Propagation Modes by Colors

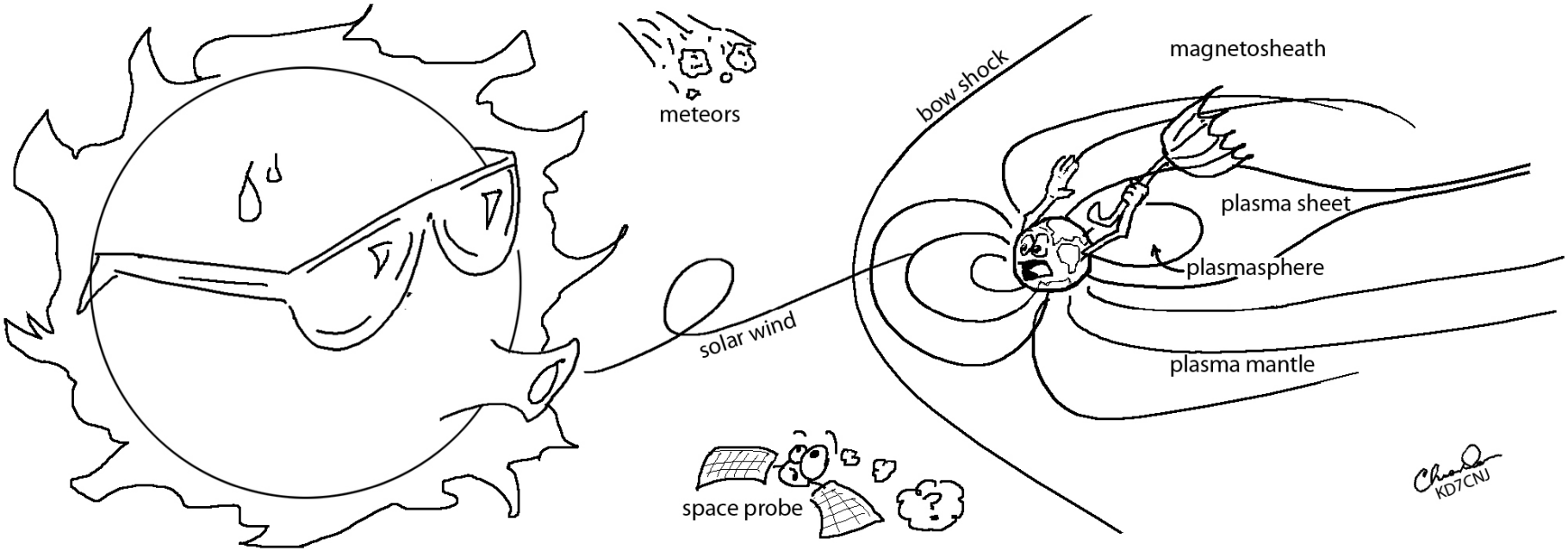
When it comes to HF operating, some modes allow you to communicate farther than others. Free software can help predict which ones are likely to be most effective.

Kai Siwiak, KE4PT

April 28, 2020 (via zoom.us)

