Low Angles on 160-Meters

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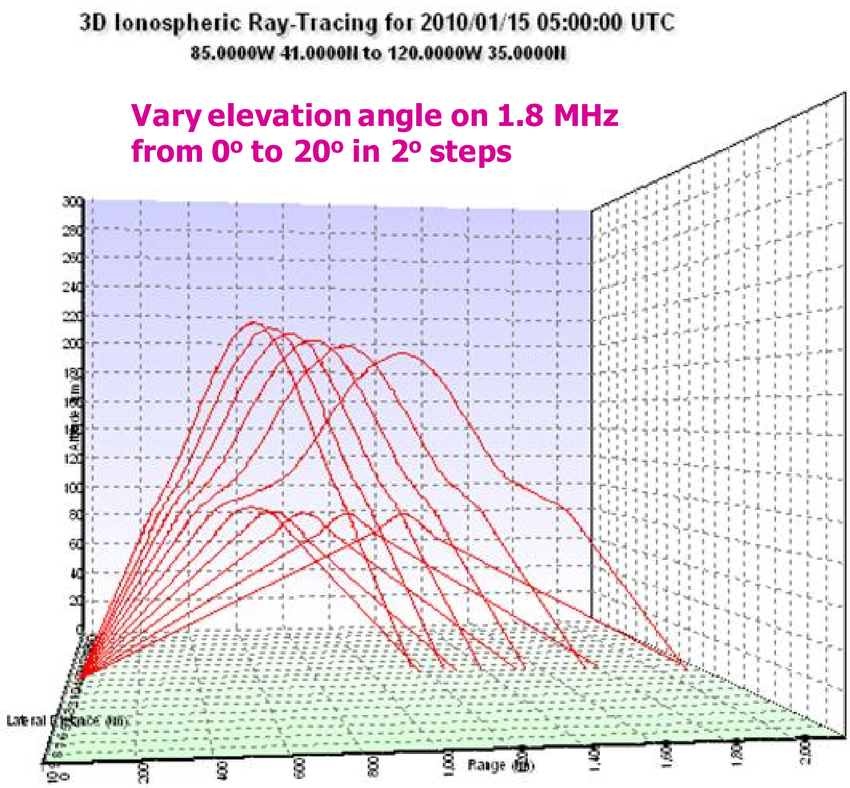
At night the ordinary wave E region critical frequency foE decreases to about 0.30 MHz. Applying the secant law to this value says 1.8 MHz RF at elevation angles less than about 9.5^o will be refracted back to Earth. In other words, low elevation angles will take E hops, while higher elevation angles will pass through the E region to take F hops. This is best seen with ray traces, and the following figure does these 160-Meter ray traces at night from 0^o elevation to 20^o elevation in 2^o steps.



The ray tracing results confirm that elevation angles below 10^o give E hops. At 10^o and above, we get F hops. Note that the elevation angle that gives the longest F hop is the angle just higher than the angle that gives the shortest E hop, and that the distance for the longest E hop (at 0^o) and the distance for the longest F hop (at 10^o) are very similar at about 2200 km.

So which angle is best? Most would say the angle that gives the F hop is best. But comparing absorption indicates the best F hop would incur 12.5 dB of absorption, but the best E hop would only incur 9.8 dB of absorption. The low angle E hop gives slightly less absorption because it doesn't get as high into the ionosphere – in fact it just barely gets into the absorbing region (which is the lower E region at night).

How important is low angle radiation on 160-Meters? This short analysis says it could definitely help with multi-hop by reducing the amount of absorption several dB per hop. But low angle radiation on 160-Meters is tough to achieve. I can only think of two ways to achieve low angle radiation on 160-Meters – being on a nice hill or being very near on salt water. The salt water aspect is interesting – perhaps this is why VE1ZZ does so well – his location allows him to take advantage of E hops at extremely low angles.