Data from the ULYSSES FINAL ARCHIVE

Open ulysses_daily_heliocentric_data_1990-2009.txt
~/PUI-fun/Ulysses/Trajectory/trajectory_data

```
lat: Sun Mean Equator and Equinox of 1950
RA and DEC: Earth Mean Orbit and Equinox of 1950
long: long of Ulysses wrt Earth in Sun Mean Equator and Equinox of 1950

YYYY MM DD YYYY DOY JD        HH MM SS  ESP    SPE    SEP     R      R              dR      V       lat    RA      DEC    long
[UTC]                                   [deg]  [deg]  [deg]   [AU]   [km]           [km/s]  [km/s]  [deg]  [deg]   [deg]  [deg]

1990 10 07 1990 280 2448171.5 00 00 00    0.08  97.86  82.06  0.999  149497071.034  -2.512  41.092   6.35   12.98   0.01    0.08
1990 10 08 1990 281 2448172.5 00 00 00    0.45  98.57  80.97  0.998  149301115.851  -2.035  40.987   6.32   14.34   0.06    0.46
1990 10 09 1990 282 2448173.5 00 00 00    0.83  97.43  81.74  0.997  149145073.980  -1.577  40.996   6.28   15.70   0.10    0.83
1990 10 10 1990 283 2448174.5 00 00 00    1.20  96.17  82.63  0.996  149028578.950  -1.119  41.008   6.24   17.06   0.15    1.21
1990 10 11 1990 284 2448175.5 00 00 00    1.58  94.86  83.56  0.996  148951687.780  -0.661  41.017   6.20   18.42   0.20    1.59
1990 10 12 1990 285 2448176.5 00 00 00    1.96  93.54  84.50  0.995  148914448.678  -0.201  41.020   6.15   19.78   0.24    1.96
1990 10 13 1990 286 2448177.5 00 00 00    2.33  92.21  85.46  0.995  148916887.222   0.258  41.019   6.10   21.14   0.29    2.34
1990 10 14 1990 287 2448178.5 00 00 00    2.71  90.88  86.42  0.996  148958991.852   0.717  41.012   6.05   22.51   0.34    2.72
```

Open helio.dat
~/PUI-fun/Ulysses/Trajectory/trajectory_data

```
Year DOY HR MN SC      Earth      Sun       Sun     Helioc.  Heliograph.    Helioc.    Helioc.      Solar
                       Sun        S/C       Earth   Range    Latitude      Rt. Asc.   Ecliptic     Longitude
                       S/C        Earth     S/C                                      Lat.         wrt Earth

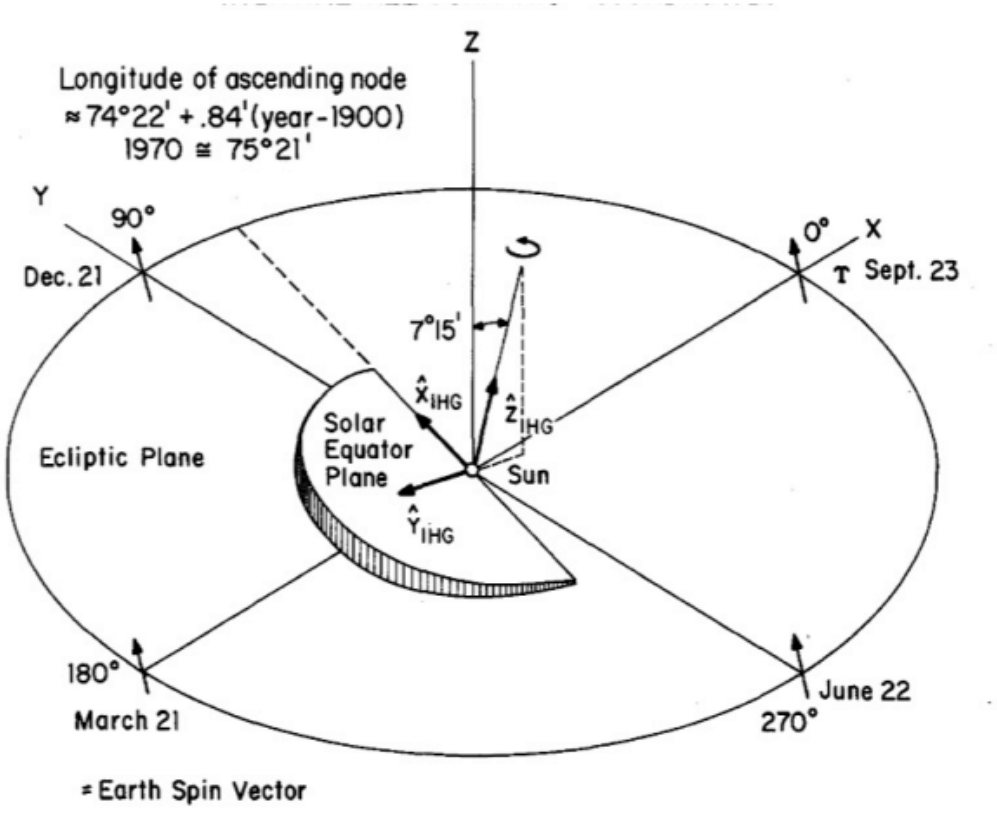
                       [deg]      [deg]     [deg]   [AU]     [deg]         [deg]      [deg]        [deg]

1990 296 00 00 00       5.93      78.96     95.11   1.0100     5.42        -999.       0.75        -999.
1990 297 00 00 00       6.25      77.64     96.11   1.0127     5.34        -999.       0.79        -999.
1990 298 00 00 00       6.58      76.31     97.11   1.0154     5.25        -999.       0.83        -999.
1990 299 00 00 00       6.89      74.99     98.12   1.0187     5.16        -999.       0.87        -999.
1990 300 00 00 00       7.19      73.67     99.14   1.0227     5.07        -999.       0.91        -999.
1990 301 00 00 00       7.48      72.35    100.20   1.0261     4.98        -999.       0.95        -999.
1990 302 00 00 00       7.76      71.03    101.20   1.0301     4.89        -999.       0.99        -999.
1990 303 00 00 00       8.04      69.72    102.20   1.0348     4.79        -999.       1.03        -999.
1990 304 00 00 00       8.30      68.41    103.30   1.0394     4.69        -999.       1.07        -999.
1990 305 00 00 00       8.54      67.10    104.40   1.0441     4.60        -999.       1.10        -999.
1990 306 00 00 00       8.78      65.79    105.40   1.0488     4.50        -999.       1.14        -999.
1990 307 00 00 00       9.01      64.49    106.50   1.0542     4.40        -999.       1.17        -999.
1990 308 00 00 00       9.22      63.19    107.59   1.0593     4.29         155.19     1.20         9.240
1990 309 00 00 00       9.42      61.90    108.69   1.0648     4.19         156.38     1.24         9.440
1990 310 00 00 00       9.60      60.60    109.79   1.0706     4.09         157.57     1.27         9.620
```