The Big Picture

It's all blowing in the Solar Wind



Artwork courtesy of Chris Dean, KD7CNJ

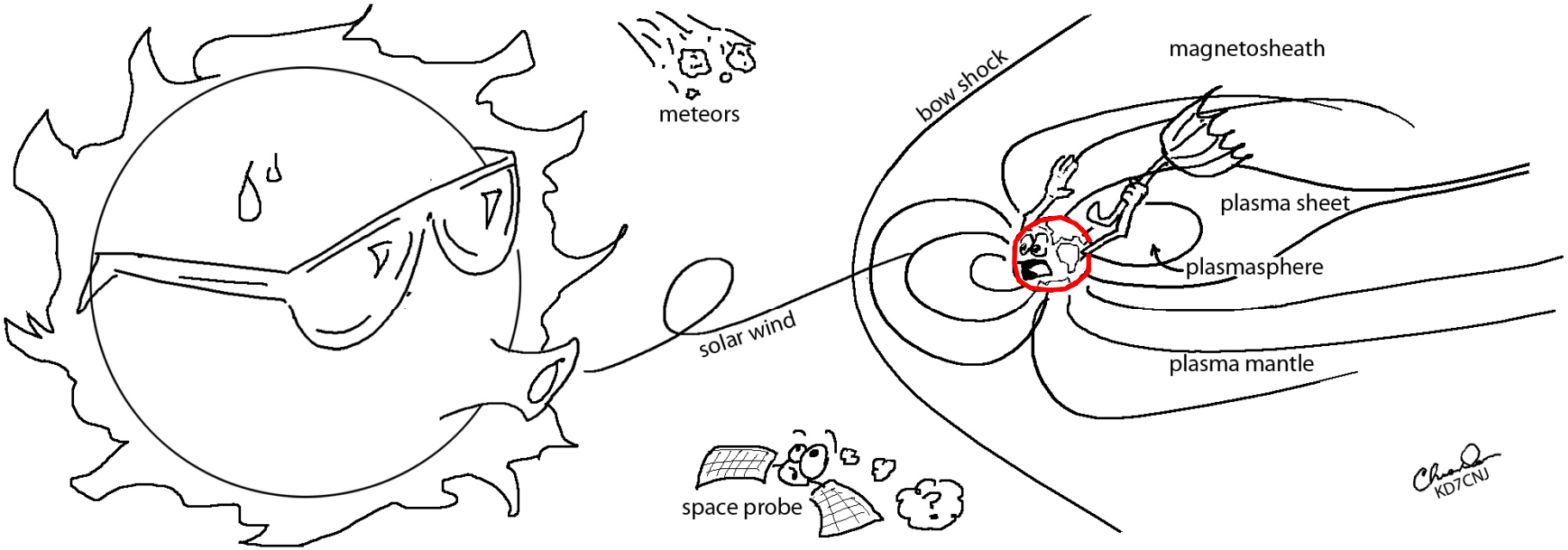
The Big Picture

The Grand Scale Events

- **What happens 150 million km away on the Sun impacts our local vicinity**
- **Resulting Space Weather drives the Ionosphere**

