

GB2RS Propagation Report

Steve Nichols G0KYA

Chairman, Propagation Studies Committee



How do we produce it? What can we learn?



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Advancing amateur radio since 1913

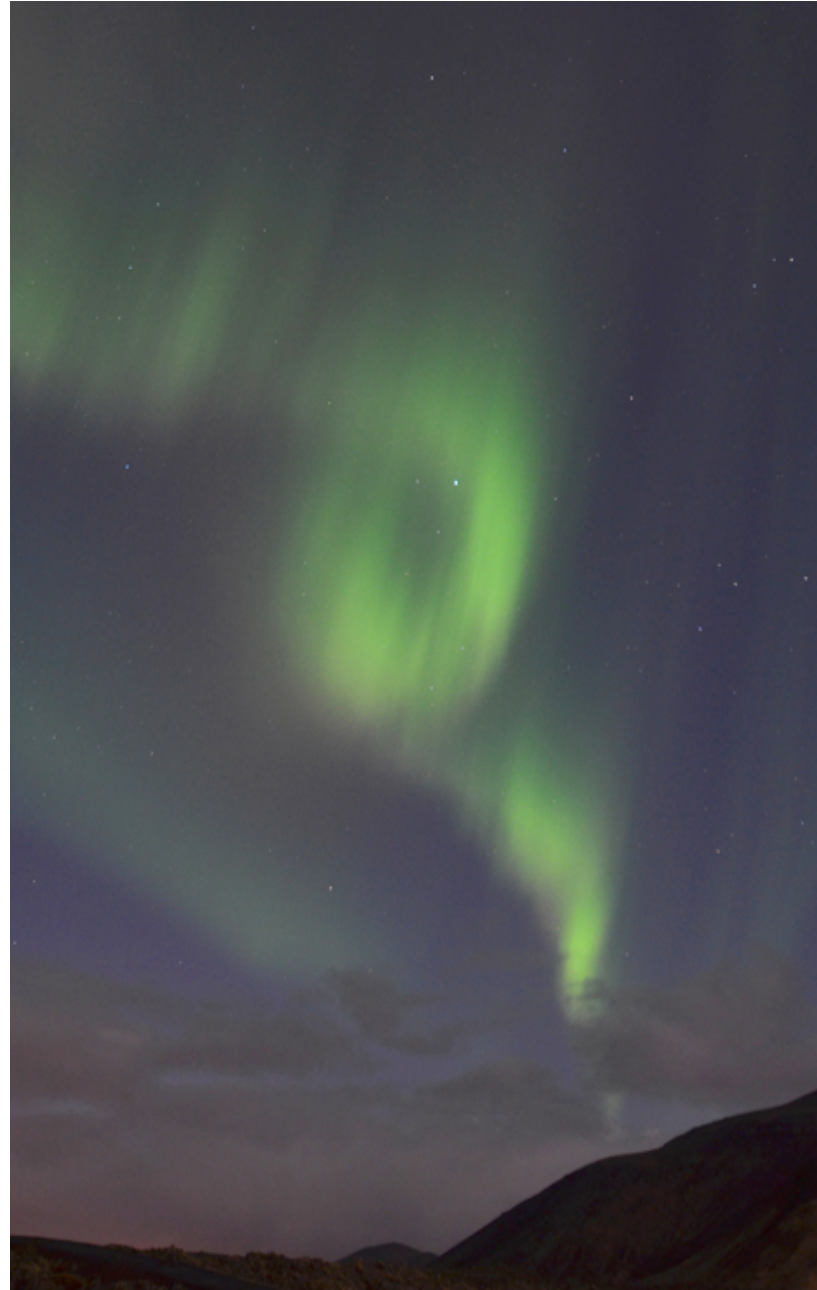


History

- GB2RS started on Sunday 25 September 1955
- GPO said “that the broadcasts would be made on Sunday mornings on a frequency in the 3.5 to 3.8Mc/s band, and that telephony and/or telegraphy may be used.”
- 7MHz came on board 14 May 1956
- The propagation segment was produced by Neil G0CAS and Martin G3USF for more than 20 years
- Consisted of the solar factual data and the solar forecast

History

- What's all this Bz stuff?
- What are nanoTeslas
- Can we make it more relevant to radio users?
- Can we include VHF?
- Can we include HF predictions?
- But don't make it any longer....



Current contents

**Steve
G0KYA**

HF

**VHF/
UHF**

**Jim
G3YLA**

**Jim
G3YLA**

Es

**EME
Aurora
Meteor
Scatter**

**John G4BAO
Sam G4DDK**

But where do the data come from?

Current contents - HF

Last week's solar flux index, K indices, events

```
:Product: Daily Solar Data          DSD.txt
:Issued: 1425 UT 26 Sep 2016
#
# Prepared by the U.S. Dept. of Commerce, NOAA, Space Weather Prediction Center
# Please send comments and suggestions to SWPC.Webmaster@noaa.gov
#
#           Last 30 Days Daily Solar Data
#
#           Radio      Sunspot      Stanford GOES15
#           Flux      SESC          Area          Solar X-Ray  ----- Flares -----
#           10.7cm Sunspot 10E-6   New          Mean  X-Ray  X-Ray  Optical
#           Date   Number Hemis. Regions Field Flux  C  M  X  S  1  2  3
#-----
2016 08 27   84    52    130     1   -999   B1.0  0  0  0  0  0  0  0
2016 08 28   85    64    200     1   -999   B1.1  1  0  0  2  0  0  0
2016 08 29   88    67    350     0   -999   B2.7  3  0  0  8  0  0  0
2016 08 30  100    64    290     0   -999   B5.0  2  0  0  1  0  0  0
2016 08 31   98    91    575     2   -999   B4.2  2  0  0  3  0  0  0
2016 09 01   95    66    730     1   -999   B3.0  0  0  0  3  0  0  0
2016 09 02   95    50    620     0   -999   B3.4  0  0  0 10  0  0  0
2016 09 03   99    46    690     0   -999   B2.1  0  0  0  2  0  0  0
2016 09 04   97    59    560     1   -999   B1.9  0  0  0  2  0  0  0
2016 09 05   94    22    420     0   -999   B1.4  0  0  0  1  0  0  0
2016 09 06   92    32    410     1   -999   B1.3  0  0  0  1  0  0  0
2016 09 07   93    50    470     0   -999   B1.4  0  0  0  0  0  0  0
2016 09 08   95    49    400     1   -999   B1.0  0  0  0  1  0  0  0
2016 09 09   91    65    430     1   -999   B1.1  0  0  0  3  0  0  0
```

From:

<ftp://ftp.swpc.noaa.gov/pub/indices/DSD.txt>

<ftp://ftp.swpc.noaa.gov/pub/indices/DGD.txt>



Current contents – HF

Next week's solar flux index, A/K indices, events



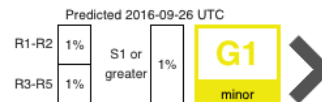
SPACE WEATHER PREDICTION CENTER
NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION

Monday, September 26, 2016 15:57:31 UTC

HOME ABOUT SPACE WEATHER PRODUCTS AND DATA DASHBOARDS MEDIA AND RESOURCES SUBSCRIBE ANNUAL MEETING FEEDBACK

Search

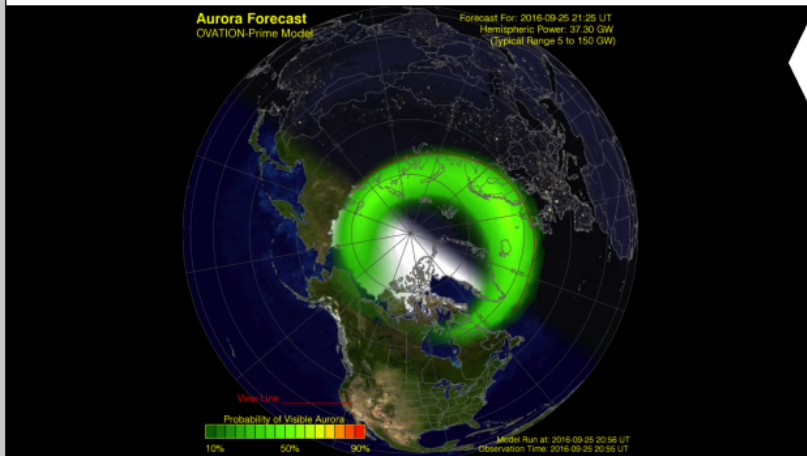
SPACE WEATHER CONDITIONS on NOAA Scales



Solar Wind Speed: 428 km/sec

Solar Wind Magnetic Fields: Bt 9 nT, Bz -7 nT

Noon 10.7cm Radio Flux: 85 sfu



Minor (G1) Geomagnetic Storms Observed - 25 Sep 2016

published: Sunday, September 25, 2016 21:00 UTC

Minor (G1) geomagnetic storm conditions were observed at 25/0559 UTC and again at 25/2037 UTC.

US-TEC Model Upgrade

published: Thursday, September 15, 2016 16:05 UTC

Early Deployment Update: SWPC will deploy the Total Electron Content model upgrade one week early, on Monday 9/19.

27 July 2016 - It's all systems go for NOAA's first deep-space space weather satellite

published: Thursday, June 23, 2016 20:40 UTC

Beginning at Noon EDT (1600 UTC) on Wednesday, July 27, 2016, SWPC will start using data from NOAA's Deep Space Climate Observatory (DSCOVR) spacecraft

SWPC now on Twitter as of 2 May

published: Monday, May 23, 2016 17:10 UTC

The Space Weather Prediction Center began use of Twitter on May 2nd as another social media outreach tool.

SERVING ESSENTIAL SPACE WEATHER COMMUNITIES

Aviation

Electric Power

Emergency Management

Global Positioning System (GPS)

From:

<http://www.swpc.noaa.gov/>



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State of the sun

The screenshot displays the SolarHam website interface. At the top, it shows the UTC Time as 16:08:14 Mon and navigation links for SolarHam Main, News Archive, Just Data, Gallery, and Ham Radio. The main content area is divided into several sections:

- Regions:** 2597
- The Sun Today:** Updated September 26, 2016. Includes images of the Sun and a Magnetogram.
- AVERAGES:** AUG. Solar Flux 85.0, Sunspots 50.4, Flare Max M1.3.
- SolarHam by Amateur Radio Station VE3EN:** Welcome to SolarHam.com. All of your solar and aurora needs in one place!
- Solar Flare Risk:** M-Class: 01%, X-Class: 01%.
- Active Watches:** Geomag. Storm YES, Radiation Storm NO.
- 3-Day Geomagnetic Forecast:**

September 26	September 27	September 28
4 (G0) Max Kp	4 (G0) Max Kp	6 (G2) Max Kp
Prob-M 10% Prob-H 40%	Prob-M 05% Prob-H 25%	Prob-M 20% Prob-H 50%
- Latest Space Weather News and Updates:** Includes imagery from GOES-15 SXI, SDO AIA 131, SDO Intensity, and Lasco C2.

