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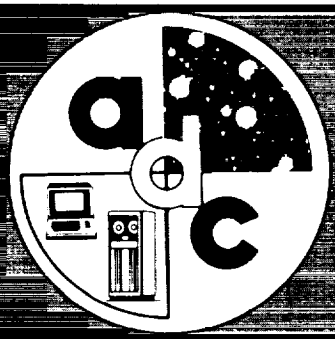
National Space Science Data Center/
World Data Center A For Rockets and Satellites

THE U. S. NAVAL OBSERVATORY ZODIACAL ZONE CATALOG

(Douglass and Harrington 1990)

Documentation for the Machine-Readable Version



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Documentation for the Machine-Readable Version

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National Space Science Data Center (NSSDC)/
World Data Center A for Rockets and Satellites (WDC-A-R&S)
National Aeronautics and Space Administration
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Abstract

The machine-readable version of the catalog, as it is currently being distributed from the Astronomical Data Center, is described. The *Zodiacal Zone Catalog* is a catalog of positions and proper motions for stars in the magnitude range $4 \leq m_v \leq 10$, lying within 16° of the ecliptic and north of declination $-30°$. The catalog contains positions and proper motions, at epoch, for equator and equinox J2000.0, magnitudes and spectral types taken mostly from the *Smithsonian Astrophysical Observatory Star Catalog*, and reference positions and proper motions for equinox and epoch B1950.0.

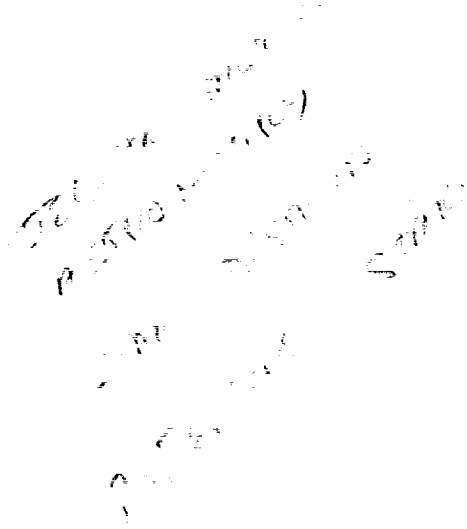

Table of Contents

List of Tables

1.0 Introduction

1.1 Description

The U. S. Naval Observatory Zodiacal Zone Catalog (ZZCAT) provides positions and proper motions at equator and equinox J2000.0, on the FK5 system, for stars in the magnitude range $4 \leq m_v \leq 10$ within 16° of the ecliptic and north of $\delta = -30°$. The catalog is a modern edition of the *Zodiacal Catalog* produced by Robertson (1940) that goes to fainter magnitudes and contains J2000.0 positions and proper motions on the system of the FK5 (Fricke *et al.* 1988). In order that references to earlier catalogs can be made, the ZZCAT also provides positions and proper motions at equinox and epoch B1950.0. However, the B1950.0 positions are referred to the FK4 (Fricke and Kopff 1963) equinox and include E terms, while the proper motions are referred to Newcomb's precession. They were computed from the J2000.0 data using the algorithm given in *The Astronomical Almanac for 1990* (p. B43). Other useful information, such as visual magnitudes and spectral types, is also provided. Stellar identification is strictly by Durchmusterung number (no new numbering system is introduced) and the catalog is ordered by J2000.0 right ascension.

Positions with a mean epoch of about 1980 and internal accuracies of 0".15 were obtained from plates taken with the U. S. Naval Observatory's twin 20-cm astrograph. Positions were also obtained from the remeasurement of Yale plates (*ca.* 1930), which were used to determine proper motions.

The catalog should be useful for Earth-based and space navigation, solar system dynamical studies, occultation predictions, the determination of cometary orbits, and general celestial positional studies.

It is important to understand, however, that the present catalog does not cover the entire zodiacal zone, since stars south of zone −29° could not be observed from the Washington site -- these will be observed from the USNO Black Birch station in New Zealand commencing in 1991.

This documentation describes the machine-readable version of *The U. S. Naval Observatory Zodiacal Zone Catalog* as it is currently being distributed from the international network of astronomical data centers. It is intended to enable users to read and process the data without problems and guesswork, and it should be used only to supplement the information contained in the source reference. The latter should be consulted for more detailed information regarding the motivation for construction of the catalog, the observations, plate measurements, reductions, and a discussion of future work to be done to complete the entire zodiacal zone. **A copy of this document should be transmitted to any recipient of the machine-readable catalog originating directly from the data centers.**

1.2 Source Reference

Douglass, G. G. and Harrington, R. S. 1990, *The U. S. Naval Observatory Zodiacal Zone Catalog*, *Astron. J.*, **100**, 1712.

