NAME

Sunrise - When does the sun rise and set for a given place?

DESCRIPTION

Given a position in longitude and latitude and date, send a **simple request** and find out when the sun and the moon rise and set. The elevation angle of the sun at solar noon is also given. You can either specify a given date using the date parameter or you can ask for a range, using the parameters from and to (which both are inclusive). Note that the algorithm estimates the timezone based on longitude, and events around midnight can therefore mistakenly be reported or omitted.

Direct requests can also be sent to the underlying astronomical event library. This option is only recommended for advanced users.

The times are all in UTC. Coordinates are given with east and north as positive values.

SCHEMA

Schema is available as **http://api.met.no/weatherapi/sunrise**/1.0/schema

USAGE

A **simple request** to retrieve processed Sun/Moon rise/set information has the following parameters:

- **lat** (latitude), in decimal degrees, mandatory
- **lon** (longtitude), in decimal degrees, mandatory
- **date**, given as YYYY-MM-DD
- **from**, given as YYYY-MM-DD
- **to**, given as YYYY-MM-DD

The from-to-query is limited to max 30 days per request.

A **direct request** to the underlying astronomical event library has the following parameters:

- **eventStart**, start time given as YYYY-MM-DDTHH:MI:SSZ
- **eventSearch**, event search code; -1:previous, +1:next, 0: both, +2:until eventStop
- **eventStop**, stop time must only be present if **eventSearch**=+2.
- **eventId**, requested event id (*SEE TABLE BELOW*)
- **eventVal<N>**, input data array, <N> is the array index (*SEE TABLE BELOW*).

Several direct requests can be put into a single URL by assigning a sequence number (from 1 to 9) immediately after "event" in the parameter name, for instance “event3Val1”. In this case, no sequence number indicates the default values (“default request” is not processed).

EXAMPLES

Sunrise data for a day (simple request):
http://api.met.no/weatherapi/sunrise/1.0/?lat=71.0;lon=-69.58;date=2008-06-23

```
<astrodata xsi:noNamespaceSchemaLocation="http://api.met.no/weatherapi/sunrise/1.0/schema">
  <meta licenseurl="http://api.met.no/license_data.html"/>
  <time date="2008-06-23">
    <location latitude="71.0" longitude="-69.58">
      <sun never_set="true">
        <noon altitude="42.413"/>
      </sun>
      <moon phase="Third quarter" rise="2008-06-23T05:13:29Z" set="2008-06-23T11:42:19Z"
                                  rise_next="2008-06-24T04:36:09Z"/>
    </location>
```

```
  </time>
</astrodata>
```

Sunrise data for a period (simple request):
***http://api.met.no/weatherapi/sunrise/1.0/**?lat=60;lon=0;from=2009-04-01;to=2009-04-02*

```
<astrodata xsi:noNamespaceSchemaLocation="http://api.met.no/weatherapi/sunrise/1.0/schema">
  <meta licenseurl="http://api.met.no/license_data.html"/>
  <time date="2009-04-01">
    <location latitude="60" longitude="0">
      <sun rise="2009-04-01T05:25:11Z" set="2009-04-01T18:44:00Z">
        <noon altitude="34.703"/>
      </sun>
      <moon phase="First quarter" rise="2009-04-01T06:54:59Z" set="2009-04-01T02:46:28Z"/>
    </location>
  </time>
  <time date="2009-04-02">
    <location latitude="60" longitude="0">
      <sun rise="2009-04-02T05:22:10Z" set="2009-04-02T18:46:26Z">
        <noon altitude="35.087"/>
      </sun>
      <moon phase="First quarter" rise="2009-04-02T08:17:59Z" set="2009-04-02T03:32:15Z"/>
    </location>
  </time>
</astrodata>
```