The Detail

Happens within 500 km of Earth

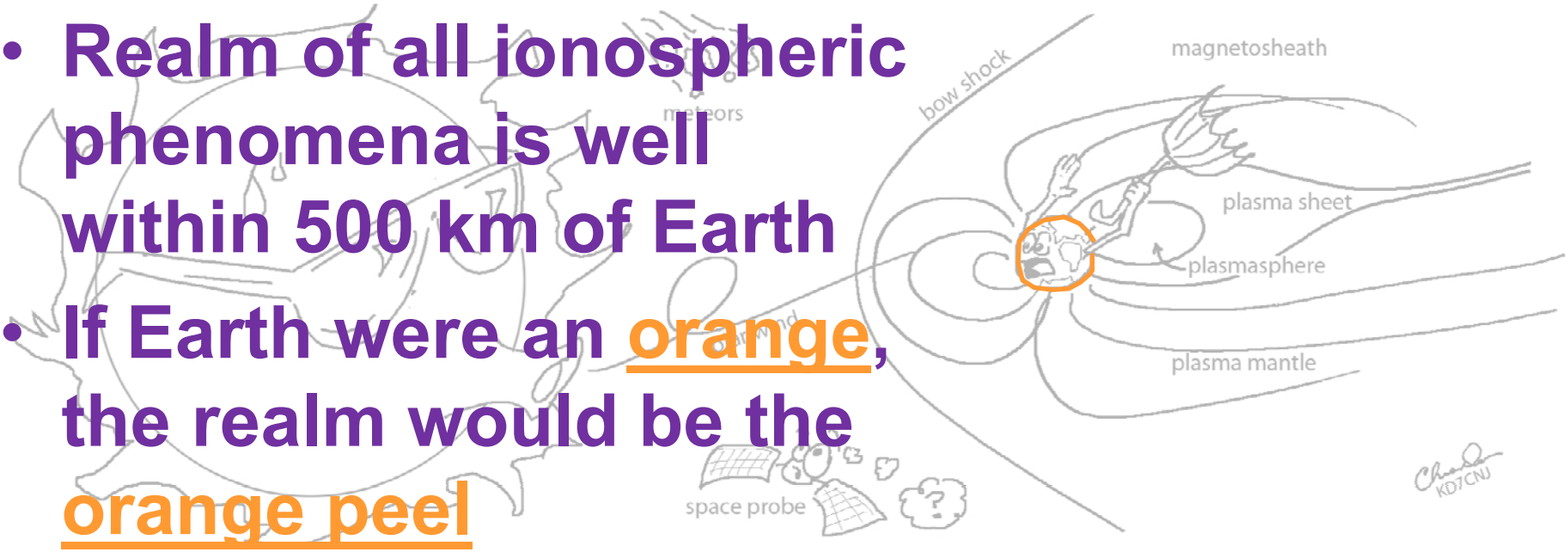


500 km is about 300 miles

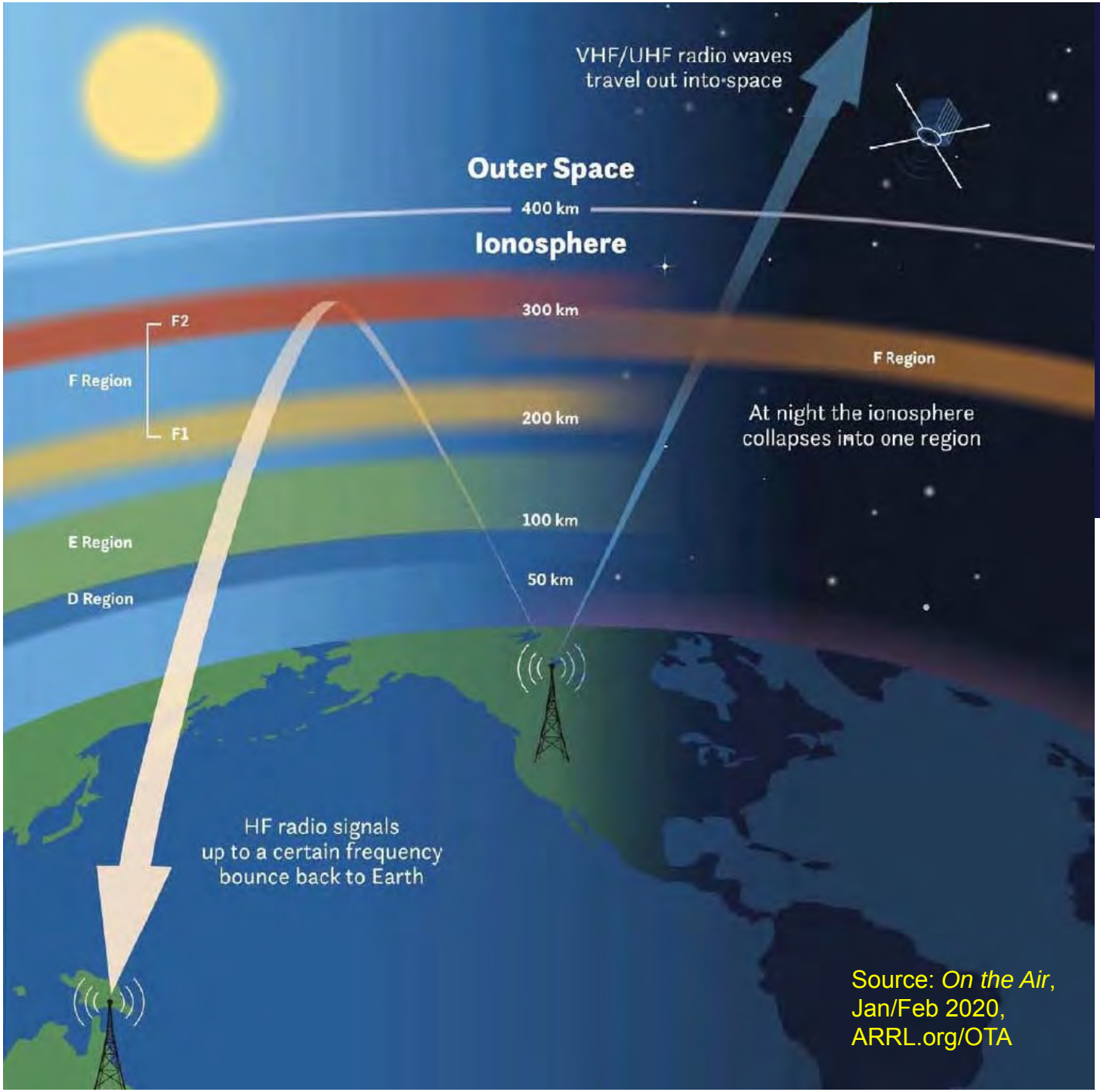
The Detail

Is In Our Immediate Vicinity

- **Realm of all ionospheric phenomena is well within 500 km of Earth**
- **If Earth were an orange, the realm would be the orange peel**



"within 500 km of Earth's surface"



"Within the Orange Peel"

This is the realm of HF propagation prediction

Source: *On the Air*, Jan/Feb 2020, ARRL.org/OTA

Modest Stations

May Need to Crank up the Range Knob

Artwork courtesy of Chris Dean, KD7CNJ

What range knob???

Range Knob Tool Kit

- **Range Knob lets you choose the best mode for your HF operation**
- **<u>Tool #1</u>: Afreet Software *HamCAP***
  - Uses *VOACAP* propagation engine
  - Select ‘MAP’ to compute propagation
  - Hover mouse over Map to read *SNR/Hz*
- **<u>Tool #2</u>: Apply the KE4PT Color and Mode Correspondence Chart**

Afreet Software, Inc.

Software created by Alex Shovkoplyas, VE3NEA

Products

new!

