The Grayzone CD-ROM
A tool to successful DXing on the low bands

By Marcel H. De Canck, ON5AU

We may begin with a quotation from the book **"Low-Band Dxing,"** published by the ARRL and written by author: John Devoldere, **ON4UN**. I know John very well; he is a close friend of mine since 1960, and we have had many talks about low band DXing and antennas for nearly a half-century.

"The most important tool is still sunrise/sunset information. Today all computer-logging programs include a SR/SS calculator. But I still use the SR/SS tables in a booklet form. Its still faster than a computer program if you want to look up information for a certain date or for a certain period of time."

"Why? You grab the tables any time and look up the required information in seconds. Just keep the little booklet within reach on your operating desk. The tables never get outdated, since sunrise/sunset times hardly change over the years"

John published more than a decade ago his booklet showing sunrise and sunset times over 500 different locations in the world (including 100 different locations in the USA) in tabular form. The increments were given per half month, (date1 and date 16). This small booklet was sold worldwide among the low-band DXers community and I believe there are only a few left.

With the Grayzone CD-ROM installed on your PC, the information is always available at your operating desk. A few mouse clicks and you have what you want to know. About 890 pre-computed worldwide tables are immediately available. The tabular form sunrise-sunset times for each location are given for three dates, (day 1, 11 and 21) for each month. These tables were computed with the included program ***"Grayline."*** You can always easily add more table for locations in which you are interested. Even more you can create tables of any location with ***daily*** sunrise-sunset data. So, for hunted DX you know now exactly the sunrise-sunset of any day of the year.

Tables are not always easy to interpret, in particular when dealing with and comparing two locations, (your QTH and the target location). A world map indicating the grayzone at time intervals should be of better help. The CD has such maps in two presentations. ***First***, in ***printable*** adobe files, ***second*** in a ***selectable wizard menu***. **3 456 maps** are available at a few mouse clicks for ***each month*** at the ***three dates*** and for ***96 times*** a day, (each 15 minutes). It is ***easy to browse through the maps***. The wizards have also the option to give you an ***animated picture*** of a chosen date.

You still prefer a hardcopy booklet! No problem you can print out the pre-computed tables including those compute by yourself. Even more you can make a booklet of all the maps as well, (36 adobe files).

How to use the sunrise-sunset times

General rules

For all **E – W**, **W – E**, **NW – SE** and **NE – SW** paths you can normally expect two propagation peaks for **short path**.

- The ***first peak*** will occur around the sunrise of the station at the eastern end of the path.
- The ***second peak*** occurs around the sunset for the station at the western end of the path. But this peak will be generally less pronounced.

With **N – S** path there are normally no pronounced peaks around sunrise-sunset times. With these path is often experienced that a peak occurs near midnight. Now, few examples to explain and to visualize:

Example 1:

What are the peak propagation times between Belgium and Japan from the tables on February 11? **Note**: all given times are in UTC.

Belgium Feb 11: SR-west = 07:06 – SS-west = 16:52 **Dark period** from 16:52 till 07:06
Japan Feb 11: SR-east = 21:33 – SS-east = 08:18 **Dark period** from 08:18 till 21:33

The first peak will be around sunrise in Japan = SR-east at 21:33. This is after the sunset of Belgium = SS-west at 16:52, this path is totally in darkness, **Fig. 1.1a, 1.1b.**
To know if the path is in darkness is very important, always check this.

The second peak will be around sunset Belgium = SS-west at 16:52. A control shows that this is also after sunset of Japan = SS-east at 08:18. Here too, the path is in darkness, **Fig. 1.2a, 1.2b.**

How long will the peaks take place? With the data from the tables, peaks are not so easy to define. The maps in the Wizard option can display more. The first peak will be open for a longer period then the second peak.

When the circuit path location is know the maps option also tells you if the path will not pass through the auroral ovals. In special 160 meters signal waves can suffer a lot when traveling through these auroral pole zones. **Note:** the circuit path locations are manually added at the map illustrations. To avoid misconceptions, there are no paths indicated at the maps in the Wizards.