Day with several moon set during midnight sun (simple request):
http://api.met.no/weatherapi/sunrise/1.0/?lat=70;lon=19;date=2011-06-07

```
<astrodata xsi:noNamespaceSchemaLocation="http://api.met.no/weatherapi/sunrise/1.0/schema">
  <meta licenseurl="http://api.met.no/license_data.html"/>
  <time date="2011-06-07">
    <location latitude="70" longitude="19">
      <sun never_set="true">
        <noon altitude="42.737"/>
      </sun>
      <moon phase="First quarter" rise="2011-06-07T07:29:57Z" set="2011-06-06T23:11:45Z" set_next="2011-06-07T22:56:17Z"/>
    </location>
  </time>
</astrodata>
```

Previous and next sun and moon set and rise at 60N 0E (direct request):
http://api.met.no/weatherapi/sunrise/1.0/?eventStart=2008-06-23T23:00:00Z;
eventSearch=0;event1Id=600;event2Id=610;event3Id=800;event4Id=810;
eventVal1=60.0;eventVal2=0.0;eventVal3=0.0

```
<astrodata xsi:noNamespaceSchemaLocation="http://api.met.no/weatherapi/sunrise/1.0/schema">
<meta licenseurl="http://api.met.no/license_data.html"/>
  <Event Seq="1" Id="600" Start="2008-06-23T23:00:00Z" Search="0" Val1="60.0" Val2="0.0" Val3="0.0" reports="2">
    <Report no="1" time="2008-06-23T02:36:33Z" repId="600" hint="2008/06/23 02:36:33 LOCAL DIURNAL SUN RISE"/>
    <Report no="2" time="2008-06-24T02:36:59Z" repId="600" hint="2008/06/24 02:36:59 LOCAL DIURNAL SUN RISE"/>
  </Event>
  <Event Seq="2" Id="610" Start="2008-06-23T23:00:00Z" Search="0" Val1="60.0" Val2="0.0" Val3="0.0" reports="2">
    <Report no="1" time="2008-06-23T21:27:50Z" repId="610" hint="2008/06/23 21:27:50 LOCAL DIURNAL SUN SET"/>
    <Report no="2" time="2008-06-24T21:27:44Z" repId="610" hint="2008/06/24 21:27:44 LOCAL DIURNAL SUN SET"/>
  </Event>
  <Event Seq="3" Id="800" Start="2008-06-23T23:00:00Z" Search="0" Val1="60.0" Val2="0.0" Val3="0.0" reports="2">
    <Report no="1" time="2008-06-22T23:12:51Z" repId="800" hint="2008/06/22 23:12:51 LOCAL DIURNAL MOON RISE"/>
    <Report no="2" time="2008-06-23T23:14:17Z" repId="800" hint="2008/06/23 23:14:17 LOCAL DIURNAL MOON RISE"/>
  </Event>
  <Event Seq="4" Id="810" Start="2008-06-23T23:00:00Z" Search="0" Val1="60.0" Val2="0.0" Val3="0.0" reports="2">
    <Report no="1" time="2008-06-23T08:00:29Z" repId="810" hint="2008/06/23 08:00:29 LOCAL DIURNAL MOON SET"/>
    <Report no="2" time="2008-06-24T09:30:12Z" repId="810" hint="2008/06/24 09:30:12 LOCAL DIURNAL MOON SET"/>
  </Event>
</astrodata>
```

