Polarization Observations on 160-Meters

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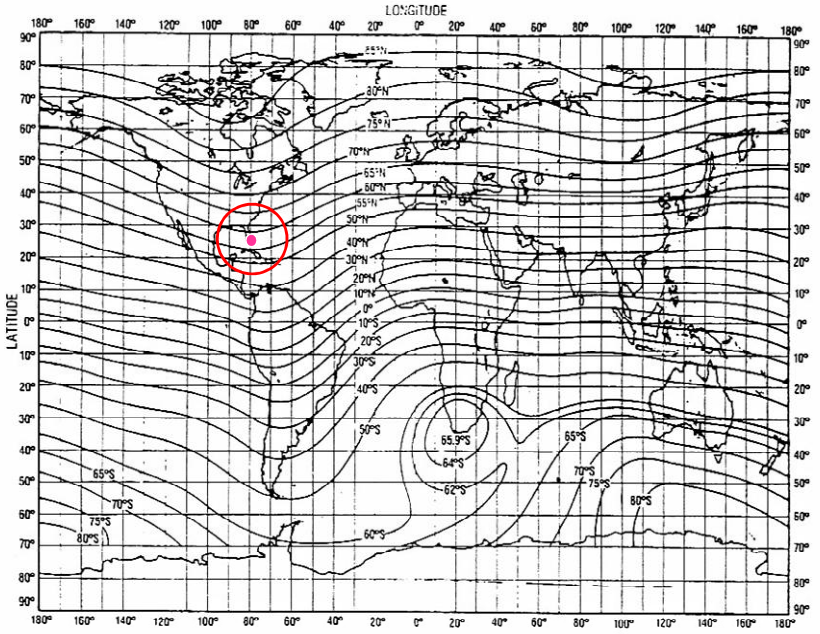
At this year's Antenna Forum at the Dayton Hamvention, W8VVG gave a presentation on the Waller Flag antenna. The Waller Flag is a low-noise receive antenna, and consists of two loops fed 180° out-of-phase. It can be mounted either horizontally (called the HWF with horizontal polarization) or vertically (called the VWF with vertical polarization).

One of the slides in the presentation had comments from N4IS on his observations when using the Waller Flag. He said "The HWF is terrific for long path pointing South, East and West. The VWF works better to North and sometimes East-West but never due South". Is there a physical reason for these comments by N4IS? Yes, there is, and the reason is due to the fact that our ionosphere is immersed in the Earth's magnetic field. What's important here is the dip angle – that's the angle at which a free-floating compass would point indicating the direction of the magnetic field, with 0° = horizontal and 90° = vertical.

The following figure shows worldwide dip angles. N4IS's QTH is the red dot, and the red circle is a radius of 1000 km from N4IS. That radius is roughly where RF from N4IS would first encounter the ionosphere.



To the South N4IS's dip angle is 45°. To the East and West the dip angle is 55°. To the North the dip angle is 67°. Now the fact that the ionosphere is immersed in the Earth's magnetic field says the polarization of the ordinary wave (one of two characteristic waves that propagates through the ionosphere – the other being the extraordinary wave, which is heavily attenuated on 160-Meters since 1.8 MHz is very close to the electron gyro-frequency) is highly elliptical with the major axis parallel to the direction of the magnetic field.

So to the South with a 45° dip angle, the ordinary wave polarization is halfway between horizontal and vertical. With horizontal antennas picking up less man-made noise, it makes sense that N4IS says the HWF is better than the VWF. To the North with a dip angle of 67°, it also makes sense that the VWF is best. To the East and West, it appears the HWF has an edge, again most likely due to the polarization of noise.

There are two moral's to this story. First, there is more order to polarization than we generally acknowledge. Second, those of you down south may want to try a low-noise horizontal receiving antenna on the "southwest at sunrise" and "southeast at sunset" long paths.