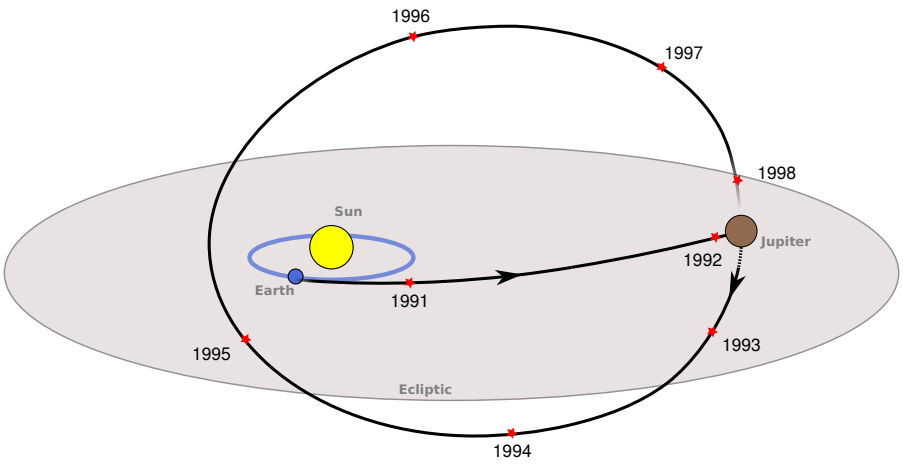
Coordinate Systems

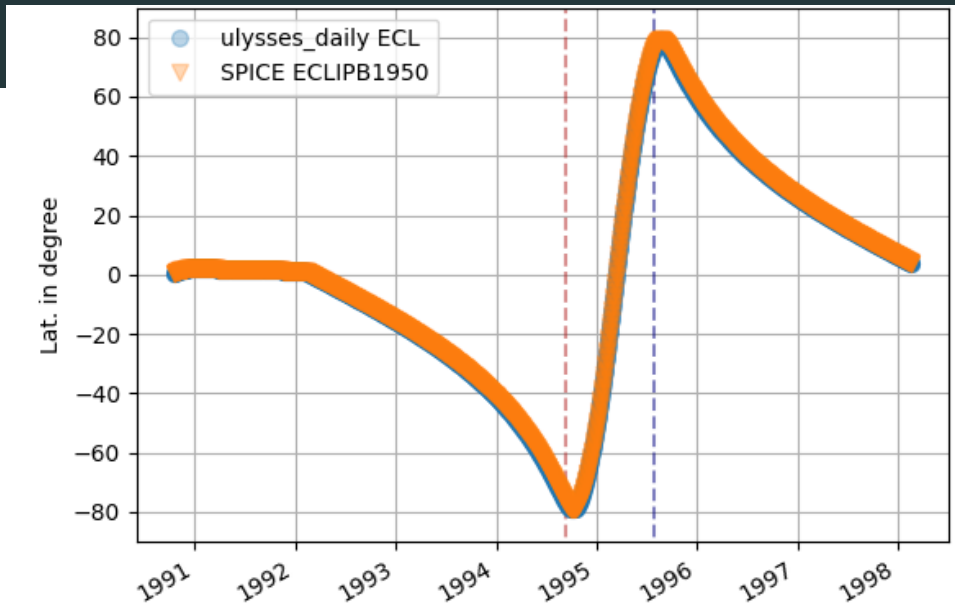
There seem to be two options for coordinate systems:

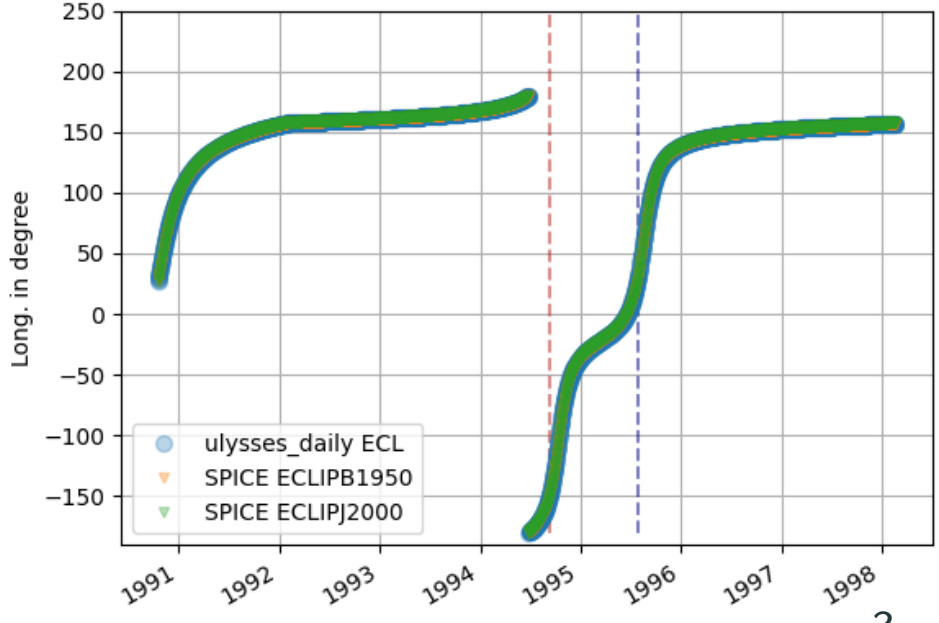
- ***Heliocentric Inertial*** (HCI) system
- ***Heliocentric Aries Ecliptic*** (HAE) system