From:
<http://www.solarham.net/>

Current contents - HF

Next week's solar flux index, A/K indices, events – both NOAA and USAF

27-DAY OUTLOOK OF 10.7 CM RADIO FLUX AND GEOMAGNETIC INDICES

```
:Product: 27-day Space Weather Outlook Table 27DO.txt
:Issued: 2016 Sep 26 0104 UTC
# Prepared by the US Dept. of Commerce, NOAA, Space Weather Prediction Center
# Product description and SWPC contact on the Web
# http://www.swpc.noaa.gov/wwire.html
```

```
# 27-day Space Weather Outlook Table
# Issued 2016-09-26
#
# UTC      Radio Flux   Planetary   Largest
# Date     10.7 cm     A Index    Kp Index
2016 Sep 26 85          18         5
2016 Sep 27 85          12         4
2016 Sep 28 85          35         6
2016 Sep 29 85          35         6
2016 Sep 30 80          35         6
2016 Oct 01 80          25         5
2016 Oct 02 80          20         5
2016 Oct 03 80          16         4
2016 Oct 04 80          10         3
2016 Oct 05 85          8          3
2016 Oct 06 85          5          2
```

USAF 45-DAY AP AND F10.7CM FLUX FORECAST

```
:Issued: 2016 Sep 25 2101 UTC
# Prepared by the U.S. Air Force.
# Retransmitted by the Dept. of Commerce, NOAA, Space Weather Prediction Center
# Please send comments and suggestions to SWPC.Webmaster@noaa.gov
```

45-Day AP and F10.7cm Flux Forecast

45-DAY AP FORECAST

```
26Sep16 018 27Sep16 012 28Sep16 035 29Sep16 035 30Sep16 035
01Oct16 025 02Oct16 020 03Oct16 015 04Oct16 015 05Oct16 015
06Oct16 005 07Oct16 005 08Oct16 005 09Oct16 005 10Oct16 005
11Oct16 005 12Oct16 005 13Oct16 005 14Oct16 005 15Oct16 005
16Oct16 018 17Oct16 020 18Oct16 012 19Oct16 008 20Oct16 005
21Oct16 005 22Oct16 005 23Oct16 015 24Oct16 010 25Oct16 035
26Oct16 035 27Oct16 035 28Oct16 030 29Oct16 015 30Oct16 015
31Oct16 015 01Nov16 015 02Nov16 005 03Nov16 005 04Nov16 005
05Nov16 005 06Nov16 005 07Nov16 005 08Nov16 005 09Nov16 005
```

45-DAY F10.7 CM FLUX FORECAST

```
26Sep16 085 27Sep16 085 28Sep16 085 29Sep16 085 30Sep16 080
01Oct16 080 02Oct16 080 03Oct16 080 04Oct16 090 05Oct16 090
06Oct16 090 07Oct16 085 08Oct16 085 09Oct16 085 10Oct16 085
11Oct16 085 12Oct16 085 13Oct16 085 14Oct16 080 15Oct16 080
16Oct16 085 17Oct16 085 18Oct16 085 19Oct16 085 20Oct16 085
```

* K/A index prediction may also inform us about VHF aurora

From:

<http://www.swpc.noaa.gov/products/27-day-outlook-107-cm-radio-flux-and-geomagnetic-indices>

<http://www.swpc.noaa.gov/products/usaf-45-day-ap-and-f107cm-flux-forecast>

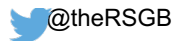


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Current contents - HF

How accurate are the NOAA/SWPC predictions? Does it matter?

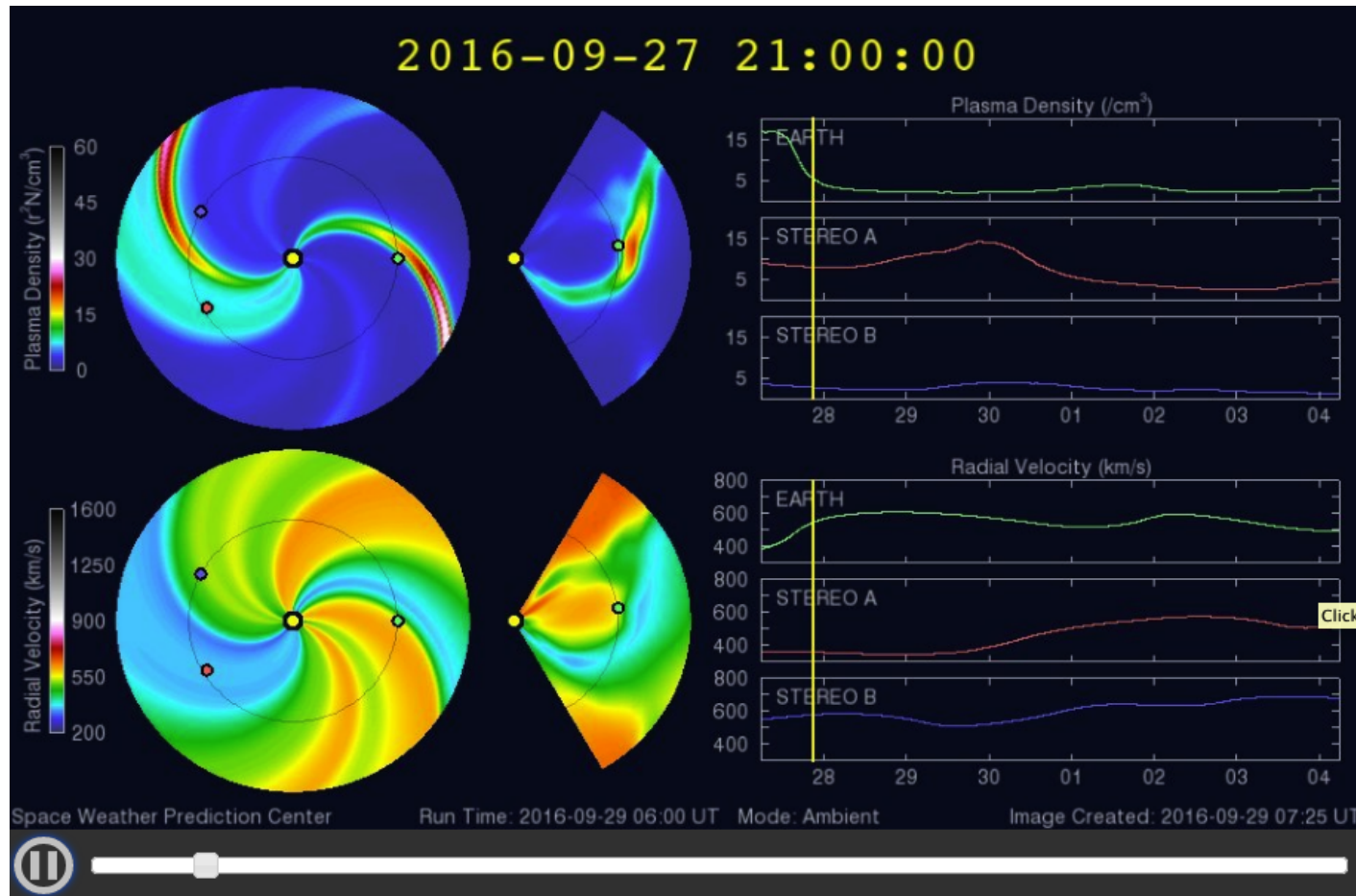
	NOAA (SWPC) prediction (SFI)	Actual
09/04/23	110-130	140-154
02/04/23	130s	127-137
26/03/23	130-140	148-160
19/03/23	135-145	143-160
12/03/23	170-185	134-143
05/03/23	145-165	143-180
26/02/23	125-145	159-182
19/02/23	130s	152-169

Note: For VOACap and Propy (ITURHFPROP) you are advised to use the predicted Smoothed (averaged) Sunspot Number or SSN. But there are at least six ways of smoothing them, including Standard, McNish and Lincoln, Kalman and combined methods!



Current contents - HF

Coronal mass ejection (CME) prediction – www.solarham.com

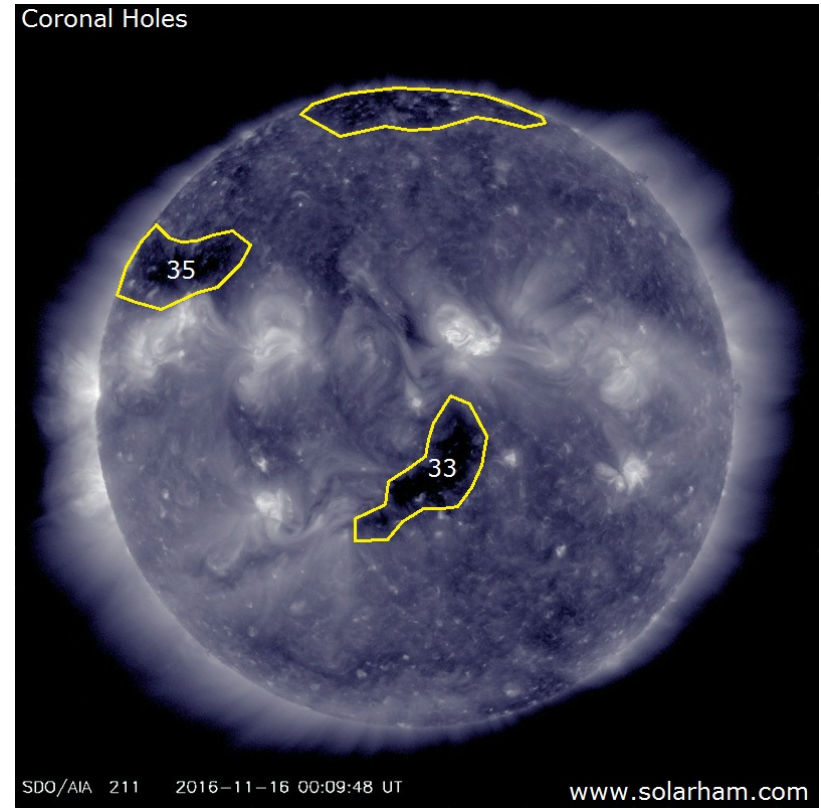
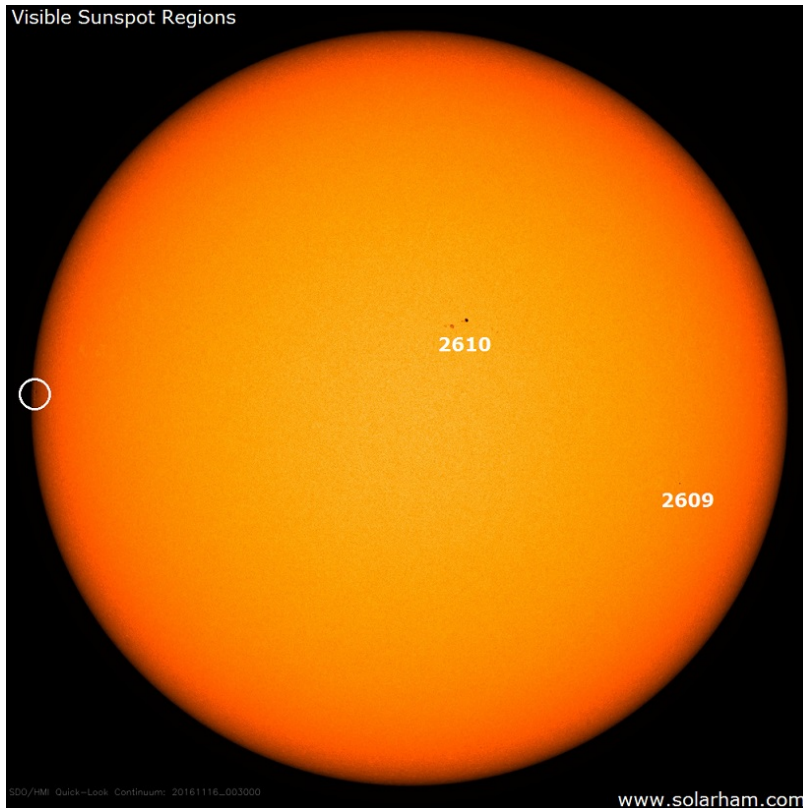