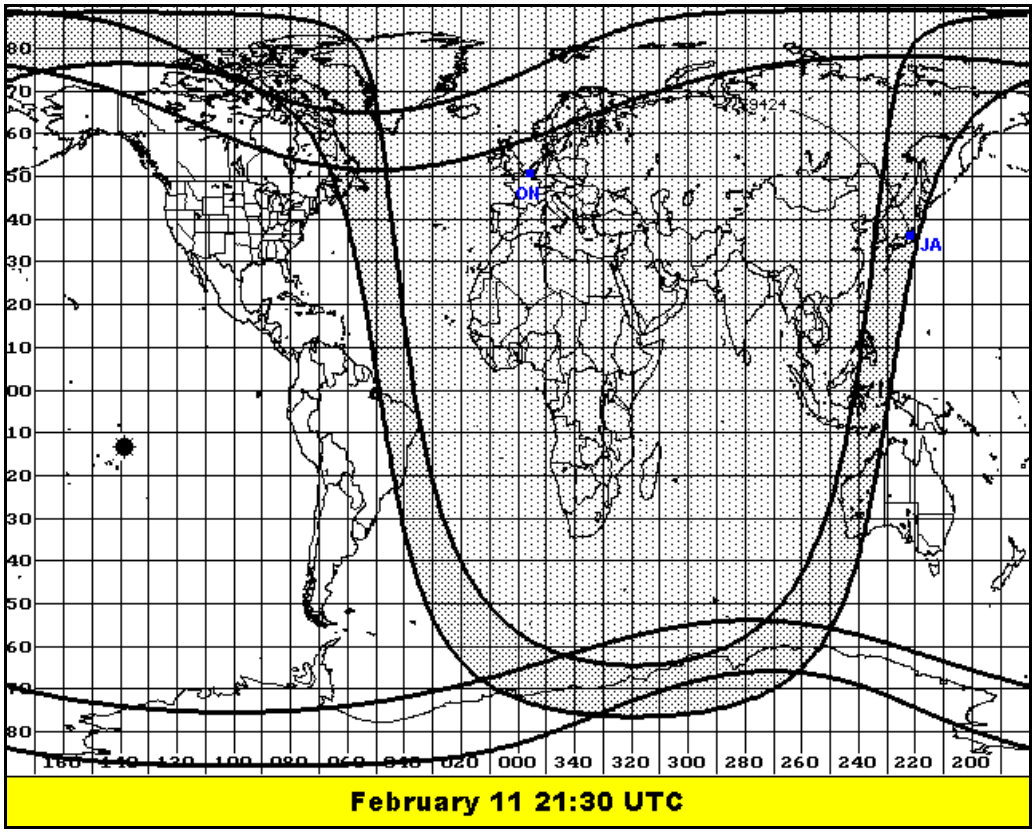


Fig. 1.1a. *The path and grayline at Japan sunrise. 21:30 UTC*

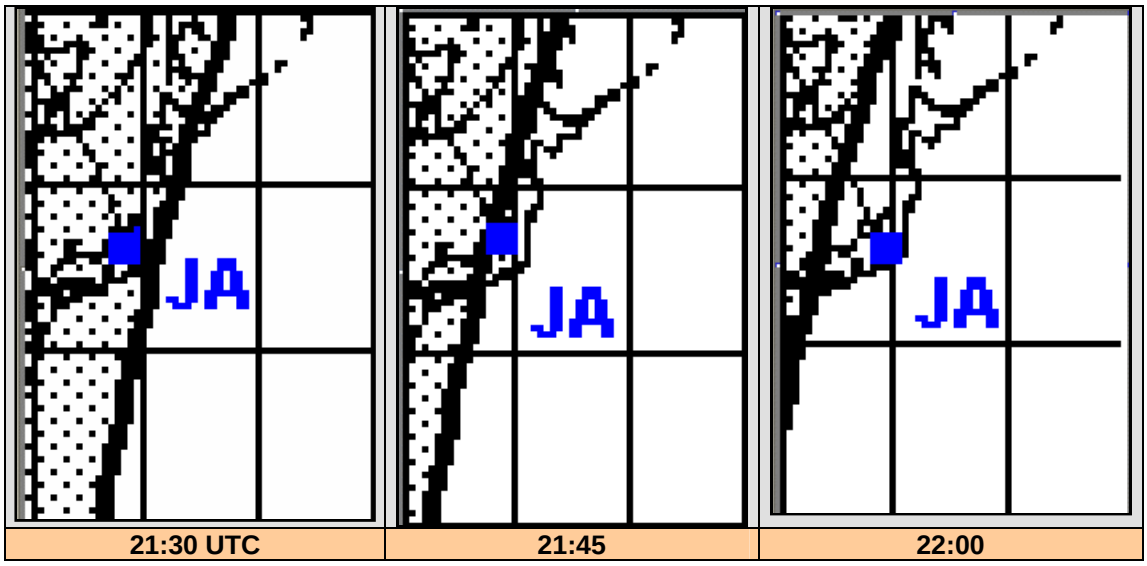


Fig. 1.1b. *Magnified sunrise picture off the Japan area at the Grayzone during sunrise.*

