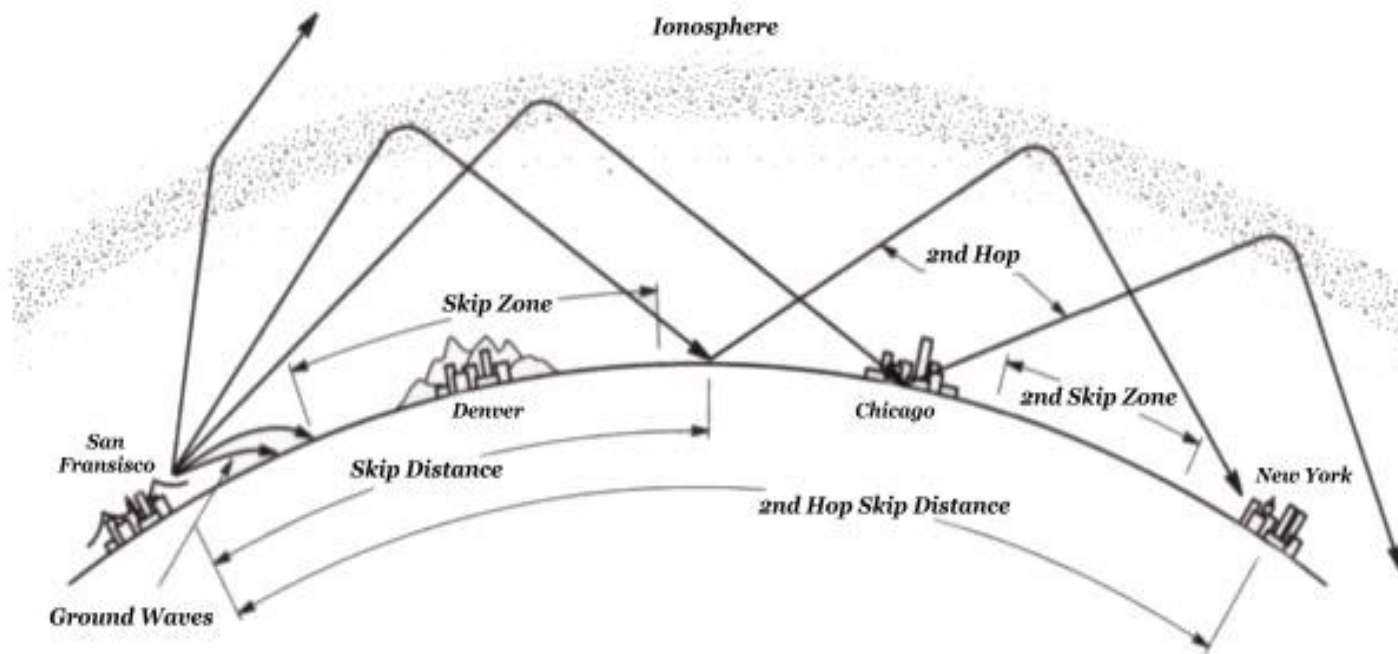


RF Propagation 101

Introduction / Overview

WB5KVV Jack Philley Jan 2016



Objective & Scope