* May also inform us about VHF aurora



Current contents - HF

State of the sun – in both visible and extreme ultraviolet using SDO



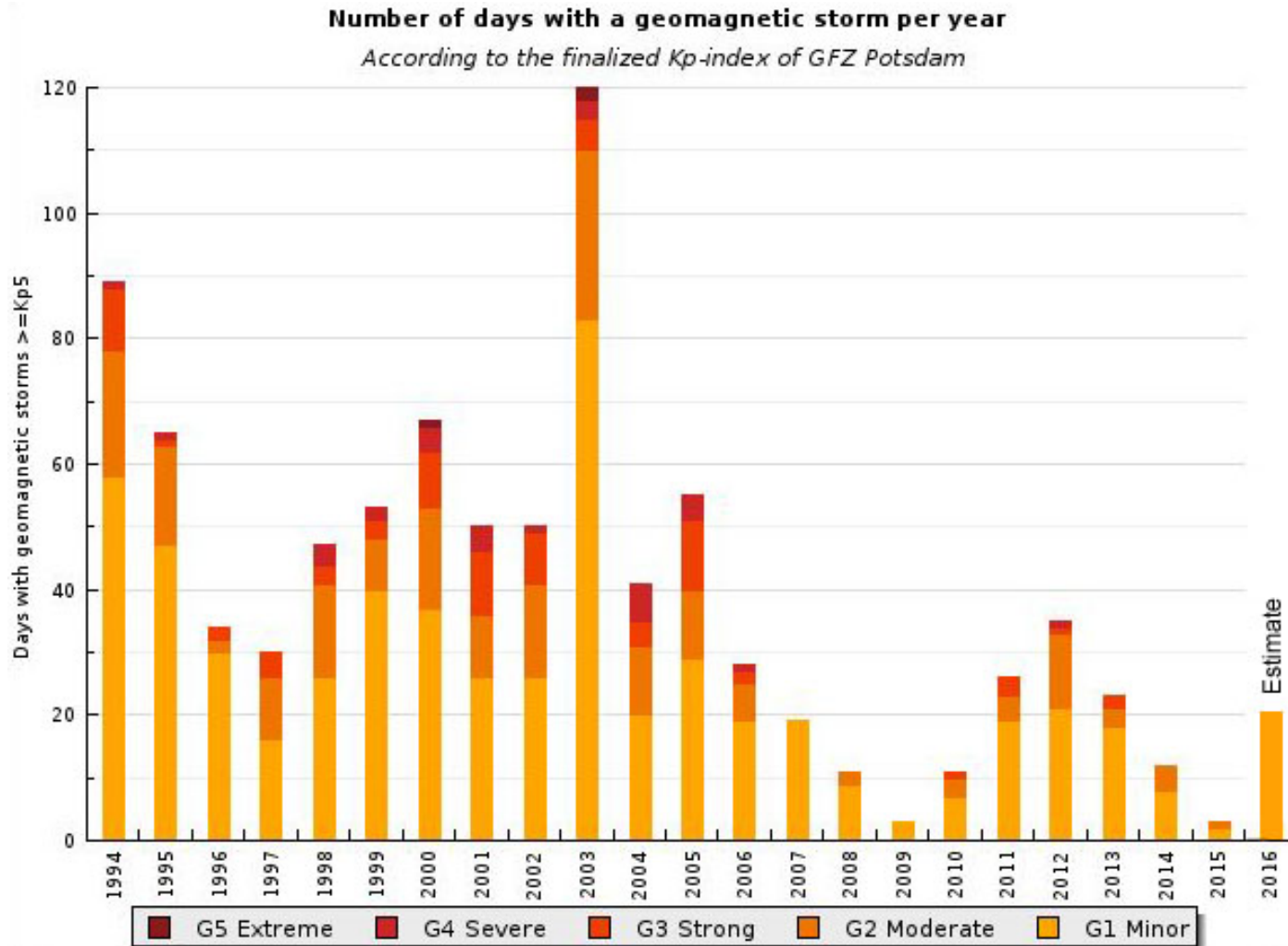
From:

http://www.solarham.net/latest_imagery/hmi1.htm

http://www.solarham.net/latest_imagery/211b.htm



Current contents - HF



© 2015 SpaceWeatherLive.com

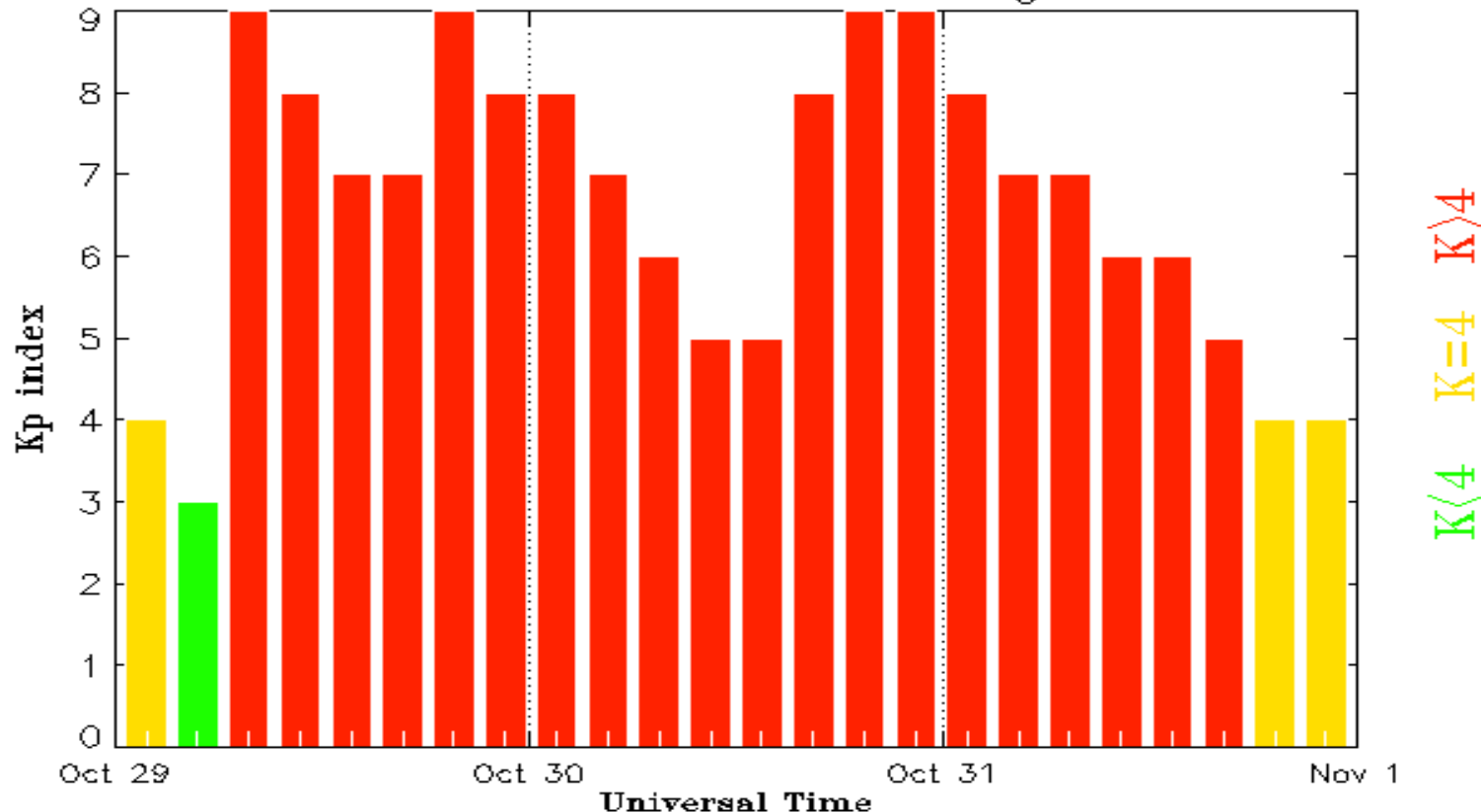
Source: NOAA®



Current contents - HF

The current unsettled geomagnetic conditions are typical of this point in the solar cycle. This is October 29 2003.