GRITTY

RTTY Skimmer Server

HamVNA

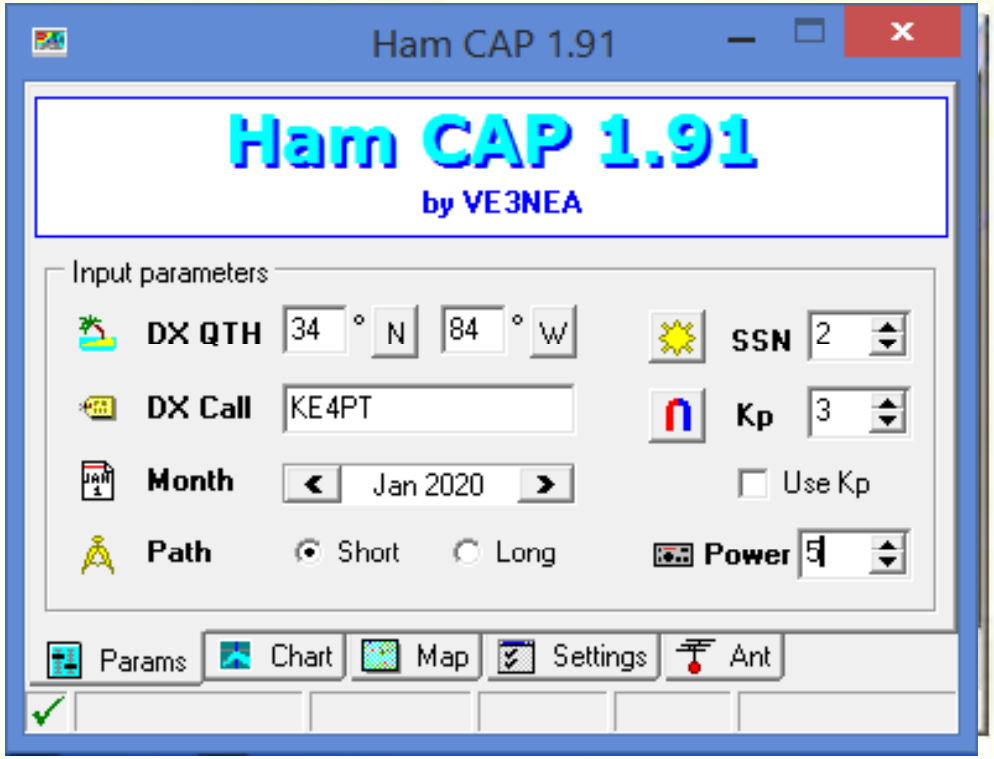
DX Atlas

http://www.dxatlas.com

Ham CAP 1.91

HF propagation prediction tool for Amateur Radio

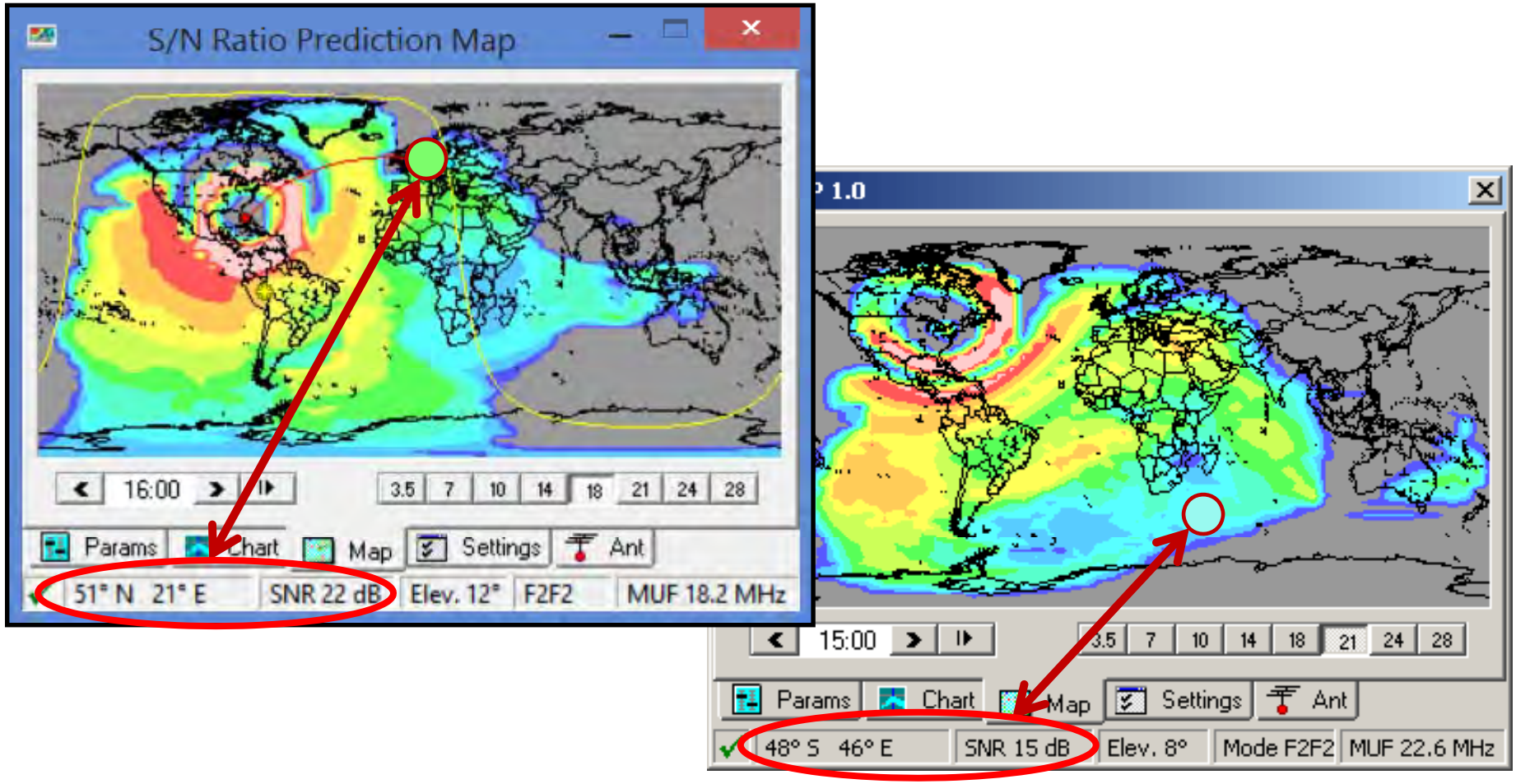
FREEWARE



HamCAP

- Uses *VOACAP* propagation engine
- You input the SSN, power, date
- Choose your antennas
- Select frequency band
- Select ‘MAP’ to compute propagation
- **Hover mouse over Map to read *SNR/Hz***

Mouse-over HamCAP Map
to see SNR in 1 Hz Bandwidth



Now You Need the "Big Box" of Crayons

The KE4PT Color and Mode Correspondence Chart

Table 1
How *HamCAP* Map Colors Correspond to Mode SNRs

SNR span (dB in 1 Hz)	Color	Mode	Threshold SNR in 1 Hz
48+	Pink	AM	+56 dB
42 – 47	Red	SSB	+42 dB
38 – 41	Orange	FM	+40 dB
33 – 37	Yellow	RTTY	+33 dB
28 – 32	Light Green	CW	+28 dB
22 – 27	Green	PSK31	+22 dB
13 – 21	Light Blue	FT8/FT4	+14/+16 dB
7 – 12	Medium Blue	JT9/JT65	+7/+9 dB