Primary Methods RF Propagation

- Ionospheric
- Ground Wave
- Free Space
- Tropospheric

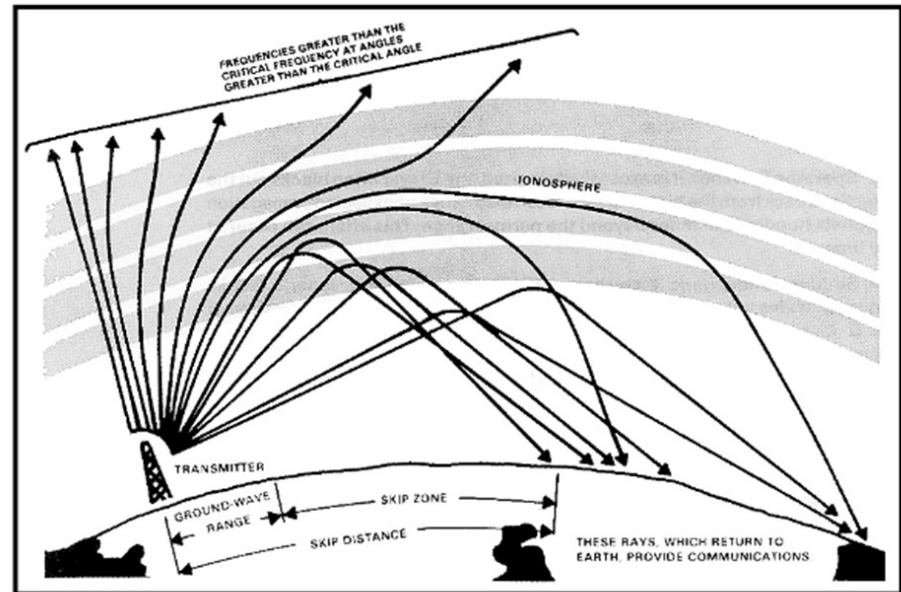
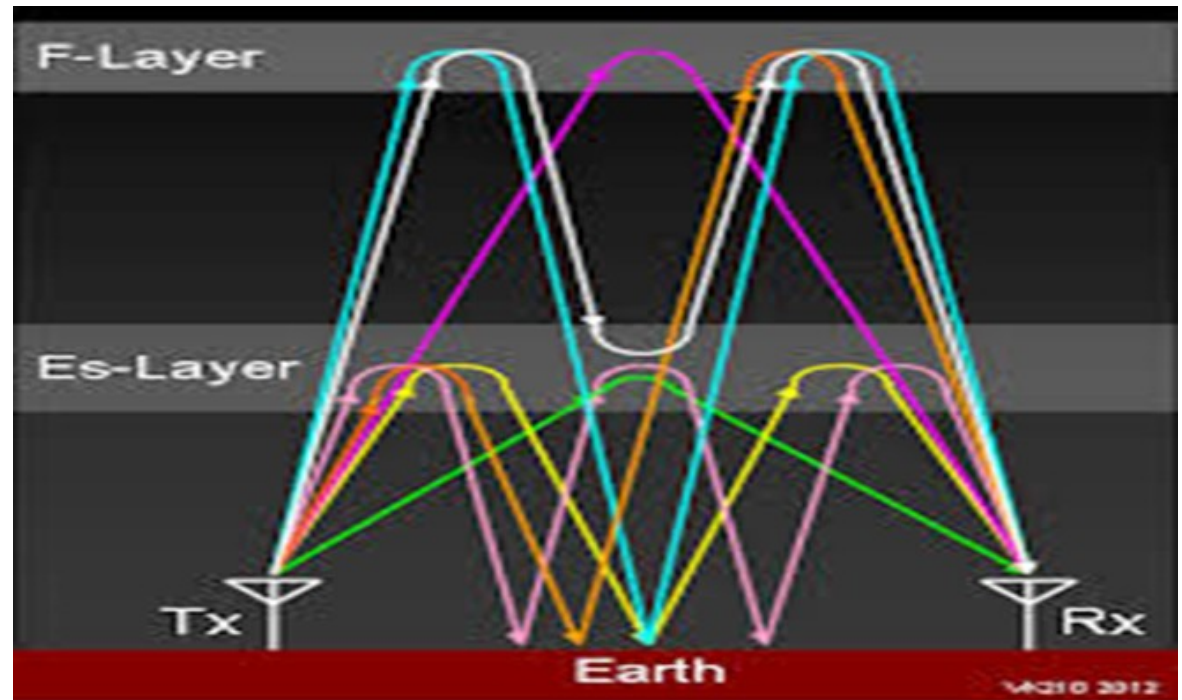