2.0 Structure

2.1 File Summary

The machine version of *The U. S. Naval Observatory Zodiacal Zone Catalog* consists of a single data file only. Table 1 gives the machine-independent file attributes. All logical records are of fixed length, and, if the catalog is received on magnetic tape, it will contain blocks of fixed length (as noted below) except that the last block of the file may be short.

The U. S. Naval Observatory Zodiacal Zone Catalog (Douglass and Harrington 1990)				
File	Contents	Record Format	Logical Record Length	Total Number of Logical Records
1	Data	FB	96	44435

Table 1. Summary Description of Catalog Files: FB = Fixed length blocks (last may be short)

Note that, while the source reference (Douglass and Harrington 1990) states that ZZCAT contains a total of 44428 stars, the present machine-readable version actually includes 44435 stars. This is because the authors retained seven stars having large proper motions that had been removed from the original version.

The information contained in the above table is sufficient for a user to describe the indigenous characteristics of the machine-readable version of *The U. S. Naval Observatory Zodiacal Zone Catalog* to a computer. Information easily varied from installation to installation, such as block size (physical record length), blocking factor (number of logical records per physical record), total number of blocks, density, number of tracks and character coding (ASCII, EBCDIC) for tapes, is not included, but should always accompany secondary copies if any are supplied to other users or installations.

2.2 *Catalog (File 1 of 1)*

The file contains all data of the machine-readable *Zodiacal Zone Catalog*. The data file is ordered by J2000.0 right ascension.

Table 2 gives a byte-by-byte description of the contents of the data file. A suggested Fortran format specification for reading each data field is included and can be modified depending upon individual programming and processing requirements (Fortran 77 character string-type formats are used throughout). Only the DM identifier and spectral-type fields contain character data, for which default values (latter field only) are always blanks. Note that all numerical data in the catalog are recorded as integers; however, the format specifications given are intended to read the data as real numbers with the correct units as given in the table.

Byte(s)	Units	Suggested Format	Default Value	Data
1-11	---	A11	---	DM number
12-14	mag	F3.1	99.9	Visual magnitude
15-16	hours	I2	---	Right ascension, α, J2000.0
17-18	m	I2	---	α
19-23	s	F5.3	---	α
24-28	s yr^{-1}	F5.4	---	Annual proper motion, μ_α, J2000.0
29-31	°	I3	---	Declination, δ, J2000.0
32-33	′	I2	---	δ
34-37	″	F4.2	---	δ
38-42	″ yr^{-1}	F5.3	---	Annual proper motion, μ_δ, J2000.0
43-44	---	A2	---	Spectral type
45-48	years	F4.2	---	Epoch - 1900.0
49-57	hours	F9.7	---	α (J2000.0)
58-67	°	F10.7	---	δ (J2000.0)
68-76	hours	F9.7	---	Right ascension, α, B1950.0
77-86	°	F10.7	---	Declination, δ, B1950.0
87-91	s yr^{-1}	F5.4	---	Annual proper motion, μ_α, B1950.0
92-96	″ yr^{-1}	F5.3	---	Annual proper motion, μ_δ, B1950.0

Table 2. Data File Record Format

DM number

Identifier from one of the Durchmusterung (DM) catalogs. A catalog identifier occurs in bytes 1-2 and identifies the DM as one of the following:

BD *Bonner Durchmusterung* (Argelander 1859-62, Küstner 1903, Schönfeld 1886)

CD *Córdoba Durchmusterung* (Thome 1892-1932)

The DM zone is in bytes 3-5 and the number in bytes 6-10. Byte 11 is reserved for a lower case DM supplemental identifier.

Visual magnitude

The visual magnitudes are for reference purposes only and taken almost exclusively from the SAO Catalog (SAO Staff 1966).

Equatorial coordinates

Positions for equator and equinox J2000.0, at the epoch reported in the catalog, are given in sexigesimal form and again in hours and degrees. B1950.0 positions are given only in hours and degrees. If the J2000.0 positions in the two forms are compared, the user should convert hours and degrees to sexigesimal, not vice versa, since round-off will produce disagreements if sexigesimal positions are converted to hours and degrees.

Proper motions

Motions are given for J2000.0 and for B1950.0, referred to the FK5 and FK4, respectively.

Spectral type

Spectral types are given for reference purposes only and taken almost exclusively from the SAO Catalog.

Epoch

The value 1900.00 must be added to the catalog epoch to produce the full epoch in years.

3.0 History

3.1 Remarks and Modifications

The machine-readable *Zodiacal Zone Catalog* was received on magnetic tape from Dr. R. S. Harrington of the U. S. Naval Observatory, originally on 2 March 1990. The initial version did not contain B1950.0 positions and proper motions. However, because of their usefulness for reference purposes, for cross identifying stars by position in certain earlier catalogs, and due to the complexity of the transformation from J2000.0 to B1950.0, it was suggested to Dr. Harrington that the B1950.0 data be retained in the present catalog. With the exception of the fact that the catalog does not now contain any stars south of $\delta = -30°$, the retention of B1950.0 data also means that the new catalog can be compared more directly with the earlier *Zodiacal Catalog* (ZC, Robertson 1940). The new catalog will be complete after the more southerly zodiacal stars to be measured from New Zealand are added.