All midnightsun start and stop for two years at 69.7N 30.1E (direct request):
http://api.met.no/weatherapi/sunrise/1.0/?eventStart=2008-06-23T23:00:00Z;
eventSearch=2;eventStop=2010-06-23T23:00:00Z;
event1Id=900;event2Id=910;event3Id=920;
eventVal1=69.7;eventVal2=30.1;eventVal3=0.0

```
<astrodata xsi:noNamespaceSchemaLocation="http://api.met.no/weatherapi/sunrise/1.0/schema">
<meta licenseurl="http://api.met.no/license_data.html"/>
  <Event Seq="1" Id="900" Start="2008-06-23T23:00:00Z" Search="2" Stop="2010-06-23T23:00:00Z" Val1="69.7" Val2="30.1" Val3="0.0" reports="4">
    <Report no="1" time="2009-05-17T17:56:09Z" repId="900" hint="2009/05/17 17:56:09 LOCAL POLAR SUN DAY START"/>
    <Report no="2" time="2010-05-17T23:44:32Z" repId="900" hint="2010/05/17 23:44:32 LOCAL POLAR SUN DAY START"/>
    <Report no="3" time="2009-05-16T22:27:52Z" repId="901" hint="2009/05/16 22:27:52 LOCAL POLAR SUN DAY START (PREVIOUS SUN RISE)"/>
    <Report no="4" time="2010-05-17T22:05:15Z" repId="901" hint="2010/05/17 22:05:15 LOCAL POLAR SUN DAY START (PREVIOUS SUN RISE)"/>
  </Event>
  <Event Seq="2" Id="910" Start="2008-06-23T23:00:00Z" Search="2" Stop="2010-06-23T23:00:00Z" Val1="69.7" Val2="30.1" Val3="0.0" reports="4">
    <Report no="1" time="2008-07-25T15:25:12Z" repId="910" hint="2008/07/25 15:25:12 LOCAL POLAR SUN DAY STOP"/>
    <Report no="2" time="2009-07-25T20:57:31Z" repId="910" hint="2009/07/25 20:57:31 LOCAL POLAR SUN DAY STOP"/>
    <Report no="3" time="2008-07-25T21:47:59Z" repId="911" hint="2008/07/25 21:47:59 LOCAL POLAR SUN DAY STOP (NEXT SUN SET)"/>
```

```
    <Report no="4" time="2009-07-26T21:30:24Z" repId="911" hint="2009/07/26 21:30:24 LOCAL POLAR SUN DAY STOP (NEXT SUN SET)"/>
  </Event>
  <Event Seq="3" Id="920" Start="2008-06-23T23:00:00Z" Search="2" Stop="2010-06-23T23:00:00Z" Val1="69.7" Val2="30.1" Val3="0.0" reports="4">
    <Report no="1" time="2008-11-26T20:58:52Z" repId="920" hint="2008/11/26 20:58:52 LOCAL POLAR SUN NIGHT START"/>
    <Report no="2" time="2009-11-27T02:48:32Z" repId="920" hint="2009/11/27 02:48:32 LOCAL POLAR SUN NIGHT START"/>
    <Report no="3" time="2008-11-26T10:08:41Z" repId="921" hint="2008/11/26 10:08:41 LOCAL POLAR SUN NIGHT START (PREVIOUS SUN SET)"/>
    <Report no="4" time="2009-11-26T10:13:48Z" repId="921" hint="2009/11/26 10:13:48 LOCAL POLAR SUN NIGHT START (PREVIOUS SUN SET)"/>
  </Event>
¡/astrodata¿
```


Next solar eclipse at 60N 0E (direct request):
http://api.met.no/weatherapi/sunrise/1.0/?eventStart=2008-06-23T23:00:00Z;
eventSearch=1;eventId=990;eventVal1=60.0;eventVal2=0.0;eventVal3=0.0


```
<astrodata xsi:noNamespaceSchemaLocation="http://api.met.no/weatherapi/sunrise/1.0/schema">
  <meta licenseurl="http://api.met.no/license_data.html"/>
  <Event Seq="Unique" Id="990" Start="2008-06-23T23:00:00Z"  Search="1" Val1="60.0" Val2="0.0" Val3="0.0" reports="3">
    <Report no="1" time="2008-08-01T08:25:43Z" repId="990" hint="2008/08/01 08:25:43 SOLAR ECLIPSE PARTIAL STARTS"/>
    <Report no="2" time="2008-08-01T09:23:50Z" repId="992" repVal="36.0268592907543"  hint="2008/08/01 09:23:50 SOLAR ECLIPSE MAX OCCULTATION=36.0%"/>
    <Report no="3" time="2008-08-01T10:21:28Z" repId="994" hint="2008/08/01 10:21:28 SOLAR ECLIPSE PARTIAL STOPS"/>
  </Event>
</astrodata>
```