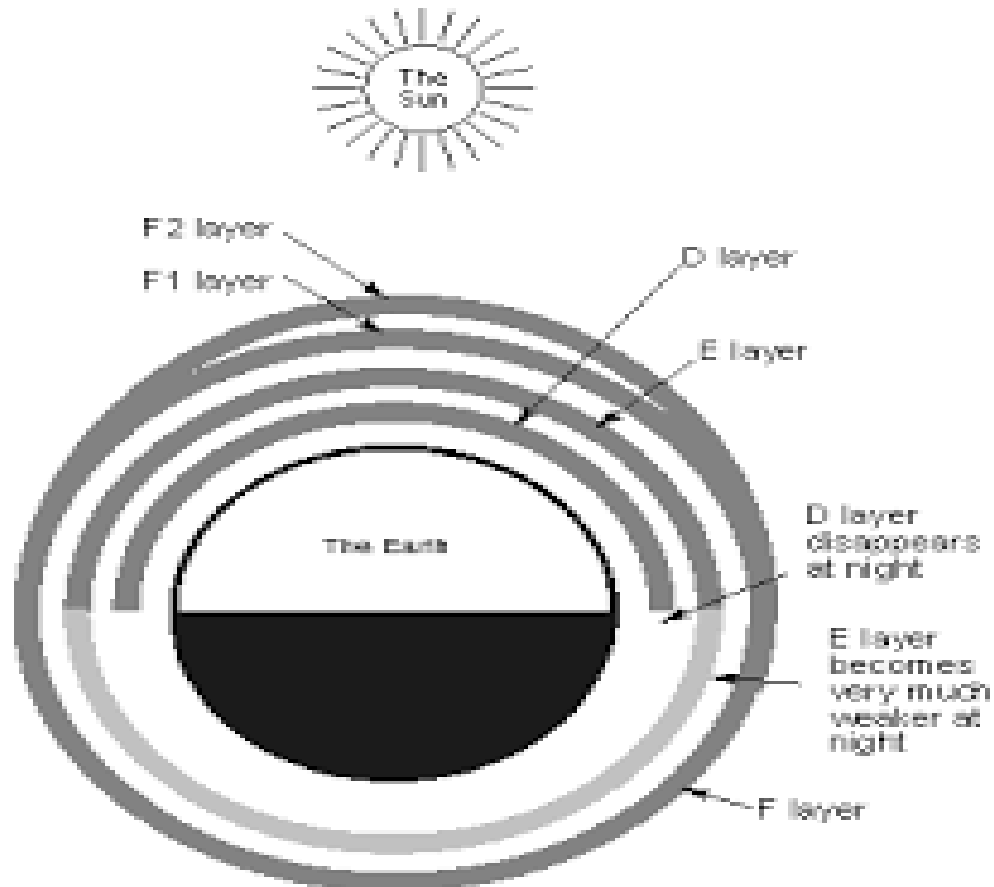
Figure 2-14. Sky wave transmission paths.

Ionospheric Propagation ITWAs

- Layers
- Frequency
- Angle
- Interaction Hop-Skip



Layers

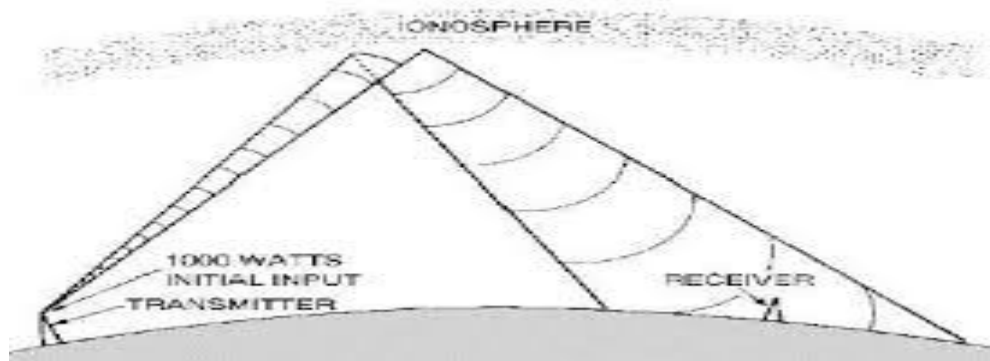


Typical Single Hop Distances

(in miles, source ARRL)

| Band | Noon (local time) | midnight |
|-----------|-------------------|----------|
| 80 meters | 0 | 0 * |
| 40 | 50 | 300 |
| 30 | 300 | 600 |
| 20 | 500 | 1000 |
| 15 | 800 | 0 |
| 10 | 1200 | 0 |

