

INTRODUCTION

This article was written as a follow-on to my presentation on the subject of 'HF Propagation Predictions' given to the Mid Sussex Amateur Radio Society on the 13th November 2015 incorporating the RSGB Propagation Studies Committee (PSC) Video 'Understanding HF Propagation' by Steve Nichols G0KYA.

Part 1 describes how to get started with HF Propagation Predictions by using online predictions.

Part 2 will cover HF Propagation Predictions software on your own computer, which I would only recommend to those who are reasonably confident with the general process of software installation, as the different versions of Microsoft Windows may or may not support the software available at least without advanced installation techniques.

I have also included a section describing how to obtain the latest solar and ionospheric indices which you may be required to enter into the online predictions where they are not already included.

HF PROPAGATION PREDICTIONS – ONLINE

PRE-PREPARED

The following HF Propagation Predictions are pre-prepared in that you do not have to input data or run software but only select those circuits or areas of interest.

RSGB RADCOM HF PROPAGATION PREDICTIONS GWYN WILLIAMS G4FKH

The RSGB RadCom HF Propagation Predictions prepared by Gwyn Williams G4FKH can also be viewed online at <http://rsgb.org/main/operating/propagation-predictions/> and as shown in **Figure 1 overleaf**.

Propagation Predictions for November 2015

Monthly HF Propagation Predictions from Gwyn Williams, G4FKH.

Data download –

- > Excel spreadsheet for the vision impaired
- > Excel spreadsheet for data manipulation

The figures represent approximate S-Points.

The colours represent expected circuit probability, i.e. Black = low to very low probability, Blue = good probability and Red = strong probability.

Band	3.5MHz	7.0MHz	10.1MHz	14.0MHz	18.1MHz	21.0MHz	24.9MHz	28.0MHz
Time (UTC)	000011111220 246802468020	000011111220 246802468020	000011111220 246802468020	000011111220 246802468020	000011111220 246802468020	000011111220 246802468020	000011111220 246802468020	000011111220 246802468020
*** Europe								
Moscow	66.....6666	666.....6666	..6....66...	..3665662...	..1666651...	...66663...	...36651....	...25531....
Time (UTC)	000011111220 246802468020	000011111220 246802468020	000011111220 246802468020	000011111220 246802468020	000011111220 246802468020	000011111220 246802468020	000011111220 246802468020	000011111220 246802468020
*** Asia								
Yakutsk	321....24444	433111134445	..132..1....	...3.....	...1.....	.....	.....	.....
Tokyo	.....3.3..	...42.44.3..	...53233.2.1	...42.11....	...3.....	...2.....	.....	.....
Singapore	.....3...	.....4554.3	.....5542.2	.....3541...	.....1343....	.....2331....	.....122....	.....111....
Bangkok	.....3..3	.....4554.4	.....5542.3	.....4542...	.....2453....	.....2441....	.....1233....	.....1221....
Hyderabad	.....33.3	41....2454.4	1....3542.1	..1...441...	...22344....	...33342....	...3333....	...1332....
Tel Aviv	.....66	66.....6666	..6....6.66	..6554552.23	..355554....	...155552....	...4433....	...2221....
Dhahran	55....35555	554...245555	324212355534	..5433453...	..254454....	...55552....	...5555....	...3552....
Time (UTC)	000011111220 246802468020	000011111220 246802468020	000011111220 246802468020	000011111220 246802468020	000011111220 246802468020	000011111220 246802468020	000011111220 246802468020	000011111220 246802468020
*** Oceania								
Wellington	.....22....	...4565....	...456653...	...456651...	...25553....	...14541....	...332....	...221....
Well (NZ) (LP)	.....	.....	.....	..1.....	..1.....	..1.....	.....	.....
Perth	.....2..	.....35.4...	.....45.32...	...244....	...343....	...1232....	...1121....	...11....
Sydney	.....	.....5543...	.....45531...	...3554....	...3453....	...13341....	...223....	...111....
Melbourne (LP)	.....	...3.....	...42.....	...33.....	...23.....	...12.....	...1.....	.....

Fig 1

There are two options near the top of the screen for downloading Excel spreadsheets for the vision impaired and for data manipulation.

HF Propagation Predictions – Part 1 by G3YTU

Clicking on a circuit name such as 'Tokyo' will reveal a BMUF/OPMUF (Basic MUF/Operational MUF) graph in a new window showing the Best Band in Blue and the 2nd Best Band in Grey for the path as shown in **Figure 2**.

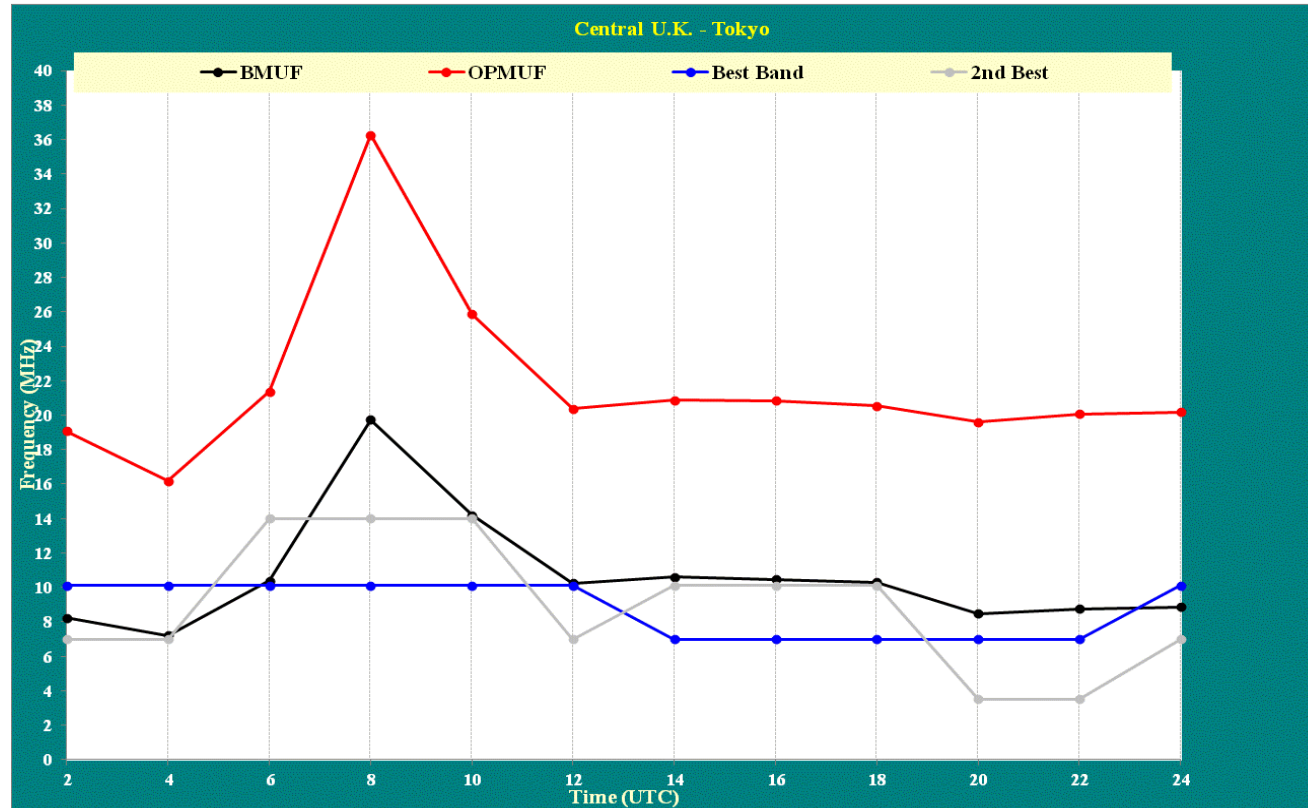


Fig 2

Further information on the predictions can be read at the bottom of the screen

The website of Gwyn Williams G4FKH at <http://g4fkh.co.uk/> has more details of propagation related information.

SHORT-PATH PROPAGATION FROM UK - BY STEVE NICHOLS G0KYA

The 'Short-Path Propagation Maps from UK' prepared by Steve Nichols G0KYA can be viewed online at <http://www.infotechcomms.co.uk/propcharts/> as shown in **Figure 3**.

Select one of the months under the 'Please select a Month' heading and a new window will appear as shown in **Figure 4 overleaf**.

Information on the current conditions are shown in the lower portion of the displayed window and include Solar Terrestrial Data from Paul L Herrman N0NBH, Estimated Planetary K Index and the Solar Wind Model from the NOAA Space Weather Prediction Centre. You can view the websites of N0NBH and NOAA by clicking on the pictures.

Click on the amateur band frequency MHz and the time in UTC of interest and the propagation forecast shown on the world map changes to what you have selected as shown in

Figure 5 overleaf which shows the 21MHz band at 13 UTC for the MSARS 15m weekday Net.

Another month, band or time can be selected and the propagation forecast changes accordingly.