Changelog

version 2.0: 2012-01-11
- Added direct request to astronomical event library.
- Uses JPL ephemerides DE405.
- Output now agrees well with "Almanakk for Norge".

version 1.0: 2012-01-11
- Maximum 30 days are accepted in from-to search

version 1.0: 2009-06-02
- Better use of algorithm, should give more accurate data
- New parameters from and to, returning all events in the range
- Either date or from and to is now compulsory
- Version 0.9 will expire 2009-06-24

version 0.9: 2008-09-10
- Algorithm for the computation is updated. Should be more accurate.
- Version 0.8 will expire 2008-10-01

version 0.8: 2008-06-24
- New product, not in accordance with the Norwegian almanac.

ASTRONOMICAL EVENT IDENTIFICATION TABLE FOR "direct requests"

eventId = 100 'REPORT LOCAL INITIAL MOON STATE'
- i eventVal1 = latitude of observer (deg)
- i eventVal2 = longtitude of observer (deg)
- i eventVal3 = height of observer (deg)
- o repId = 100 -> if (repval >= 1) "moon is above horison"
  (repval <=-1) "moon is below"
- o repId = 101 -> if (repval >= 1) "lunar polar day"
  (repval =0) "no lunar polar effect"
  (repval<=-1) "lunar polar night"
- o repId = 102 -> moon phase

eventid = 105 : 'REPORT LOCAL VISIBLE MOON IN PERIOD'
- i eventVal1 = latitude of observer (deg)
- i eventVal2 = longtitude of observer (deg)
- i eventVal3 = height of observer (deg)
- o repId = 105 -> repVal = hours visible moon in period
- o repId = 106 -> Moon rise
- o repId = 107 -> Moon set

eventId = 110 : 'REPORT LOCAL TC EF MOON POSITION AT TIME INCREMENT'
- i eventVal1 = latitude of observer (deg)
- i eventVal2 = longtitude of observer (deg)
- i eventVal3 = height of observer (deg)
- i eventVal4 = time increment (days)
- o repId = 110 -> repval = moon elevation (deg)
- o repId = 111 -> repval = moon azimuth (deg)
- o repId = 112 -> repval = moon range (km)

eventId = 120 : 'REPORT LOCAL INITIAL SUN STATE'
- i eventVal1 = latitude of observer (deg)
- i eventVal2 = longtitude of observer (deg)
- i eventVal3 = height of observer (deg)
- o repId = 120 -> if (repval >= 1) "sun is above horison"
  (repval <=-1) "sun is below"
- o repId = 121 -> if (repval >= 1) "polar day"
  (repval =0) "no polar effect"
  (repval<=-1) "polar night"

eventid = 125 : 'REPORT LOCAL VISIBLE SUN IN PERIOD'
- i eventVal1 = latitude of observer (deg)
- i eventVal2 = longtitude of observer (deg)
- i eventVal3 = height of observer (deg)
- o repId = 125 -> repVal = hours visible sun in period
- o repId = 126 -> Sun rise
- o repId = 127 -> Sun set

eventId = 130 : 'REPORT LOCAL TC EF SUN POSITION AT TIME INCREMENT'
- i eventVal1 = latitude of observer (deg)
- i eventVal2 = longtitude of observer (deg)
- i eventVal3 = height of observer (deg)
- i eventVal4 = time increment (days)
- o repId = 130 -> repval = sun elevation (deg)
- o repId = 131 -> repval = sun azimuth (deg)
- o repId = 132 -> repval = sun range (km)

eventId = 150 : 'DETECT WINTER SOLSTICE'

