograph. The observatory staff will carry out the daily observations and the original data will belong to the observatory. The decision on who can use which data will be done by the program committee. At present, we do not have a program committee, but it will be formed in near future. Data Use Coordinators are now assigned for the internal use of the data and for cooperative researches with outside users. We also propose open use of data through cooperative researches between outside users and resident astronomers of the Nobeyama Radio Observatory. The stored data are mostly not in the form of maps, but the complex correlations among the 84 signals in every one second. To make maps, phase and amplitude calibration by the data from redundant array combination, Fourier transform, and CLEAN are necessary. The main frame computer of the data acquisition and processing system of the Radioheliograph is used to make maps for detailed study after the daily observation has ended. So, it is necessary to visit Nobeyama or ask observatory staffs to make maps. Cooperative research is more realistic at present due to limited human power at Nobeyama. We would like to put emphasis on cooperation with Yohkoh satellite while it is active. We provide anonymous ftp utility for outside users to check what kind of data are taken by the Radioheliograph. Among them are, observing time logs, event lists, time plots of the cross correlation

coefficients, and several maps per day. These data are stored on one of the workstations as files and can easily be accessed through computer network. These data will be used as information for the application of cooperative research.

If you have any questions concerning the cooperative research with Nobeyama Radioheliograph, please contact to the following address.


```
Mail:      Data use coordinator
           Solar Radio Facilities
           Nobeyama Radio Observatory
           Minamimaki, Minamisaku
           Nagano 384-13
           Japan
E-mail:    duc@helio_gw.nro.nao.ac.jp(internet)
FAX.:      +81-267-98-4444
Phone:     +81-267-98-4477
```


Proposals of the cooperative research should be sent to the following address using the following format. Submission of proposals do not necessarily mean the priority for exclusive use of the data. Scientific ideas included in the proposal should be respected. Please keep updating the proposals, otherwise the proposal will be expired.

E-mail: duc@helio_gw.nro.nao.ac.jp(internet)

1.1. Non-military principle of the Nobeyama Radio Observatory

Nobeyama Radio Observatory (NRO) keeps the policy of conducting no military related researches. Researchers who belong to a military organization are requested, when they propose to use the NRO observation facilities, to submit a declaration that the proposal has no direct relation with military purposes and that the observational results will be fully reported in open literatures.

1.2. Format of Proposals for Radioheliograph Data Analysis

```
1. Name(s) of proposer(s):
2. Title of the research:
3. Flare ID or AR ID (flare on yymmdd at hhmmUT, NOAA nnnn etc.):
4. Kind of data(SXT, HXT, BCS, WBS, Ha, Mag. field, etc.) to use:
5. Description of the analysis:
    motivation or objectives of data analysis
    how Radioheliograph data are used
    status of the analysis
    results
    etc.
6.Others
```

2. Online Data Access

Documents and data are available through computer network by anonymous ftp utility to enhance cooperative researches. You can access them by the following manner.

```
ftp 133.40.76.80
Name: anonymous
```

```
Password: (your e-mail address)
```

First get a file 'readme.doc'. Then get a file 'pub/commonuse.doc' (policy of open use). Please read carefully the policy of open use when you use the data. Observation logs are stored in 'pub/obs_list/obs92.list' and 'pub/obs_list/obs93.list' (Table 1). List of radio bursts detected by the Radioheliograph are stored under the directory 'pub/event_list' (Table 2). These are all Ascii files and will be updated or added regularly. Time series of correlation coefficients are stored under the directory 'pub/cor_plot' (Table 3). Radio images both of intensity and circular polarization difference are available in every one hour. These are stored under the directory 'pub/map' (Table 4). These data are in 'FITS' format.

The members of Nobeyama Radioheliograph Group hope that these data can contribute to solar physics and related fields.