Estimated Planetary K index (3 hour data) Begin: 2003 Oct 29 0000 UTC



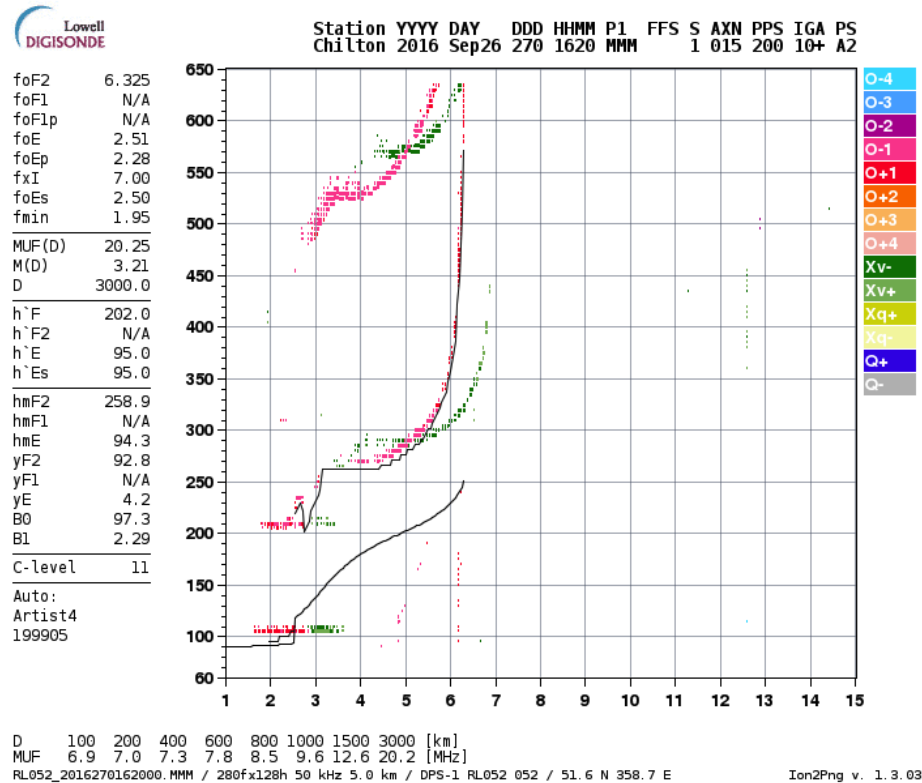
Updated 2003 Nov 1 02:45:03 UTC

NOAA/SEC Boulder, CO USA

Current contents - HF

Real-life/historical conditions using RAL Chilton (near Harwell), RAF Fairford or Dourbes ionosonde

2016-09-26 16:20:00



From:

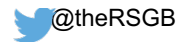
http://www.ukssdc.ac.uk/ionosondes/view_latest.html

<http://car.uml.edu/common/DIDBFastStationList>



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Current contents - HF

Propquest: Real-time/historical conditions using RAL Chilton (near Harwell), RAF Fairford or Dourbes ionosondes



EPI



Es blog



foF2



about

SERVICE STATUS
08 FEB 2023 - Ionosonde data availability is generally good, please use tick boxes below to select alternatives if a site is temporarily missing

Today

Archive >

NVIS

Compare

Averages

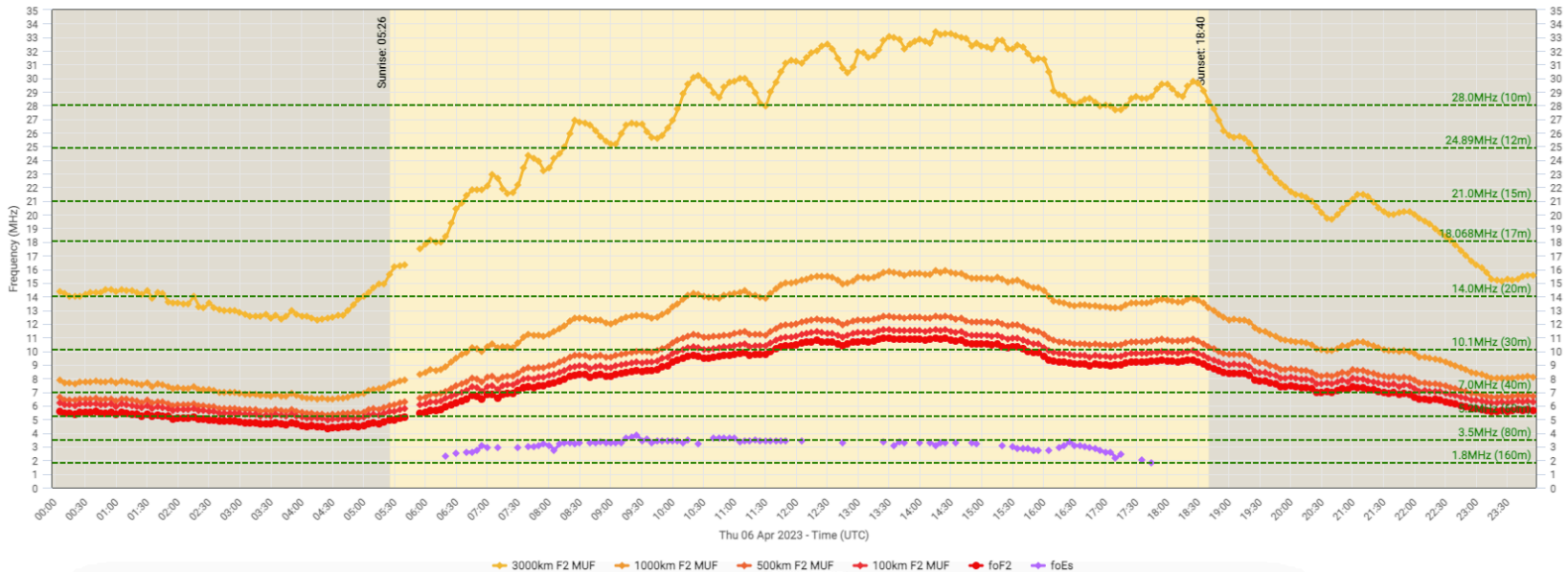
2023-04-06

GO

FF051 Fairford | RL052 Chilton | DB049 Dourbes

F2 (foF2) and Es (foEs) Critical Frequency / F2 Maximum Usable Frequency (MUF) for selected skip distances

Source: DB049 Dourbes | Global Ionospheric Radio Observatory



in association with Weatherquest

© propquest 2023

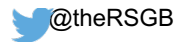
From:
www.propquest.co.uk



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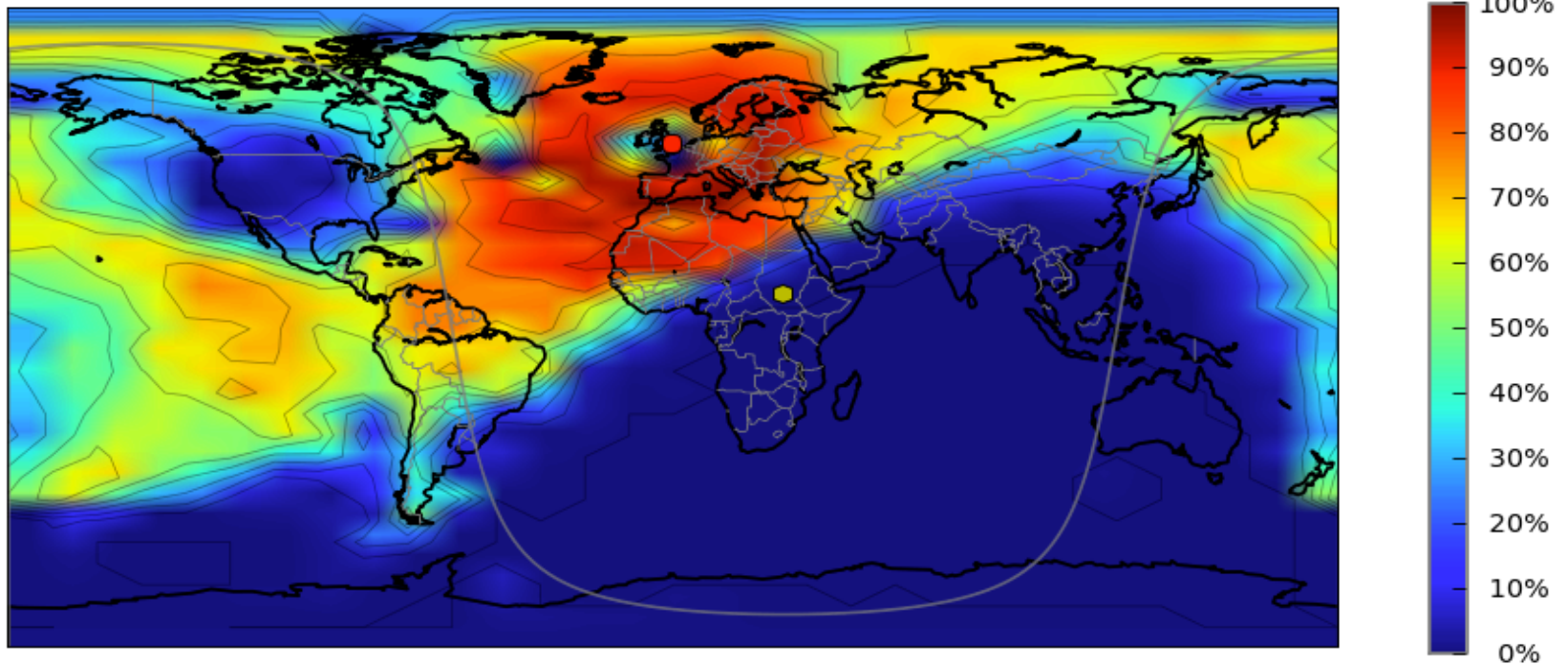


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Current contents - HF

Putting it all together – knowledge, past experience, VOACAP, Proppy

London (51.58N, 0.00E), Apr, 10 UTC, 14.100 MHz, 80 W, SSN 62, Mode: CW
TX Ant: [voaant/d10m.ant], RX Ants: [voaant/d10m.ant]