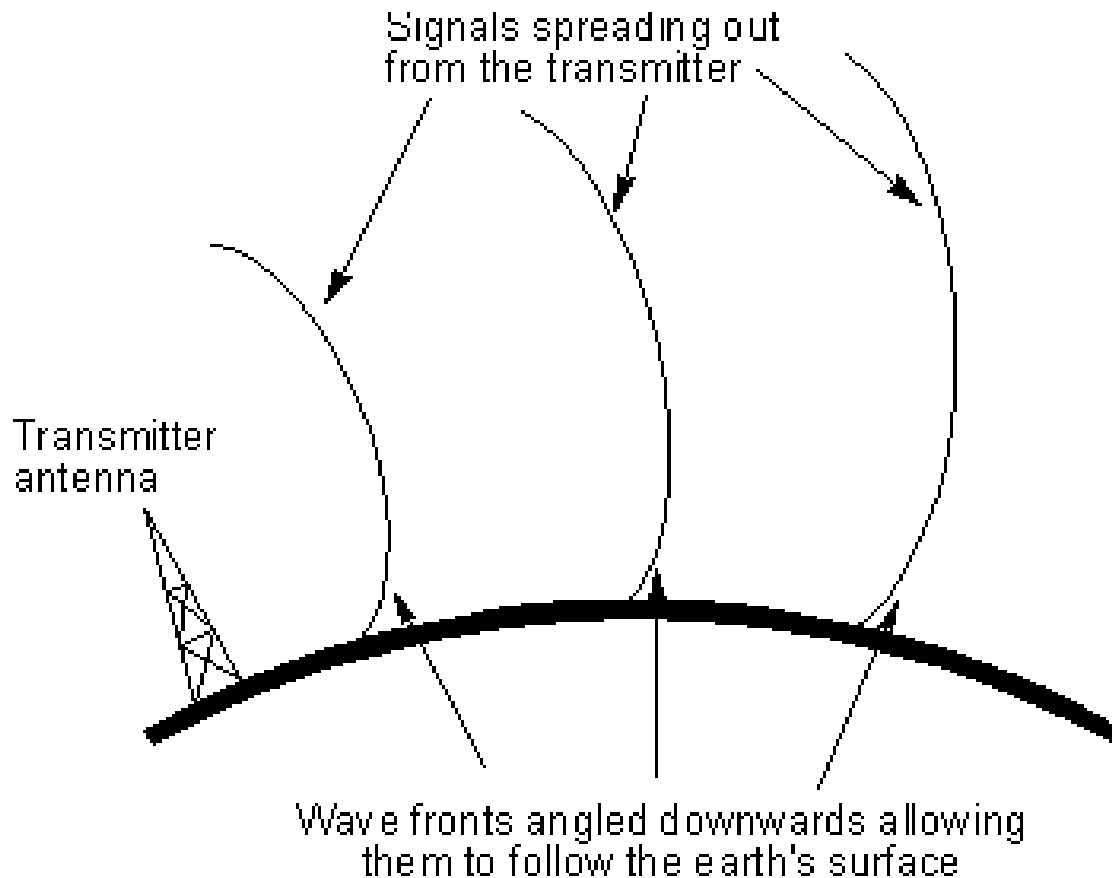
* ARRL says 0, Philley says highly variable