o repId = 150 -> event found
eventId = 160 : 'DETECT VERNAL EQUINOX'
o repId = 160 -> event found
eventId = 170 : 'DETECT SUMMER SOLSTICE'
o repId = 170 -> event found
eventId = 180 : 'DETECT AUTUMNAL EQUINOX'
o repId = 180 -> event found
eventId = 190 : 'DETECT EARTH IN PERIHELION'
o repId = 190 -> repval = sun range (km)
eventId = 200 : 'DETECT EARTH IN APHELION'
o repId = 200 -> repval = sun range (km)
eventId = 210 : 'DETECT NEW MOON (PHASE=0/100)'
o repId = 210 -> event found
eventId = 220 : 'DETECT FIRST QUARTER MOON (PHASE=25)'
o repId = 220 -> event found
eventId = 230 : 'DETECT FULL MOON (PHASE=50)'
o repId = 230 -> event found
eventId = 240 : 'DETECT LAST QUARTER MOON (PHASE=75)'
o repId = 240 -> event found
eventId = 250 : 'DETECT MOON PHASE (0 TO 100)'
i eventVal1 = target moon phase
o repId = 250 -> event found
eventId = 260 : 'DETECT MOON ILLUMINATION MINIMUM'
o repId = 260 -> event found
eventId = 270 : 'DETECT MOON ILLUMINATION MAXIMUM'
o repId = 270 -> event found
eventId = 280 : 'DETECT MOON ILLUMINATION (0 TO 100)'
i eventVal1 = target moon illumination
o repId = 280 -> event found
eventId = 300 : 'DETECT MERCURY INFERIOR CONJUNCTION'
o repId = 300 -> event found
eventId = 310 : 'DETECT MERCURY SUPERIOR CONJUNCTION'
o repId = 310 -> event found
eventId = 320 : 'DETECT MERCURY GREATEST WESTERN ELONGATION'
o repId = 320 -> event found
eventId = 330 : 'DETECT MERCURY GREATEST EASTERN ELONGATION'
o repId = 330 -> event found
eventId = 340 : 'DETECT VENUS INFERIOR CONJUNCTION'
o repId = 340 -> event found
eventId = 350 : 'DETECT VENUS GREATEST WESTERN ELONGATION'
o repId = 350 -> event found
eventId = 360 : 'DETECT VENUS SUPERIOR CONJUNCTION'
o repId = 360 -> event found
eventId = 370 : 'DETECT VENUS GREATEST EASTERN ELONGATION'
o repId = 370 -> event found
eventId = 380 : 'DETECT MARS CONJUNCTION'
o repId = 380 -> event found
eventId = 390 : 'DETECT MARS WESTERN QUADRATURE'
o repId = 390 -> event found
eventId = 400 : 'DETECT MARS OPPOSITION'
o repId = 400 -> event found
eventId = 410 : 'DETECT MARS EASTERN QUADRATURE'

o repId = 410 -> event found
eventId = 420 : 'DETECT JUPITER CONJUNCTION'
o repId = 420 -> event found
eventId = 430 : 'DETECT JUPITER WESTERN QUADRATURE'
o repId = 430 -> event found
eventId = 440 : 'DETECT JUPITER OPPOSITION'
o repId = 440 -> event found
eventId = 450 : 'DETECT JUPITER EASTERN QUADRATURE'
o repId = 450 -> event found
eventId = 460 : 'DETECT SATURN CONJUNCTION'
o repId = 460 -> event found
eventId = 470 : 'DETECT SATURN WESTERN QUADRATURE'
o repId = 470 -> event found
eventId = 480 : 'DETECT SATURN OPPOSITION'
o repId = 480 -> event found
eventId = 490 : 'DETECT SATURN EASTERN QUADRATURE'
o repId = 490 -> event found
eventId = 500 : 'DETECT MERCURY TRANSIT (ANYWHERE ON EARTH)'
o repId = 500 -> transit starts
o repId = 501 -> transit ends
eventId = 520 : 'DETECT VENUS TRANSIT (ANYWHERE ON EARTH)'
o repId = 520 -> transit starts
o repId = 521 -> transit ends
eventId = 550 : 'DETECT LUNAR ECLIPSE (MINOCC MAXOCC)'
i eventVal1 = minimum occultation (0 to 100)
i eventVal2 = maximum occultation (0 to 100)
o repId = 550 -> penumbra contact starts (P1)
o repId = 551 -> umbra contact starts (U1)
o repId = 552 -> total eclipse starts (U2)
o repId = 553 -> repval = maximum occultation
o repId = 554 -> total eclipse stops (U3)
o repId = 555 -> umbra contact stops (U4)
o repId = 556 -> penumbra contact stops (P2)
eventId = 560 : 'DETECT LUNAR ECLIPSE -LUNECL[0]'
o repId = 560 -> penumbra contact starts (P1)
o repId = 561 -> umbra contact starts (U1)
o repId = 562 -> total eclipse starts (U2)
o repId = 563 -> repval = maximum occultation
o repId = 564 -> total eclipse stops (U3)
o repId = 565 -> umbra contact stops (U4)
o repId = 566 -> penumbra contact stops (P2)
eventId = 600 : 'DETECT LOCAL DIURNAL SUN RISE'
i eventVal1 = latitude of observer (deg)
i eventVal2 = longtitude of observer (deg)
i eventVal3 = height of observer (deg)
o repId = 600 -> event found
eventId = 610 : 'DETECT LOCAL DIURNAL SUN SET'
i eventVal1 = latitude of observer (deg)
i eventVal2 = longtitude of observer (deg)
i eventVal3 = height of observer (deg)
o repId = 610 -> event found
eventId = 620 : 'DETECT LOCAL DIURNAL MAXIMUM SOLAR ELEVATION'