Table 1. Observing Log (example)

```
Observation Table of the Nobeyama radio heliograph

 date    start (JST) end                comments
           (UT=JST-9h)
-------------------------------------------------------------------------------

94/01/01 07:45:19 15:42:53
94/01/02 07:45:18 15:42:52
94/01/03 07:45:19 15:42:53
94/01/04 07:45:18 15:42:52
94/01/05 07:45:20 15:42:54
94/01/06 07:45:23 15:42:52
94/01/07 07:45:18 15:42:52
94/01/08 09:25:19 15:44:58
94/01/09 -------- --------   Data are stored only on digital magnetic tape.
94/01/10 07:45:19 15:42:58
94/01/11 07:45:22 15:42:51
94/01/12 07:45:19 15:42:53
94/01/13 07:45:20 15:42:54
94/01/14 07:45:23 15:42:52
94/01/15 07:45:21 15:42:55
94/01/16 07:45:22 15:42:51
94/01/17 07:45:19 15:42:53
94/01/18 07:45:18 15:42:52
94/01/19 07:45:18 15:42:52
94/01/20 07:45:19 15:42:53
94/01/21 07:45:20 15:42:54
94/01/22 07:45:19 15:42:58   N2 was attenuated 10db from 08:08 until the end.
94/01/23 07:45:22 15:42:51
94/01/24 07:45:21 09:47:40   Data between 09:47:40 and 15:42 are stored only on
94/01/25 07:45:22 15:42:51
94/01/26 07:45:19 15:42:53   N14 was attenuated 10db from 13:45 until the end.
94/01/27 07:45:22 15:42:56
94/01/28 07:45:19 15:42:58
94/01/29 07:45:18 15:42:52   All signals were attenuated by snow until 10:40.
```

```
94/01/30 07:45:19 15:42:53
94/01/31 07:45:19 15:42:58   E28 was attenuated 10db from 15:02 until the end.
```

Table 2. Event List (example)

EVENTLIST JANUARY 1994

NOBEYAMA RADIOHELIOGRAPH
OBS-FREQ = 17GHZ

NO.	DAY	START	END	MAX.TIME	DUR.	PEAK	MEAN	STD.DEV	TH_U/L
1	94/01/01	00:19:39	00:23:59	00:19:42	260	39	20.0	3.2	34/ 25
2	94/01/01	00:26:43	00:28:39	00:26:58	116	87	20.0	3.2	34/ 25
3	94/01/01	00:32:31	00:36:00	00:32:49	209	272	20.0	3.2	34/ 25
4	94/01/01	00:45:33	00:50:09	00:45:59	276	311	20.0	3.2	34/ 25
5	94/01/01	00:52:44	00:55:37	00:52:51	173	229	20.0	3.2	34/ 25
6	94/01/01	00:58:31	01:00:53	00:58:49	142	182	20.0	3.2	34/ 25
7	94/01/01	01:02:16	01:02:52	01:02:37	36	60	20.0	3.2	34/ 25
8	94/01/01	01:12:20	01:14:17	01:13:23	117	121	20.0	3.2	34/ 25
9	94/01/01	01:16:37	01:16:54	01:16:40	17	40	20.0	3.2	34/ 25
10	94/01/01	01:17:41	01:19:27	01:17:47	106	125	20.0	3.2	34/ 25
11	94/01/01	01:32:22	01:34:36	01:32:38	134	509	20.0	3.2	34/ 25
12	94/01/01	02:16:08	02:16:33	02:16:09	25	33	20.0	3.2	34/ 25