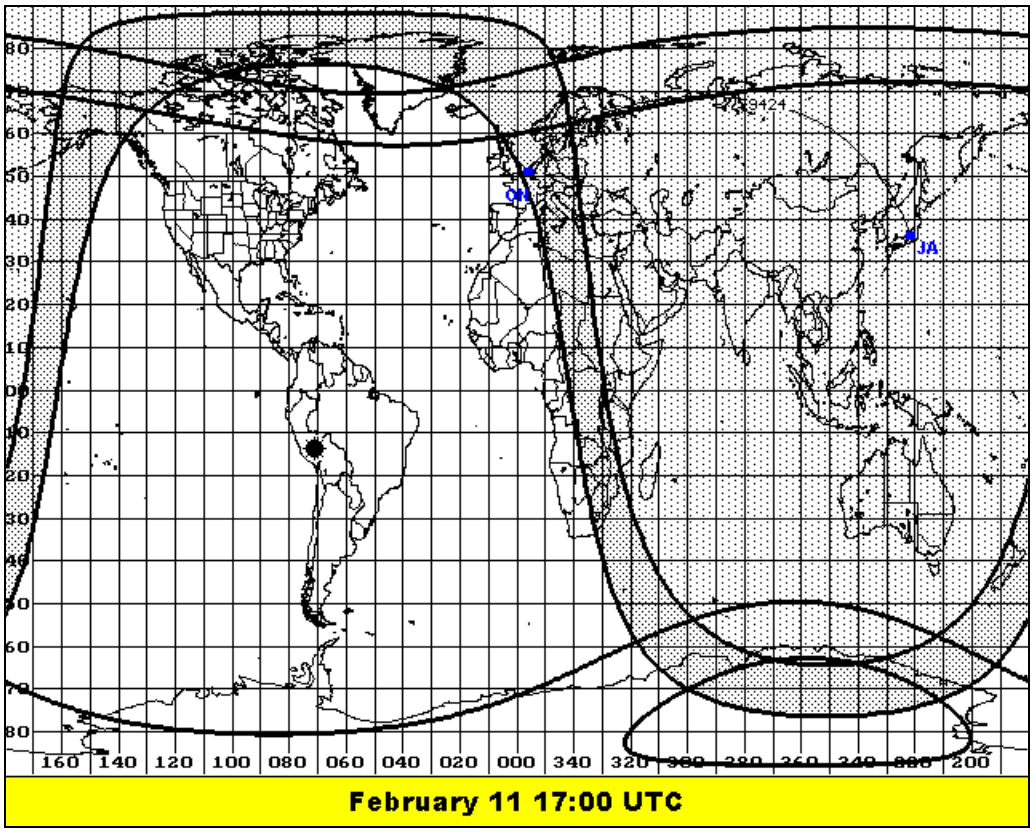


Fig. 1.2.a. *The path and grayline at Belgium sunset, 17:00 UTC*

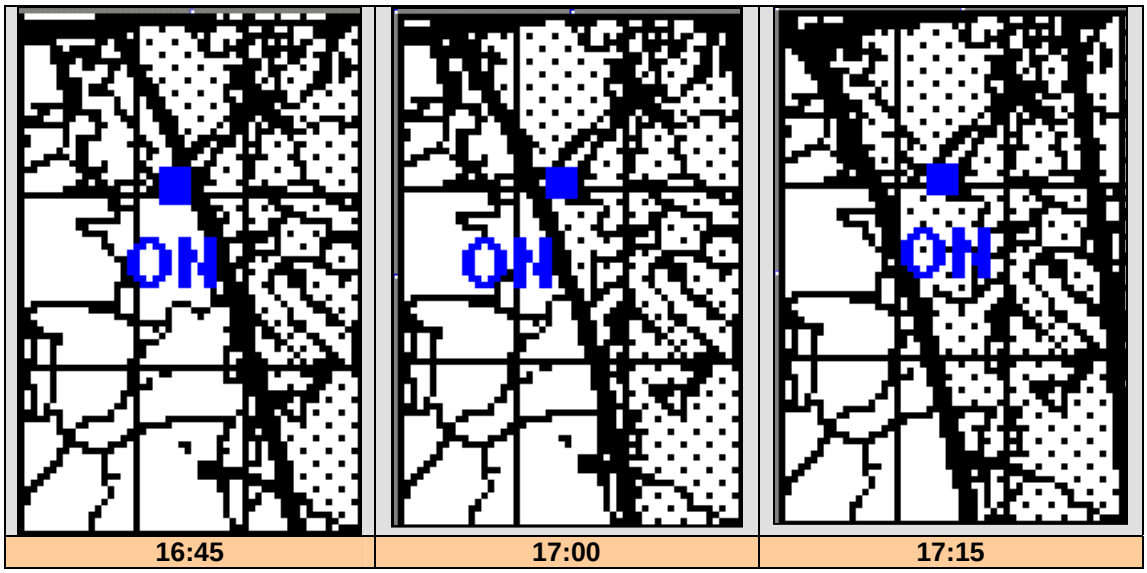


Fig. 1.2.b. *Magnified sunrise picture off the Belgium area at the Grayzone during sunset.*