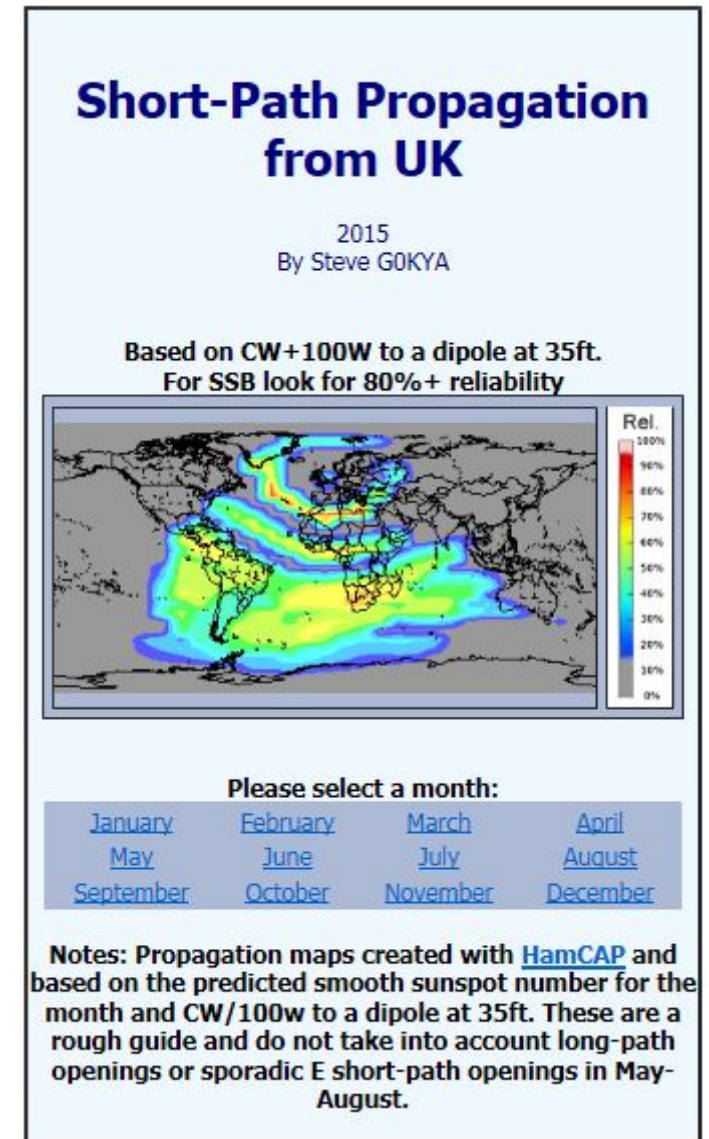


Fig 3

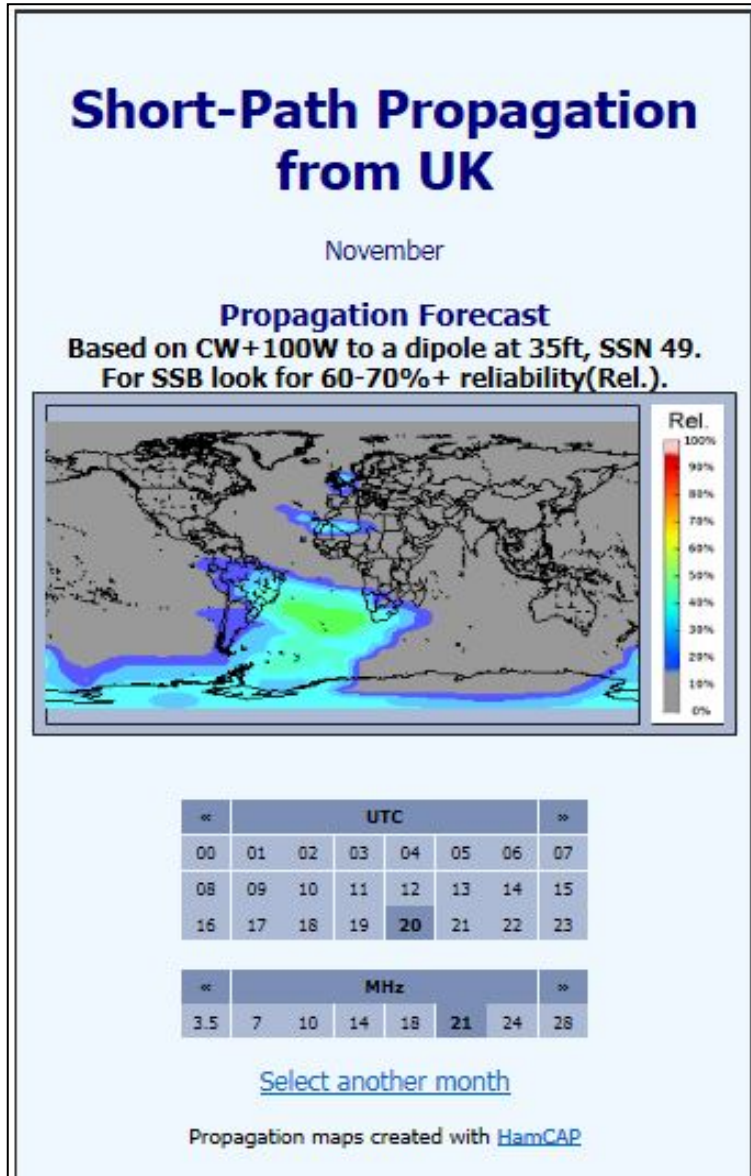


Fig 4

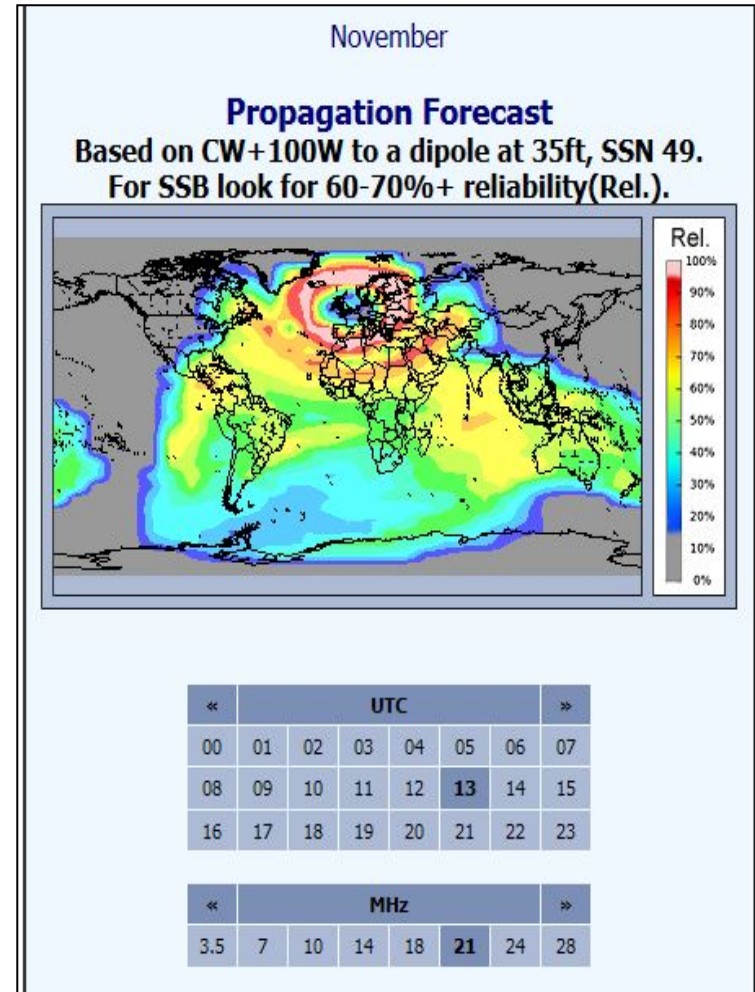


Fig 5

MORE COMPLEX

The following HF Propagation Predictions are more complex than the pre-prepared ones in that you have to input or select data but they have more flexibility in the choice of circuits or areas you wish to investigate and the display options available.

The VOACAP Online Prediction Services, Point to Point Predictions and the Coverage Area Maps are relatively straight forward and are a good starting point in addition to the Australian Government, Space Weather Services, Ionospheric Prediction Service (IPS) Online Prediction Tools.

VOACAP ONLINE PREDICTION SERVICES

The Voice of America Coverage Analysis Program (VOACAP) is available for use online at <http://www.voacap.com/> which is managed by Jari Perkiömäki, OH6BG/OG6G. This first webpage looks quite complicated with many links and topics of interest. However, for online predictions, there are only a few links which you need to use.

The top part of the webpage is shown in **Figure 6 overleaf**, and under the title 'VOACAP Online Prediction Services' there are four graphics with links underneath each one to the online predictions options.

Point to Point Predictions

Propagation between two locations, all frequencies, showing reliability and signal strength.

Coverage Area Maps –

Propagation from one location, single frequency showing reliability to other parts of the world.

VOACAP Propagation Planner –

Propagation from one location to DX sites in either the 40 CQ Zones or the ITU Zones. Described as ‘A tool for professional HF contest & DX expedition planning’.

VOACAP DX Charts –

Propagation from your location to the DXpeditions listed.

These are described in more detail overleaf:-

VOACAP Quick Guide

HF Propagation Prediction and Ionospheric Communications Analysis

by **Jari Perkiömäki**, OH6BG/OG6G

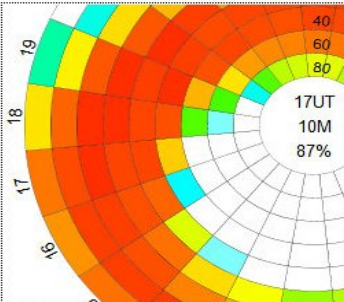
This is a 'work-in-progress' guide to using [VOACAP \(Voice of America Coverage Analysis Program\)](#) - free professional HF propagation prediction software from NTIA/TTS, originally developed for Voice of America (VOA). This guide should get you well started with VOACAP. A more comprehensive discussion about the finer details of using the software can be found in George Lane's book [Signal-to-Noise Predictions Using VOACAP. A User's Guide](#). The book is now available on CD-ROM.

There is now also ["The Official VOACAP Blog"](#) - well, it's not too official.

NEW:

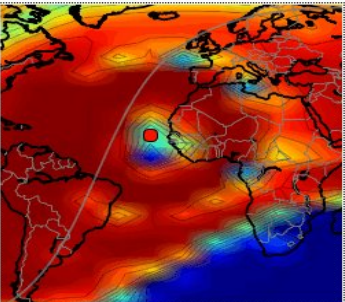
- 24 July 2015: [VOACAP DX Charts](#) - predictions for upcoming DXpeditions
- 19 July 2015: [VOACAP Propagation Planner](#) - a visual planning tool for HF contesters and DXers - now provides more sophisticated propagation prediction charts by zone and by band.

VOACAP Online Prediction Services



[Point-to-Point Predictions](#)

[11M Point-to-Point Predictions](#)



[Coverage Area Maps](#)

[11M Coverage Area Maps](#)

15M SP	01	02	03	04	05	06	07	08	09	10	11	1
01 KL7												
02 VO2												
03 VE7												
03 W6												
04 W0												
04 W5												
05 W1												
05 W4												
06 XE												
07 TI												
08 KP4												
09 8R												

[VOACAP Propagation Planner](#)
Visual tool for HF contesters and DXers

VK0EK HEARD ISL															
KP03 SD to VK0EK HEARD (via SP, Mar 2016)															
	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15
10															
12															
15															
17															
20															
30															
40															
80															
TX															
RX															

[VOACAP DX charts](#)
Predictions for upcoming DXpeditions

Fig 6

HF Propagation Predictions – Part 1 by G3YTU

Point to Point Predictions at <http://www.voacap.com/prediction.html>

The Point to Point Predictions option is shown here in **Figure 7** which comprises screen areas divided into a world map, circular predictions chart, propagation parameters, transmitter and receiver sites and an online help box.

Select the transmitter and receiver sites either by using the world map and moving the red and blue markers with a left mouse click and hold / release or:

By using the transmitter and receiver sites boxes where you can select preset locations with a drop down menu under QTH or enter a locator reference in the Name box and click on **Loc calc**.

Select the Transmitter Antenna, Power, Mode and Receiver Antenna.

Underneath the world map the current date and time is displayed, which you can alter by clicking on the calendar to select a different date, and selecting the hour and minutes from the drop down menu boxes. When you have selected the desired date and time click on the **Set** and the map display changes to reflect the time chosen displaying the Grayline between the transmitter and receiver. You can reset the date and time to the current value by clicking on the **Reset** button.

The circular predictions chart now shows the probability for the route for each hour of the day and bands 80m to 10m.

If you hover your mouse over a coloured segment of the circle the time, band and percentage are displayed in the centre circle.

If you click on the **Run Prediction!** Below the Receiver Site data entry area, a new page appears with two charts of Circuit Reliability (%) and Signal Strength at Receiver (dBW) for the full HF Band between 2 and 30MHz as shown in **Figures 8a & 8b overleaf**.