1 – 6	Blue	WSPR	+6 dB

The 'range knob' extends over more than 50 dB!!

Source: *QST*, April 2020, ARRL.org/QST

Different Software Report SNR in Different Bandwidths

- WSJT-X reports SNR in 2500 Hz BW
  - *reference*
- HamCAP displays SNR in 1 Hz BW
  - add 10 log(2500/1) = +34 dB to *reference*
- VOACAP Online displays SNR in 50 Hz
  - add 10 log(2500/50) = +17 dB to *reference*

The KE4PT Color and Mode Correspondence Chart

Table 1
How *HamCAP* Map Colors Correspond to Mode SNRs

SNR span (dB in 1 Hz)	Color	Mode	Threshold SNR in 1 Hz	Threshhold SNR in 2500 Hz BW
48+	Pink	AM	+56 dB	+22 dB
42 – 47	Red	SSB	+42 dB	+8 dB
38 – 41	Orange	FM	+40 dB	+6 dB
33 – 37	Yellow	RTTY	+33 dB	-1 dB
28 – 32	Light Green	CW	+28 dB	-6 dB
22 – 27	Green	PSK31	+22 dB	-12 dB
13 – 21	Light Blue	FT8/FT4	+14/+16 dB	-20/-18 dB
7 – 12	Medium Blue	JT9/JT65	+7/+9 dB	-27/-25 dB
1 – 6	Blue	WSPR	+6 dB	-28 dB