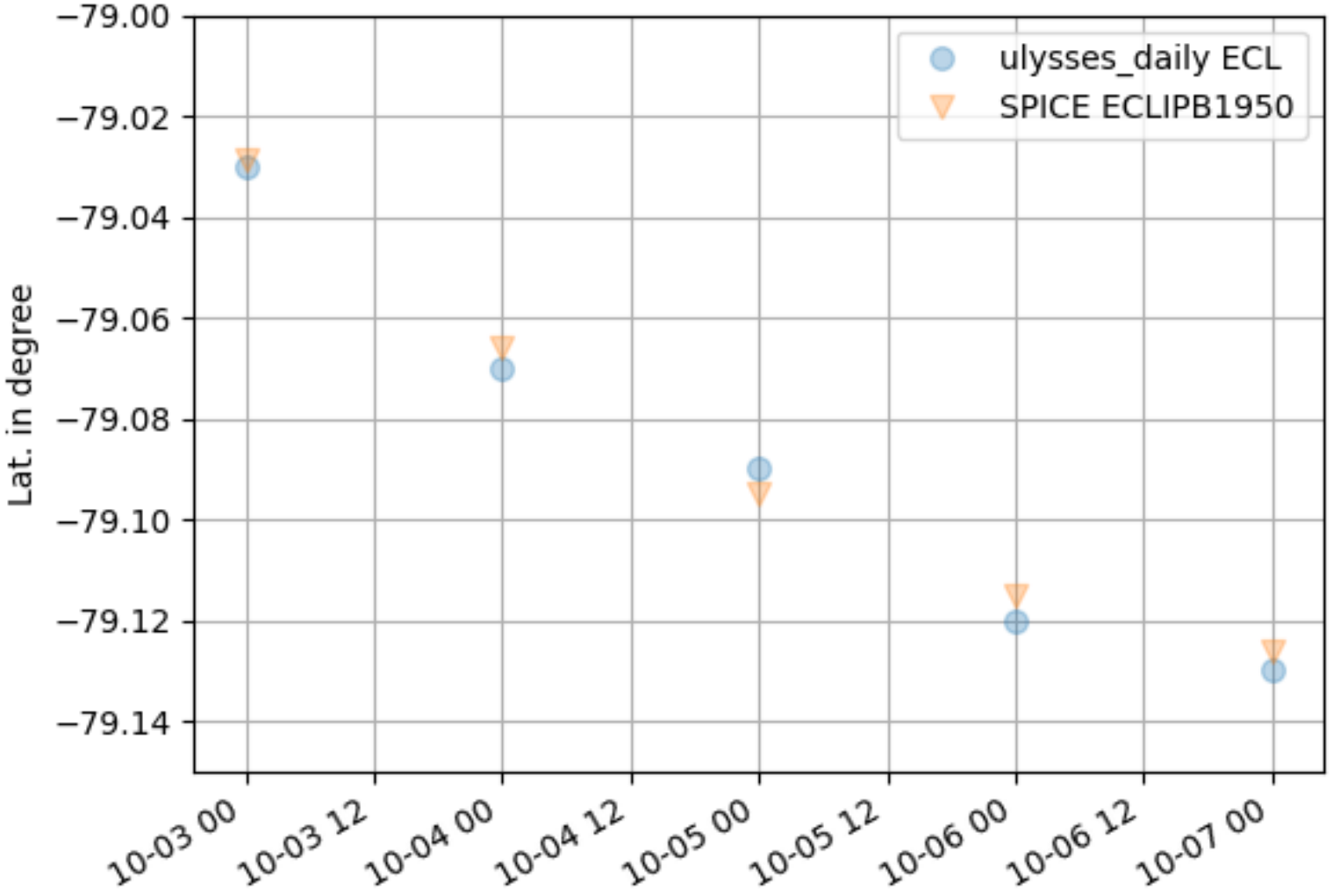
Ulysses' 1st Orbit







Ecliptic System – Latitude



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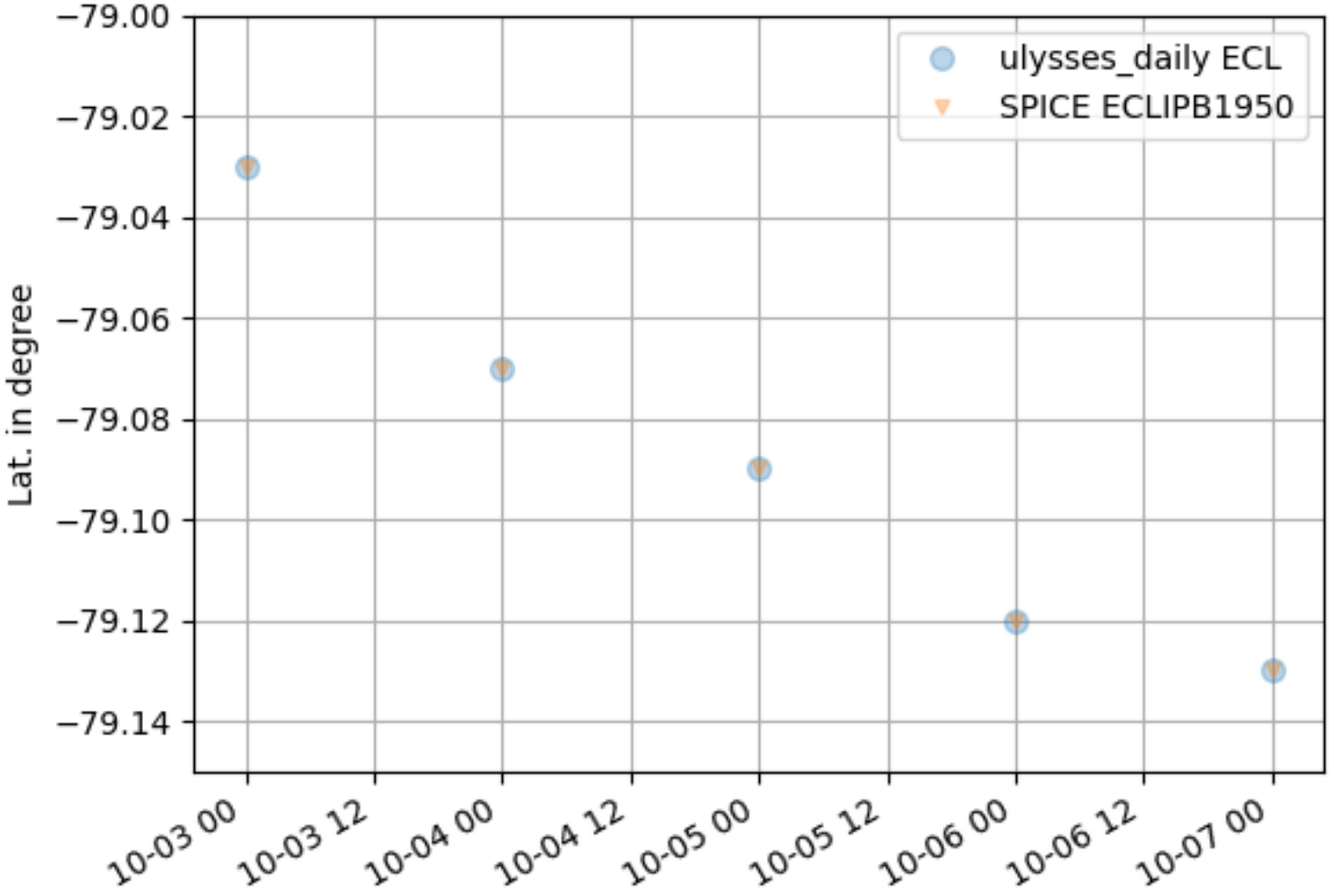