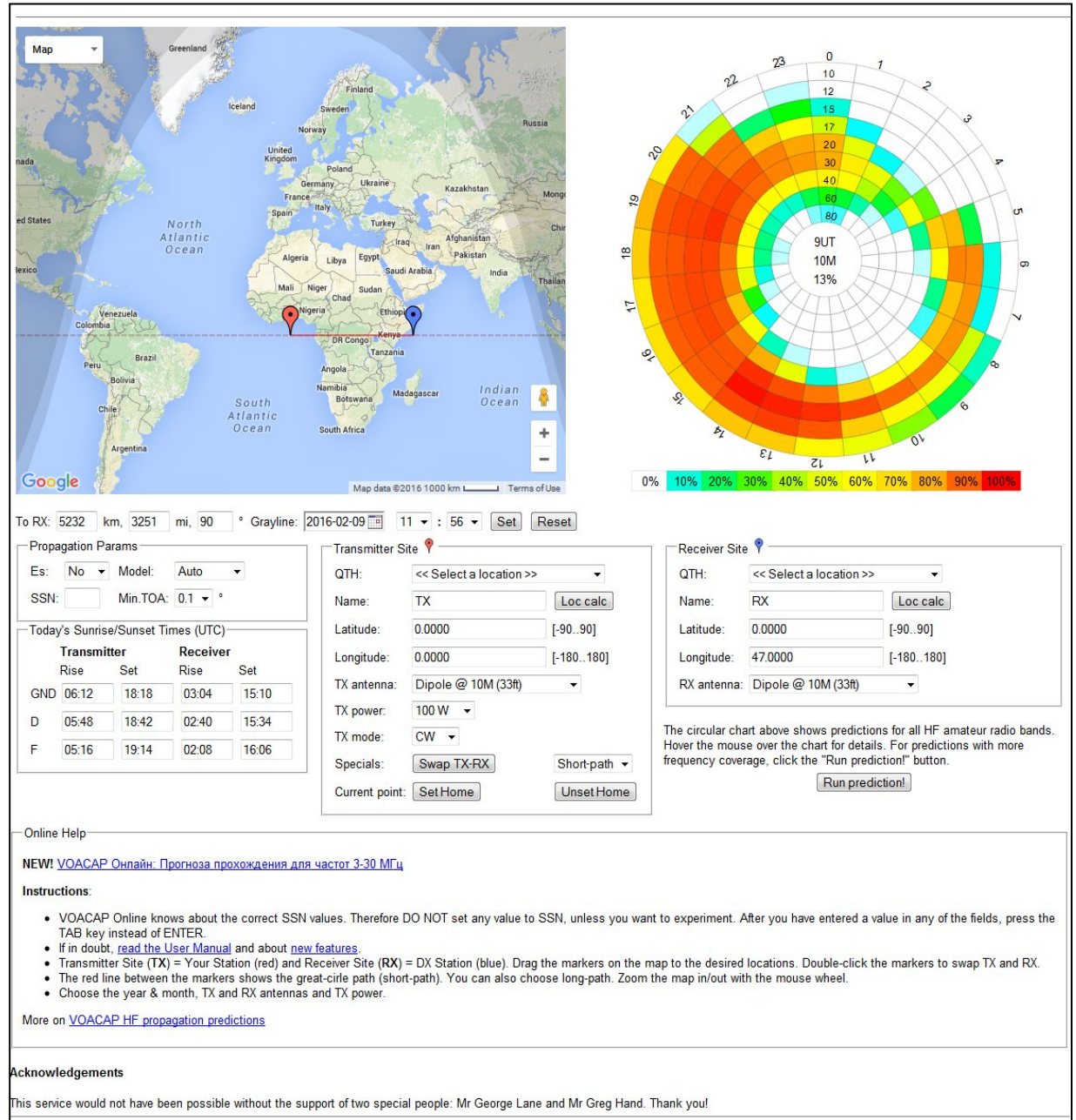


Fig 7

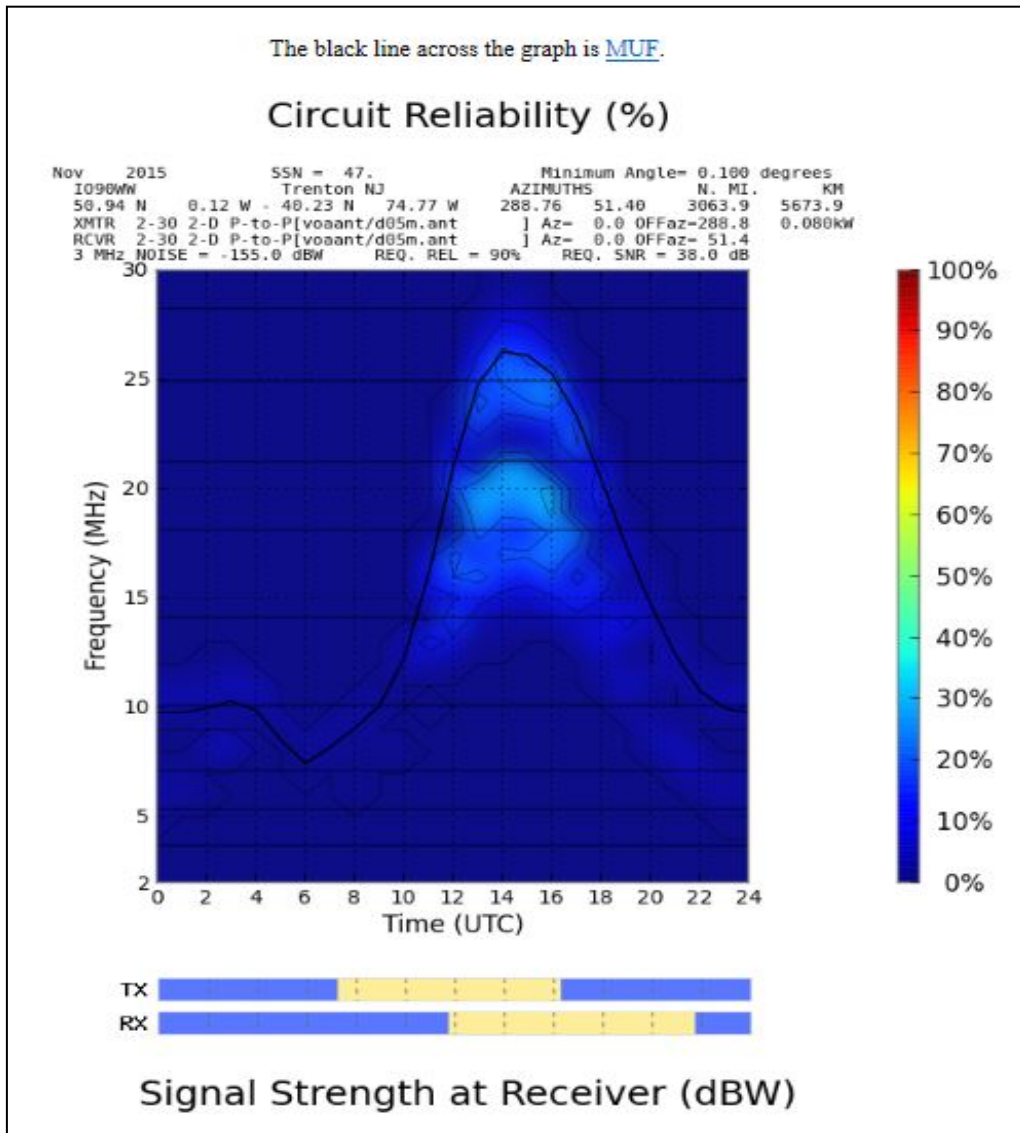


Fig 8a

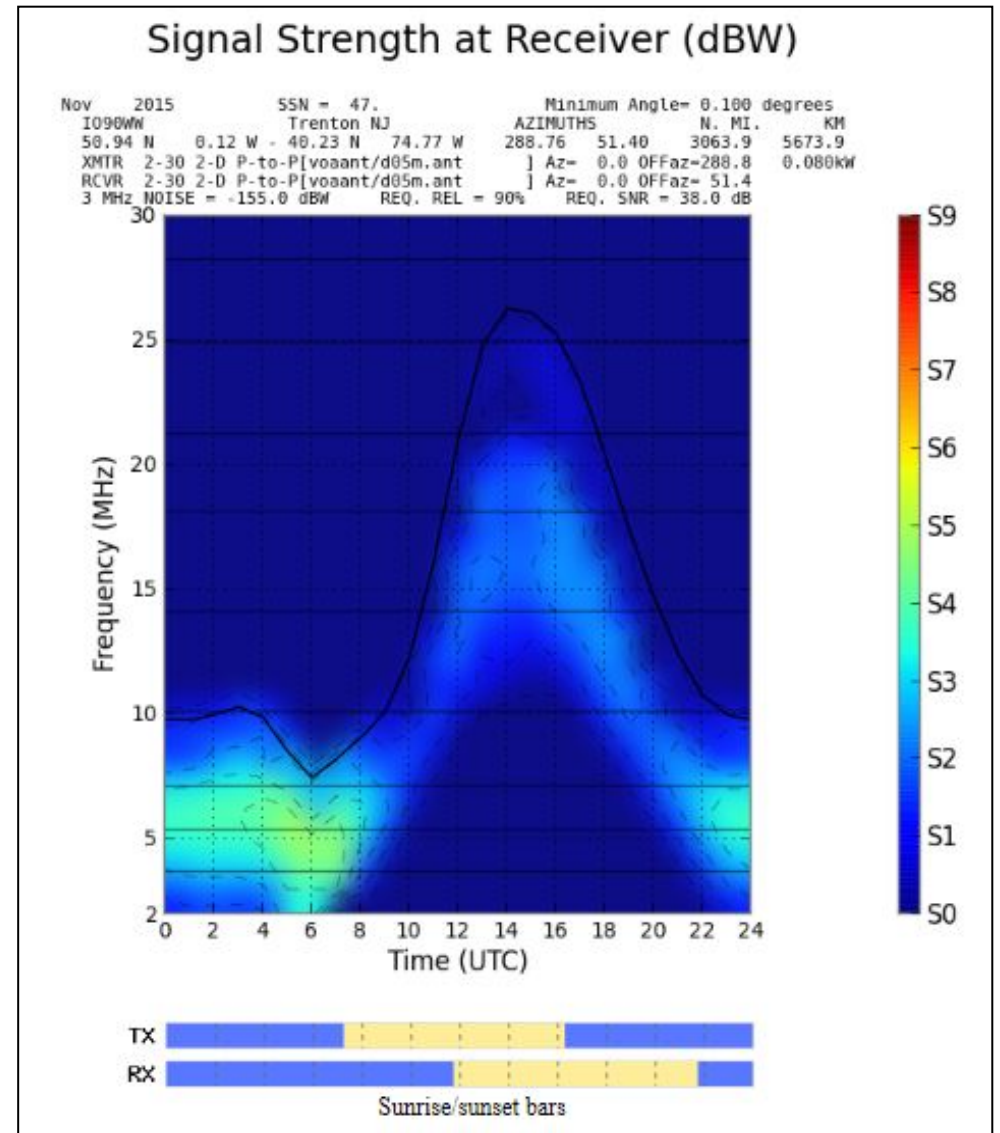


Fig 8b

Coverage Area Maps at <http://www.voacap.com/coverage.html>

The Coverage Area Maps option is shown here in **Figure 9** which comprises screen areas divided into a world map, Date, Transmitter Site and Receiver sites.

The Date area will default to the current date and time which you can change if you wish to any other month, year and hour.

Select the Transmitter Site details in a similar manner to the Point to Point Predictions and also select the band of interest (80m – 10m) from the drop down menu.

Select the Receiver Site antenna.

Click on **Run the prediction!** below the Receiver Sites data entry area and a new page appears with a world map showing the probability as coloured areas as shown in **Figure 10** overleaf.

VOACAP Online Coverage Maps

Professional-grade high-frequency (3-30 MHz) coverage area predictions

Date

Year: 2015

Month: November

Time UTC: 22 Remember these values

Transmitter Site

QTH: << Select a location >>

Name: TX

Latitude: 0.0000 [-90..90]

Longitude: 0.0000 [-180..180]

TX antenna: Dipole @ 10M (33ft)

TX power: 100 W

TX mode: CW

Band: 20M (14.1 MHz)

Great-circle path: Short-path

Current point:

Receiver Sites

RX antenna: Dipole @ 10M (33ft)

[VOACAP Онлайн: Карты покрытия](#)

This service would not have been possible without the support of two special people: Mr George Lane and Mr Greg Hand. Thank you!

© 2010-15 Jari Perkiömäki (OH6BG), James Watson (HZ1JW) and Juho Juopperi (OH8GLV). **Questions or suggestions?** Write to [our Helpdesk](#).

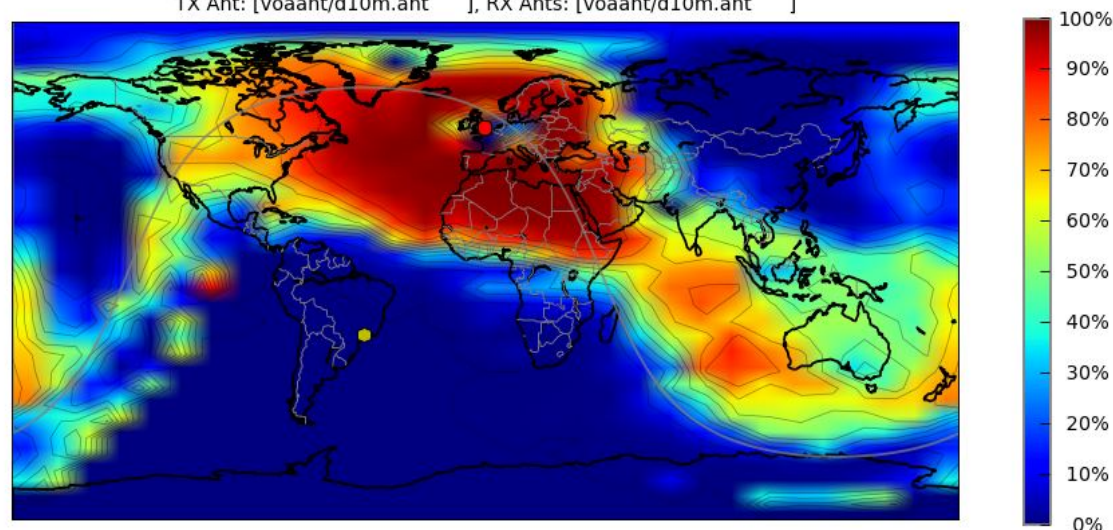
Fig 9

VOACAP Online Coverage Maps

[Professional-grade high-frequency \(3-30 MHz\) coverage area predictions](#)

This graph shows the probability of achieving the chosen grade of service (TX mode).

