The Effect of a Traveling Ionospheric Disturbance at YK9A

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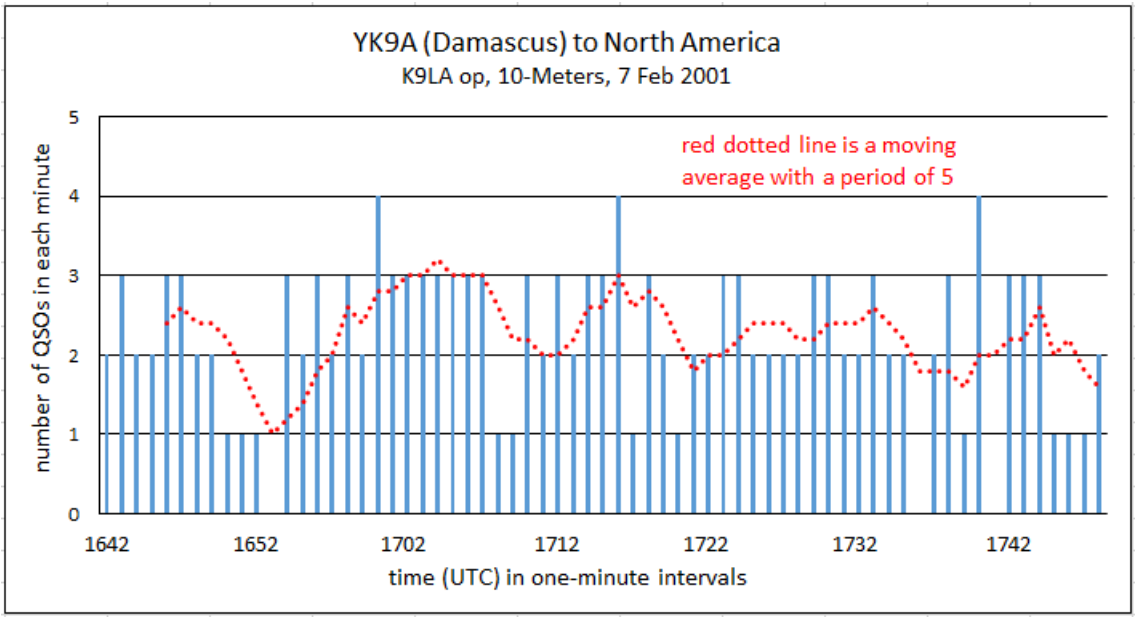
The March 2020 Monthly Feature reviewed events in the lower atmosphere (hurricanes, cyclones, thunderstorms, frontal passages, etc) and at ground level (underground nuclear explosions, earthquakes, tsunamis, etc) that could cause a perturbation in the electron density in the ionosphere (note that I said perturbation – not a major worldwide change). Several examples were given of these events and how they affected the ionosphere. This March 2020 Monthly Feature reminded me of a long ago personal observation.

In February 2001, Bob W4DR, Rosie N4CFL, Jim W4PRO (SK), Lee VE7CC, Melissa VA7MI, Dick N7RO, Al K7AR, Vicky AE9YL and I traveled to Damascus, Syria to put this rare country on the air using the call YK9A. In the 10 days of operation (February 4 – February 13), over 27,000 QSOs were made on 160m through 10m on CW, SSB and RTTY.

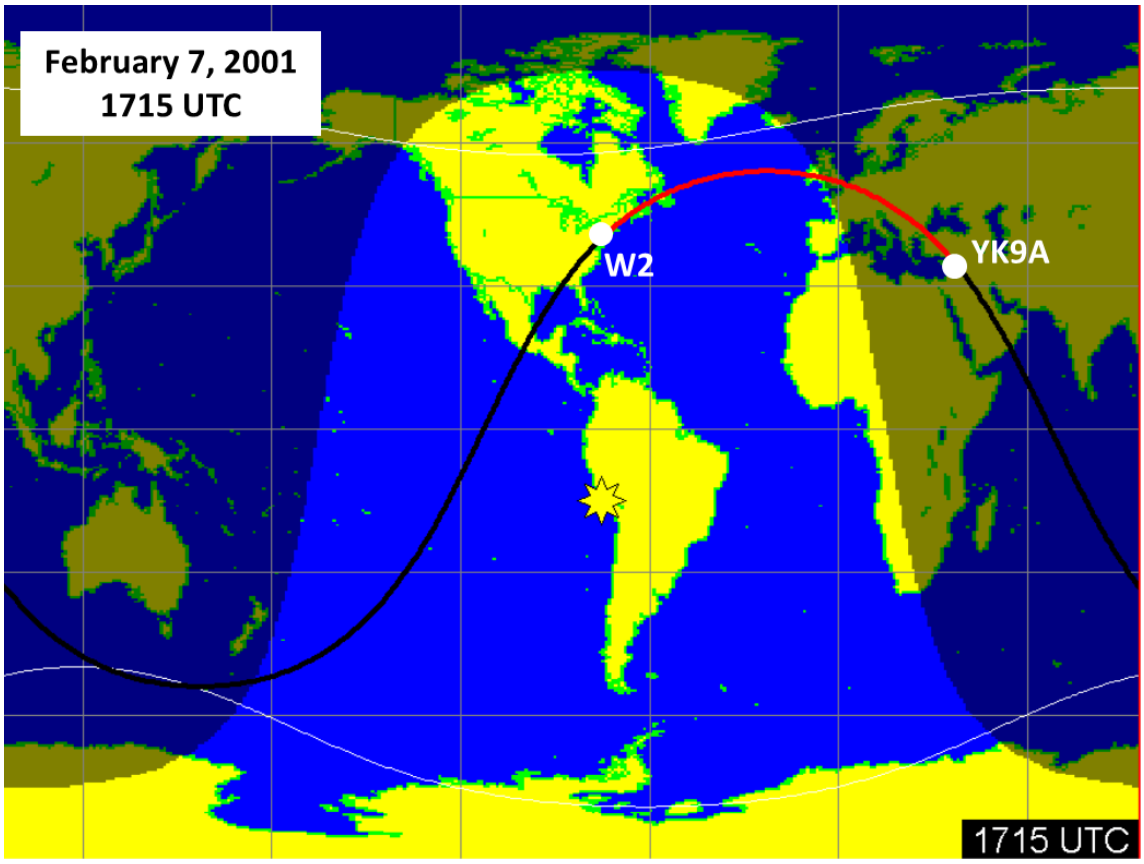
Since February 2001 was around solar maximum for Cycle 23, worldwide propagation on the higher bands (15m, 12m and 10m) was good. During one of my operating sessions on 10m SSB, I was working North American stations and noticed an unusual pattern develop. I would work 3 to 4 North Americans each minute, but then I would only work 1 or even no North Americans for a minute or two. This pattern repeated itself several times. It was as if the F2 region MUF (maximum useable frequency) between Syria and North America was going up and down around 28 MHz in a cyclic nature. Here's a plot (from the YK9A log) of the QSOs I made during this unusual period.