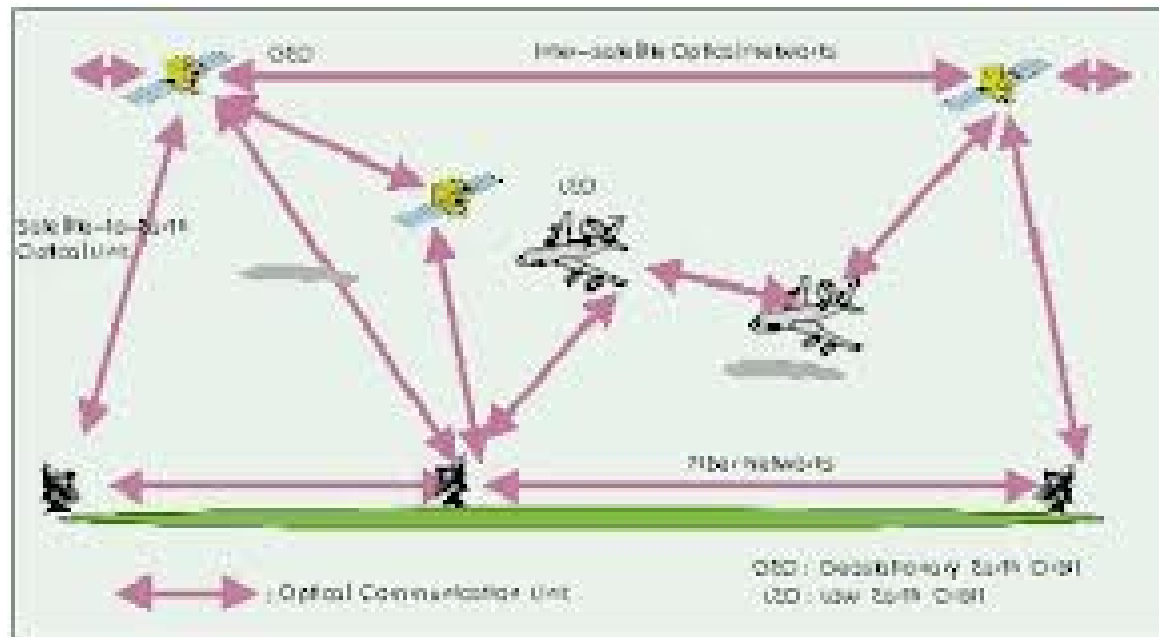
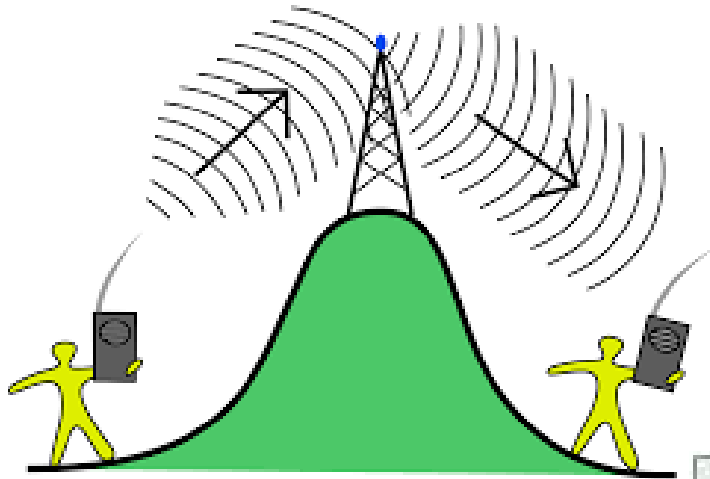
PUDs –Potentially Useful Definitions

- **MUF** – maximum usable frequency
- **FOT** – frequency of optimal transmission
- **Critical Frequency**
- **Critical Angle**
- **LUF** – lowest usable frequency
- **Skip Distance** – single hop
- **Skip Zone** – skip over zone