Source: *QST*, April 2020, ARRL.org/QST

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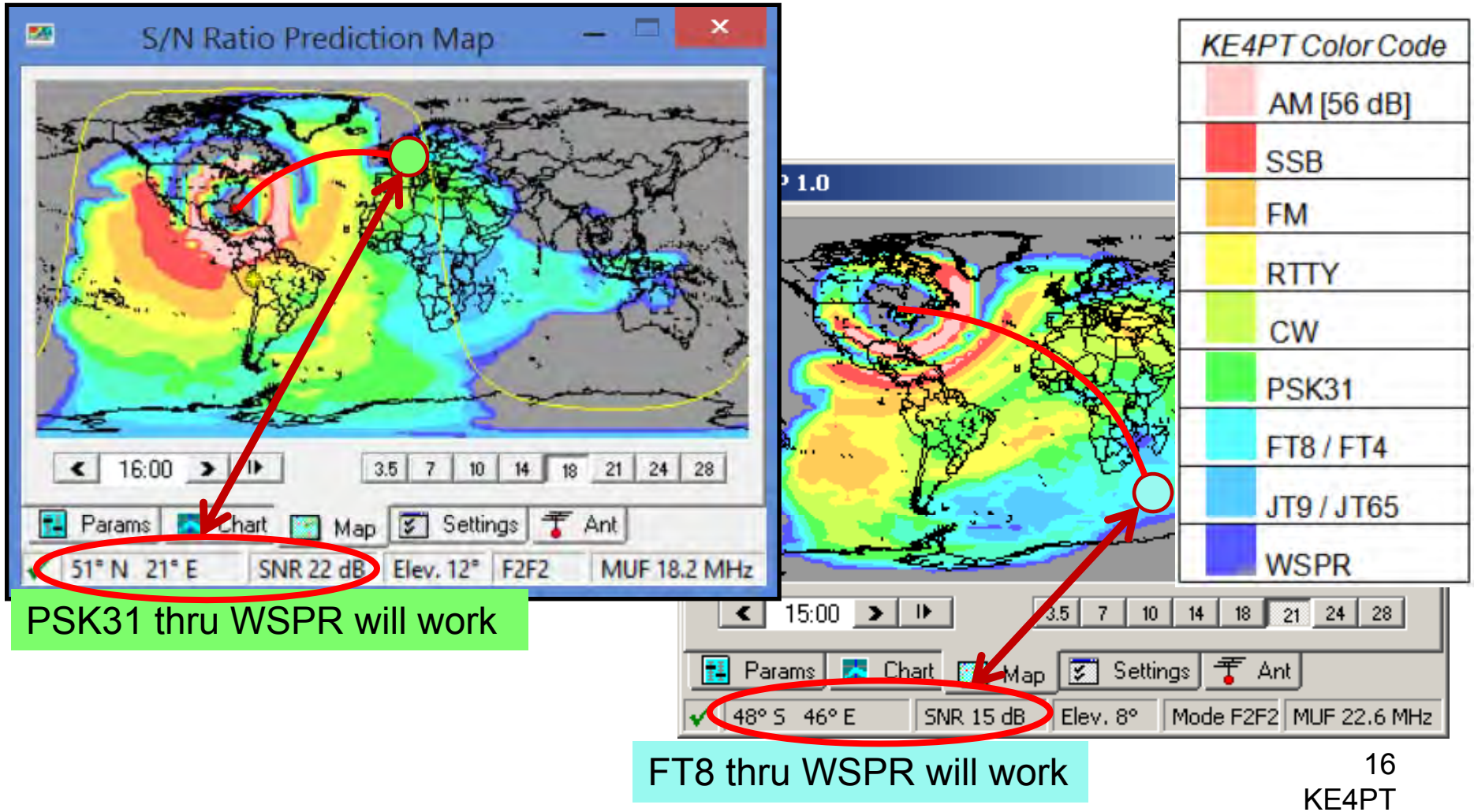
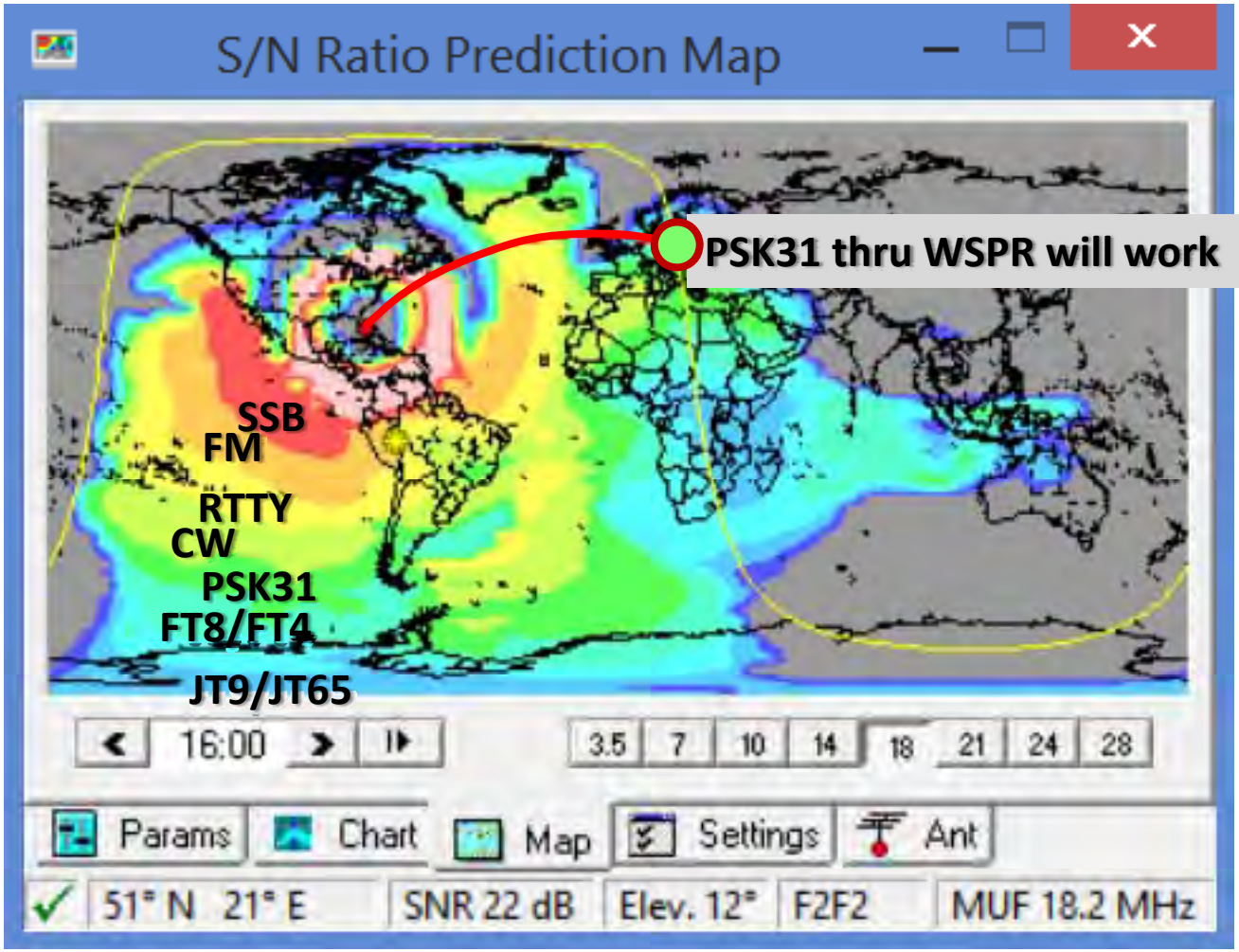
Mode