Example 2:

Now, for the long-path story: For the same two stations, is there a possibility to a long path circuit at the same date (February 11)? The definition for a long path opening is this: we must have sunset at the eastern end before sunrise at the western end of the path, **Fig. 1.3.**

Belgium Feb 11: SR-west = 07:06 – SS-west = 16:52 **Dark period** from 16:52 till 07:06
Japan Feb 11: SR-east = 21:33 – SS-east = 08:18 **Dark period** from 08:18 till 21:33

At this example this is not true, the SR-west of Belgium = 07:06 and not later than or at the SS-east of Japan = 08:18

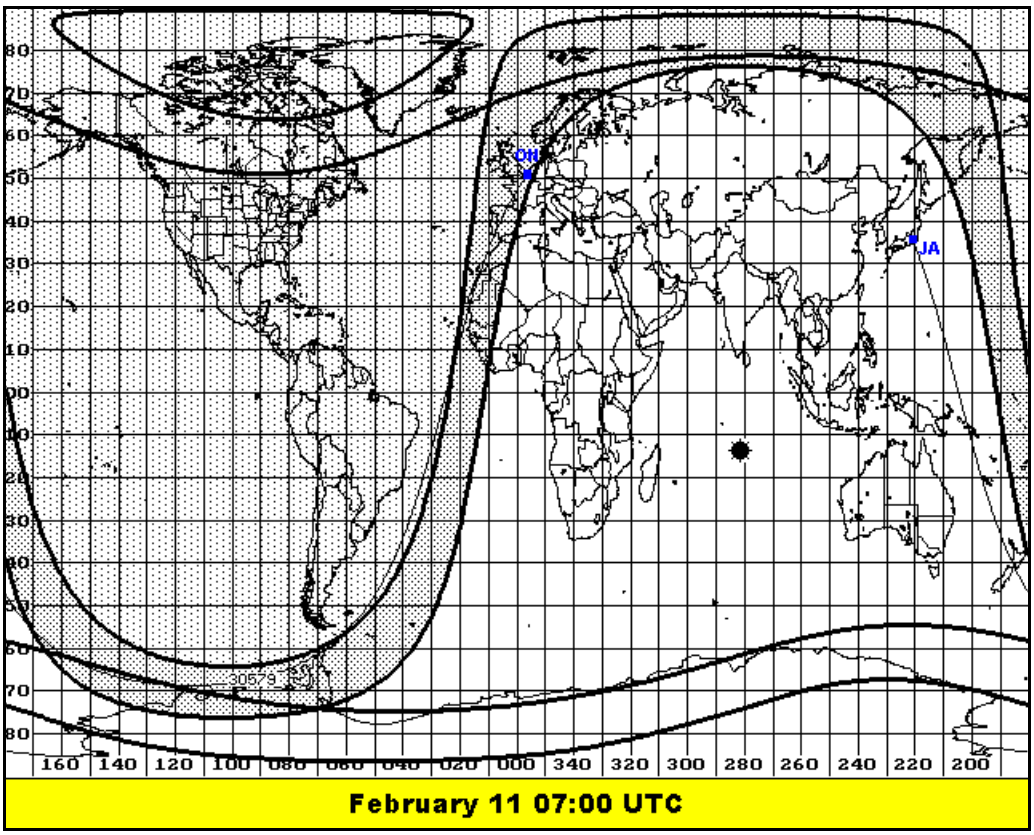


Fig. 1.3. *No long path properties at this date and time.*

Example 3:

Is there a long path opening from Belgium to Japan at December 21? At this date the SR-west of Belgium = 07:45 and is not earlier than SS-east of Japan = 07:31. In other words the sunrise at the western circuit end (SR-west = 07:45) is later then the sunset at the eastern circuit end (SS-east = 07:31), **Fig. 1.4a.**

Belgium Dec 21: SR-west = 07:45 – SS-west = 15:40 **Dark period** from 15:40 till 07:45
Japan Dec 21: SR-east = 21:46 – SS-east = 07:31 **Dark period** from 07:31 till 21:46