Minor format modifications were made to the catalog at the Astronomical Data Center in order to place signs always to occur in the same bytes of each data field, to add " + " signs to positive declinations and proper motions, and to add DM identifier abbreviations to the Durchmusterung numbers. These changes were made with the approval of the authors.

4.0 Acknowledgments and References

4.1 Acknowledgments

Appreciation is expressed to Dr. R. S. Harrington for supplying *The U. S. Naval Observatory Zodiacal Zone Catalog* on magnetic tape, for adding the B1950.0 data, and for his review of and comments on a draft version of this document. I also wish to thank Dr. Mitsuru Sôma of the National Astronomical Observatory, Tokyo, for pointing out some errors in a previous version of the document.

4.2 References

Argelander, F. W. A. 1859-62, *Bonner Sternverzeichniss*, erste bis dritte Sektion, *Astronomischen Beobachtungen auf der Sternwarte der Königlichen Rhein.*, Friedrich-Wilhelms-Universität zu Bonn, Bände **3-5**.

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Fricke, W., Schwan, H., and Lederle, T. (in collaboration with Bastian, U., Bien, R., Burkhardt, G., du Mont, B., Hering, R., Jährling, R., Jahreiss, H., Röser, S., Schwerdtfeger, H. M., and Walter, H. G.) 1988, *Fifth Fundamental Catalogue* (FK5), Part I. The Basic Fundamental Stars, *Veröff. Astron. Rechen-Institut Heidelberg* No. 32.

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Schönfeld, E. 1886, *Bonner Sternverzeichniss*, vierte Sektion, *Astronomische Beobachtungen auf der Sternwarte der Königlichen Rheinischen Friedrich-Wilhelms-Universität zu Bonn* **8**, Part IV (Bonn: Adolph Marcus).

Thome, J. M. 1892-1932, *Córdoba Durchmusterung, Resultados del Observatorio Nacional Argentino* **16** (1892, Part I: $-22°$ to $-32°$); **17** (1894, Part II: $-32°$ to $-42°$); **18** (1900, Part III: $-42°$ to $-52°$); **21** (Part I) (1914, Part IV, $-52°$ to $-62°$); **21** (Part II) (1932, Part V: $-62°$ to $-90°$).

Appendix A. Sample Listing

The sample listing given on the following pages shows logical records exactly as they are recorded in the machine-readable version of the catalog. Groups of records from the beginning and end of the file are illustrated. The beginning of each record and the bytes within the record are indicated by the column heading index across the top of each page (digits read vertically).

L I S T I N G   O F   R E C O R D S   F R O M   D A T A   F I L E

Data File Name: Zodiacal Zone Cat (1990)

Records 1 to 20

Data File 7

Record Length 96 bytes

Input VOLSER YWK010

```
C O L U M N                                                                                                                      111111111111111
H E A D I N G            111111111122222222223333333333444444444455555555556666666666777777777788888888889999999999000000000011111
I N D E X       12345678901234567890123456789012345678901234567890123456789012345678901234567890123456789012345678901234567890123345

Record      1 BD-06 6337  88 0 0     56+  21- 5293946-   10G57955      156- 549429402395729 15- 57726770+  19-   6
Record      2 BD-00 5077  90 0 0    226+   2+ 1 52046-    7F57929      628+ 10890165239573507+  8106437     0-   3
Record      3 BD-15 6527  94 0 0  1592+  12-14485523+  24K07987     4421-14815343023957701 0-150937404+  10+  28
Record      4 BD-09 6300  92 0 0  6997+  21- 8115573-   10K57955    19437- 81988135239592160- 84772016+  19-   6
Record      5 BD-01 4515  73 0 011545+  41- 0213739-   12K07927    32070-  3603870239604924-  6387633+  40-   8
Record      6 BD+12 5055  85 0 015753+  42+13274134+   6  7955    43758+13461483523961681 4+131831295+  40+  10
Record      7 BD+07 5113  80 0 015853+  43+ 8 02606     0K27957    44037+ 8007240023961701 2+ 77288772+  41+   4
Record      8 BD+12 5056  75 0 017833+  44+13184387+    2F27955    49537+13312185023962 2585+130338306+  42+   6
Record      9 BD-14 6597  90 0 020327-  67-13233567-   40F57987    56463-1339324302396291 40-136716401-  69-  35
Record     10 BD+01 4814  80 0 023550+   4+ 2403174+    2K27958    65418+ 26754840239638311+ 23971119+   2+   6
Record     11 BD-11 6175  80 0 023810-   3-10274494+  28F27966    66138-10462484023963 8865-107408770-   5+  32
Record     12 BD-09 6301  93 0 024323+ 114- 9 53472-   69G57966    67563- 909297832396403 09- 93713692+ 112-  64
Record     13 BD-15 6528  86 0 024501+ 114-14292570+   2G57987    68058-1449047302396407 34-147688721+ 112+   6
Record     14 BD+11 5085  81 0 024751+  36+1216 134+   20K07968    68754+12267039323964 1766+119886828+  34+  24
Record     15 BD+07 5114  90 0 025584-   4+ 830 698-   28  7957    71067+ 85019390239644030+ 82235762-   5-  24
Record     16 BD-00 4601  90 0 027712+  19+ 0121723+   45F87927    76979+  204787323964984 1-   735895+  17+  49
Record     17 BD+05 5246  88 0 028791+  37+ 5551874-   35G57956    79974+ 59218720239652901+ 56435048+  36-  31
Record     18 BD+07 5115  84 0 031838+   7+ 828 735+    4F27969    88438+ 84687087239661388+ 81903456+   6+   8
Record     19 BD-04 6003  83 0 031852+  15- 3182328+    9K27955    88478- 33064675239661303- 35848499+  14+  13
Record     20 BD+00 5080  88 0 034394+   7+ 1 35805+    6K07951    95539+ 10661253239668410+  7877498+   6+  10
```