From:


www.voacap.com



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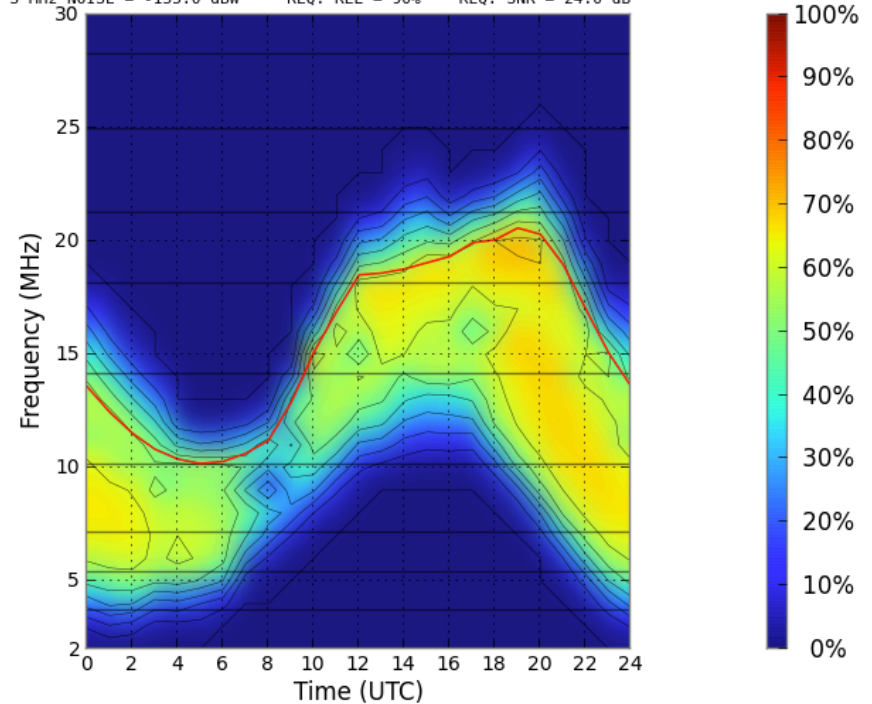
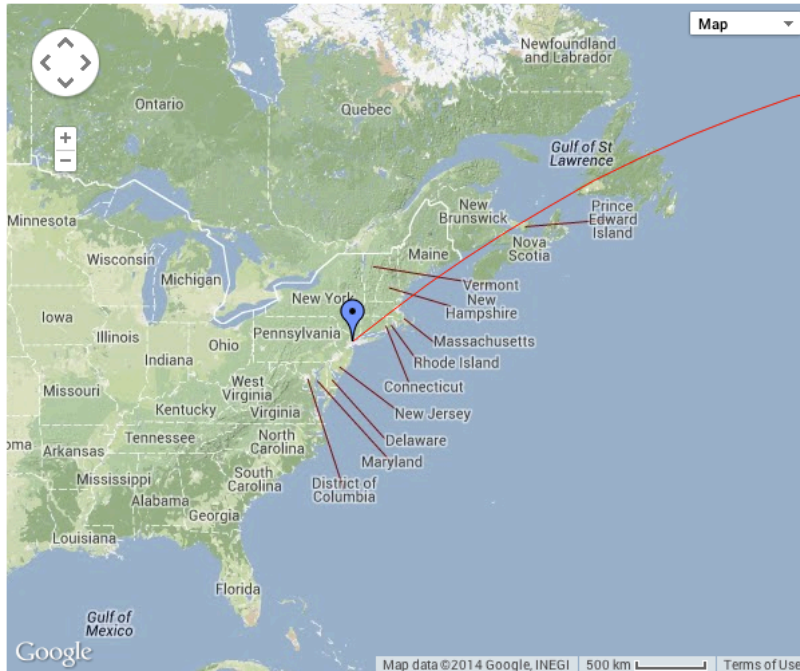
 @theRSGB

Current contents - HF

Putting it all together – knowledge, past experience, VOACAP, Predtest

Circuit Reliability (%)

Apr 2014 SSN = 62. Minimum Angle= 0.100 degrees
London New York City, NY AZIMUTHS N. MI. KM
51.58 N 0.00 E - 40.80 N 74.00 W 288.44 51.15 3007.1 5568.7
XMTR 2-30 2-D P-to-P[voacant/d10m.ant] Az= 0.0 OFFaz=288.4 0.080kW
RCVR 2-30 2-D P-to-P[voacant/d10m.ant] Az= 0.0 OFFaz= 51.2
3 MHz NOISE = -155.0 dBW REQ. REL = 90% REQ. SNR = 24.0 dB

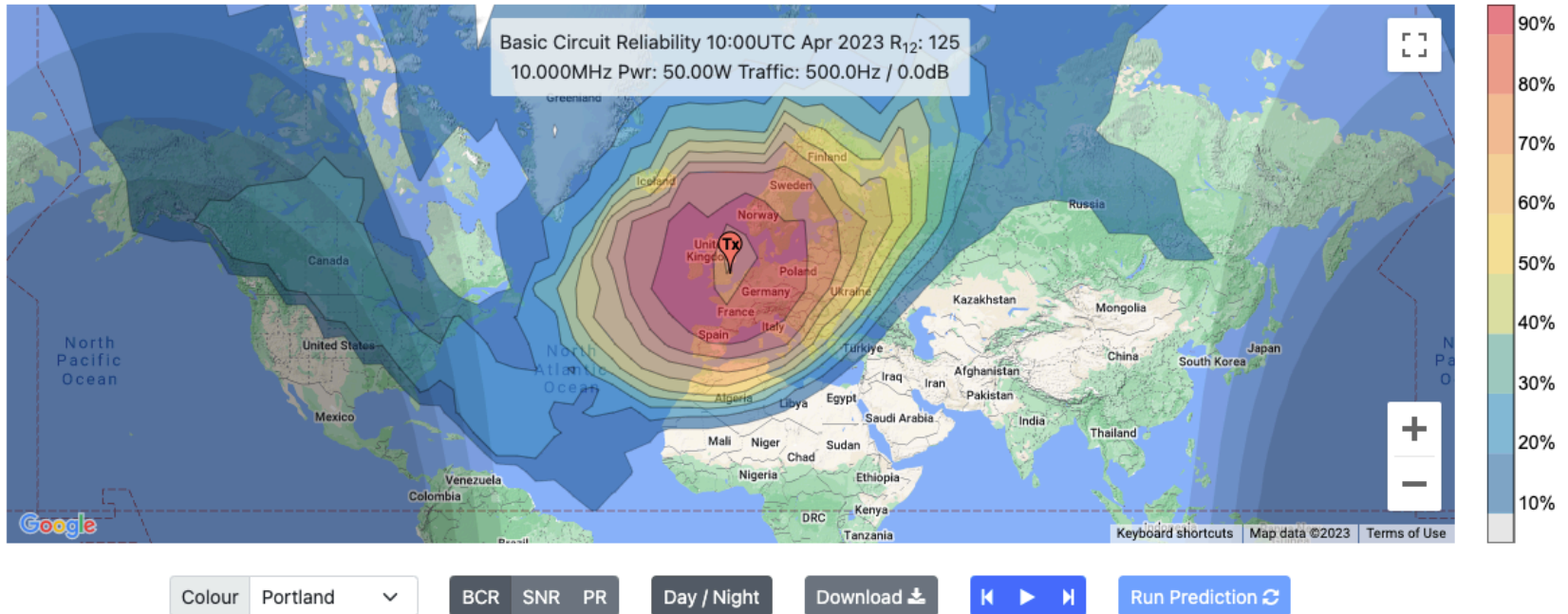


From:
www.voacap.com

Current contents - HF

Putting it all together – knowledge, past experience, VOACAP, Proppy

Proppy HF Circuit Prediction: Area



From:
<https://soundbytes.asia/propy/>



VHF – weather models

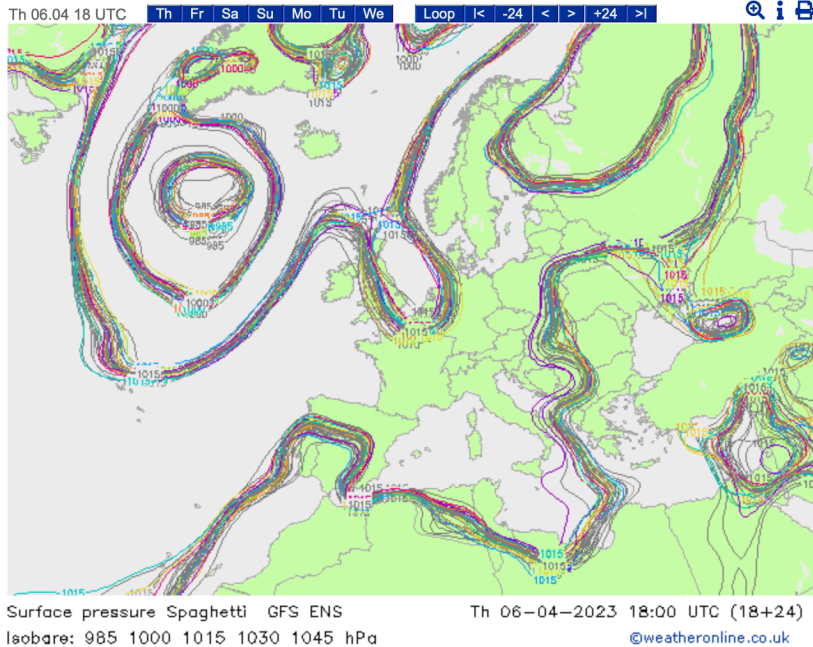
Looking for tropospheric enhancements

- Huge amounts of weather data out there
- Need to extract what matters for propagation
- Consider uncertainty of model output
- Concentrate on the well-supported indicators
- Long lead times up to 10 days, so may change
- Use ensembles (multiple runs of model)