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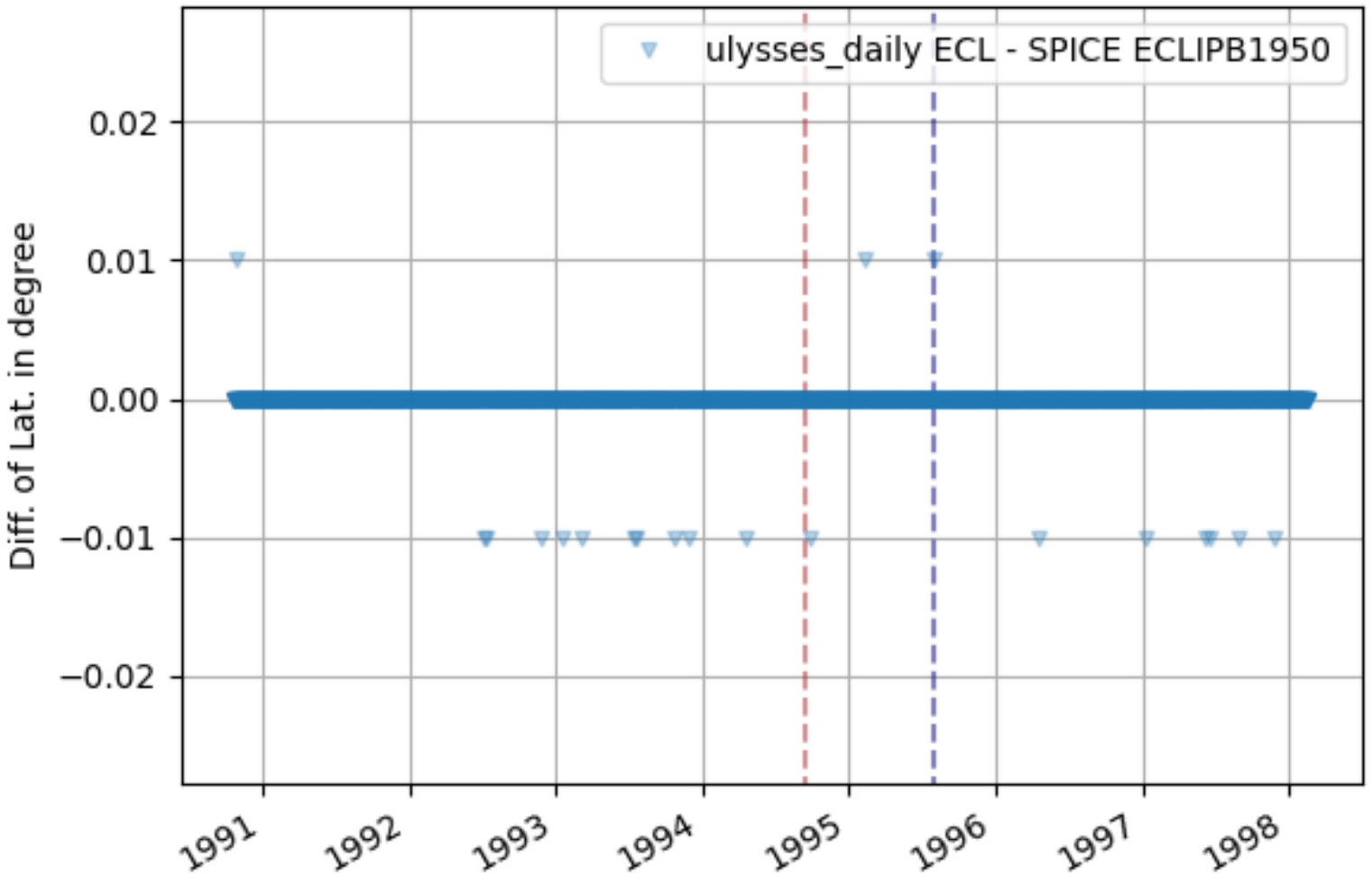
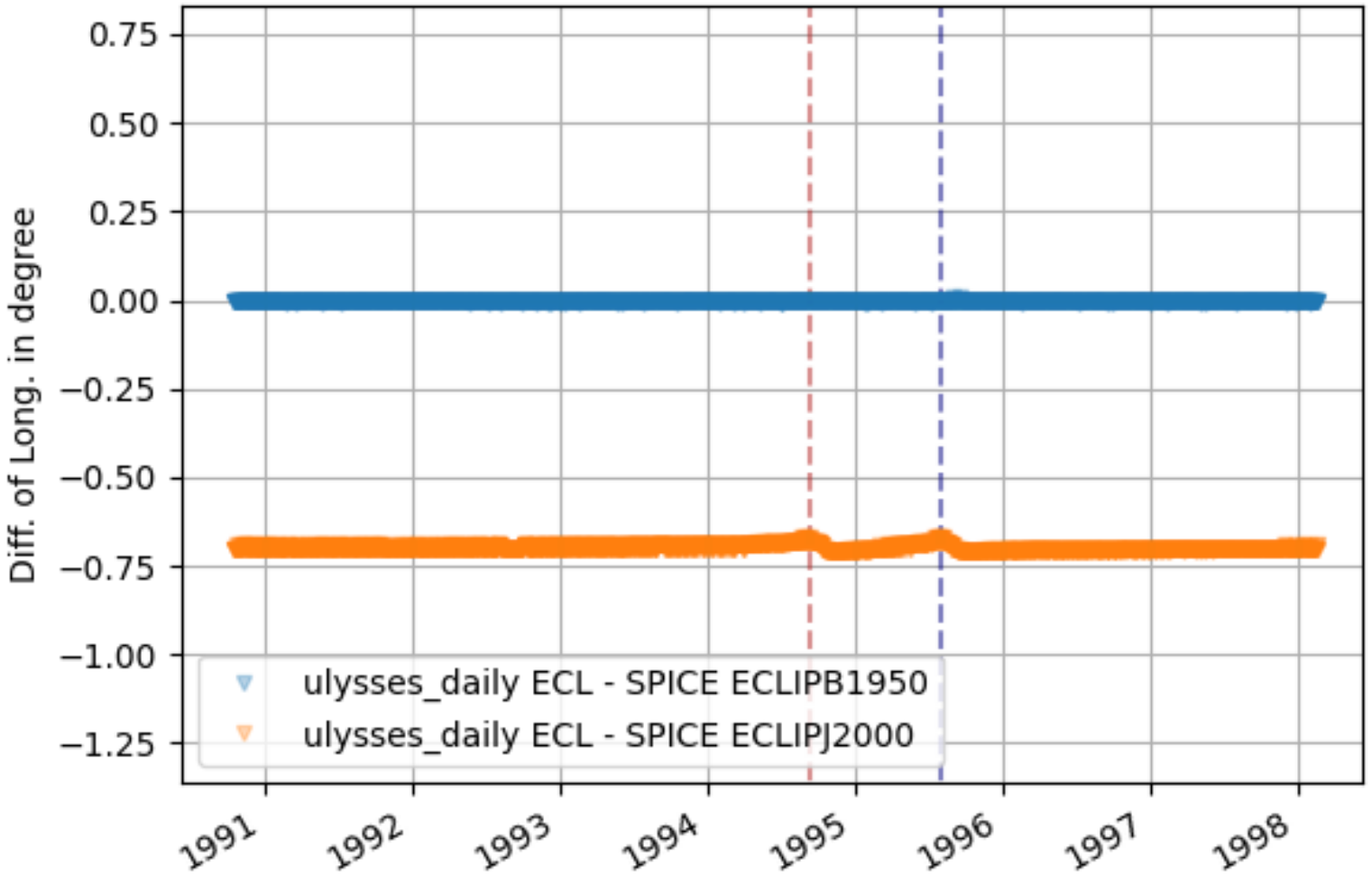
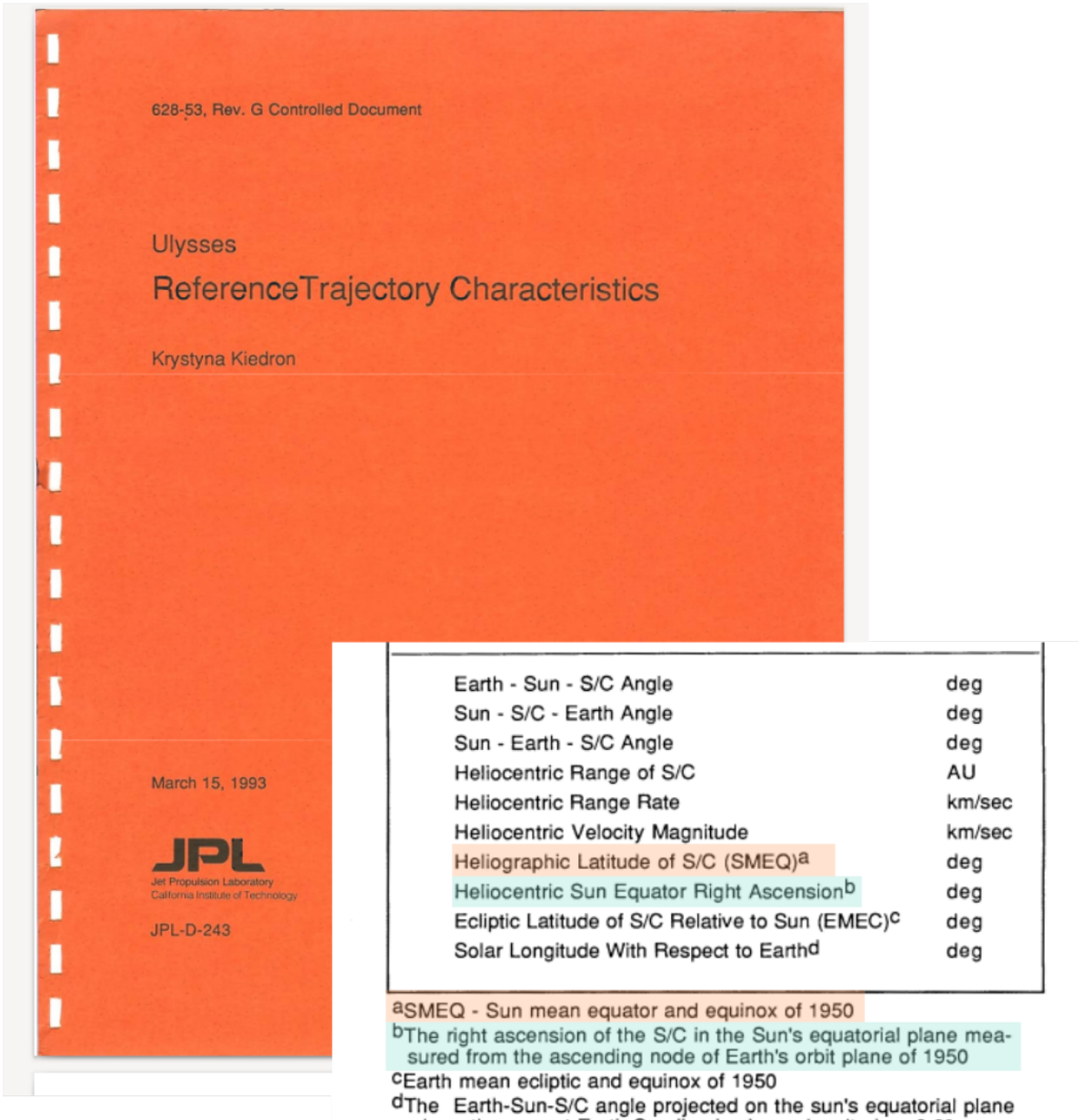