London (51.58N, 0.00E), Dec, 15 UTC, 14.100 MHz, 80 W, SSN 46, Mode: CW
TX Ant: [voaant/d10m.ant], RX Ants: [voaant/d10m.ant]



[View the coverage map on Google Earth \(beta\)](#)

To make another map, go back using the browser's Back button. - [VOACAP Online point-to-point predictions](#)

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Fig 10

If you click on the 'View the coverage map on Google Earth' beneath the map, the predictions will be saved to a file which is then opened with Google earth as shown in **Figure 11 overleaf**

HF Propagation Predictions – Part 1 by G3YTU

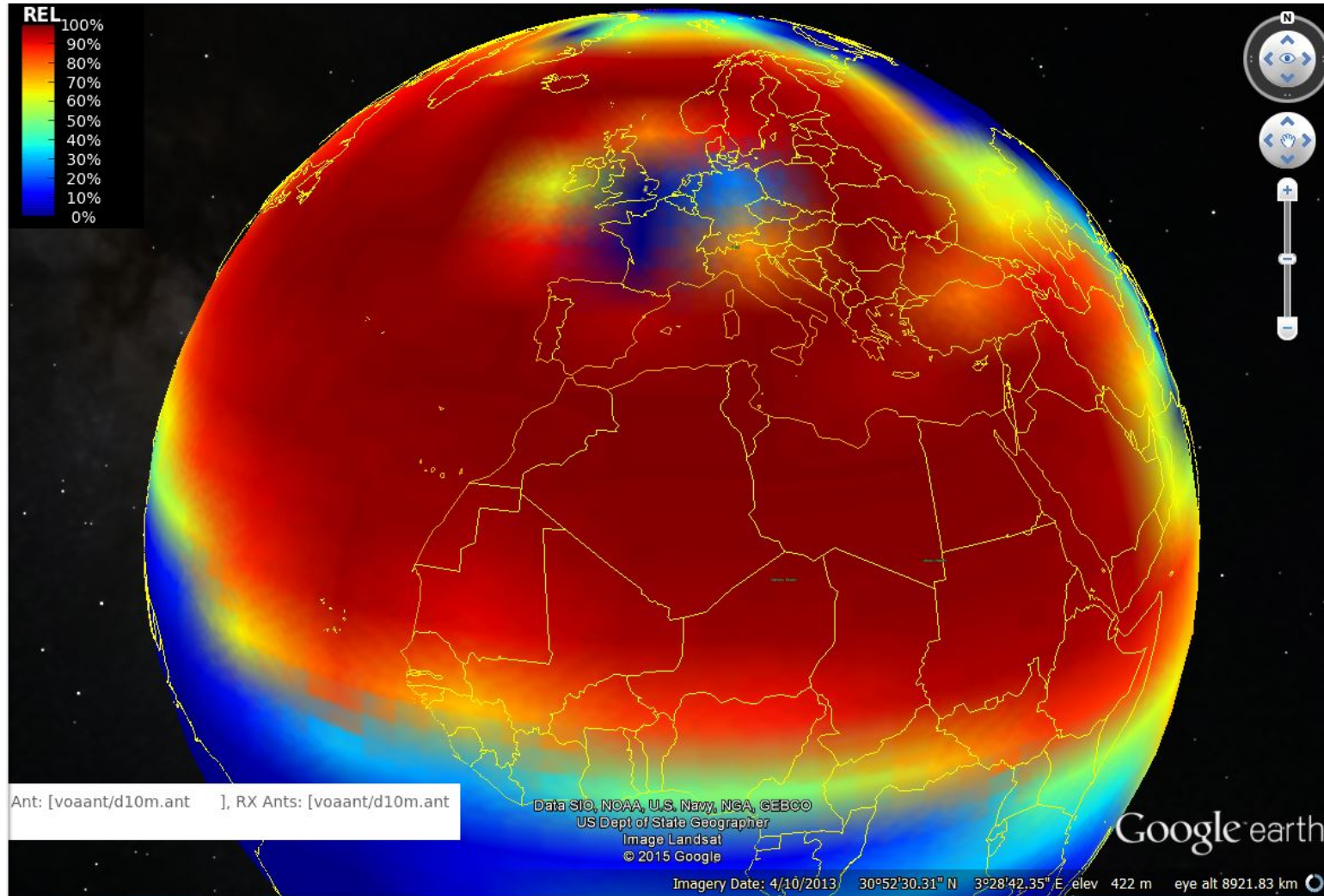


Fig 11

HF Propagation Predictions – Part 1 by G3YTU

VOACAP Propagation Planner at <http://www.voacap.com/planner.html>

The VOACAP Propagation Planner option is shown in **Figure 12** which comprises screen areas divided into Date, Ionospheric Parameters (Optional), TX Site Settings and DX Site Settings. There is also a **Helpdesk** link near the bottom of the screen to an overview of the propagation planner.

VOACAP Propagation Planner, v2.0b

A tool for professional HF contest & DX expedition planning

Date
Year: Month:

TX Site Settings
QTH:
Name:
Latitude: [-90..90]
Longitude: [-180..180]
Antennas:
10M:
12M:
15M:
17M:
20M:
30M:
40M:
80M:
Power:
Mode:

Ionospheric Parameters (OPTIONAL)
Sporadic E: SSN:

DX Site Settings
Antennas:
10M:
12M:
15M:
17M:
20M:
30M:
40M:
80M:
DX sites:
 All 40 CQ Zones, Short Path
 All 40 CQ Zones, Long Path
 ITU Zones, Short Path
 ITU Zones, Long Path

Helpdesk: [An overview of the Version 2.0b](#). For the earlier Version 1.0: [VOACAP Propagation Planner User's Manual](#), PDF.

Note: VOACAP Propagation Planner knows about the correct monthly SSN values. Therefore DO NOT set any value to SSN (an optional Ionospheric Parameter), unless you want to experiment.

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Fig 12

HF Propagation Predictions – Part 1 by G3YTU

The Date area will default to the current year and month, which you can change if you wish, to any other year and month.

The Ionospheric Parameters area is optional as the note at the bottom of the screen explains...

'VOACAP Propagation Planner knows about the correct monthly SSN values. Therefore DO NOT set any value to SSN (an optional Ionospheric Parameter), unless you want to experiment.'

TX Site Settings – Select the QTH either by using the drop down menu, which shows locations by callsign prefix or, by entering the locator in the Name box and clicking on the **Loc Calc** box, which then enters the values in the Latitude and Longitude boxes. Select the transmit antennas for each band, the transmit power and mode.

DX Site Settings – Select the receive antennas for each band and the presentation of the results required choosing either 40 CQ Zones or ITU Zones which are both available as Short Path or Long Path.

Click on the **Run the prediction!** box below the DX Site Settings, and a new page appears with a selection of different options to view the prediction results as shown in **Figure 13 overleaf**.

VOACAP Propagation Planner, v2.0b

A tool for professional HF contest & DX expedition planning

Your prediction is complete! Now you can:

1. View the **zone-specific propagation charts** from your TX to the world.
 - [Zones with WARC bands](#)
 - [Zones without WARC bands](#)
2. View the **band-specific propagation charts** from your TX to the world.
 - [80 meters](#)
 - [40 meters](#)
 - [30 meters](#)
 - [20 meters](#)
 - [17 meters](#)
 - [15 meters](#)
 - [12 meters](#)
 - [10 meters](#)

The Google Chrome browser is recommended for viewing the charts above. Other browsers cannot print their colors correctly.

Alternatively, you can also:

- Download [your VOACAP prediction as text raw data](#) (right-click to save target to disk)
- Download a propagation data analysis tool, **Propagation Planner**, which is available for [Windows](#) and [Intel Macs](#) (v0.94).
- Open the prediction text file with Propagation Planner
- For **CQ Zones**:
 - Download **this Excel workbook** [[Office 2010 and later](#)] or [[Office 2003 and earlier](#)], and copy the band-specific predictions from Propagation Planner to their corresponding tabs (80...10) in the workbook. The 40+ CQ Zone summary tabs will be populated automatically!
- For **ITU Zones**:
 - Download **this Excel workbook** [[Office 2010 and later](#)] or [[Office 2003 and earlier](#)], and copy the band-specific predictions from Propagation Planner to their corresponding tabs (80...10) in the workbook. The 110+ ITU Zone summary tabs will be populated automatically!
- Enjoy!

To make another VOACAP prediction, go back using the browser's Back button - or [click here](#).

As you know, [any software or service on this website is provided "as is"](#). Use at your own risk.

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Fig 13

Option 1 – View the zone-specific propagation charts

You can select either with or without the WARC bands by clicking on the highlighted text of your choice and another page appears as shown in **Figure 14 overleaf**, which shows the first three zones.

Option 2 – View the band-specific propagation charts.

You can select any band between 80m and 10m by clicking on the highlighted text of your choice and another page appears as shown in **Figure 15 overleaf**, which shows the 40 CQ Zones (Short Path) for the 15m band.

HF Propagation Predictions – Part 1 by G3YTU

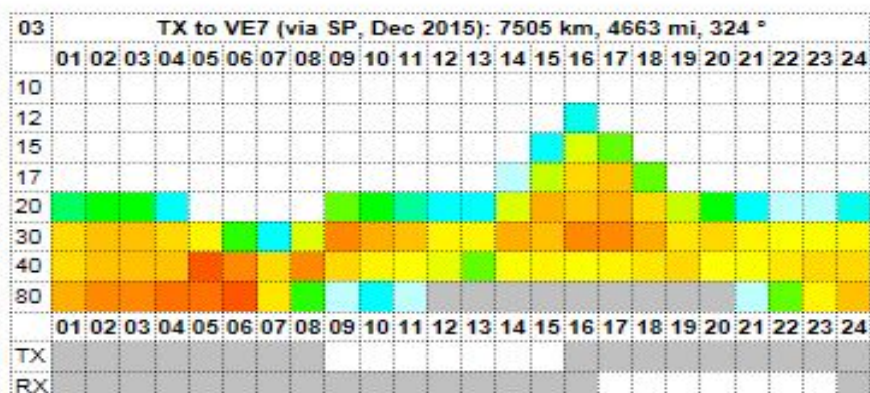
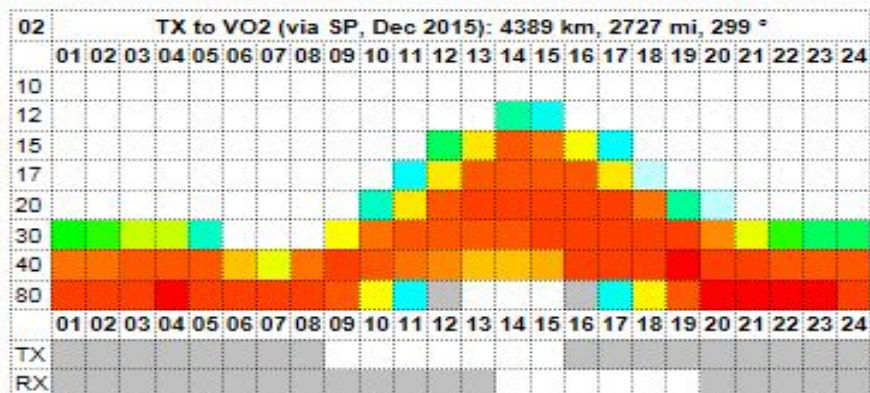
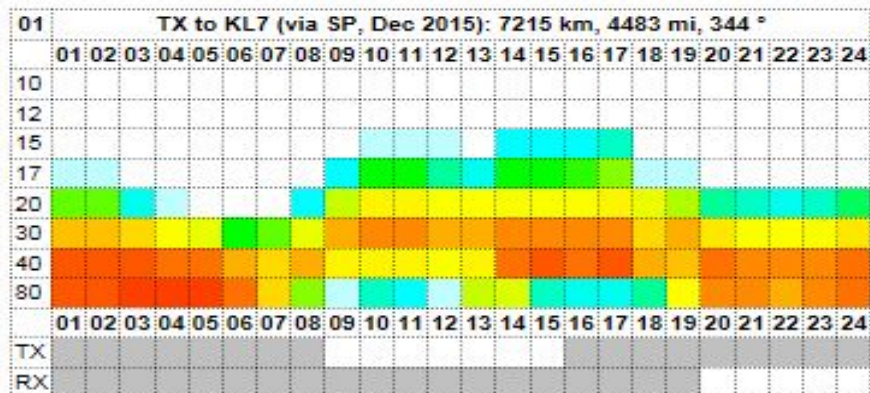