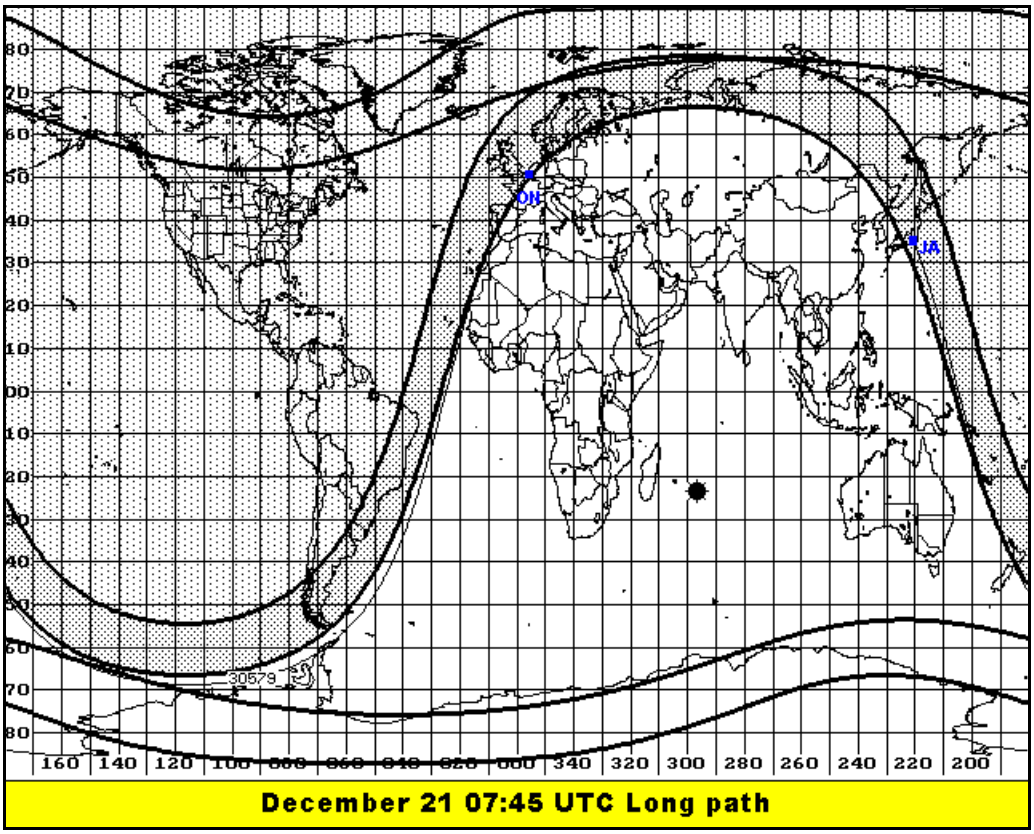


Fig. 1.4a. *Long path properties available at this date, practically along the terminator grayline.*

How about the short path possibilities at the same time? This is not likely to happen, because the entire path is in darkness and cannot profit from the ducting mechanism with lesser signal attenuation. More likely the signals will not reach that distance because of more attenuation (more traditional hops). **Fig. 1.4b.** That signal wave ducting is the reason of the peak conditions.

The short path peak possibilities will take place as explained in example 1.

Belgium Dec 21: SR-west = 07:45 – SS-west = 15:40 **Dark period** from 15:40 till 07:45
Japan Dec 21: SR-east = 21:46 – SS-east = 07:31 **Dark period** from 07:31 till 21:46

Two short path openings exist: the ***first peak*** around sunrise Japan = SR-east at 21:46. This is after the sunset of Belgium = SS-west at 15:40, the path will be in darkness. The ***second peak*** around sunset Belgium = SS-west at 15:40 this is after the sunset of Japan = SS-east at 07:31, here to the path is in darkness.