Ecliptic System – Longitude



Equatorial System



628-53, Rev. G Controlled Document

Ulysses

ReferenceTrajectory Characteristics

Krystyna Kiedron

March 15, 1993

JPL

Jet Propulsion Laboratory
California Institute of Technology

JPL-D-243

Earth - Sun - S/C Angle	deg
Sun - S/C - Earth Angle	deg
Sun - Earth - S/C Angle	deg
Heliocentric Range of S/C	AU
Heliocentric Range Rate	km/sec
Heliocentric Velocity Magnitude	km/sec
Heliographic Latitude of S/C (SMEQ)[a]	deg
Heliocentric Sun Equator Right Ascension[b]	deg
Ecliptic Latitude of S/C Relative to Sun (EMEC)[c]	deg
Solar Longitude With Respect to Earth[d]	deg

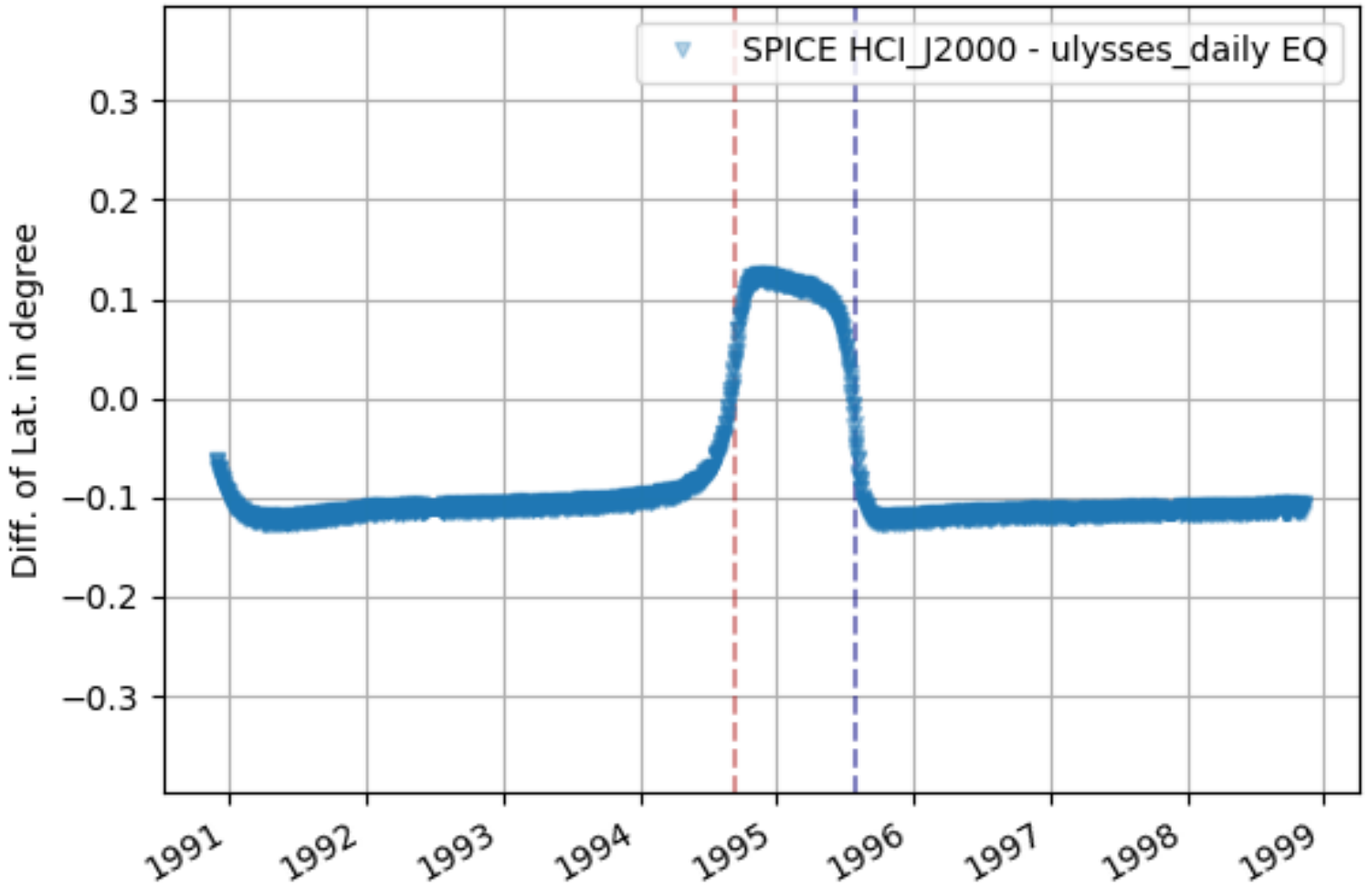
[a]SMEQ - Sun mean equator and equinox of 1950

[b]The right ascension of the S/C in the Sun's equatorial plane measured from the ascending node of Earth's orbit plane of 1950

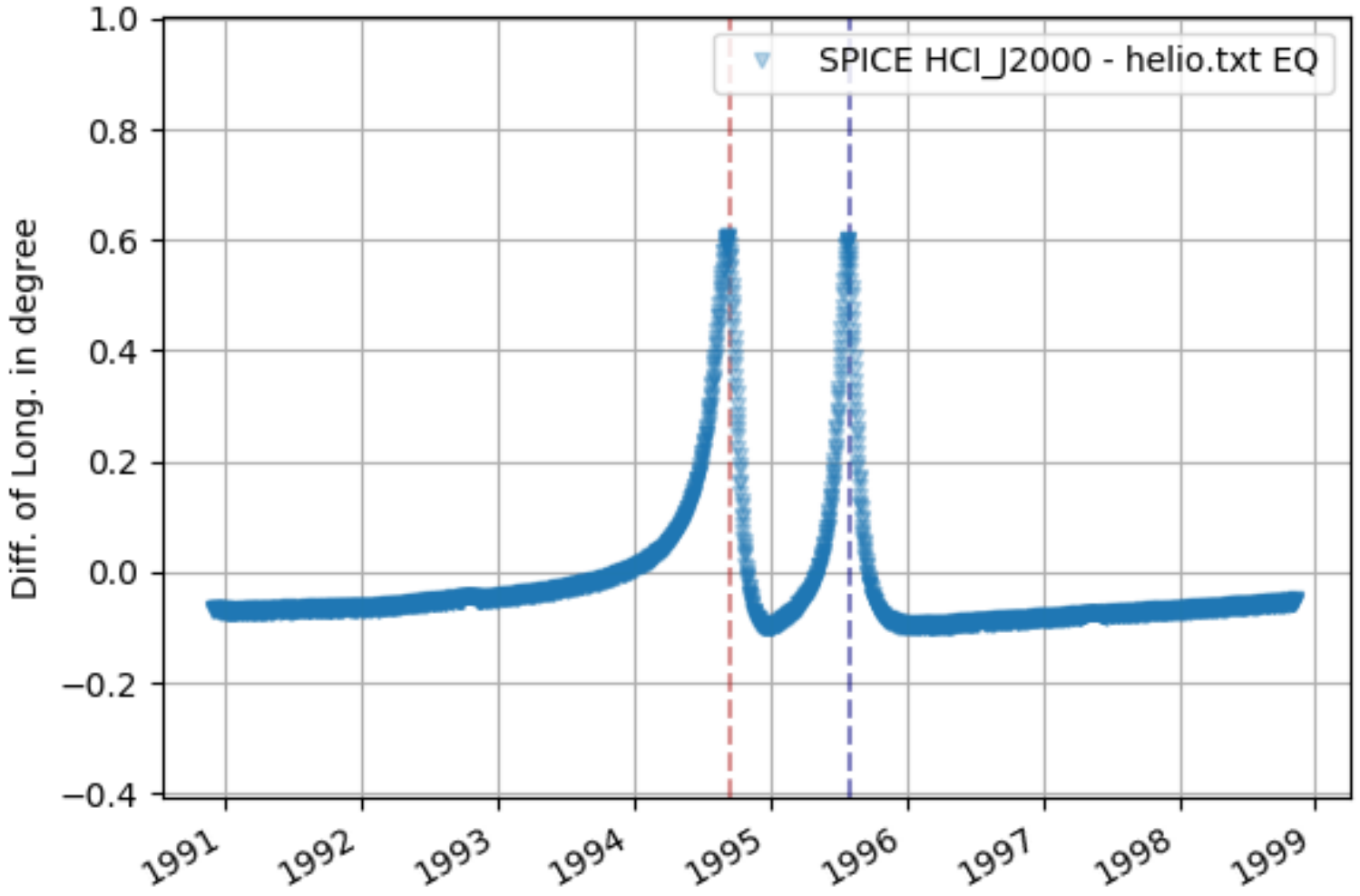
[c]Earth mean ecliptic and equinox of 1950