i eventVal1 = latitude of observer (deg)
i eventVal2 = longtitude of observer (deg)
i eventVal3 = height of observer (deg)
o repId = 620 -> repval = maximum solar elevation (deg)

eventId = 630 : 'DETECT LOCAL DIURNAL MINIMUM SOLAR ELEVATION'

i eventVal1 = latitude of observer (deg)
i eventVal2 = longtitude of observer (deg)
i eventVal3 = height of observer (deg)
o repId = 630 -> repval = minimum solar elevation (deg)

eventId = 640 : 'DETECT LOCAL DIURNAL CIVIL TWILIGHT START'

i eventVal1 = latitude of observer (deg)
i eventVal2 = longtitude of observer (deg)
i eventVal3 = height of observer (deg)
o repId = 640 -> event found

eventId = 650 : 'DETECT LOCAL DIURNAL CIVIL TWILIGHT STOP'

i eventVal1 = latitude of observer (deg)
i eventVal2 = longtitude of observer (deg)
i eventVal3 = height of observer (deg)
o repId = 650 -> event found

eventId = 660 : 'DETECT LOCAL DIURNAL NAUTICAL TWILIGHT START'

i eventVal1 = latitude of observer (deg)
i eventVal2 = longtitude of observer (deg)
i eventVal3 = height of observer (deg)
o repId = 660 -> event found

eventId = 670 : 'DETECT LOCAL DIURNAL NAUTICAL TWILIGHT STOP'

i eventVal1 = latitude of observer (deg)
i eventVal2 = longtitude of observer (deg)
i eventVal3 = height of observer (deg)
o repId = 670 -> event found

eventId = 680 : 'DETECT LOCAL DIURNAL ASTRONOMICAL TWILIGHT START'

i eventVal1 = latitude of observer (deg)
i eventVal2 = longtitude of observer (deg)
i eventVal3 = height of observer (deg)
o repId = 680 -> event found

eventId = 690 : 'DETECT LOCAL DIURNAL ASTRONOMICAL TWILIGHT STOP'

i eventVal1 = latitude of observer (deg)
i eventVal2 = longtitude of observer (deg)
i eventVal3 = height of observer (deg)
o repId = 690 -> event found

eventId = 700 : 'DETECT LOCAL DIURNAL NIGHT START'

i eventVal1 = latitude of observer (deg)
i eventVal2 = longtitude of observer (deg)
i eventVal3 = height of observer (deg)
o repId = 700 -> event found

eventId = 710 : 'DETECT LOCAL DIURNAL NIGHT STOP'

i eventVal1 = latitude of observer (deg)
i eventVal2 = longtitude of observer (deg)
i eventVal3 = height of observer (deg)
o repId = 710 -> event found