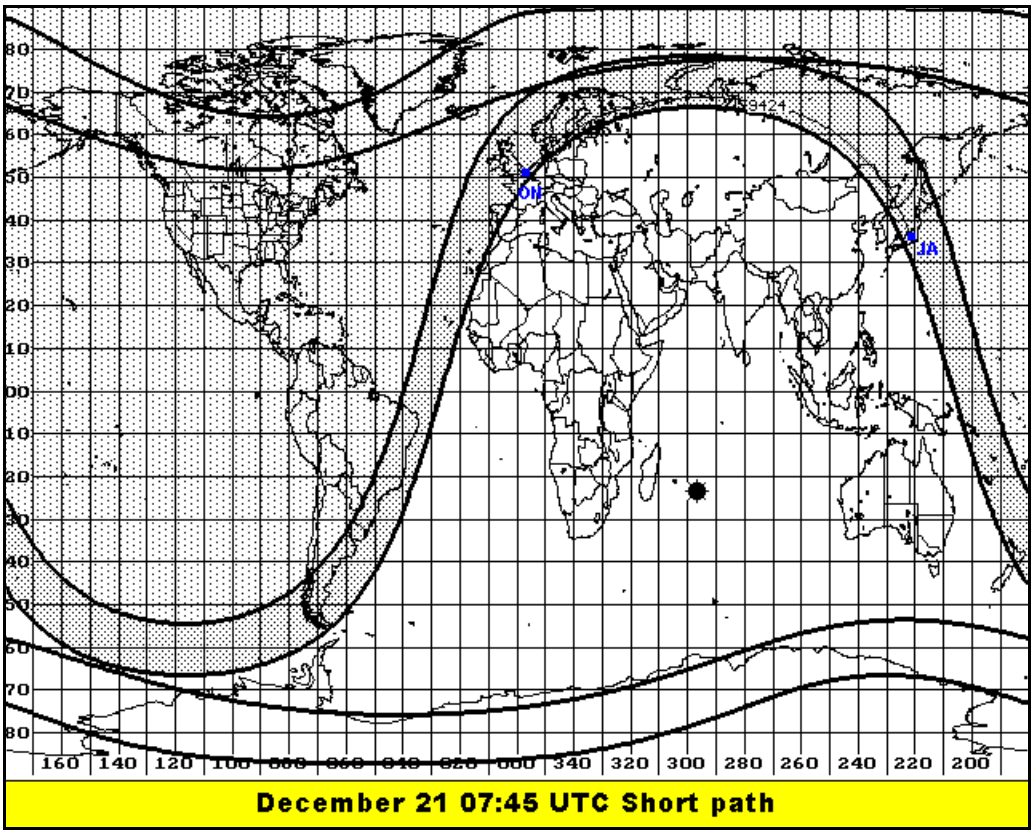


Fig. 1.4b. *The short path is totally in darkness and could most likely not experience the ducting mechanism.*

Pre-sunset and post-sunrise long path openings

Long path openings are possible even where the path is partly in daylight. This happens also frequent at the higher ham-bands. Along the terminator in the daylight side we have the tilted F-region and the lesser ionization of the D- and E-layer, the necessary ingredients for signal ducting. It is not exceptional but not a rule, that low band signals travels the world around by the ducting process within the daylight part of the grayzone for a period of about 1 hour after sunrise or 1 hour before sunset. That zone is easily found with the wizard maps.

The low band local midnight peak

The so-called ***mid-way midnight peak*** for east-west or west-east paths (within ± 45°), **Fig. 1.5.** These openings are observed and occurring more during high sun activity years, when the grayzone enhancements seem to be less common then during low sun activity years. This midnight peak does not exist on 40 meters but is observed at the 80 and 160 meters band.

How to calculate these peaks from the sunrise-sunset tables? An example midnight circuit, Kansas City and Belgium at February 21, the sunset-sunrise data are:

Kansas city **sunset**: 00:02 UTC **sunrise**: 13.03 UTC
Belgium **sunset**: 17:10 UTC **sunrise**: 06:47 UTC

Midnight at Kansas city: 00.02 + (13.03 – 00.02) / 2 = 06.52 UTC
Midnight at Belgium: 17.10 + (24.00 – 17.10 + 06.47) / 2 = 23.78 [78 min =1.18 hours]
so 23.00 = 1.18 = 00.18 UTC.

The halfway midnight peak is the mathematical average between the two midnight times;

The local halfway midnight is: (00.18 + 06.52) / 2 = 03:33 UTC.

Note: When the sunset time is between 12:00 and 24:00 then you must subtract this sunset time first from 24.00, this is the sunset time value ahead of midnight. If the minutes value is 60 or higher then you must translate this value to hour/minutes and add it to the previous hour only value.