[d]The Earth-Sun-S/C angle projected on the sun's equatorial plane where the current Earth-Sun line is always longitude = 0.0°

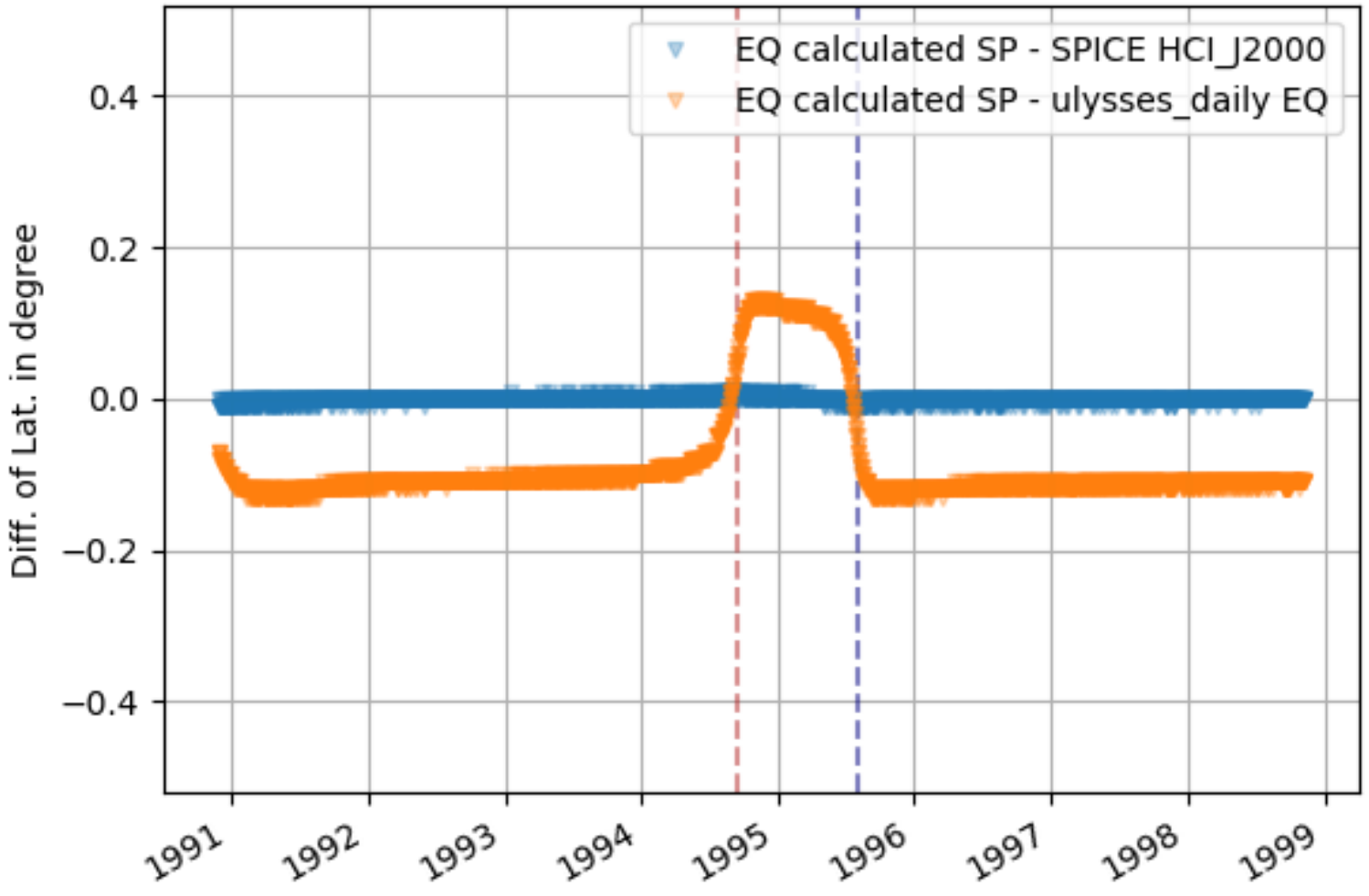
Equatorial System – Latitude



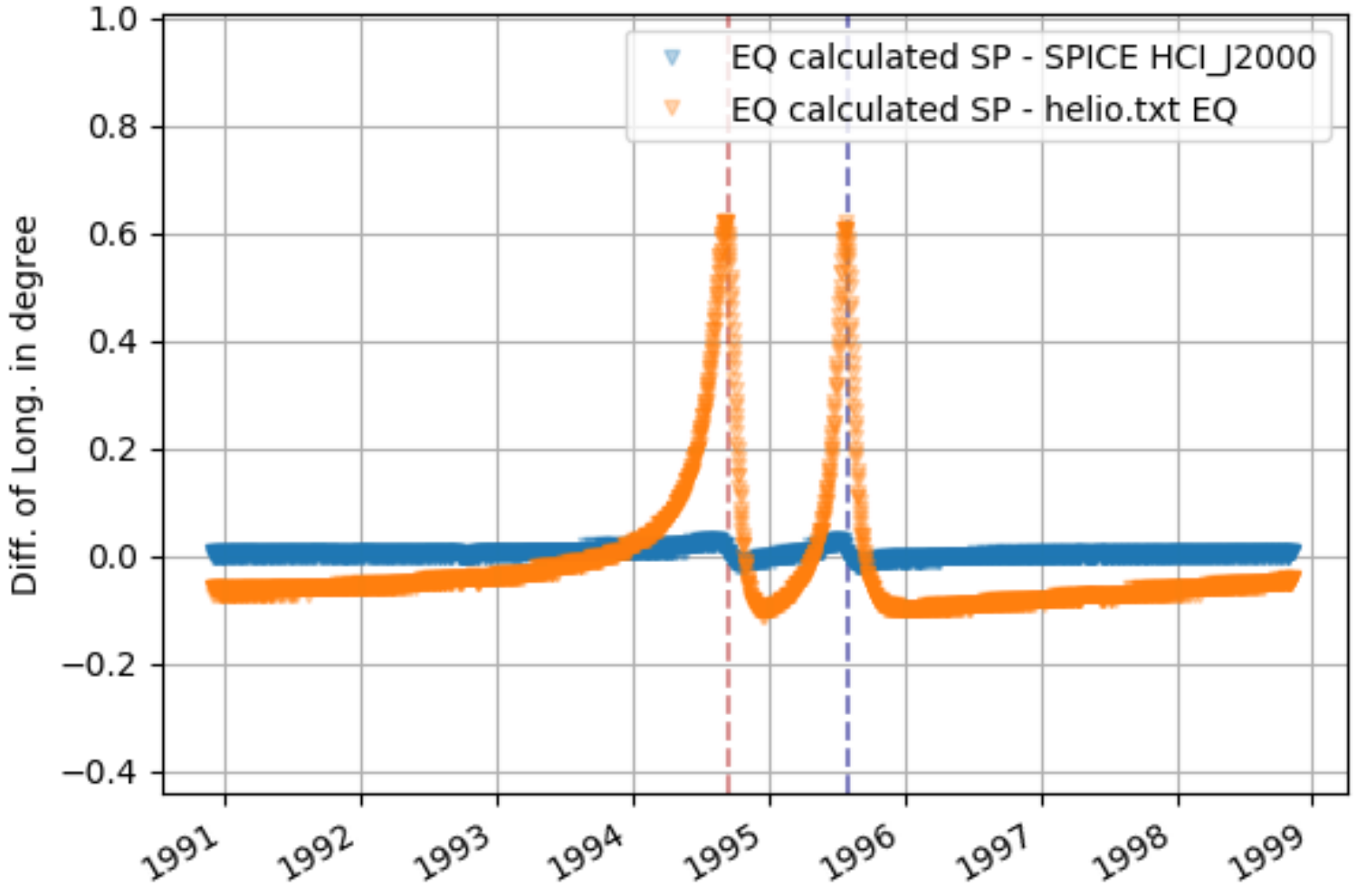