Fig 14

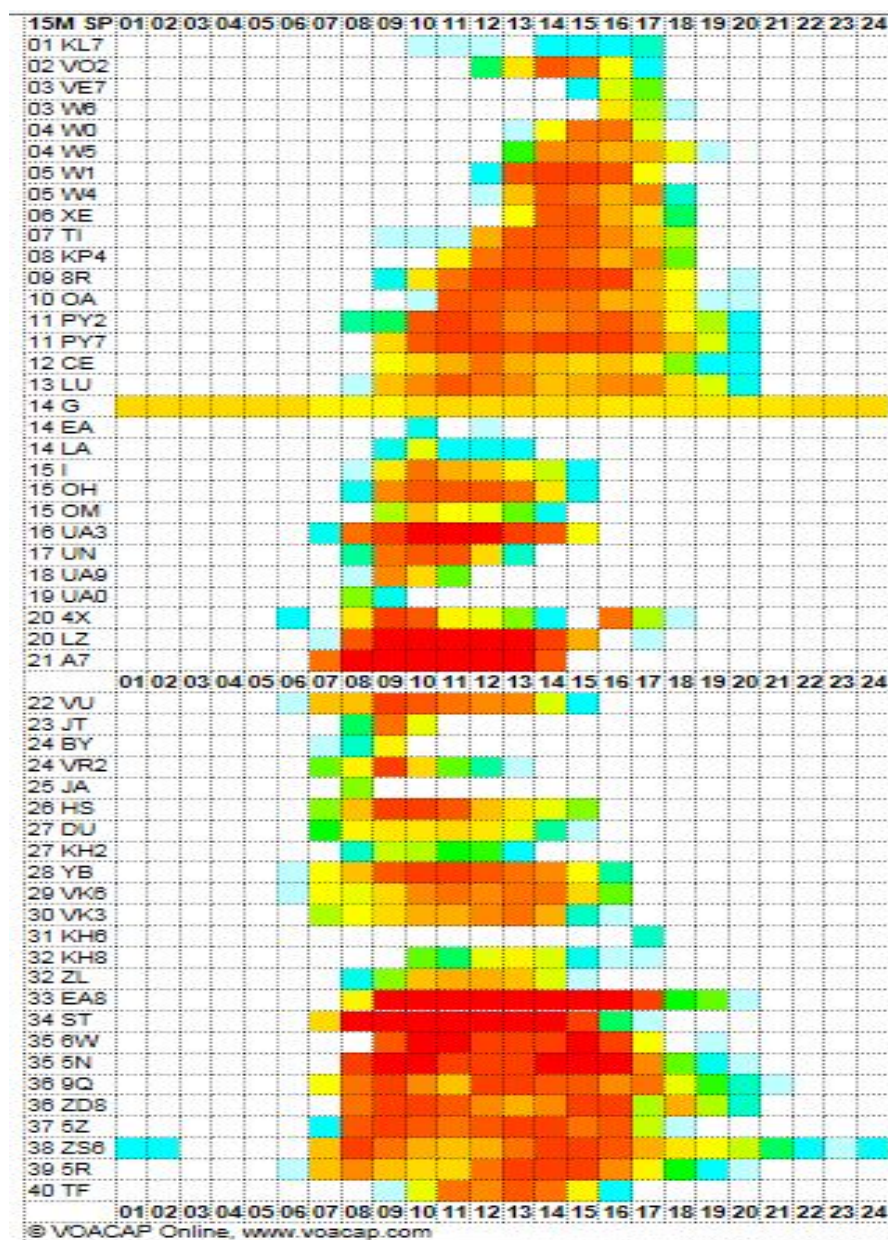


Fig 15

HF Propagation Predictions – Part 1 by G3YTU

Other Options – These include downloading the prediction as text together with a data analysis tool, or downloading the results as an Excel spreadsheet. I have not shown these options in figures but have left it to the reader to try these options.

VOACAP DX Charts at <http://www.voacap.com/dx.html>

The VOACAP DX Charts option is shown in **Figure 16** with a link 'VOACAP DX Charts' to a short introduction at <http://voacap.blogspot.fi/2015/07/introducing-voacap-dx-charts.html> where this prediction option is described in more detail.

VOACAP DX Charts

Make your HF propagation predictions for DXpeditions

Just enter your Maidenhead grid locator below, and short-path and long-path HF propagation predictions will be calculated to the DX sites below. Read the short introduction to [VOACAP DX Charts](#).

Your grid locator:

DX Sites

- [3B9HA](#), Rodrigues Isl (mid-Nov 2015)
- [VK9WA](#), Willis Isl (Nov 14-23, 2015)
- [FR/OH2YL](#), Reunion (Nov 22 - Dec 1, 2015)
- [KSP](#), Palmyra (Jan 11-26, 2016)
- [E51J](#), Rarotonga, Southern Cook Isl (Jan 12-21, 2016)
- [VF83GI](#), South Georgia (Jan 2016)
- [VF83TI](#), South Sandwich (Jan 2016)
- [A3](#), Tonga (Feb 18-24, 2016)
- [3XY1T](#), Guinea (Feb 18 - Mar 4, 2016)
- [VK9CK](#), Cocos (Keeling) Isl (Mar 15-26, 2016)
- [VK0EK](#), Heard Isl (Mar 6 - Apr 20, 2016)
- [PT4JA](#), Juan de Nova (Mar 31 - Apr 14, 2016)

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Fig 16

HF Propagation Predictions – Part 1 by G3YTU

Under the title 'DX Sites' a list of current or future operations are listed together with links to their own websites.

You will need to enter your Maidenhead grid locator and click the Box. If you are not sure of your Maidenhead grid locator then try the following website which calculates it for you. <http://qthlocator.free.fr/index.php>

Once you have run the prediction option you will see a series of graphics showing both the Short and Long Path predictions for all the DX Sites. The Short Path and Long Path predictions for 3B9HA Rodriguez are shown in **Figure 17**.

If you hover your mouse over any of the coloured squares in the top chart with bands and times, you will see the probability of a QSO and the calculated signal level displayed.

Similarly, the TX and RX squares in the bottom chart will show the exact times of sunrise and sunset which are shown by the greyed out boxes.

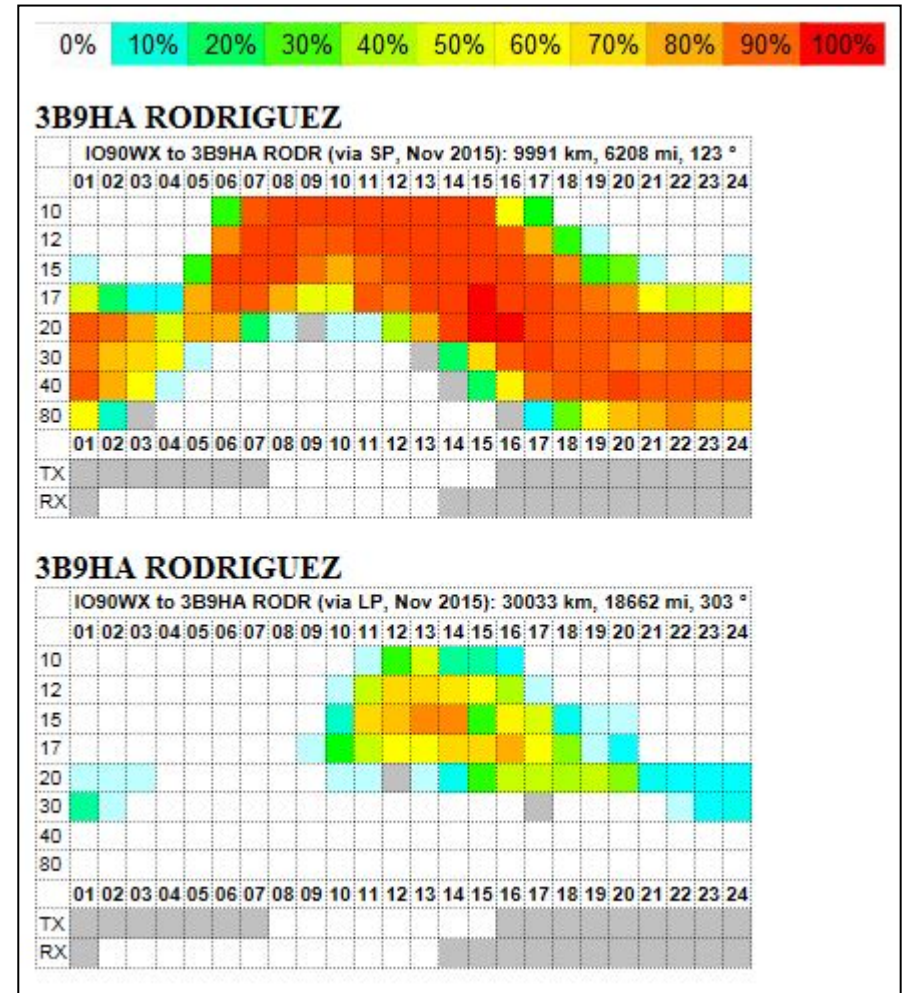


Fig 17

HF Propagation Predictions – Part 1 by G3YTU

AUSTRALIAN GOVERNMENT SPACE WEATHER SERVICES IONOSPHERIC PREDICTION SERVICE (IPS)

The Australian Government, Space Weather Services, Ionospheric Prediction Service (IPS) provides a number of Online Prediction Tools at http://www.sws.bom.gov.au/HF_Systems/7/1 which are shown in **here**:

The screenshot displays the website for the Australian Government Space Weather Services, specifically the Ionospheric Prediction Service (IPS). The page is titled "HF Systems" and features a navigation menu with options like Home, Space Weather, Satellite, Geophysical, Solar, HF Systems, Products and Services, Educational, and World Data Centre. The main content area is titled "Prediction Tools" and lists several online tools with their descriptions:

Tool	Description
Combined HF Prediction	HAP, Min-Max HAP, URSL, GRAFEX, Air Route, RAAF Air Route, LAMP and Frequency selection.
Digital HF Prediction	Reliability and other features of digital HF radio.
VHF/UHF Area Prediction	Calculates and displays RF signal loss for VHF/UHF (30MHz - 3GHz).

Below the table, there is a section for "Advanced" tools, which includes information about the IPS Advanced Stand Alone Prediction System and the IPS Ground Wave prediction System (GWPS). There are also links for "More about ASAPS", "More about GWPS", and "How to order ASAPS or GWPS".

The page also includes a "Troubleshooting" section, which provides instructions on how to check if Java is working correctly and how to download the latest version of Java.

The footer of the page contains the text "Space Weather Workshop" and "Space Weather Services Review Report and Management Response", along with a copyright notice for the Commonwealth of Australia 2015, Bureau of Meteorology (ABN 92 637 533 532).

Fig 18

HF Propagation Predictions – Part 1 by G3YTU

For HF Predictions options, select the 'Combined HF Prediction' tool and a pop-up window will appear asking 'Do you want to run the application?' as shown in **Figure 19a**. Tick the 'Do not show this again for apps from the publisher and location above' and then click the Run button and the screen shown in **Figure 19b** overleaf, should appear.



Fig 19a

The screenshot shows the Australian Government Bureau of Meteorology Space Weather Services website. The header includes the Australian Government logo and the text "Australian Government Bureau of Meteorology" and "Space Weather Services". A navigation bar contains links for Home, Space Weather, Satellite, Geophysical, Solar, HF Systems, Products and Services, Educational, and World Data Centre. The main content area is titled "HF Systems" and features a status bar with "FORECAST SOL: Normal", "MAG: Normal", and "ION: Normal", along with a search function. The left sidebar lists various tools and information sections, including Australasia, High Latitude and IPY, and Global HF. The main content area displays the "Combined HF Prediction Tool" with instructions to choose a tool from a panel. The "Choose Tool" panel lists several options with radio buttons:

- Air Route Chart Base to aircraft HF communication prediction.
- GRAFEX Point to point HF communication prediction.
- Hourly Area Prediction (HAP) Base to area HF communication prediction.
- Local Area Mobile Prediction (LAMP) Point to point HF communication prediction, within 1000km of base point.
- Min-Max (Area of Coverage) HAP Base to area of coverage HF communication prediction for a given frequency.
- Network Frequency Selection Point to point HF network frequency selection.
- RAAF Air Route Chart RAAF base to aircraft HF communication prediction.
- URSL Upper, Recommended, Secondary and Lower HF frequency prediction.

Fig 19b

HF Propagation Predictions – Part 1 by G3YTU

There are eight options but only five are considered in this paper as being of interest to amateur radio operators and are listed below:-

- **GRAFEX – Point to point HF communication prediction**
- **Hourly Area Prediction (HAP) – Base to area HF communication prediction**
- **Local Area Mobile Prediction (LAMP) – Point to point HF communication for a given frequency**
- **Min-Max (Area of Coverage) HAP – Base to area of coverage HF communication prediction for a given frequency**
- **URSL – Upper, Recommended, Secondary and Lower HF frequency prediction**

These are described in more detail as follows:-

GRAFEX

The GRAFEX option is shown in **Figure 20 on the following page**, and comprises a world map with three tabs:

Map view

Circuit

Date + T-index

Where you can either select or enter data.

There are four buttons beneath the tabs and data window:

Predict to run the predictions,

Reset to clear all the settings,

Clear Circuit to clear the Circuit details and

Help which provides further information to help you with running these predictions.

HF Propagation Predictions – Part 1 by G3YTU

Click the **'Map view'** Tab and centre the map on the U.K. by clicking on the 0 degrees in the Map view box above the world map.

Click the **'Circuit'** Tab and either enter the details of the transmitter and receiver together with the latitude and longitude in the boxes within the window, or use the left hand mouse button to click first on the world map where the transmitter is located, and then again where the receiver is located.

The transmitter and receiver locations can be cleared by clicking on the **'Clear Circuit'** button above the world map.

If you start to type a location such as 'London' in the entry box, if it is a location held in the database, then any names will be shown in a drop down list from which you can select the wanted location.

Any locations not in the database will need to be entered manually or by means of the World Map.