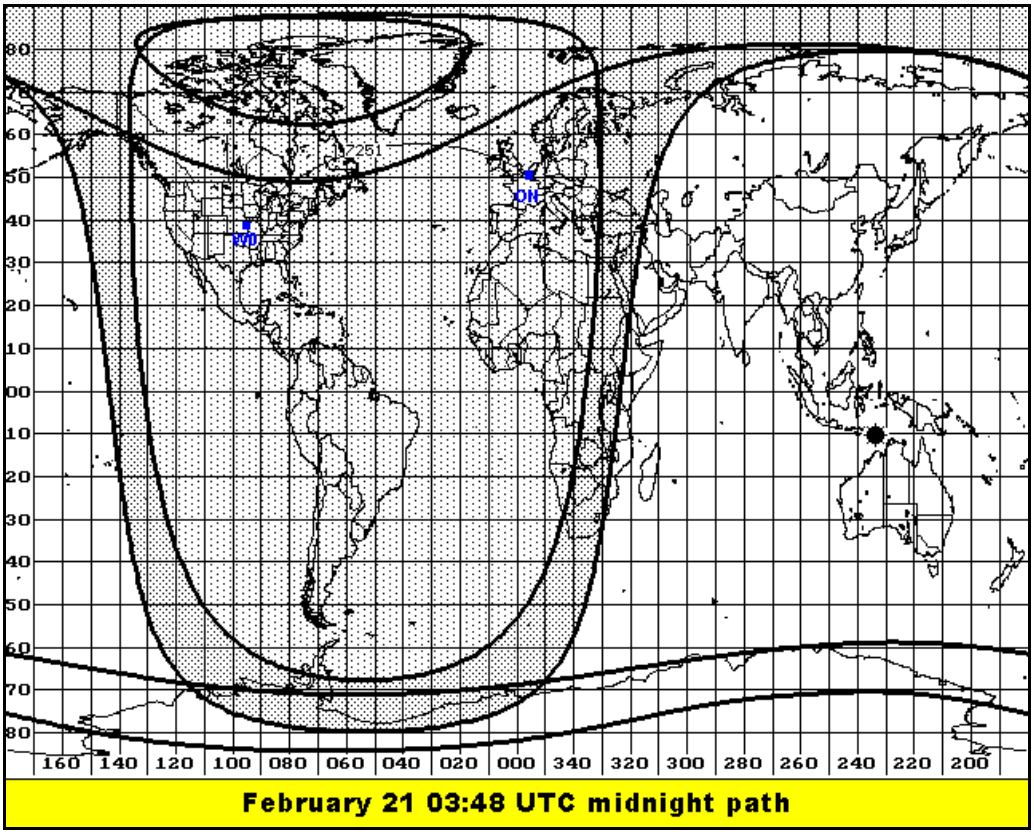


Fig. 1.5. *A mid-way midnight west-east path.*

A similar low band local midnight peak for 80 and 160 meters is also observed at north-south or south-north paths (within ± 30°), **Fig. 1.6.** The calculation is similar as the above east-west west-east method. An example midnight circuit, Harrisburg PA-USA to Buenos Aires Argentina at June 21, the sunset-sunrise data are:

Harrisburg **sunset**: 00:41 UTC **sunrise**: 09:38 UTC
Buenos Aires **sunset**: 20:51 UTC **sunrise**: 11:01 UTC

Midnight at Harrisburg: 00.41 + (09.38 – 00.41) / 2 = 04.91 = 05:31 UTC
Midnight at Buenos Aires: 20.51 + (24.00 – 20.51 + 11.01) / 2 = 27.76 – 24.00 = 03.76 = 04:16 UTC

The local Half-way midnight is: (05.31 + 04.16) / 2 = 04:73 = 05:13 UTC

Note: if a midnight value result is higher then 24.00 then you must subtract 24.00 from that value. Also the same rule counts for higher than 59 minutes results.