Note that the number of QSOs per minute and the trend line appear to be cyclic in nature. At the time this was happening, I remembered one of my NCJ Propagation columns about a contester experiencing a cyclic rate in his QSOs. This NCJ column was about TIDs – Traveling Ionospheric Disturbances in the F2 region. A TID is a cyclic variation of the electron density – in

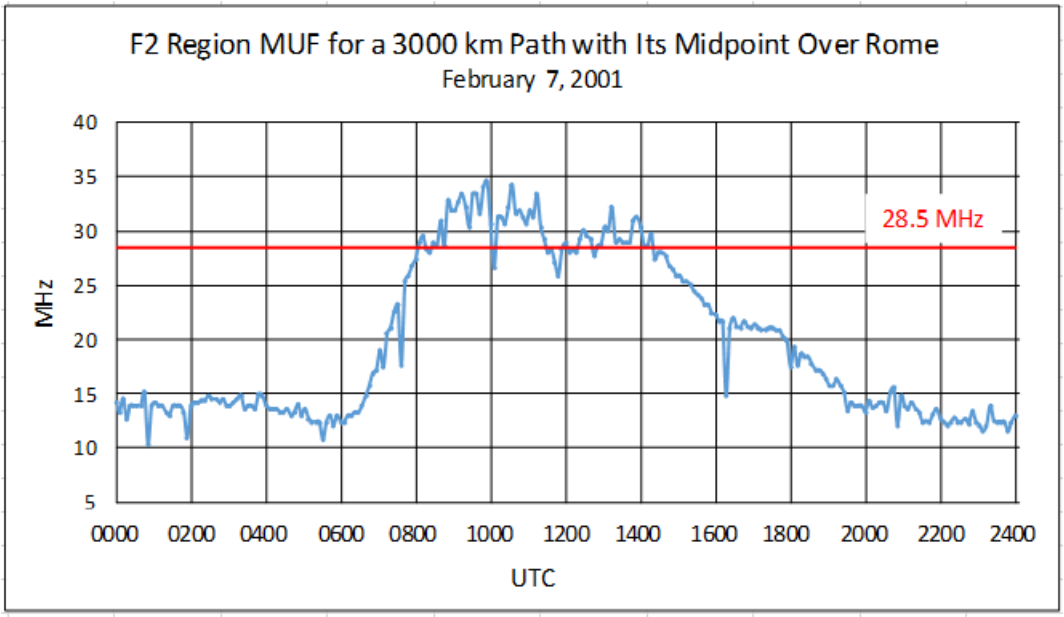
other words, the MUF is going up and down. So TIDs are what I thought of when I was working North Americans from YK9A. I didn't do any more analysis after returning home from the YK9A DXpedition.

But recently I decided to see if I could "see" TIDs in ionosonde data from February 7, 2001. Here's the short path (the red portion) from YK9A to North America (I chose W2 on the North American end as I worked a bunch of East Coast stations during this interesting period).



There are a number of ionosondes near this path. I was looking for two criteria – they had to have data (!) and they had to take data at a minimum of every 5 minutes. Why 5 minutes? If the ionosonde only took data every 15 minutes (or every 30 minutes), the TID may not show up based on the periods seen in the QSO plot.

I looked at many ionosondes in Europe and even at Goose Bay (Labrador), but found that only the Juliusruh (Germany) ionosonde, the Chilton (England) ionosonde, the Rome (Italy) ionosonde and the Millstone Hill (Massachusetts) ionosonde had data. Juliusruh, Chilton and Millstone Hill are near the path but unfortunately only took data every 15 minutes, 30 minutes and 15 minutes, respectively. Although the Rome ionosonde isn't as near the path as the other ionosondes, it took data every 5 minutes. Here's the Rome data.



What's important to note in this plot is there was a short-term cyclic nature of the MUF over the Rome ionosonde during the day (but not as much at night). The Millstone Hill ionosonde showed a hint of a cyclic nature of the MUF, but the depth of the MUF valleys and the height of the MUF peaks were muted by taking data only every 15 minutes.

In summary, since the YK9A end of the path was in darkness, I think it's very likely that TIDs were happening in the daylight portion of the path from YK9A to North America. I believe that these TIDs were the cause of my 10m observations at YK9A.

What caused these TIDs? It could have been an event in the lower atmosphere (or even at ground level) generating a gravity wave that coupled up to the ionosphere. Or it could have been geomagnetic field activity (elevated K indices) generating a gravity wave that coupled up to the ionosphere. Maybe one of these days I'll take a look at this.