Polk County Amateur Radio Association
2010 General Class Study Guide
Lesson 15
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Week 4 - February 27th - Lessons 13 - 16

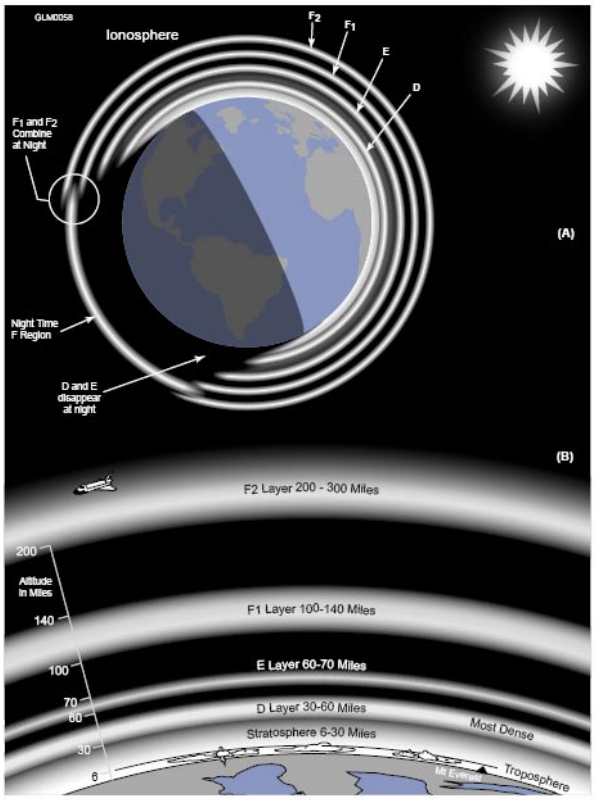
Lesson 15 - "Propagation"

- Chapter 7, pp 7-1 to 7-12

On the HF bands, propagation is strongly affected by what's happening on the surface of the Sun. Now that you will be using new privileges which allow for DX contacts due to propagation, you need to understand solar events and the effects to our ionosphere. We will use sample questions from the question pool to help understand propagation.

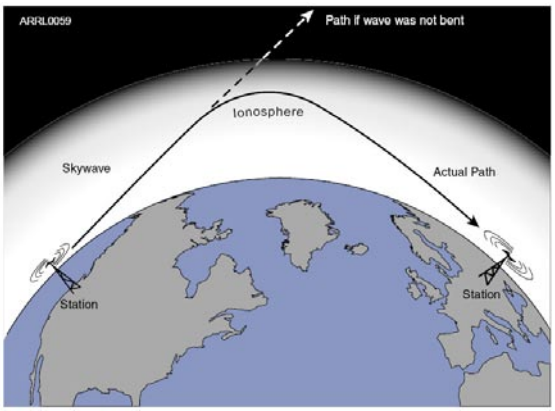
The ionosphere extends 300 miles above the Earth. Gas molecules, atoms, ions and electrons are so far apart that this is essentially the vacuum of space.

G3C01 – Which of the following ionospheric layers is closest to the surface of the Earth? The D layer. This layer is only present when illuminated by the sun and disappears at night because the ions and free electrons are close enough together to recombine quickly when no UV is present. Figure 7-1 on page 7-2 illustrates the layers during day and night.



G3C02 – When can the F2 region be expected to reach its maximum height at your location? At noon during the summer. At any particular location, the stronger the illumination from the Sun, the higher the F2 layer will be.

G3C04 – What does the term "critical angle" mean as used in radio wave propagation? The highest takeoff angle that will return a radio wave to the Earth under specific ionospheric conditions. The point where the ionosphere can bend the signal enough to return it to Earth. Figure 7-2 on page 7-3 shows how a signal leaves your station and is bent at the critical angle and returns to Earth.