L I S T I N G   O F   R E C O R D S   F R O M   D A T A   F I L E

```
                    Data File Name:  Zodiacal Zone Cat (1990)
                           Records   44416 to   44435
                         Data File       7
                     Record Length      96 bytes
                      Input VOLSER   YWK010

C O L U M N                                                                                                           111111111111111
H E A D I N G             1111111111222222222233333333334444444444555555555566666666667777777777888888888899999999990000000000111111
I N D E X       123456789012345678901234567890123456789012345678901234567890123456789012345678901234567890123456789012345

Record   44416 BD+07 5110 100235920216-   7+ 831 281-   6K07957239889489+ 85174480239462582+ 82390933-   9-   1
Record   44417 BD+13 5193  91235922929+  22+14105592    0F87988239897024+141822000239470269+139038544+  20+   4
Record   44418 BD-14 6592  90235925313+  46-13184885-   3F07955239903648-133135690239476148-135919595+  45+   1
Record   44419 BD-03 5741  73235931295+  15- 2503798+   7F07955239920264- 28438840239493051- 31222589+  14+  11
Record   44420 BD+06 5228  86235931965-   2+ 747 243-  45K07957239922125+ 77840070239495176+ 75056492-   3-  40
Record   44421 BD-02 6071  72235934844+ 105- 151   51+  31F07947239930121- 18501423239502934- 21285163+ 103+  35
Record   44422 BD+03 4917  89235937216+  22+ 4 94304-   4K07958239936712+ 41619560239509668+ 38835916+  21+   1
Record   44423 BD-06 6335  68235940599+  28- 5533400-  58G57955239946107- 58927780239518831- 61711592+  26-  54
Record   44424 BD+10 5016  82235944857-   6+11213779-  12K07955239957936+113604970239531043+110821431-   8-   8
Record   44425 BD-01 4514  70235946510+   2- 0164796-  31M07927239962529-   2799890239535382-   5583623    0-  27
Record   44426 BD+10 5017  66235947804+   8+11162408-  22A27955239966121+112733560239539219+109950016+   6-  18
Record   44427 BD+05 5244  86235947878-  35+ 6395474- 166K57956239966328+ 66652050239539327+ 63868432-  37- 161
Record   44428 BD+03 4918  90235947979-  24+ 4445709-  26K07947239966607+ 47491907239539565+ 44708256-  26-  22
Record   44429 BD-02 6072  81235949004+  55- 2 64504-  22G57955239969456- 21125105239542271- 23908868+  53-  18
Record   44430 BD+14 5080  88235950718+   2+15465833+   4A 79882399742 18+157828690239547404+155045219     0+   8
Record   44431 BD-02 6073  89235950922+  38- 1115022+  84G07927239974782- 11972830239547616- 14756584+  36+  89
Record   44432 BD+10 5018  73235951297    0+11402538+  12K27955239975824+116737160239548921+113953618-   2+  16
Record   44433 BD+07 5111  87235951501+  15+ 8154999-  19K07957239976392+ 82638855239549418+ 79855258+  13-  14
Record   44434 BD+05 5245  79235954237+  17+ 5572430-  33K07956239983993+ 59567510239556968+ 56783872+  15-  29
Record   44435 BD-13 6500  89235956305-   3-12555950-  17F57955239989736-129331950239562344-132115893-   5-  13
```