Click the **'Date +T-index'** Tab and select the Prediction date on the left hand side and the T-index selection on the right hand side.

The T-index should generally be set to 'Australian T-index forecast' and 'Monthly' but you may wish to experiment with the 'Current real-time T-index' settings.

Once all the data has been selected or entered, run the predictions by clicking on the **'Predict'** button above the world map.

Online Tools

Combined HF Prediction Tool

Choose an HF prediction tool from the **Choose Tool** panel.

If you need more information on how to use a tool, please click its **Help** button. Your [feedback](#) is welcome.

Choose Tool **GRAFEX**

Map view

Centre longitude View

180 degrees Normal

0 degrees Zoomed

Predict **Reset** **Clear Circuit** **Help** lat long

Fig 20

The GRAFEX output

The GRAFEX output is shown in **Figure 21**, and consists of a combined graph and tables for the first and second modes of propagation giving:

OWF (Optimum Working Frequency),

EMUF (E Layer Maximum Usable Frequency),

ALF (Absorption Limiting Frequency) for each hour in UT.

The key below the graph indicates the meaning of the characters used to plot the graph.

Further information is available online by clicking on the 'Help' button above the world map on the GRAFEX page.

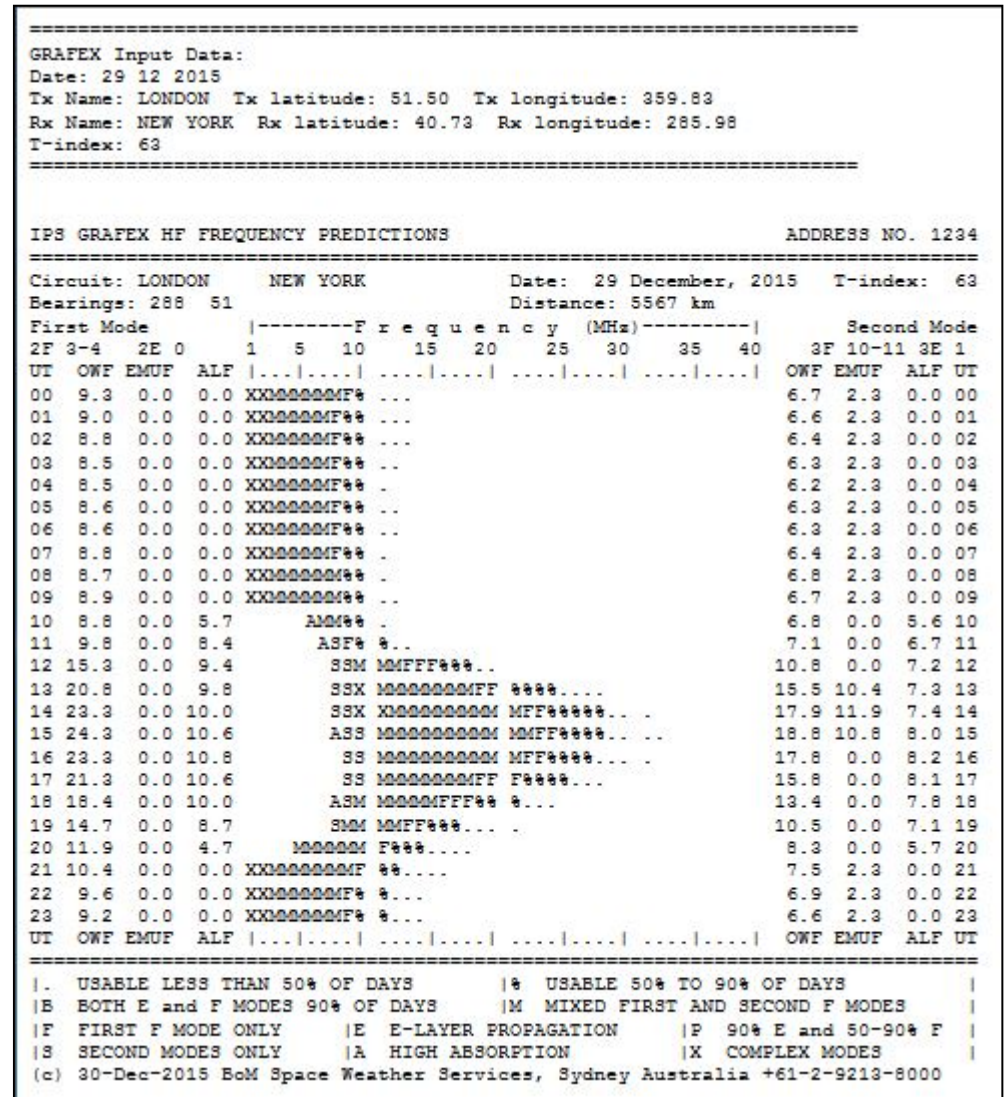


Fig 21

Hourly Area Prediction (HAP)

The Hourly Area Prediction (HAP) option is shown here in **Figure 22** and comprises a world map with four tabs:

Map view

Base location

Frequencies

Date + T-index

Where you can either select or enter data.

There are three buttons beneath the tabs and data window:

Predict to run the predictions

Reset to clear all the settings

Help provides further information to help you with running these predictions.

Click the **'Map view'** Tab and centre the map on the U.K. by clicking on the 0 degrees in the Map view box above the world map.

Click the **'Base location'** Tab and either enter the name of the base together with the latitude and longitude in the boxes within the window, or use the left hand mouse button to click first on the world map where the base is located. **Continued overleaf:**

The screenshot shows the Australian Government Bureau of Meteorology Space Weather Services website. The main navigation bar includes links for Home, Space Weather, Satellite, Geophysical, Solar, HF Systems, Products and Services, Educational, and World Data Centre. The current page is titled 'HF Systems' and features a forecast summary: SOL: Normal, MAG: Moderate, ION: Moderate. The 'Online Tools' section is active, displaying the 'Combined HF Prediction Tool'. The tool has four tabs: 'Choose Tool', 'HAP', 'Map view', 'Base location', 'Frequencies', and 'Date + T-index'. The 'Map view' tab is selected, showing a world map with a grid. The map view settings include 'Centre longitude' (radio buttons for 180 degrees and 0 degrees) and 'View' (radio buttons for Normal and Zoomed). Below the map are buttons for 'Predict', 'Reset', and 'Help', along with a latitude input field labeled 'lat'.

Fig 22

HF Propagation Predictions – Part 1 by G3YTU

The base location can be cleared by clicking on the **'Reset'** button above the world map. If you start to type a location such as 'London' in the entry box then, if it is a location held in the database, then any names will be shown in a drop down list from which you can select the wanted location.

Any locations not in the database will need to be entered manually or by means of the World Map.

Click the **'Frequencies'** Tab and click either the 'Defaults' or 'Amateur' buttons and a set of frequency bands will be entered into the 10 boxes above. Clicking on the 'Clear' button will clear the boxes. You can also type into the boxes with any other frequencies of your choice but note that they are in kHz so 14 MHz is entered as '14000'.

Click the **'Date +T-index'** Tab and select the Prediction date on the left hand side and the T-index selection on the right hand side. The T-index should generally be set to 'Australian T-index forecast' and 'Monthly' but you may wish to experiment with the 'Current real-time T-index' settings.

Click on the world map with the left hand mouse button where you want the top left hand corner of the area to be and drag the mouse to select the rectangular area required.

Once all the data has been selected or entered, run the predictions by clicking on the **'Predict'** button above the world map.

The HAP output is shown in **Figure 23 overleaf**, and consists of a summary of the prediction input data with the results on four separate pages according to the time period shown. To view any of the pages click on the link and the results are as shown in **Figure 24 overleaf**:

HF Propagation Predictions – Part 1 by G3YTU

```

=====
Input Data:
Date: 5 1 2016
Base Name: LONDON Base latitude: 52 Base longitude: 360
Region NW latitude: 45 Region NW longitude: -125 (rounded)
Number of Frequencies: 9
    1838 3650 7150 10125 14175
    18118 21225 24940 28850 -1
=====
Data is being Processed.
Execution time varies with machine load, and area of HAP chart.

LONDON

T index used for prediction: 0061

Click here for HAP Result Page 1 \(00-05UT\)
Click here for HAP Result Page 2 \(06-11UT\)
Click here for HAP Result Page 3 \(12-17UT\)
Click here for HAP Result Page 4 \(18-23UT\)
    
```

Fig 23

Further information is available online by clicking on the 'Help' button above the world map on the HAP page.

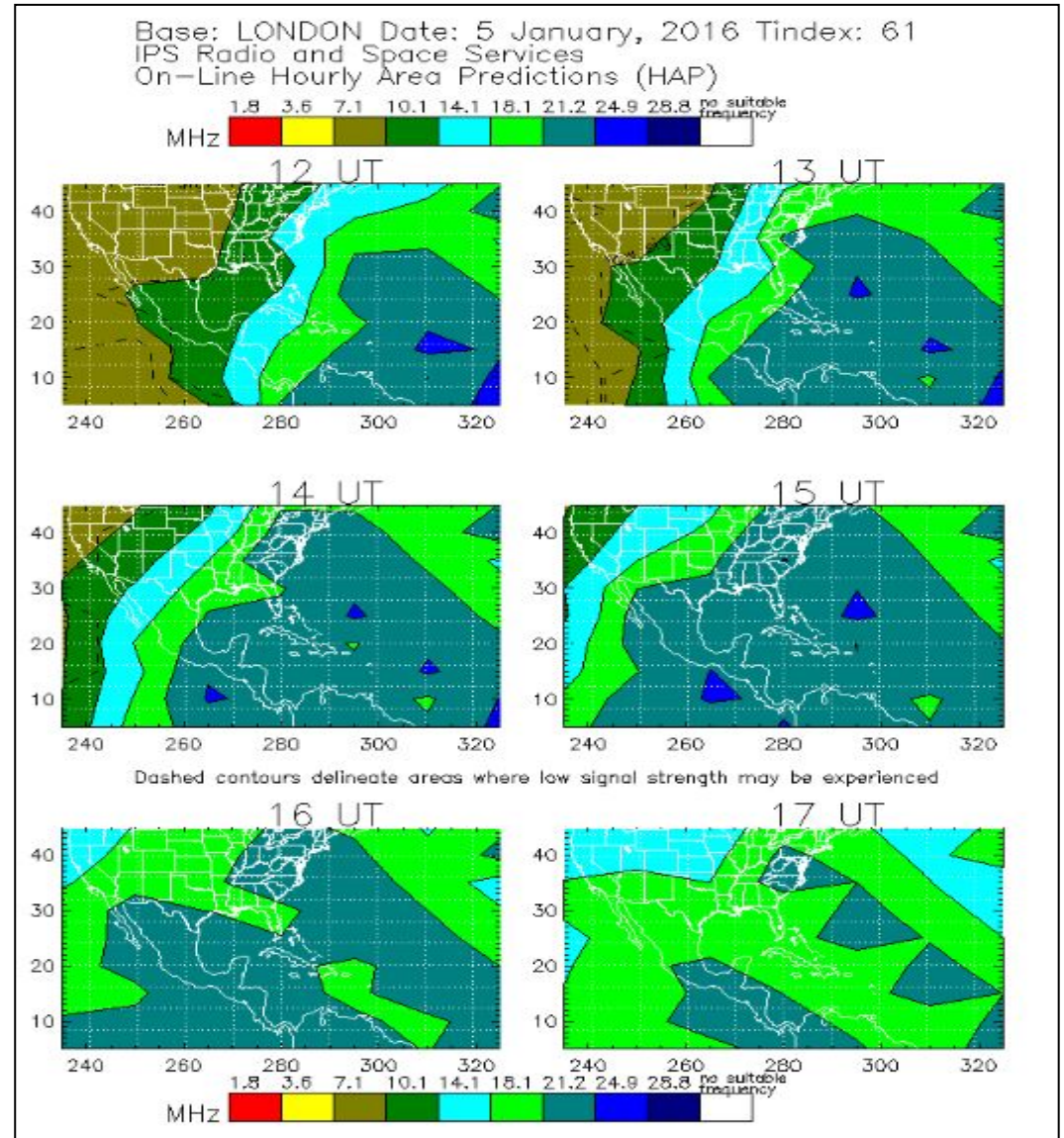


Fig 24

Local Area Mobile Prediction (LAMP)

The Local Area Mobile Prediction (LAMP) option is shown in **Figure 25**, and comprises a world map with four tabs:

Map view

Base location

Frequencies and

Date + T-index, where you can either select or enter data.

There are three buttons beneath the tabs and data window:

Predict to run the predictions

Reset to clear all the settings and

Help, which provides further information to help you with running these predictions.

Click the **'Map view'** Tab and centre the map on the U.K. by clicking on the 0 degrees in the Map view box above the world map.