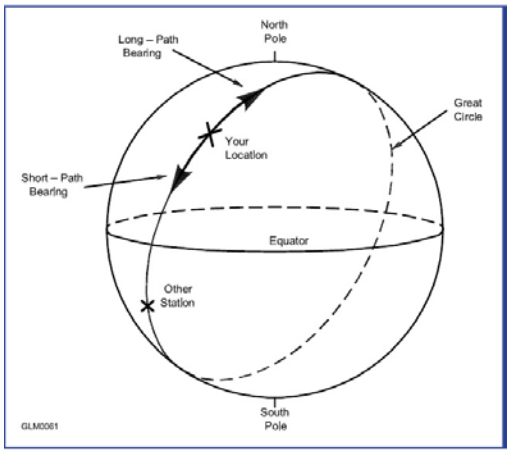
G3C05 – Why is long distance communication on the 40, 60, 80 and 160 meter bands more difficult during the day? The D layer absorbs these frequencies during daylight hours. The D region is not very good at diffraction at all. In the HF bands below 10 MHz. The D region absorbs radio waves completely during the day.

G3C12 – Which ionospheric layer is the most absorbent of long skip signals during daylight hours on frequencies below 10 MHz. The D layer.

G3B09 – What is the maximum distance along the Earth's surface that is normally covered in one hop using the F2 region. 2,500 miles. The higher the region from which the reflection takes place, the longer the hop. The E region skip is 1,200 miles in a single hop.

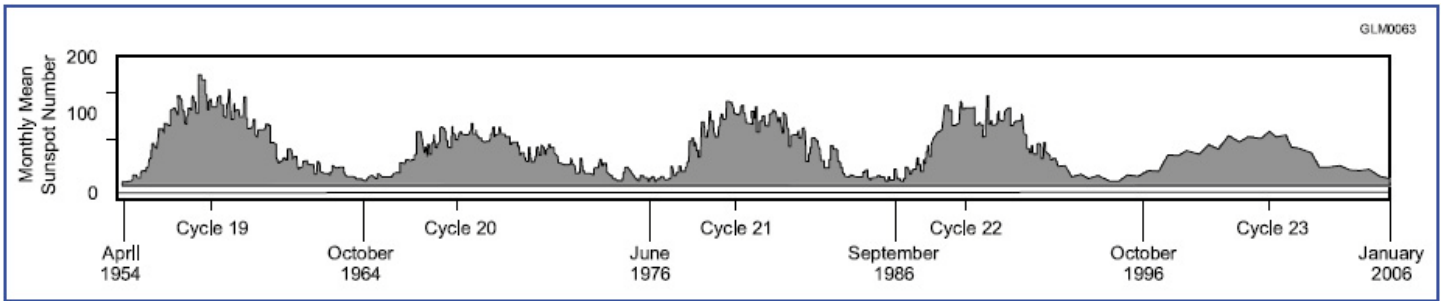
G3B14 – Which of the following is a good indicator of the possibility of sky-wave propagation on the 6 meter band? Short hop sky-wave propagation on the 10 meter band.

G2D06 – How is a directional antenna pointed when making a "long-path" contact with another station? 180 degrees from its short-path heading. Figure 7-4 on page 7-5 illustrates the "great circle routes" of an RF signal between two points.



G3B13 – How might a sky-wave signal sound if it arrives are your receiver by both short path and long path propagation? A well-defined echo can be heard.

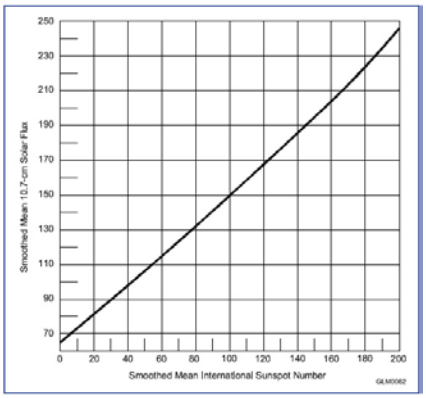
G3A09 – What is the effect on radio communications when sunspot numbers are high? Long-distance communications in the upper HF and lower VHF range is enhanced. The more sunspots that are observed, the more UV rays are generated which creates more intense ionization in the ionosphere, improving propagation on the HF bands above 10 MHz and even into the lower VHF range.