Table 3. Fits Header of Correlation Plot (example)

```
SIMPLE  =                    T / BASIC FITS TAPE FORM
BITPIX  =                   16 / 2-BYTE TWO'S COMPLEMENT INTEGER
NAXIS   =                    1 / 1-DIMENSIONAL TEMPORAL PROF
NAXIS1  =                28655 / # PIXEL/ROW
BSCALE  =          0.3053E-05 / SFACT/32768, REAL = TAPE * BSCALE + BZERO
BZERO   =                0.00 / NO BITS ADDED
BUNIT   = 'CORRELATION COEFF.' / CROSS CORRELATION COEFFICIENT
BLANK   =               -32768 / VALUE FOR VALUE-UNDEFINED PIXEL
CRVAL1  = '22:45:19.742      ' / REF POINT VALUE IN HH:MM:SS (UT)
STARTFRM=                    1 / REF FRAME NUMBER
CRPIX1  =                 1.00 / REF POINT PIXEL LOCATION
CTYPE1  = 'TIME(SECOND)      ' / TYPE OF PHYSICAL COORD. ON AXIS1
CDELT1  =                 1.00 / PIXEL SIZE ON AXIS1 IN SECOND
FUND-AMP=                12173 / COR_AMP. OF FUND. ANTENNA SPACING AT STARTFRAM
OBJECT  = 'SUN               ' / OBJECT NAME
IMAGE1  = 'R+L               ' /
OBS-FREQ= '17GHZ             ' / INTENSITY AT 17GHZ
TELESCOP= 'RADIOHELIOGRAPH   ' / NOBEYAMA RADIO HELIOGRAPH
DATE-OBS= '31/12/93          ' / DATE OF DATA ACQUISITION DD/MM/YY (UT)
JSTDATE = '01/01/94          ' / DATE OF DATA ACQUISITION DD/MM/YY (JST)
JSTTIME = '07:45:19.742      ' / TIME OF DATA ACQUISITION HH/MM/SS (JST)
```

```
ORIGIN  = 'NOBEYAMA RADIO OBS' / TAPE WRITE INSTITUTION
DATE    = '02/01/94          ' / DATE WHEN DATA FILE WRITTEN DD/MM/YY (JST)
PVERSION= '2.10              ' / CODED BY SEKIGUCHI & NISHIO   01.JUN.93
COMMENT BUNIT IS  THE MEAN  OF CORRELATION COEFFICIENTS OF THE ANTENNA BASELINE
COMMENT LENGTH ABOVE  100*D*COS(THETA).
COMMENT THETA: ANGLE BETWEEN THE ANTENNA BASELINE & THE DIRECTION OF THE SUN.
COMMENT D    : FUNDAMENTAL BASELINE LENGTH OF 1.528 METERS
COMMENT SFACT: FACTOR INTRODUCED TO REDUCE THE DISCRETIZATION ERROR
END
```

Table 4. Fits Header of Maps (example)

```
SIMPLE  =                    T / FILE DOES CONFORM TO FITS STANDARD
BITPIX  =                   32 / NUMBER OF BITS PER DATA PIXEL
NAXIS   =                    2 / NUMBER OF DATA AXES
NAXIS1  =                  512 / LENGTH OF DATA AXIS   1
NAXIS2  =                  512 / LENGTH OF DATA AXIS   2
DATE-OBS= '01/01/94'           /
TIME-OBS= '02:45:14.797'       /
JSTDATE = '01/01/94'           /
JSTTIME = '11:45:14.797'       /
JST-STRT= '11:45:09.797'       /
JST-END = '11:45:19.797'       /
STARTFRM=                14391 /
ENDFRM  =                14400 /
POLARIZ = 'R+L     '           /
ATT-10DB= '00DB    '           /
OBS-FREQ= '17GHZ   '           /
DATA-TYP= 'CLEANED_MAP'        /
OBJECT  = 'SUN     '           /
TELESCOP= 'RADIOHELIOGRAPH'    /
ORIGIN  = 'NOBEYAMA RADIO OBS' /
PVERSION= '4.2     '           /
BUNIT   = 'K       '           / DISK = 10000 K
CRITER  =             30000.00 / CLEAN CRITERION
NCOMPO  =                  667 / NUMBER OF CLEAN COMPONENTS
DDOFF1  =                    4 / X-OFFSET OF THE DIRTY DISK
DDOFF2  =                    0 / Y-OFFSET OF THE DIRTY DISK
MBEAMC  = 'YES     '           / MAIN BEAM CORRECTION
CRVAL1  =                 0.00 / DISK CENTER
CRVAL2  =                 0.00 / DISK CENTER
CRPIX1  =               257.00 /
CRPIX2  =               257.00 /
CDELT1  =              4.91104 / ARCSEC
CDELT2  =              4.91104 / ARCSEC
CTYPE1  = 'SOLAR-WEST'         /
CTYPE2  = 'SOLAR-NORTH'        /
SOLR    =               977.50 / OPTICAL SOLAR RADIUS (ARCSECOND)
SOLP    =               2.0900 / SOLAR POLAR ANGLE (DEGREE)
SOLB    =              -3.0318 / SOLAR BO (DEGREE)
DEC     =             -23.0271 / DECLINATION (DEGREE)
```

```
HOURA    =              -252.10 / HOUR ANGLE (SECOND)
AZIMUTH  =            358.8611 / AZIMUTH (DEGREE)
ALTITUDE=             31.8847 / ALTITUDE (DEGREE)
PMAT1    =             0.99983 / PROJECTION MATRIX
PMAT2    =            -0.01054 / PROJECTION MATRIX
PMAT3    =            -0.00717 / PROJECTION MATRIX
PMAT4    =             0.52838 / PROJECTION MATRIX
END
```