Click the **'Base location'** Tab and either enter the name of the base together with the latitude and longitude in the boxes within the window, or use the left hand mouse button to click first on the world map where the base is located.

The screenshot shows the 'Australian Government Space Weather Services' website. The main heading is 'Space Weather Services'. Below it, there's a navigation bar with links: Home, Space Weather, Satellite, Geophysical, Solar, HF Systems, Products and Services, Educational, World Data Centre. The current page is 'HF Systems'. A forecast bar shows: FORECAST SOL: Normal, MAG: Moderate, ION: Moderate. The date is Tuesday, Jan 05 2016 19:05 UT. The main content area is titled 'Combined HF Prediction Tool'. It has a 'Choose Tool' panel with 'LAMP' selected. Below this are four tabs: 'Map view', 'Base location', 'Frequencies', and 'Date + T-index'. The 'Map view' tab is active, showing a world map with a shaded prediction area over the UK. There are radio buttons for 'Centre longitude' (180 degrees, 0 degrees) and 'View' (Normal, Zoomed). Below the map are buttons for 'Predict', 'Reset', and 'Help', and a 'lat' input field.

Fig 25

HF Propagation Predictions – Part 1 by G3YTU

The base location can be cleared by clicking on the **'Reset'** button above the world map. If you start to type a location such as 'London' in the entry box then, if it is a location held in the database, then any names will be shown in a drop down list from which you can select the wanted location.

Any locations not in the database will need to be entered manually or by means of the World Map. You will see an oval drawn in blue dashes on the world map which shows the local area for which the prediction will cover.

Click the **'Frequencies'** Tab and click either the 'Defaults' or 'Amateur' buttons and a set of frequency bands will be entered into the 10 boxes above. Clicking on the 'Clear' button will clear the boxes. You can also type into the boxes with any other frequencies of your choice but note that they are in kHz so 14 MHz is entered as '14000'.

Click the **'Date +T-index'** Tab and select the Prediction date on the left hand side and the T-index selection on the right hand side. The T-index should generally be set to 'Australian T-index forecast' and 'Monthly' but you may wish to experiment with the 'Current real-time T-index' settings.

Once all the data has been selected or entered, run the predictions by clicking on the **'Predict'** button above the world map.

The LAMP output is shown opposite in **Figure 26**, and consists of a summary of the prediction input data with the results presented on a graph below of distance and time for the frequencies shown in the coloured key above the graph.

The prediction is designed for either a Base to Mobile or Mobile to Mobile communications within 1000km of the base location.

Further information is available online by clicking on the 'Help' button above the world map on the LAMP page.

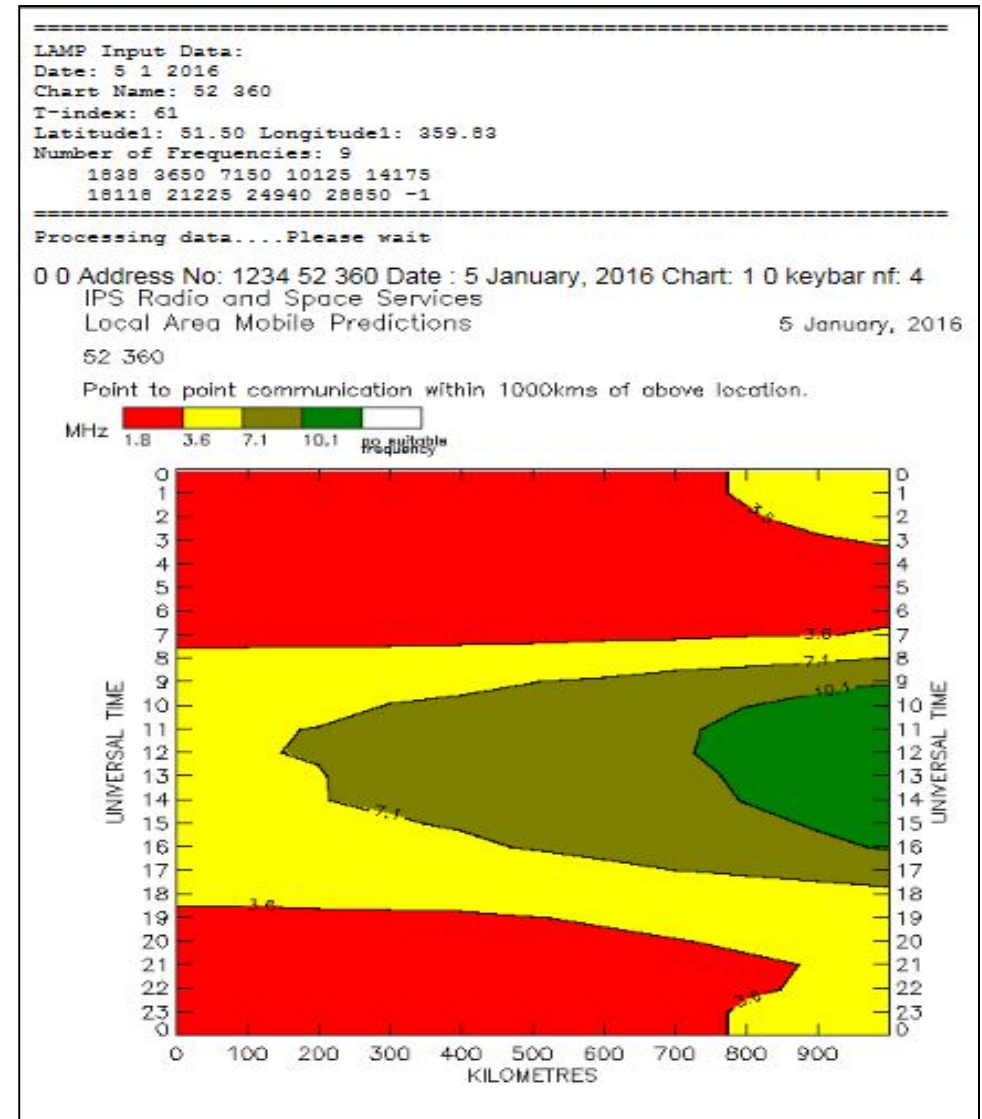


Fig 26

Min-Max (Area of Coverage) HAP

The Min-Max (Area of Coverage) Hourly Area Prediction (HAP) option is shown in **Figure 27** and comprises a world map with four tabs:

Map view

Base location

Frequencies and

Time + T-index

Where you can either select or enter data.

There are three buttons beneath the tabs and data window:

Predict to run the predictions

Reset to clear all the settings and

Help, which provides further information to help you with running these predictions.

Click the '**Map view**' Tab and centre the map on the U.K. by clicking on the 0 degrees in the Map view box above the world map.

Continued overleaf:

The screenshot displays the 'Space Weather Services' website interface. At the top, it features the Australian Government Bureau of Meteorology logo and the title 'Space Weather Services'. The main navigation bar includes links for Home, Space Weather, Satellite, Geophysical, Solar, HF Systems, Products and Services, Educational, and World Data Centre. The current page is 'HF Systems', with a sub-menu for 'Online Tools' and 'Prediction Tools'. The 'Forecast' status is shown as SOL: Normal, MAG: Moderate, and ION: Moderate. The date and time are Tuesday, Jan 05 2016 19:05 UT.

The 'Combined HF Prediction Tool' section is active, with the 'Min/Max HAP' tab selected. Below this, the 'Map view' sub-tab is chosen. The 'Map view' settings are: Centre longitude (180 degrees selected, 0 degrees unselected) and View (Normal selected, Zoomed unselected). The world map shows a shaded area of coverage over the North Atlantic and Europe. Below the map are buttons for 'Predict', 'Reset', and 'Help', and a text input field for 'lat'.

Fig 27

HF Propagation Predictions – Part 1 by G3YTU

Click the '**Base location**' Tab and either enter the name of the base together with the latitude and longitude in the boxes within the window, or use the left hand mouse button to click first on the world map where the base is located.

The base location can be cleared by clicking on the '**Reset**' button above the world map. If you start to type a location such as 'London' in the entry box then, if it is a location held in the database, then any names will be shown in a drop down list from which you can select the wanted location.

Any locations not in the database will need to be entered manually or by means of the World Map.

Click the '**Frequencies**' Tab and click either the 'Defaults' or 'Amateur' buttons and a set of frequency bands will be entered into the 10 boxes above. Clicking on the 'Clear' button will clear the boxes. You can also type into the boxes with any other frequencies of your choice but note that they are in kHz so 14 MHz is entered as '14000'.

Click the '**Date +T-index**' Tab and select the Prediction date on the left hand side and the T-index selection on the right hand side. The T-index should generally be set to 'Australian T-index forecast' and 'Monthly' but you may wish to experiment with the 'Current real-time T-index' settings.

Enter the prediction time (hour) in a two digit format.

Click on the world map with the left hand mouse button where you want the top left hand corner of the area to be and drag the mouse to select the rectangular area required.

Once all the data has been selected or entered, run the predictions by clicking on the '**Predict**' button above the world map.

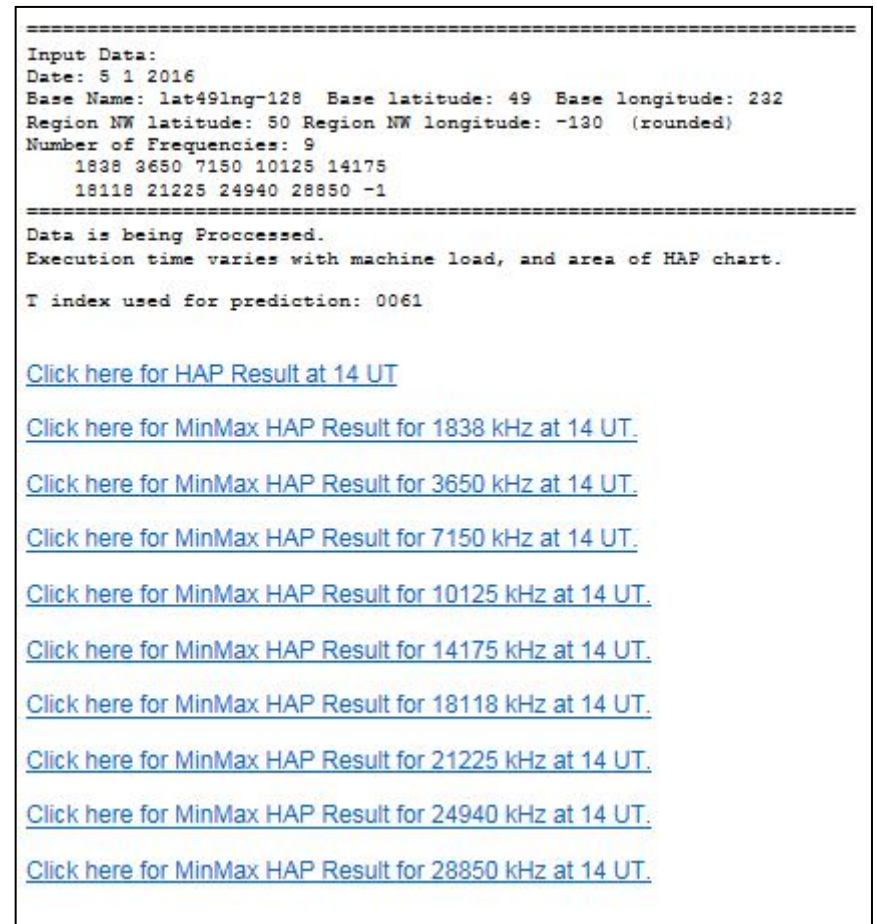


Fig 28

The Min-Max HAP output is shown in **Figure 28** and consists of a summary of the prediction input data with the results on separate pages, the first one for the time entered and the others for each of the frequencies entered.

To view any of the pages click on the links. The results for the time entered are shown in **Figure 29a overleaf**, consisting of a coloured chart of the area selected on the world map with suitable frequencies shown on the map in colour according to the key above the chart.

The results for the frequencies are as shown in **Figure 29b overleaf**, consisting of a white outline map on black background of the area selected on the world map with suitable frequencies shown on the map in colour according to the key above the chart.

Further information is available online by clicking on the 'Help' button above the world map on the Min-Max HAP page.