Equatorial System – Longitude



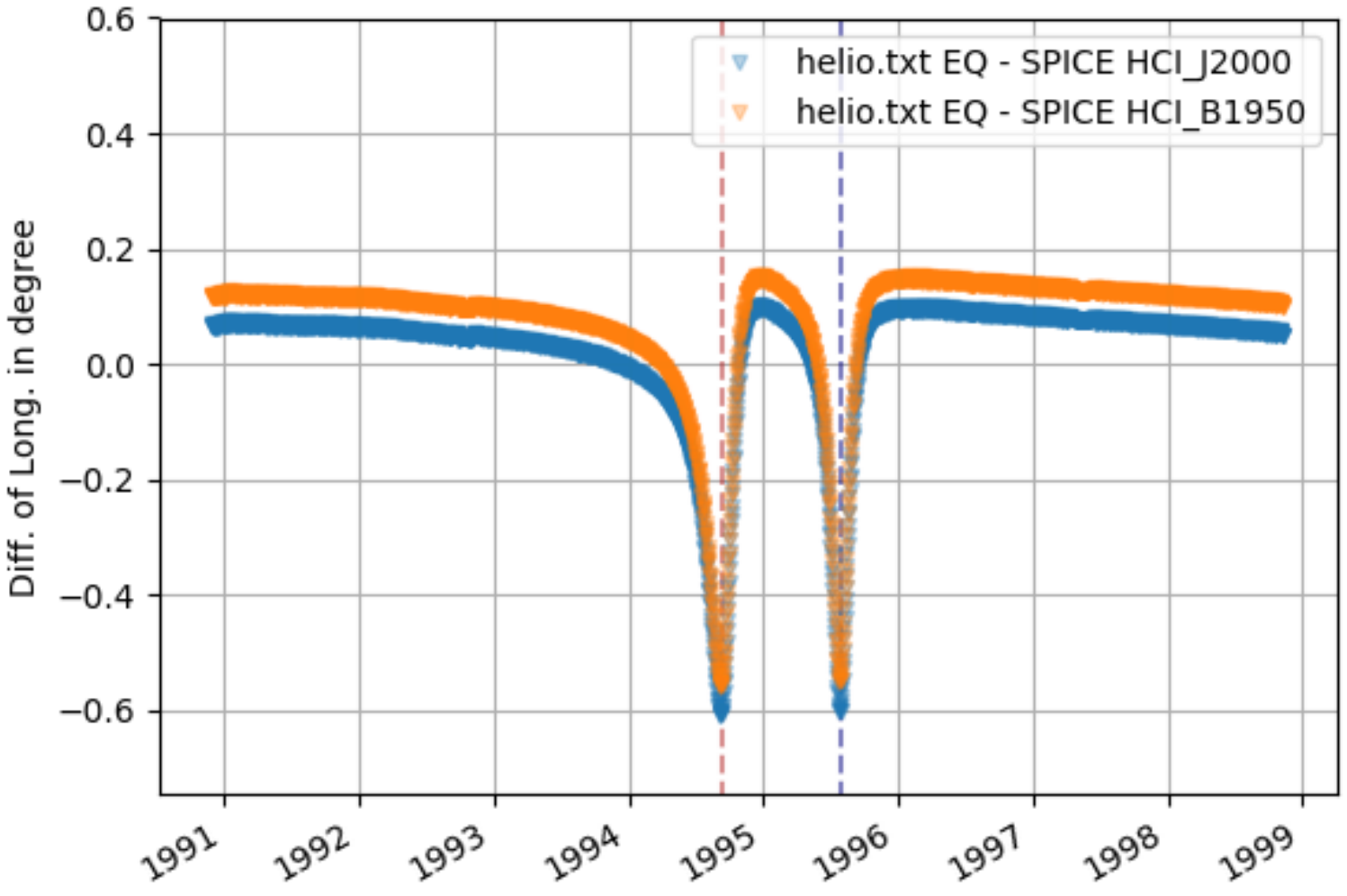
Equatorial System – Latitude calculated



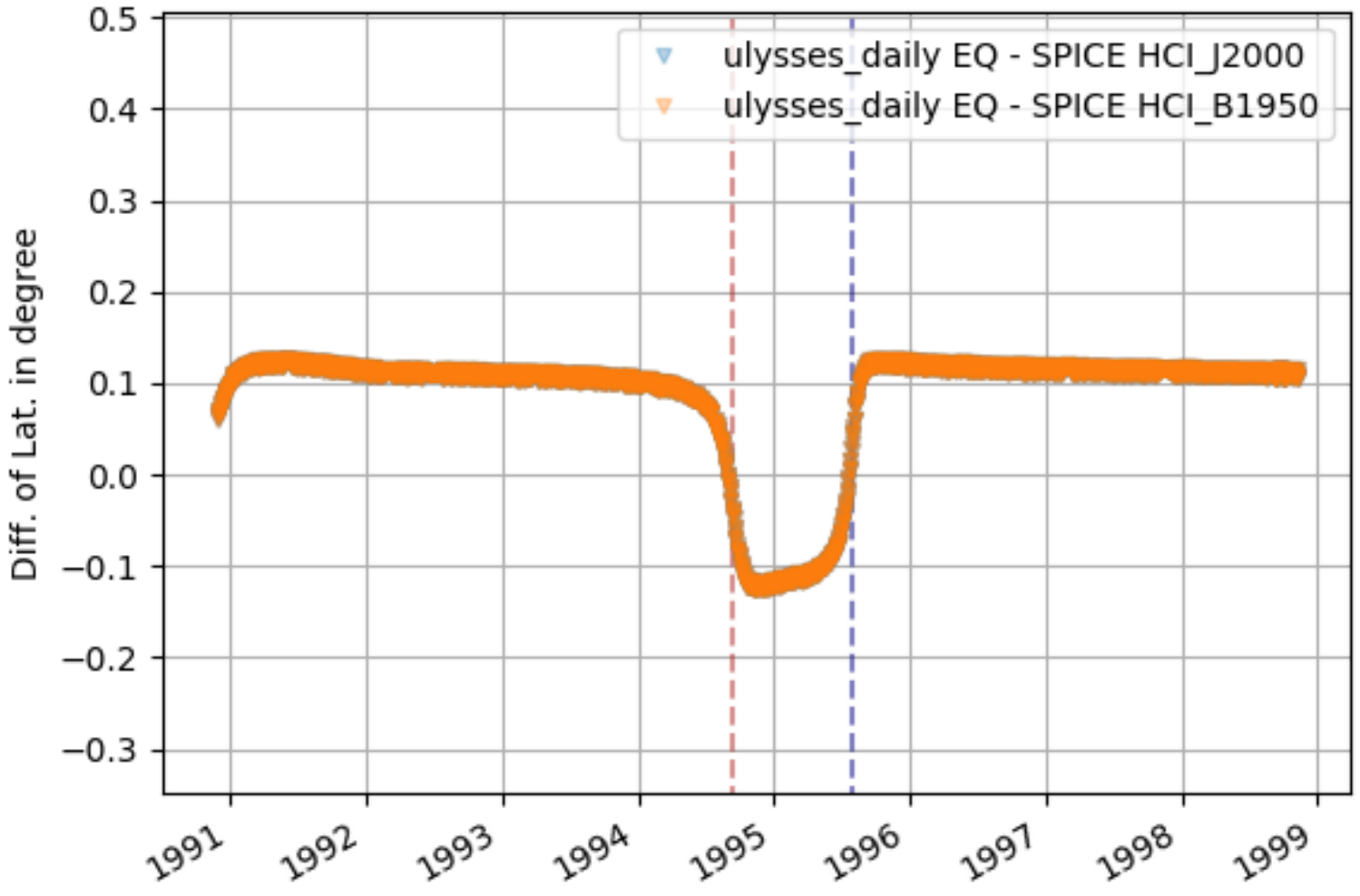
Equatorial System – Longitude calculated