eventId = 750 : 'DETECT LOCAL DIURNAL SUN AZIMUTH (0=NORTH, 90=EAST)'

i eventVal1 = latitude of observer (deg)
i eventVal2 = longtitude of observer (deg)

i eventVal3 = height of observer (deg)
i eventVal4 = sun azimuth (deg)
o repId = 750 -> event found

eventId = 760 : 'DETECT LOCAL DIURNAL APPARENT SOLAR TIME'
i eventVal1 = latitude of observer (deg)
i eventVal2 = longtitude of observer (deg)
i eventVal3 = height of observer (deg)
i eventVal4 = apparent solar time (0 to 24)
o repId = 760 -> event found

eventId = 770 : 'DETECT LOCAL DIURNAL APPARENT LUNAR TIME'
i eventVal1 = latitude of observer (deg)
i eventVal2 = longtitude of observer (deg)
i eventVal3 = height of observer (deg)
i eventVal4 = apparent lunar time (0 to 24)
o repId = 770 -> event found

eventId = 800 : 'DETECT LOCAL DIURNAL MOON RISE'
i eventVal1 = latitude of observer (deg)
i eventVal2 = longtitude of observer (deg)
i eventVal3 = height of observer (deg)
o repId = 800 -> event found

eventId = 810 : 'DETECT LOCAL DIURNAL MOON SET'
i eventVal1 = latitude of observer (deg)
i eventVal2 = longtitude of observer (deg)
i eventVal3 = height of observer (deg)
o repId = 810 -> event found

eventId = 820 : 'DETECT LOCAL DIURNAL MAXIMUM MOON ELEVATION'
i eventVal1 = latitude of observer (deg)
i eventVal2 = longtitude of observer (deg)
i eventVal3 = height of observer (deg)
o repId = 820 -> repVal = maximum moon elevation

eventId = 830 : 'DETECT LOCAL DIURNAL MINIMUM MOON ELEVATION'
i eventVal1 = latitude of observer (deg)
i eventVal2 = longtitude of observer (deg)
i eventVal3 = height of observer (deg)
o repId = 830 -> repVal = minimum moon elevation

eventId = 840 : 'DETECT LOCAL DIURNAL MOON AZIMUTH (0=NORTH, 90=EAST)'
i eventVal1 = latitude of observer (deg)
i eventVal2 = longtitude of observer (deg)
i eventVal3 = height of observer (deg)
i eventVal4 = moon azimuth (deg)
o repId = 840 -> event found

eventId = 900 : 'DETECT LOCAL POLAR SUN DAY START'
i eventVal1 = latitude of observer (deg)
i eventVal2 = longtitude of observer (deg)
i eventVal3 = height of observer (deg)
o repId = 900 -> event found
o repId = 901 -> previous sun rise

eventId = 910 : 'DETECT LOCAL POLAR SUN DAY STOP'
i eventVal1 = latitude of observer (deg)
i eventVal2 = longtitude of observer (deg)
i eventVal3 = height of observer (deg)
o repId = 910 -> event found

o repId = 911 -> next sun set

eventId = 920 : 'DETECT LOCAL POLAR SUN NIGHT START'

i eventVal1 = latitude of observer (deg)
i eventVal2 = longtitude of observer (deg)
i eventVal3 = height of observer (deg)
o repId = 920 -> event found
o repId = 921 -> previous sun set

eventId = 930 : 'DETECT LOCAL POLAR SUN NIGHT STOP'

i eventVal1 = latitude of observer (deg)
i eventVal2 = longtitude of observer (deg)
i eventVal3 = height of observer (deg)
o repId = 930 -> event found
o repId = 931 -> next sun rise

eventId = 940 : 'DETECT LOCAL POLAR LUNAR DAY START'

i eventVal1 = latitude of observer (deg)
i eventVal2 = longtitude of observer (deg)
i eventVal3 = height of observer (deg)
o repId = 940 -> event found
o repId = 941 -> previous moon rise