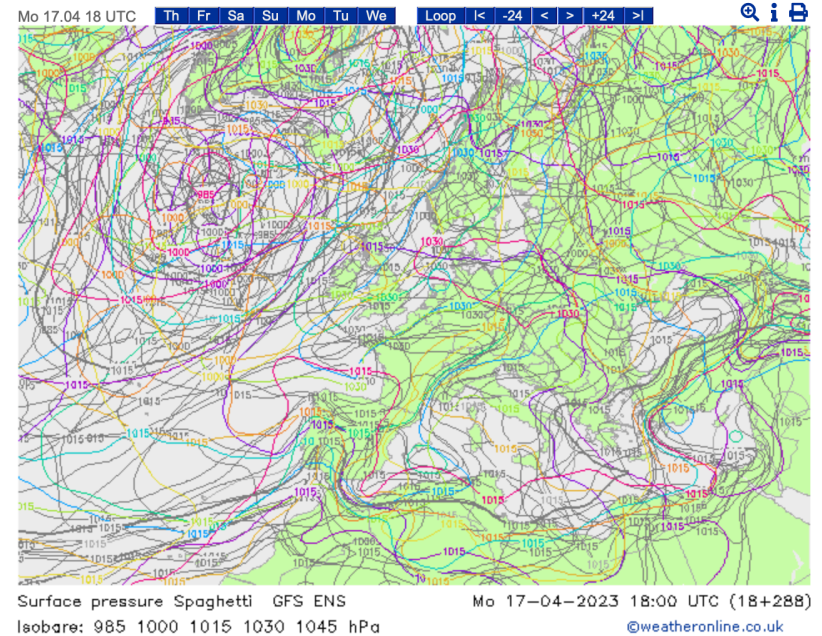
Current contents - VHF

Looking for tropospheric enhancements

One day



12 days



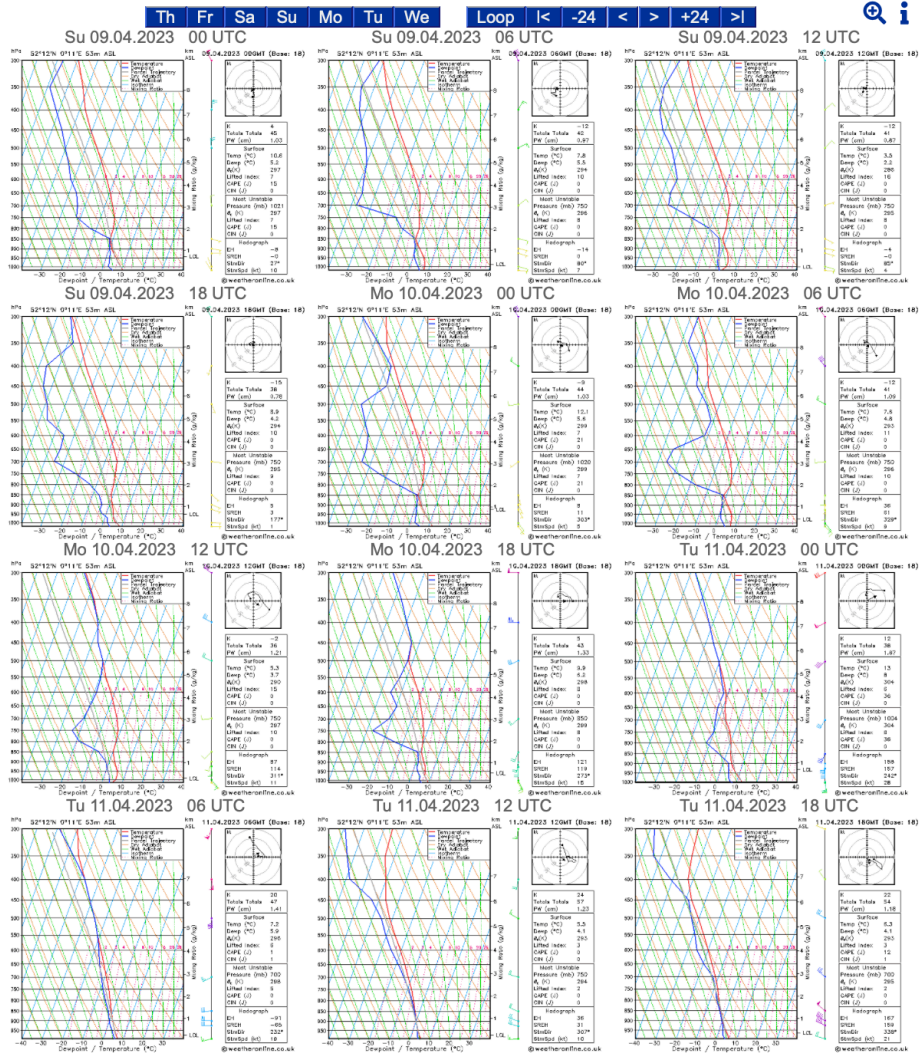
Forecast charts of multiple runs of same model with small variations in initial conditions show how uncertainty increases with forecast period.

Uncertainty of Tropo pattern occurring using these plots, often with multiple forecast models. Some weeks reliability is good throughout the period, but usually loses coherence half way through the week.



Current contents - VHF

Looking for tropospheric enhancements



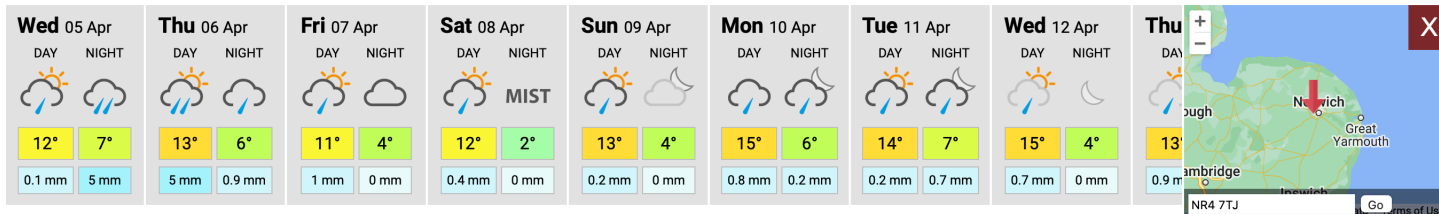
The models can even give a good approximation of the vertical temperature profile

This is a useful way to see if any strong inversions develop or can be used to determine if heavy showers are likely for rain scatter prospects on the GHz bands

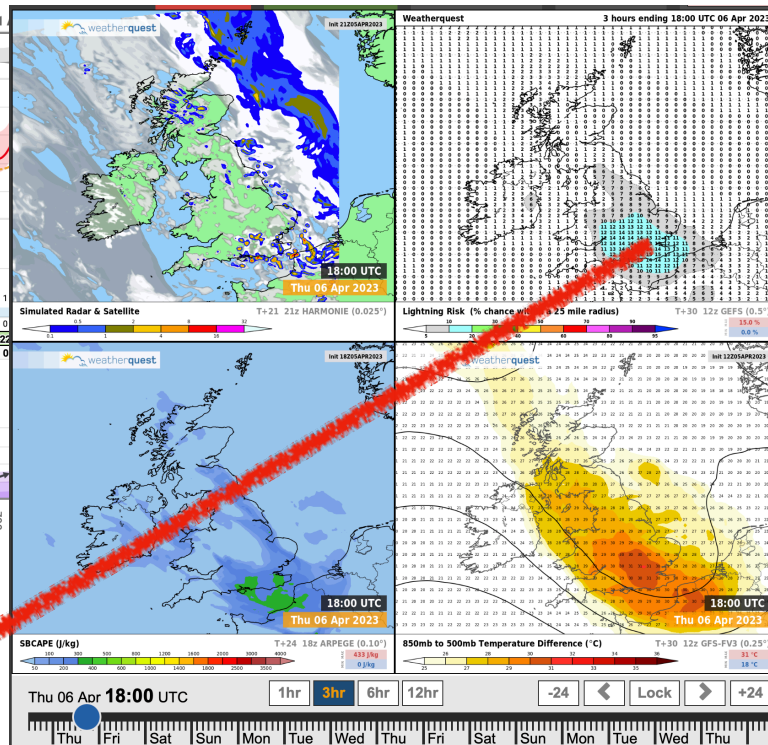
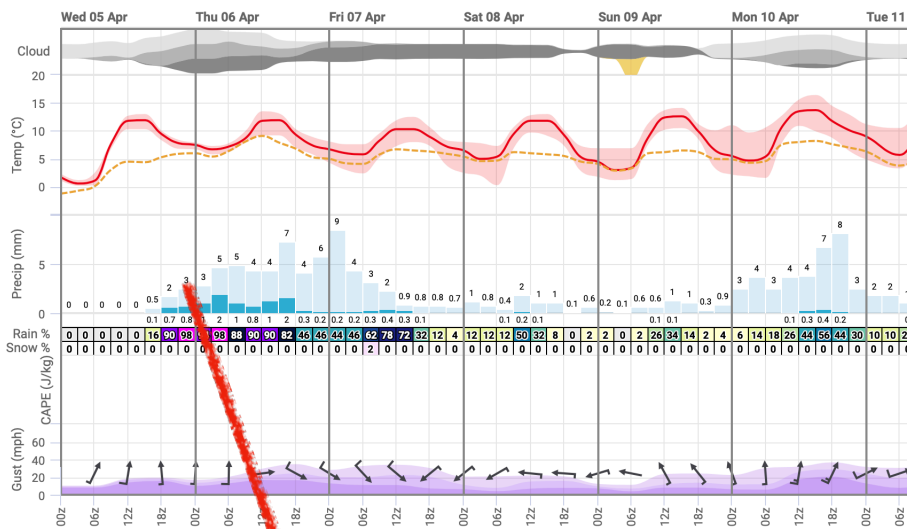


Current contents - VHF

Looking for tropospheric enhancements



Meteogram: NR4 7TJ

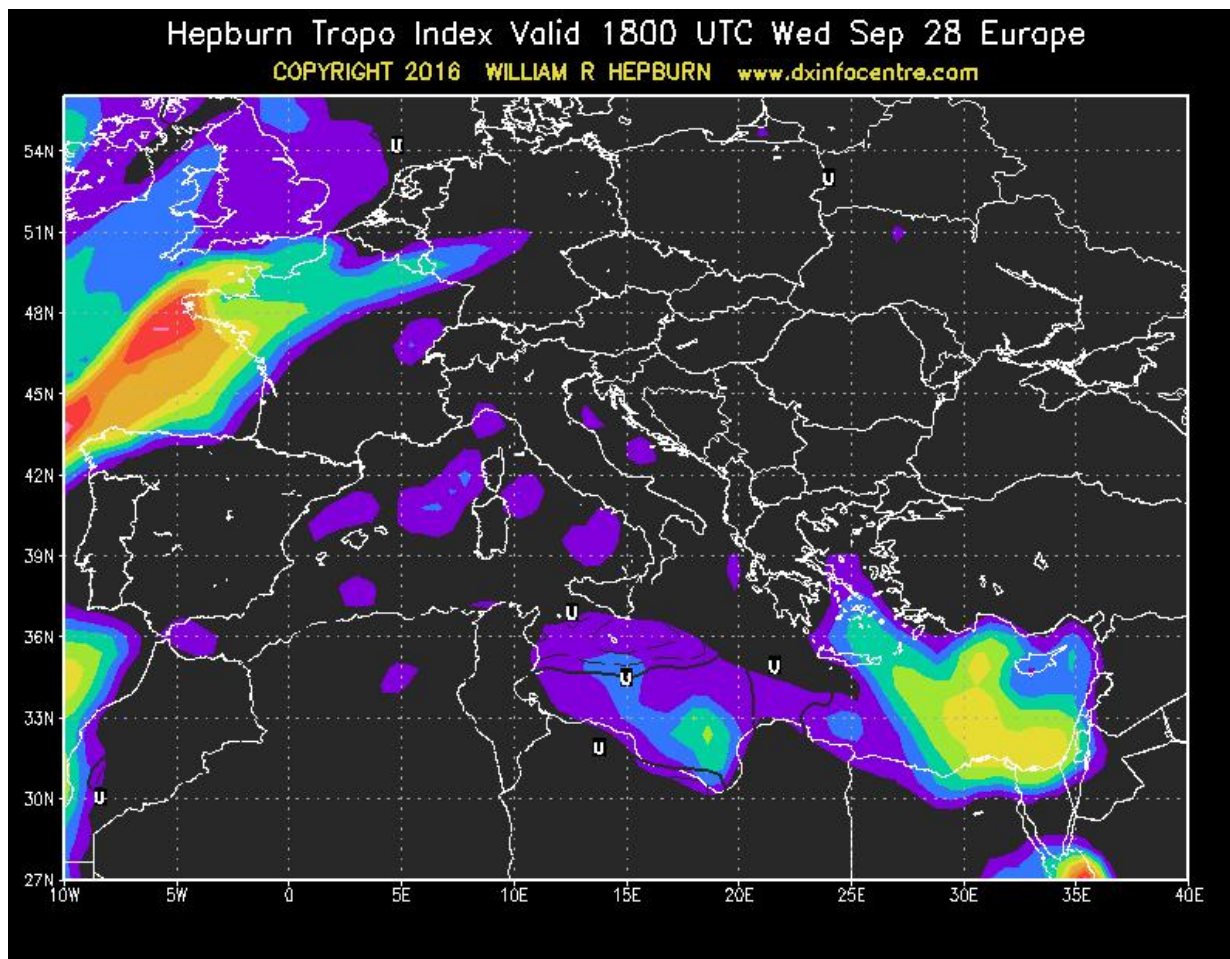


A timeline for a given location is a good way to see changes during the week, if there are any