G3A11 – How long is the typical sunspot cycle? Approximately 11 years. Figure 7-5 on page 7-6 shows the sunspot cycles and the monthly mean sunspot numbers.

G3A18 – If the HF radio-wave propagation (skip) is generally good on the 24-MHz and 29-MHz bands for several days, when might you expect a similar condition to occur? 28 days later. Sunspots seem to move across the Sun's surface because the Sun rotates once every 28 days.

G3A04 – What is measured by the solar flux index? The radio energy emitted by the sun. More specifically it is a measure of radio energy at 2800 MHz. The index starts at 65 and has no maximum value. Take a look at Figure 7-6 on page 7-7 to see the correlation between solar flux and sunspot number.

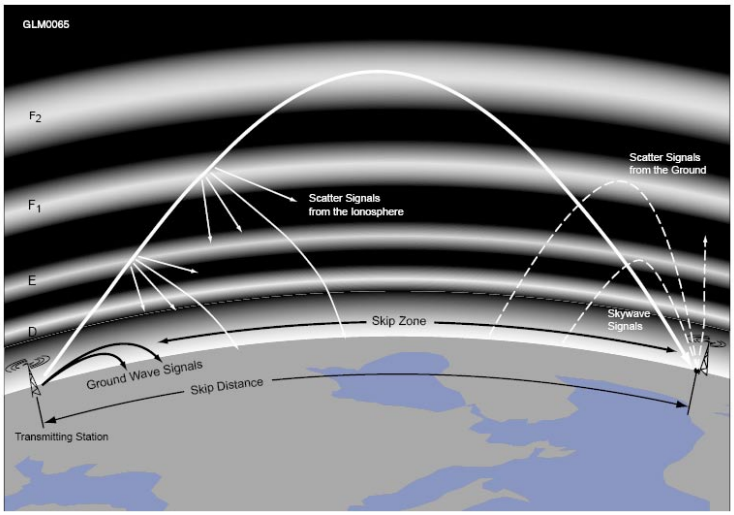


G3A12 – What is the K-index? A measure of the short term stability of the Earth's magnetic field. The values are from 0 to 9 and are measured every 3 hours at the National Institute of Science and Technology, Boulder, Colorado.
G3A13 – What is the A-index? An indicator of the long term stability of the Earth's geomagnetic field. Eight previous K-index values from around the world are used. Values of 0 (stable) to 400 (greatly disturbed) are possible.

G3B03 – Which of the following guidelines should be selected for lowest attenuation when transmitting on HF? Select a frequency just below the MUF. To make contact with a distant station, you will have to use a frequency between the LUF (lowest usable frequency) and the MUF (maximum usable frequency). If the MUF drops below the LUF, then no propagation exists between those two points. The MUF is affected by the path distance and location of the stations wishing to make contact, time of day and season and, solar radiation and ionospheric disturbance.

G3A01 – What can be done at an amateur station to continue communications during a sudden ionospheric disturbance? Try a higher frequency. During daytime SID, the effects are greater on lower frequencies more than those on higher frequencies. It takes about 8 minutes for an increase in X-ray and UV rays to reach the Earth. Energy generated by coronal mass ejections on the sun's surface take 20 to 40 hours to reach the Earth.

G3C06 – What is a characteristic of HF scatter signals? They have a wavering sound. Figure 7-8 on page 7-11 is an illustration of scatter signals.



G3C07 – What makes HF scatter signals often sound distorted? Energy is scattered into the skip zone through several radio wave paths.

G3C08 – Why are HF scatter signals in the skip zone usually weak? Only a small part of the signal energy is scattered into the skip zone.

G3C10 – Which of the following might be an indication that signals heard on the HF bands are being received via scatter propagation? The signal is heard on a frequency above the maximum usable frequency.

G3C14 – Which of the following antennas will be most effective for skip communications on 40 meters during the day? A horizontal dipole placed between 1/8 and 1/4 wavelength above the ground. This type of antenna is called an NVIS antenna. Figure 7-9 on page 7-12 shows how an NVIS antenna relies on signals are reflected back to Earth in the region around the transmitter.