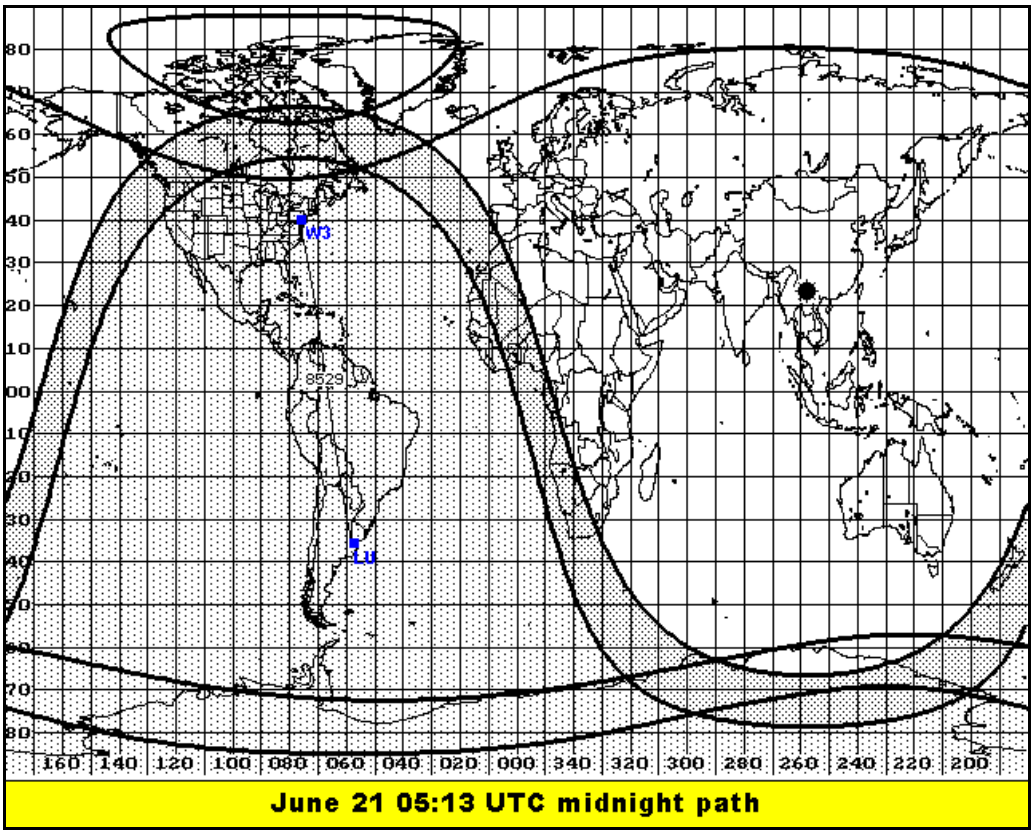


Fig. 1.6. *A mid-way midnight north-south path.*

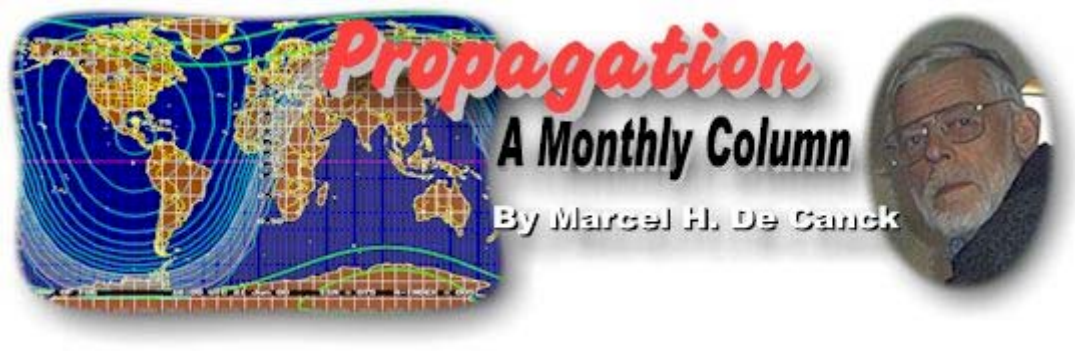
Are all the calculated circuits path opening peak times certain? Certainly not! The ionosphere never behaves the same; it's an always and never-ending changing propagation medium. But the calculated times are the times that the openings could exists. At least you know when to look for a given DX contact. John, ON4UN, explained me several times that he was patient, listening day after day at the same calculated time range to add a wanted DX-country to his DXCC list, and finally succeeded. For some on the 160 meters band openings, he told me, "You could adjust your clock on it, and the path opening time gap was so small that missing the correct call and report was equal to losing this much-wanted valid QSO".

I started with a quote from John's **"Low band DXing"** book; let me end with another quote from this low band DXing bible:

"For low banders, especially on 160 meters, it is important to know precise sunrise and sunset times for both ends of a path. On some of the long-haul path, openings may only last a few minutes right at sunrise-sunset, so accurate information produced with computer programs or a sunrise-sunset booklet is critical."

An additional option at the grayline program to compute the local midnight time for a given circuit is planned. Also the option to chose the circuit end locations from a predefined list, I shall keep you informed. **–30-**

Reference: *Low-Band Dxing*, published by the ARRL, from the author John Devoldere, ON4UN.
Also my thanks to John, ON4UN, for his valuable information.



Brief Biography - Marcel H. De Canck, ON5AU

At the tender age of 10 (born 1943), I became fascinated with radio when my father finally bought a radio set. What a miracle in the house now, from out of nothing and everywhere came wireless music and voices! But already at this young age, I was puzzled at a phenomenon noticed on the MF band at the higher frequency scale. During the evening hours something strange happened: the signal would exhibit a fading and a reduction of the sound volume. My mother called it "blowing away" like a wind can do. No one I asked had an answer for me at this time. Later this all became clear, it had something to do with propagation properties.

At the age of 13 I built my very first radio "crystal" set. Fascinated by this wonder of no power consumption I wanted to know more about radio in general. I enrolled to a technical course by postal correspondence about radio techniques. By age 14, I started doing repairs at every opportunity on defective radio sets of neighbors and relatives. All the more I wondered about "how do those radio signals get into the air"?

After a long search I was able to locate some literature and a book about the exciting radio amateur hobby. Shortly after, I became a member of the UBA Union Belgium Amateurs and helped by the members, I started studying transmitting theory and CW. In 1961 I obtained a license and was granted the call **ON5AU.**

After finishing high school radio electronics, I worked as a radio and TV repair technician in a local company. In 1974 I became interested in microprocessors, microcomputers and computer programming. During that same year I started working at the ***Bell Company Belgium***, as a maintenance technician for their CNC machines. Fifteen years later, I become a field repair technician in a company that specialized in the manufacture of microprocessor-controlled presence terminals and access controls.

After early retirement in the summer of 2000, I had more time to pursue my interests in the hobby of amateur radio and increase my knowledge of propagation. Additionally, I became an editor for the radio amateur club's quarterly club magazine.

Other hobbies are photography, reading, writing, traveling, gardening and home brewing ham equipment and antennas. I may be contacted at on5au@skynet.be or at my web site at http://users.skynet.be/on5au/ , and of course, frequently on the HF bands in SSB.

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