eventId = 950 : 'DETECT LOCAL POLAR LUNAR DAY STOP'

i eventVal1 = latitude of observer (deg)
i eventVal2 = longtitude of observer (deg)
i eventVal3 = height of observer (deg)
o repId = 950 -> event found
o repId = 951 -> next moon set

eventId = 960 : 'DETECT LOCAL POLAR LUNAR NIGHT START'

i eventVal1 = latitude of observer (deg)
i eventVal2 = longtitude of observer (deg)
i eventVal3 = height of observer (deg)
o repId = 960 -> event found
o repId = 961 -> previous moon set

eventId = 970 : 'DETECT LOCAL POLAR LUNAR NIGHT STOP'

i eventVal1 = latitude of observer (deg)
i eventVal2 = longtitude of observer (deg)
i eventVal3 = height of observer (deg)
o repId = 970 -> event found
o repId = 971 -> next moon rise

eventId = 980 : 'DETECT LOCAL SOLAR ECLIPSE (MINOCC MAXOCC)'

i eventVal1 = latitude of observer (deg)
i eventVal2 = longtitude of observer (deg)
i eventVal3 = height of observer (deg)
i eventVal4 = minimum occultation (0 to 100)
i eventVal5 = maximum occultation (0 to 100)
o repId = 980 -> partial solar eclipse starts
o repId = 981 -> total solar eclipse starts
o repId = 982 -> repVal = maximum occultation
o repId = 983 -> total solar eclipse stops
o repId = 984 -> partial solar eclipse stops

eventId = 990 : 'DETECT LOCAL SOLAR ECLIPSE'

i eventVal1 = latitude of observer (deg)
i eventVal2 = longtitude of observer (deg)
i eventVal3 = height of observer (deg)

o repId = 990 -> partial solar eclipse starts
o repId = 991 -> total solar eclipse starts
o repId = 992 -> repVal = maximum occultation
o repId = 993 -> total solar eclipse stops
o repId = 994 -> partial solar eclipse stops

eventId = 1000 : 'REPORT LOCAL TC EF SOLAR SYSTEM POSITIONS AT TIME INCREMENT'

i eventVal1 = latitude of observer (deg)
i eventVal2 = longtitude of observer (deg)
i eventVal3 = height of observer (deg)
i eventVal4 = time increment (days)
o repId = 1000 -> repval = sun elevation (deg)
o repId = 1001 -> repval = sun azimuth (deg)
o repId = 1002 -> repval = sun range (km)
o repId = 1010 -> repval = mercury elevation (deg)
o repId = 1011 -> repval = mercury azimuth (deg)
o repId = 1012 -> repval = mercury range (km)
o repId = 1020 -> repval = venus elevation (deg)
o repId = 1021 -> repval = venus azimuth (deg)
o repId = 1022 -> repval = venus range (km)
o repId = 1030 -> repval = moon elevation (deg)
o repId = 1031 -> repval = moon azimuth (deg)
o repId = 1032 -> repval = moon range (km)
o repId = 1040 -> repval = mars elevation (deg)
o repId = 1041 -> repval = mars azimuth (deg)
o repId = 1042 -> repval = mars range (km)
o repId = 1050 -> repval = jupiter elevation (deg)
o repId = 1051 -> repval = jupiter azimuth (deg)
o repId = 1052 -> repval = jupiter range (km)
o repId = 1060 -> repval = saturn elevation (deg)
o repId = 1061 -> repval = saturn azimuth (deg)
o repId = 1062 -> repval = saturn range (km)
o repId = 1070 -> repval = uranus elevation (deg)
o repId = 1071 -> repval = uranus azimuth (deg)
o repId = 1072 -> repval = uranus range (km)
o repId = 1080 -> repval = neptun elevation (deg)
o repId = 1081 -> repval = neptun azimuth (deg)
o repId = 1082 -> repval = neptun range (km)
o repId = 1090 -> repval = pluto elevation (deg)
o repId = 1091 -> repval = pluto azimuth (deg)
o repId = 1092 -> repval = pluto range (km)