Figure 1. Intensity Maps

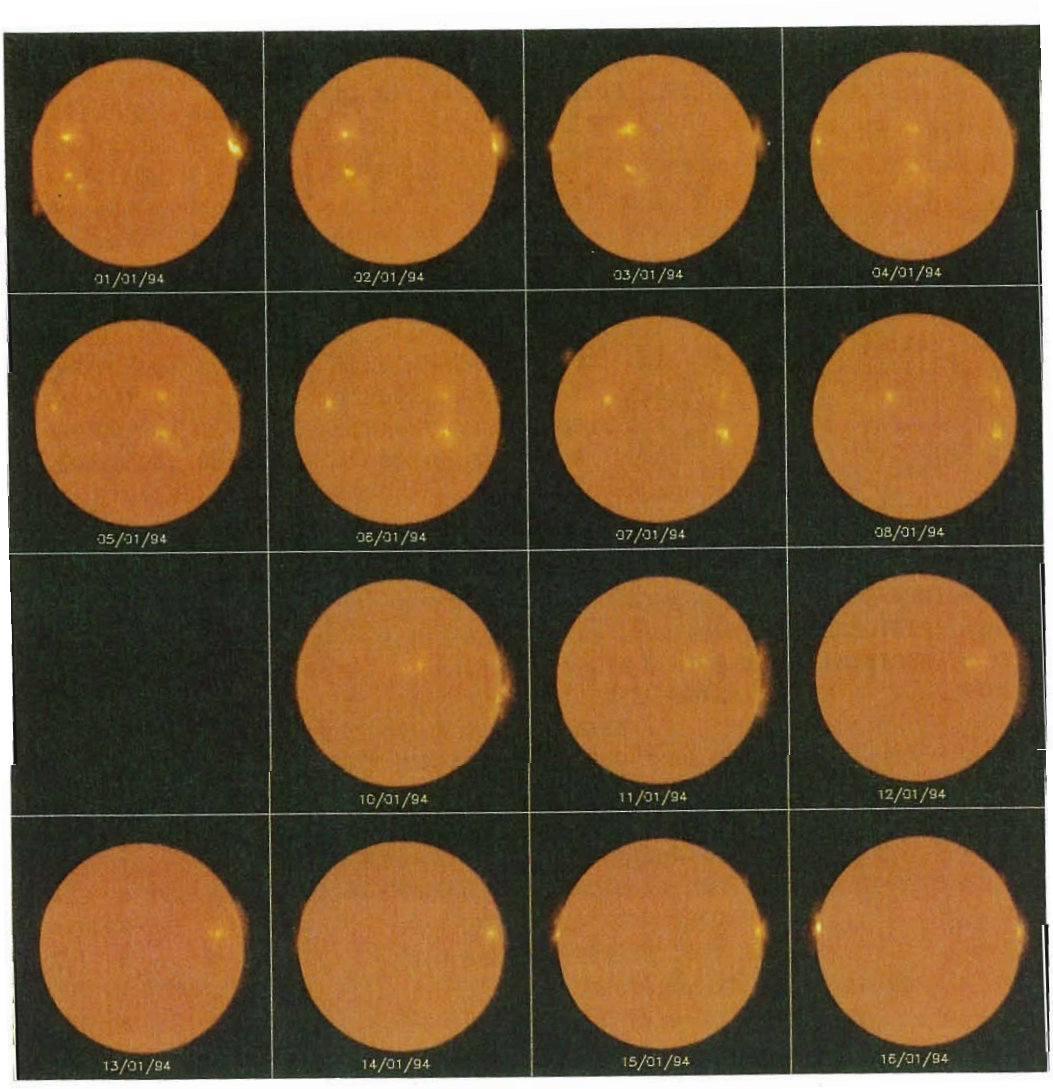

Figure 2. Correlation Plots together with GOES Data