Sensitivity in 2500 Hz

Mouse-over HamCAP Map
and apply the Color Code



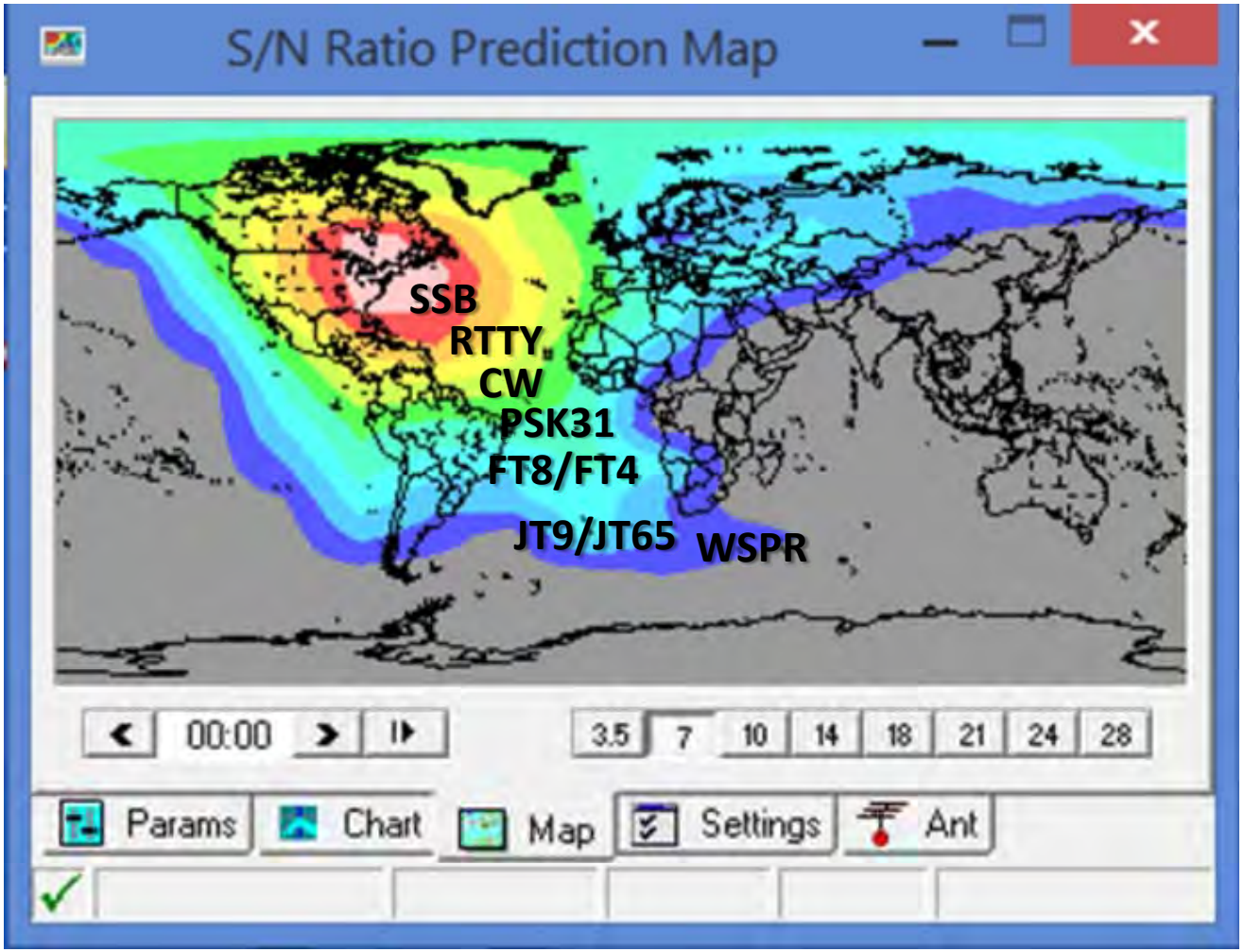
Range Comparison of HF Modes



KE4PT Color Code
AM [56 dB]
SSB
FM
RTTY
CW
PSK31
FT8 / FT4
JT9 / JT65
WSPR

Each mode includes all the colors above its limit color in the Color Code Chart

QRP – April 2020 Ionosphere at 00:00z, on 7 MHz Band



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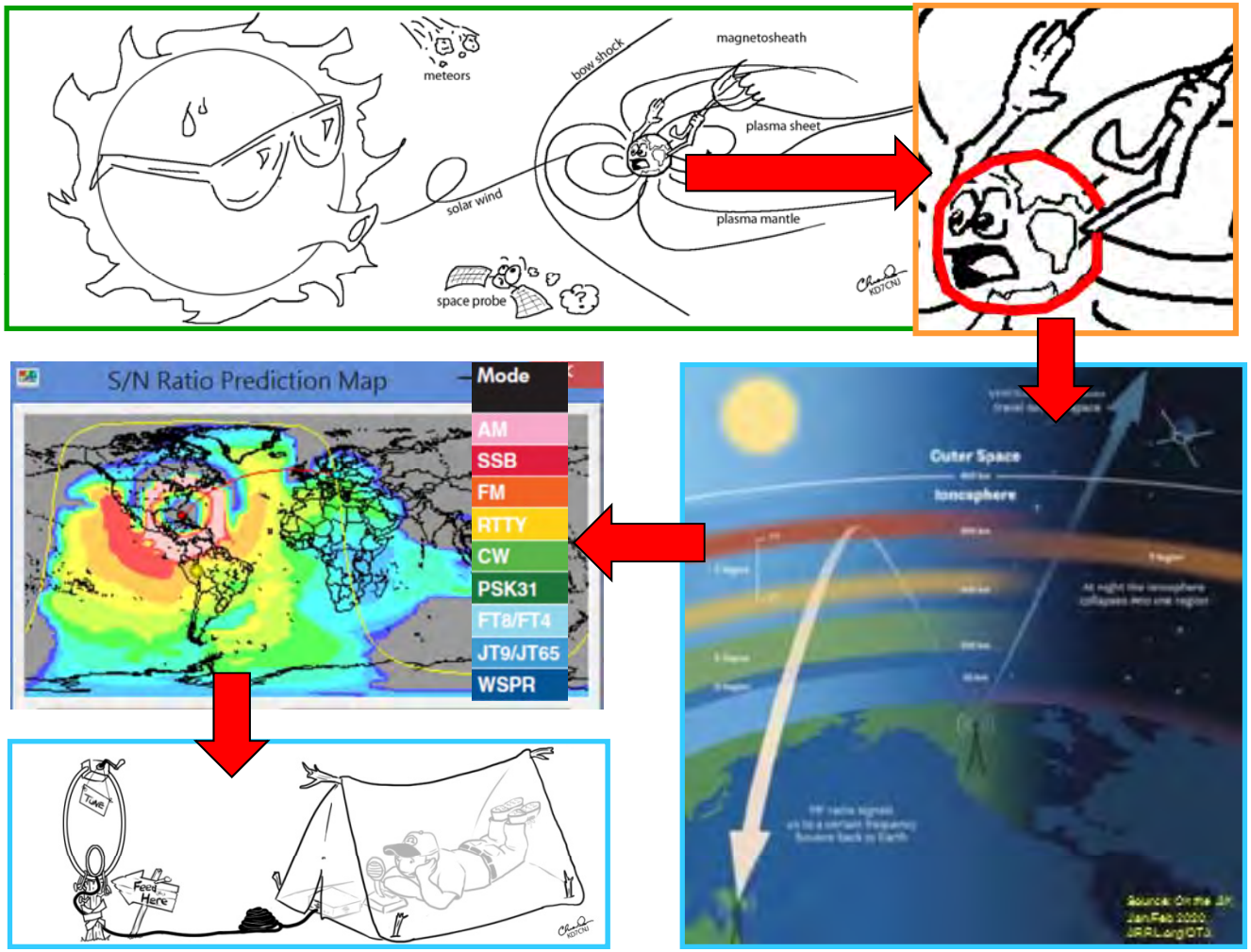
From the Sun to Your Ham Shack



Summary: Range Knob Tool Kit

- *HamCAP Freeware* is the propagation tool for predicting signal level at a given range and coverage area

- *The KE4PT Color Correspondence Chart* is tool for choosing the best mode for your HF operation over the given range

“When it rains it pours”

- Take all this with a grain of salt
- This is all VERY approximate
- It is for your amusement only
- Maybe even:

  take it all with a pound of salt!

Thanks for your Attention

?? questions ??

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Thanks for your Attention

?? how about answers ??

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