Map displays can highlight regions of the country where particular weather might occur, such as thunderstorms

Current contents - VHF

Looking for tropospheric enhancements



From: http://www.dxinfocentre.com/tropo_eur.html



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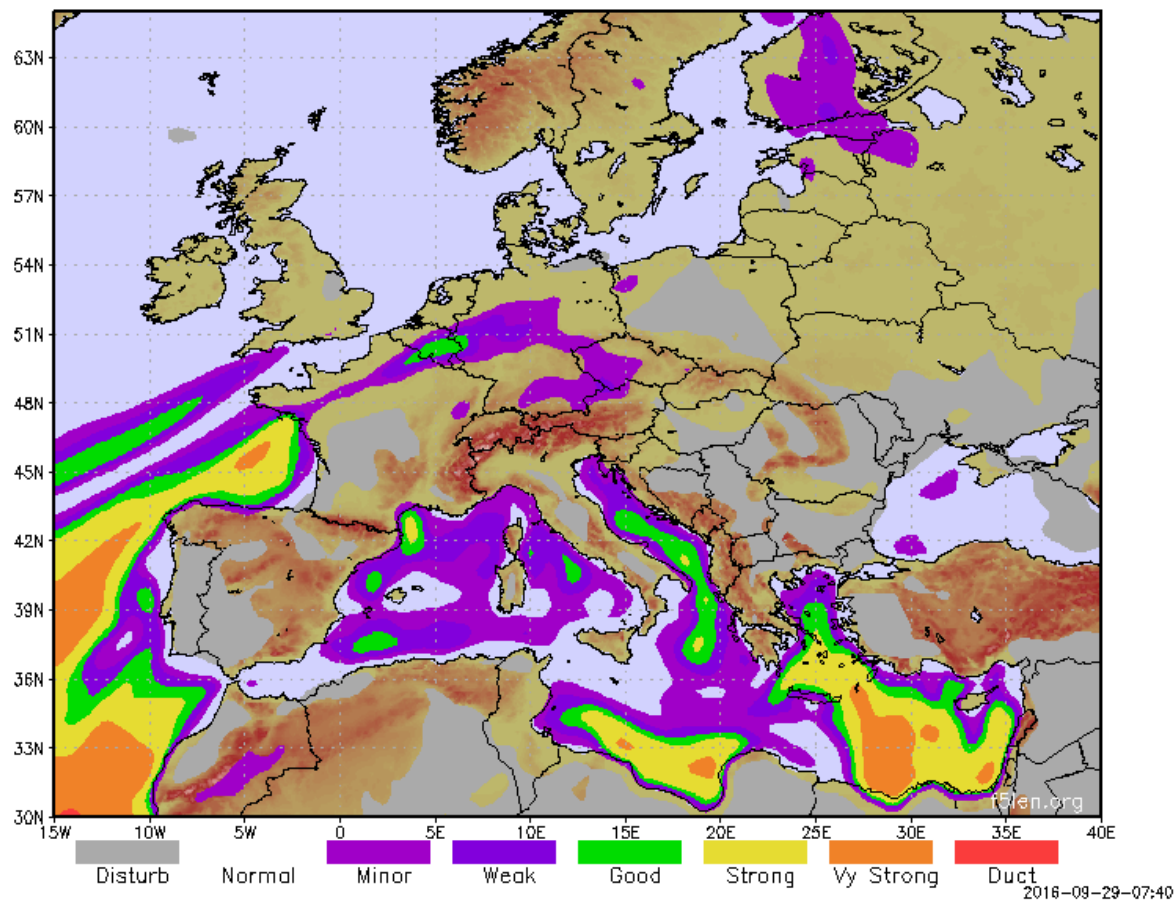
 theRSGB

 @theRSGB

Current contents - VHF

Looking for tropospheric enhancements

Jeudi 29 SEP 2016 - 12Z



From:

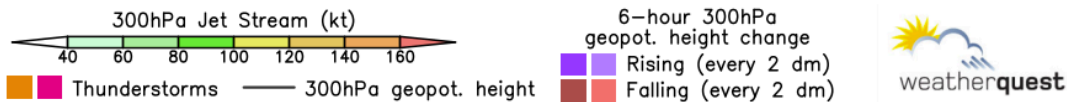
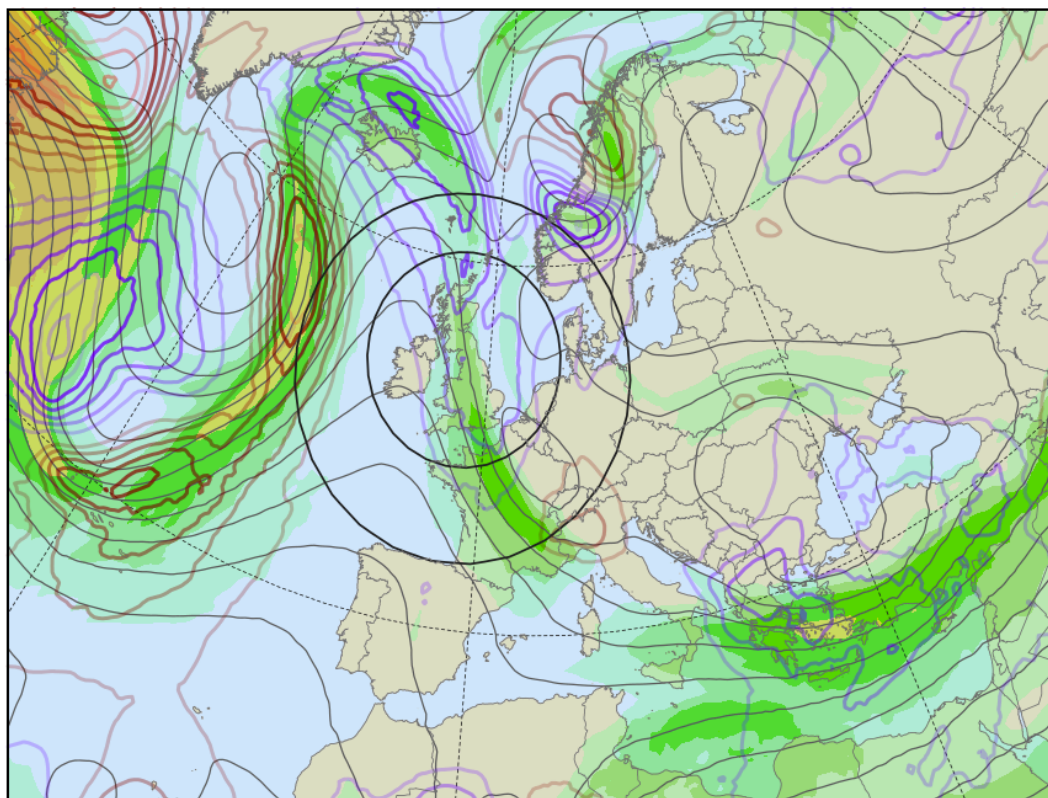
<http://tropo.f5len.org/forecasts-for-europe/>



Current contents - VHF

Looking for Sporadic E – May to end of August (also short spell just after Christmas)

06:00 Fri 07 APR 2023



From:

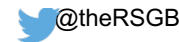
<http://www.propquest.co.uk/blog.php>

300mb jet stream



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Current contents - VHF

Meteor Scatter – main showers

Name	Date of Peak	Moon
Quadrantids	Night of January 3	Rises after midnight
Lyrids	Night of April 21	Full Moon
Eta Aquarids	Night of May 4	New Moon
Perseids	Night of August 11	Sets after midnight
Orionids	Night of October 21	Sets after midnight
Leonids	Night of November 16	Just past full
Geminids	Night of December 13	Full Moon

From:

<https://stardate.org/nightsky/meteors>



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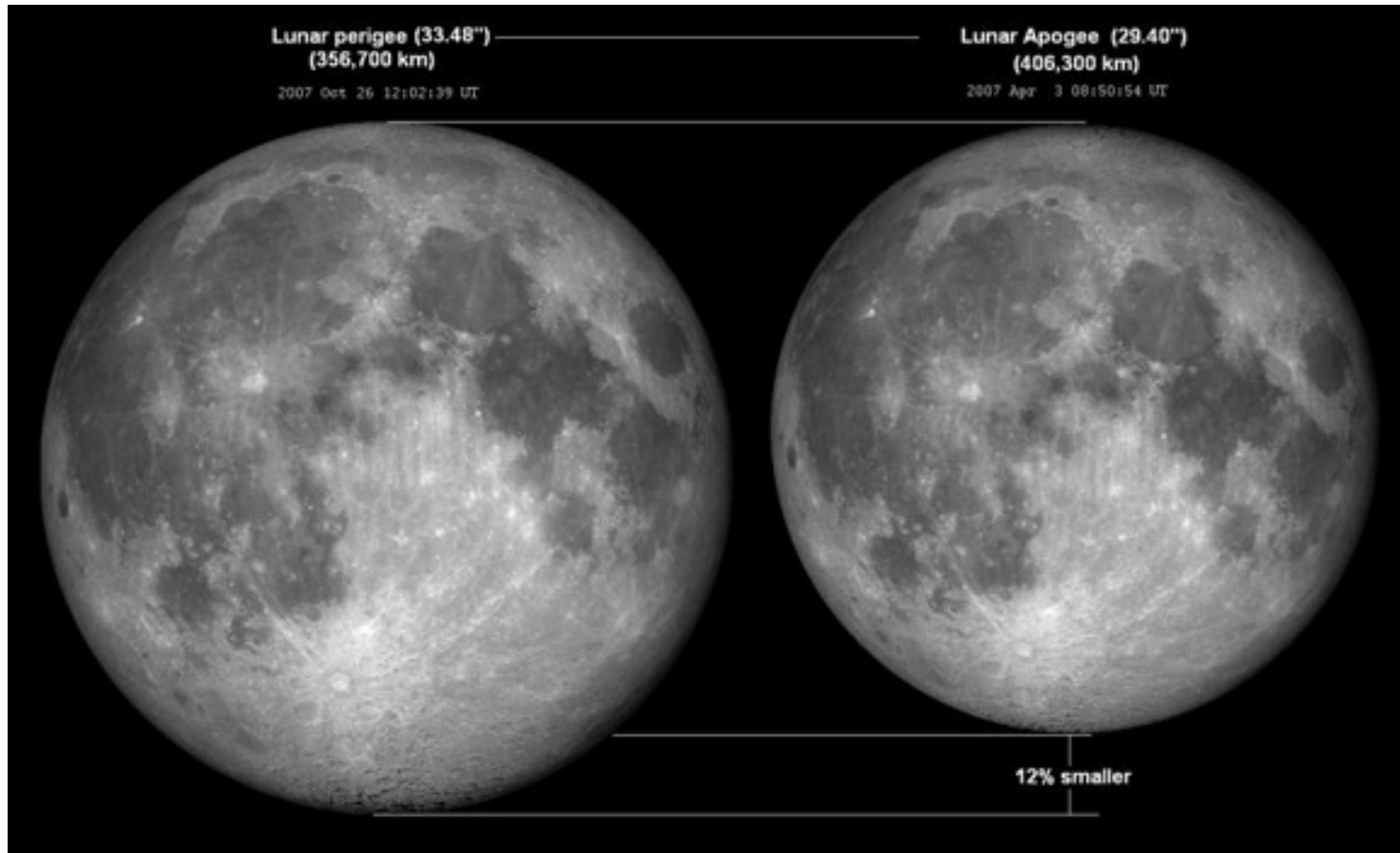
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Current contents – VHF and above

Moon bounce (EME)



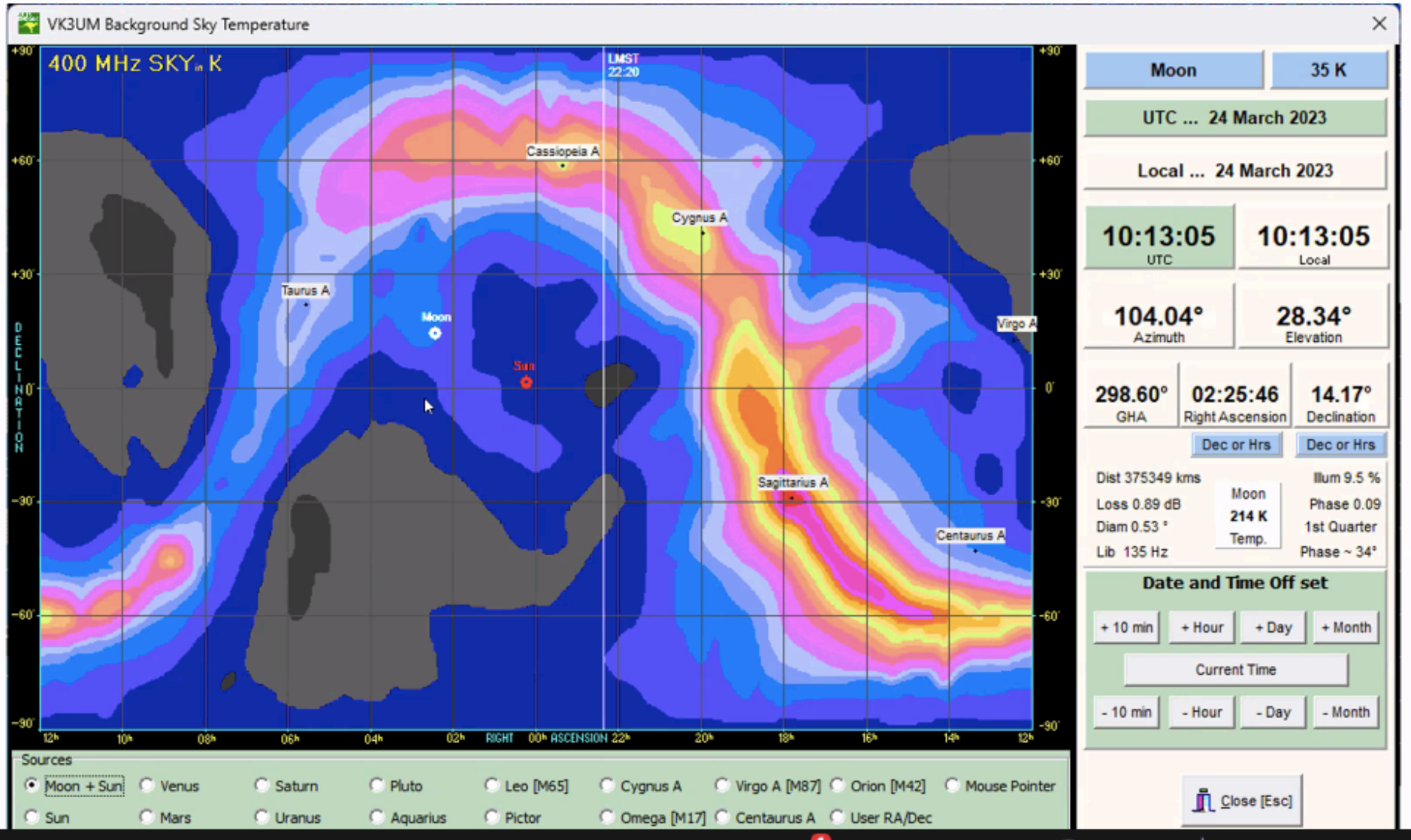
Perigee

Apogee



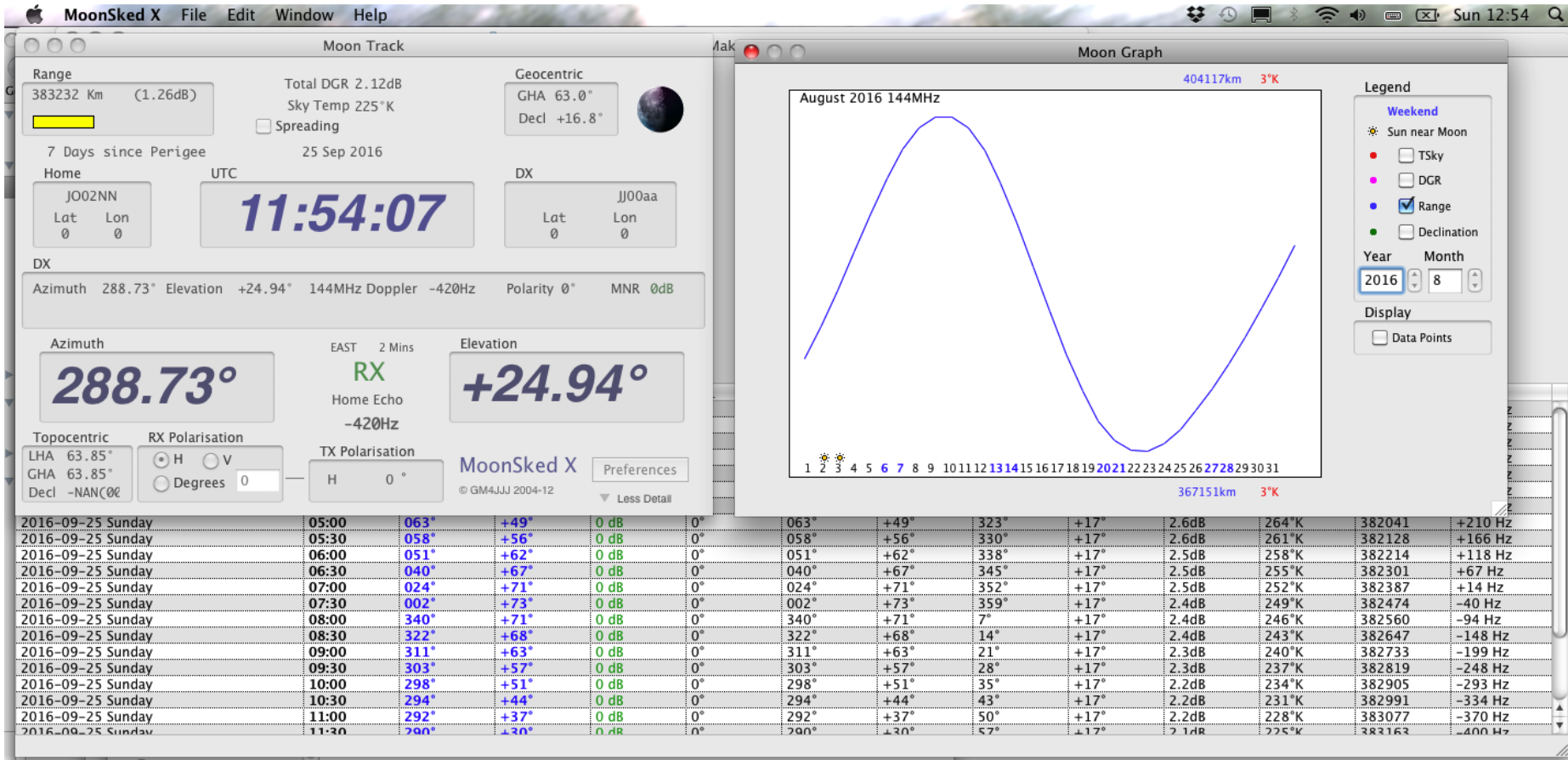
Current contents - VHF

Moon bounce (EME) – sky temperature (from VK3UM software)



Current contents - VHF

Moon bounce (EME)



Source: MoonSked software by GM4JJJ (www.gm4jjj.co.uk)

GB2RS Propagation Report

Any questions + club presentations

- Understanding HF Propagation
- Understanding VHF Propagation
- Steve Nichols G0KYA
psc.chairman@rsgb.org.uk

Presentation at: g0kya.blogspot.co.uk