Ground Wave RF Propagation

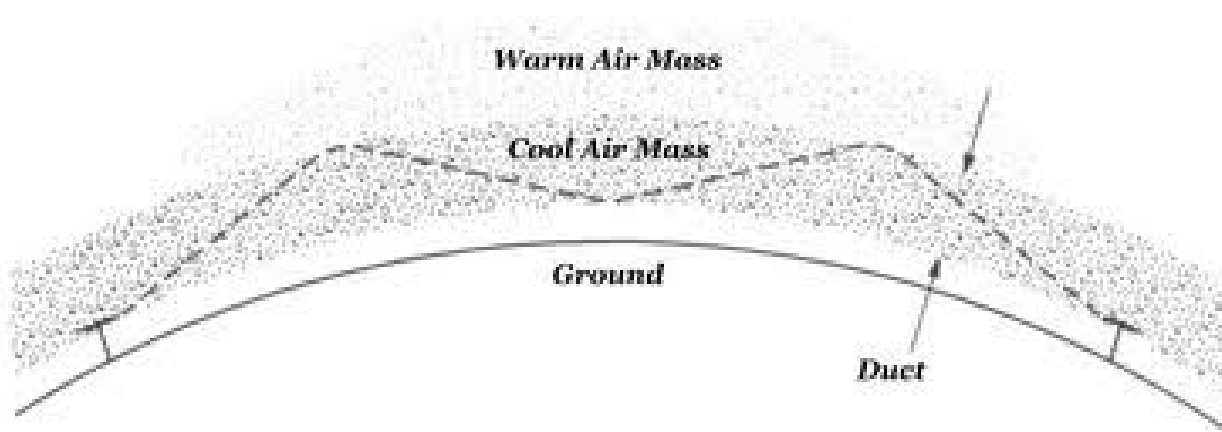


Free Space RF Propagation



▲ Figure 1. Space-ground laser communications system

Tropospheric RF Propagation

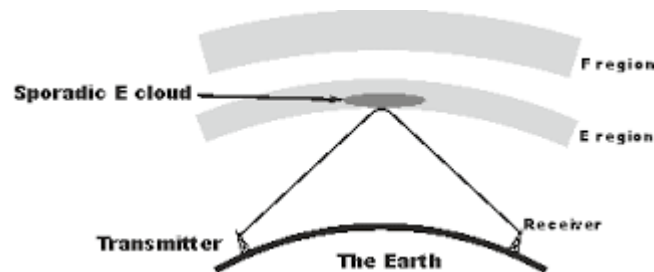
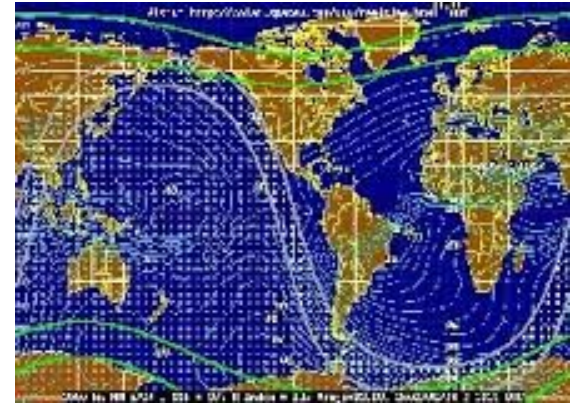


Propagation ITWAs

- **Frequency**
- **Time-of-day**
- **Take off (and incidence) angle**
- **Polarization (of signal/antenna)**
- **Multi-path (multi-hop/bounce)**
- **Atmospheric conditions**
- **Solar Activity** – normal solar radiation, sun spots, solar flares, corona mass ejections

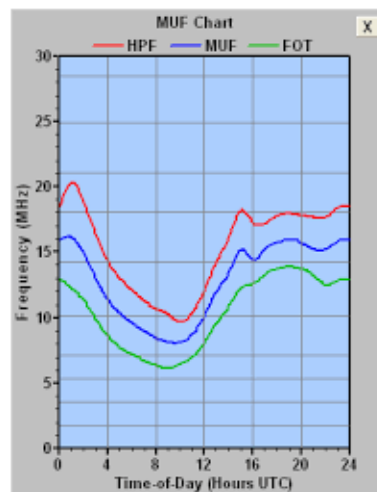
Special Cases

- Gray Line
- Trans Equatorial Propagation
- Meteor Burst
- Sporadic E
- NVIS near vertical incidence skywave
- Auroral ionization, EME, Knife Edge Diffraction



Resources

- Beacons
- KARS webpage
- Internet
- Software
- QST *How's DX, World Above 50 MHz*
- MUF Charts
- ARRL – handbook, webpages
- DX maps and active QSO maps



Solar-Terrestrial Data
15 Nov 2015 1430 GMT
 SFI: **106** SN: **48**
 A: **10** K: **2**
 X-Ray: **B2.4**
 304A: **149.2** @ SEM
 Ptn Flx: **0.16**
 Elc Flx: **1290.00**
 Aurora: **2/n=1.99**
 Bz: **2.8** SW: **423.2**

HF Conditions

| Band | Day | Night |
|---------|------|-------|
| 80n-40n | Fair | Good |
| 30n-20n | Good | Good |
| 17n-15n | Fair | Fair |
| 12n-10n | Poor | Poor |

VHF Conditions

Aur Lat **66.5°**
 Aurora **Band Closed**
 6n EsEU **Band Closed**
 4n EsEU **Band Closed**
 2n EsEU **Band Closed**
 2n EsNA **Band Closed**
 EME Deg **Very Poor**
 Solar Flare Prb **25%**
 MUF **ES - SEASON BREAK**
 MS **0** MIN **6** **12** **18** UTC **MAX**

Geonag Field QUIET
 Sig Noise Lvl **S1-S2**
 MUF US Boulder **17.00**
<http://www.n0nbh.com>
 Copyright Paul L Herrman 2012

datzit