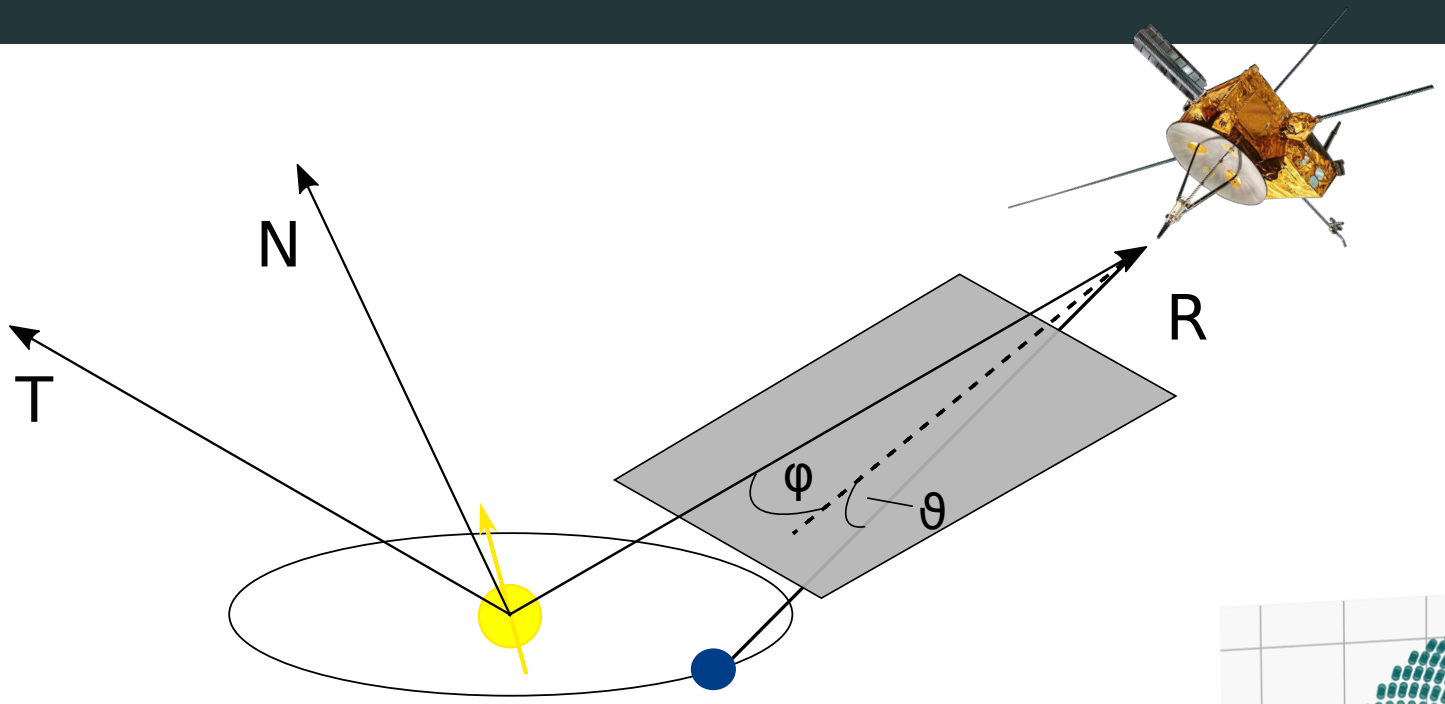
Equatorial System – Longitude – B1950 vs. J2000

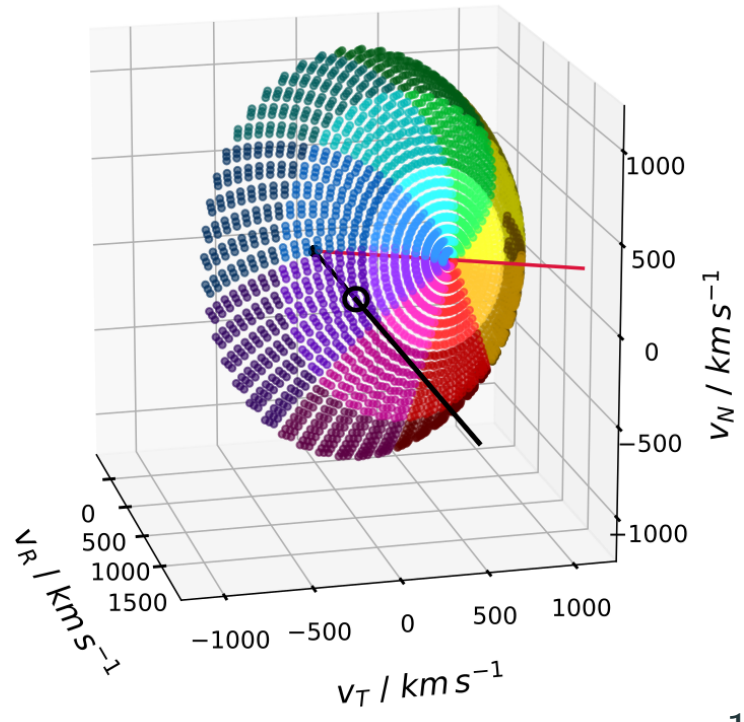


Equatorial System – Latitude – B1950 vs. J2000



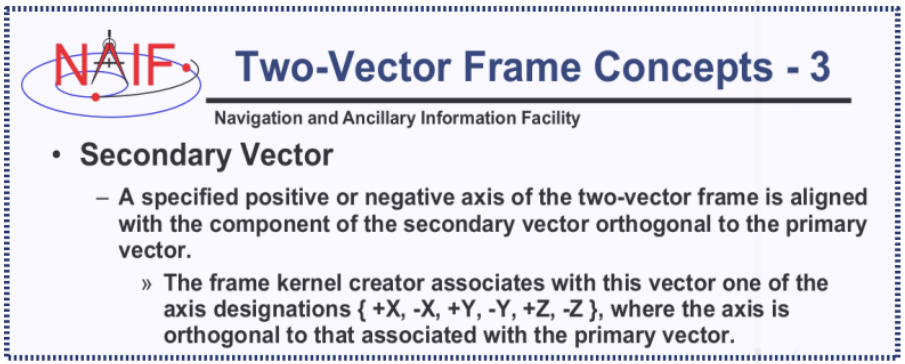
Aspect Angle






asptheta B1950
asptheta J2000
Aspect Latitude / deg.
25
0
−25
B1950 - J2000
0.5
0.0
−0.5
aspphi B1950
aspphi J2000
Aspect Latitude / deg.
25
0
−25
B1950 - J2000
1
0
−1
1990
1992
1994
1996
1998
2000
2002
2004
2006
2008
2010

SPICE Reference Frame Kernel




```
Heliocentric Inertial (HCI) Frame

     Definition of the Heliocentric Inertial frame:

          All vectors are geometric: no aberration corrections are
          used.

          The solar rotation axis is the primary vector: the Z axis points
          in the solar north direction (IAU_SUN frozen at J2000 epoch).

          The ascending node on the ecliptic of J2000 of the IAU_SUN
          equator forms the X axis.  *** N.B this is accomplished by
          using the +Z axis of the ecliptic of J2000 as the secondary
          vector and HCI +Y as the secondary axis

          The Y axis is Z cross X, completing the right-handed
          reference frame.

\begindata

        FRAME_HCI                    =  1810420
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        FRAME_1810420_CLASS          =  5
        FRAME_1810420_CLASS_ID       =  1810420
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