HF Propagation Predictions – Part 1 by G3YTU

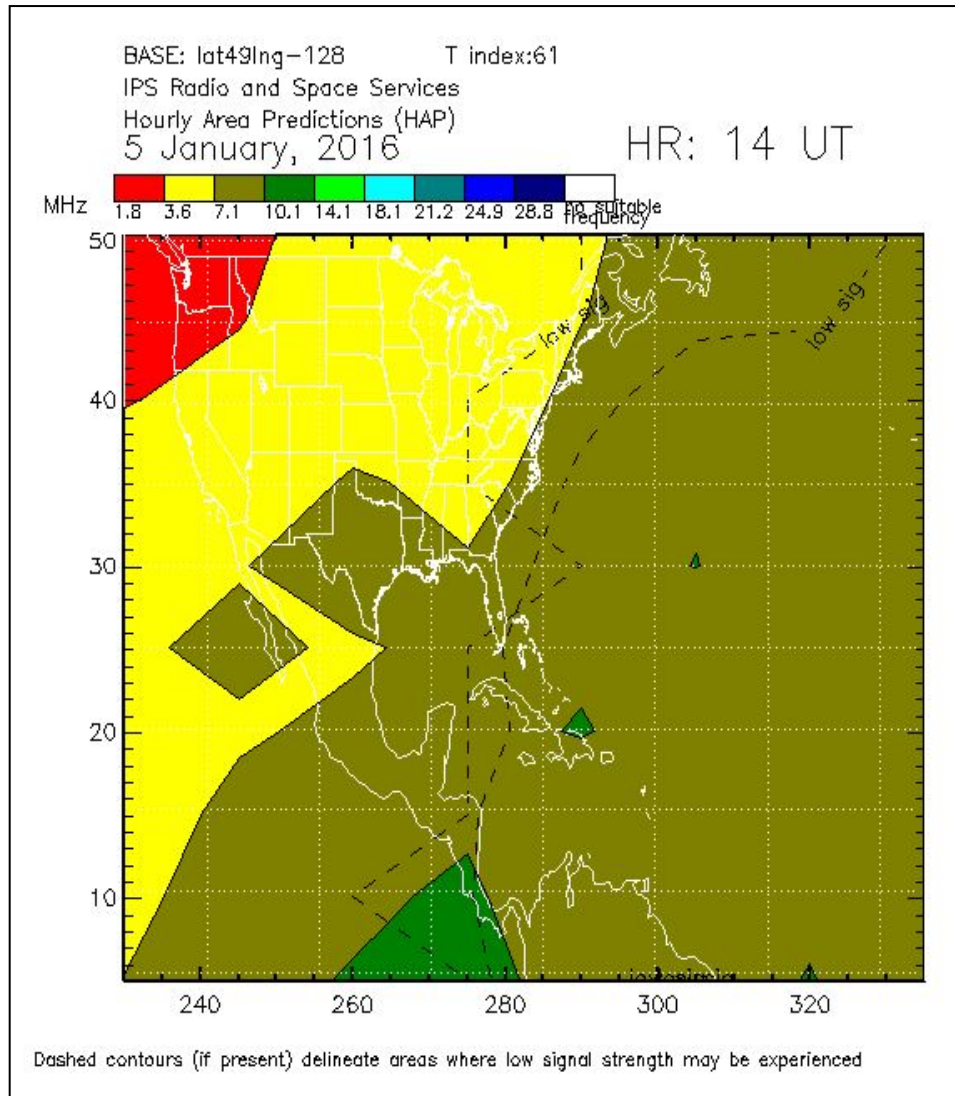


Fig 29a

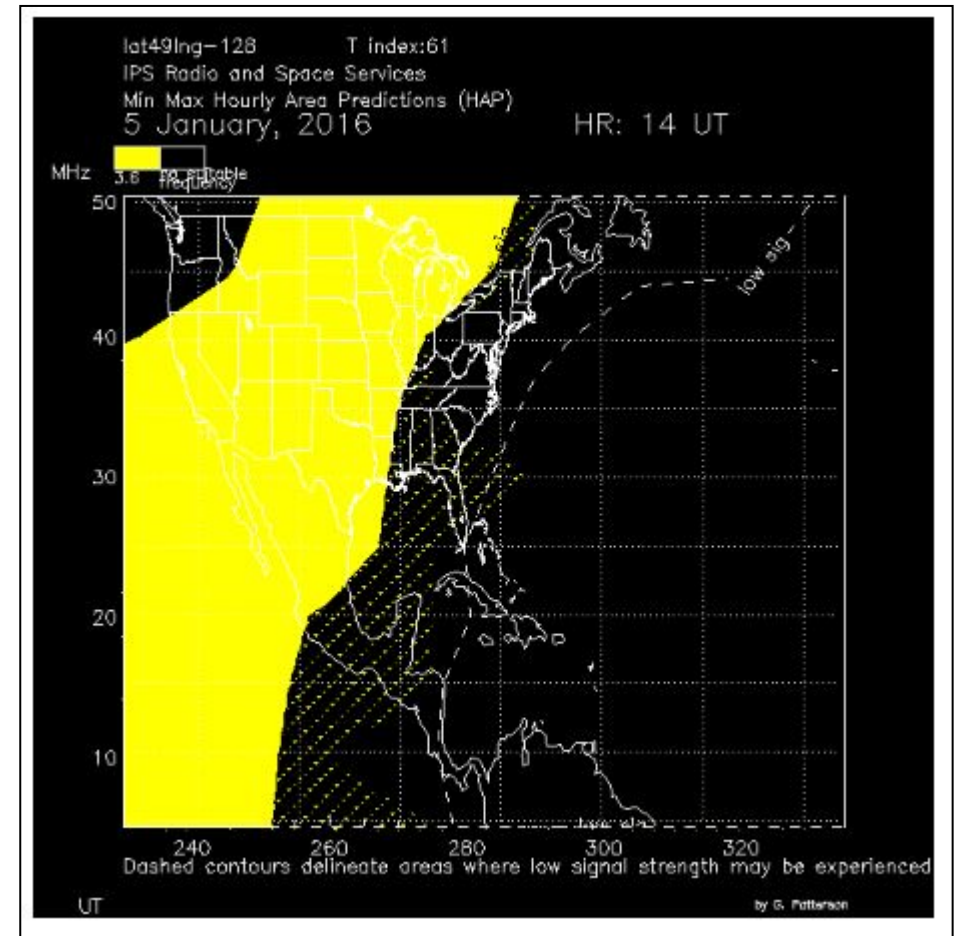


Fig 29b

URSL – Upper, Recommended, Secondary and Lower HF Frequency

The Upper, Recommended, Secondary and Lower HF Frequency (URSL) option is shown in **Figure 30** and comprises a world map with four tabs:

Map view

Circuit

Frequencies and

Date + T-index

Where you can either select or enter data.

There are four buttons beneath the tabs and data window:

Predict to run the predictions

Reset to clear all the settings

Clear Circuit to clear the circuit data and

Help, which provides further information to help you with running these predictions.

Click the **'Map view'** Tab and centre the map on the U.K. by clicking on the 0 degrees in the Map view box above the world map.

The screenshot shows the 'Australian Government Bureau of Meteorology Space Weather Services' website. The main heading is 'Space Weather Services'. Below the navigation bar, there's a status bar showing 'FORECAST SOL: Normal', 'MAG: Moderate', and 'ION: Moderate'. The page title is 'HF Systems' and the sub-page is 'Combined HF Prediction Tool'. The interface includes a sidebar with various tool categories, a main control panel with tabs for 'Map view', 'Circuit', 'Frequencies', and 'Date + T-index', and a world map at the bottom. The 'Map view' tab is active, showing options for 'Centre longitude' (180 degrees and 0 degrees) and 'View' (Normal and Zoomed). The map shows a shaded area over the North Atlantic and Europe, indicating the predicted HF propagation path.

Fig 30

Continued overleaf:

HF Propagation Predictions – Part 1 by G3YTU

Click the '**Circuit**' Tab and either enter the details of the transmitter and receiver together with the latitude and longitude in the boxes within the window or use the left hand mouse button to click first on the world map where the transmitter is located and then again where the receiver is located.

The transmitter and receiver locations can be cleared by clicking on the '**Clear Circuit**' button above the world map. If you start to type a location such as 'London' in the entry box then, if it is a location held in the database, then any names will be shown in a drop down list from which you can select the wanted location.

Any locations not in the database will need to be entered manually or by means of the World Map.

Click the '**Frequencies**' Tab and click either the 'Defaults' or 'Amateur' buttons and a set of frequency bands will be entered into the 10 boxes above. Clicking on the 'Clear' button will clear the boxes. You can also type into the boxes with any other frequencies of your choice but note that they are in kHz so 14 MHz is entered as '14000'.

Click the '**Date +T-index**' Tab and select the Prediction date on the left hand side and the T-index selection on the right hand side. The T-index should generally be set to 'Australian T-index forecast' and 'Monthly' but you may wish to experiment with the 'Current real-time T-index' settings. Enter the prediction time (hour) in a two digit format.

Click on the world map with the left hand mouse button where you want the top left hand corner of the area to be and drag the mouse to select the rectangular area required.

Once all the data has been selected or entered, run the predictions by clicking on the '**Predict**' button above the world map.

The URSL output is shown in **Figure 31 overleaf**, and consists of a summary of the prediction input data with the results below in tabular form of the suitable Upper & Lower Usable frequencies, Recommended and Secondary frequencies for each hour.

Further information is available online by clicking on the 'Help' button above the world map on the URSL page.

Continued on next page:

HF Propagation Predictions – Part 1 by G3YTU

The URSL Output

=====

URSL Input Data:

Date: 5 1 2016

Chart Name: LONDON_NEW YORK

T-index: 61

Latitude1: 40.73 Longitude1: 285.98

Latitude2: 51.50 Longitude1: 359.83

Number of Frequencies: 9

1 3 7 10 14

18 21 24 28 -1

=====

Processing data....Please wait

ADDRESS NO. 1234

URSL - RECOMMENDED FREQUENCIES FOR HF COMMUNICATIONS FOR CIRCUITS LISTED

5 January, 2016

=====

**UNITS: FREQUENCY - MHZ, TIME - UT , DISTANCE - KMS

R AND S ARE RECOMMENDED AND SECONDARY FREQUENCIES**

U AND L ARE UPPER AND LOWER USABLE FREQUENCIES**

VERTICAL ANGLE(S) - DEGREES

NO SUITABLE FREQUENCY INDICATED BY ZERO**

A VALUE PRECEDED BY AN ASTERISK (E.G., "*4") INDICATES A LOW PROBABILITY OF SUCCESS

=====

NAME	DISTANCE	UT	00	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
LONDON_NEW YORK	5567	U	10	10	10	10	10	10	10	10	10	10	10	10	14	24	24	28	24	24	21	14	14	10	10	10	10
		R	7	7	7	7	7	7	7	7	7	7	7	7	14	18	21	21	21	21	18	14	10	10	7	7	7
2F 3- 4 3F 10-11 2E 0 3E 1		S	3	3	3	3	3	3	3	3	3	3	*10	*10	10	14	18	18	18	18	14	10	7	7	3	3	3
		L	1	1	1	1	1	1	1	1	1	1	7	7	10	10	10	10	10	10	10	10	7	1	1	1	1

=====

Prepared on 6-Jan-2016 by BOM SPACE WEATHER SERVICES, Sydney - PO Box 1386, Haymarket NSW 1240, Australia - Tel:+61-2-9213-8000

Fig 31

SOLAR & IONOSPHERIC INDICES

ROYAL OBSERVATORY OF BELGIUM SOLAR INFLUENCES DATA ANALYSIS CENTRE (SIDC)

The link <http://www.sidc.be/silso/> takes you to the Solar Influences Data Analysis Centre (SIDC) page for the Sunspot Index and Long-Term Solar Observations (SILSO) where you can read the latest sunspot bulletin by clicking on the link 'Latest Sunspot Bulletin'.

The Bulletin shows the provisional international and normalized hemispheric daily sunspot numbers for the month of publication and includes predictions of the monthly smoothed Sunspot Number for the next 12 months.

Note: The method of calculation of Sunspot Numbers was changed on the 1st July 2015 and the historical data amended accordingly. This unfortunately means that the measured and predicted values are different from those produced by the National Geophysical Data Centre, Boulder Colorado and are not suitable for use with HF Predictions Programs such as VOACAP without further adjustments.

NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION (NOAA) NATIONAL CENTRE FOR ENVIRONMENTAL INFORMATION (NCEI)

FORMERLY - NATIONAL GEOPHYSICAL DATA CENTER (NGDC), BOULDER, COLORADO

The National Oceanic and Atmospheric Administration (NOAA), National Centre for Environmental Information (NCEI), formerly the National Geophysical Data Centre (NGDC), is responsible for the archive and access of solar and space environmental data and derived products collected by NOAA observing systems and acquired through the World Data Center for Solar and Terrestrial Physics (Boulder).

Archives include extensive collections of data from solar observatories, ground ionospheric sounders, and satellites plus modelled space climatologies.

The link <https://www.ngdc.noaa.gov/stp/spaceweather.html> takes you to the Space Weather page where you can find the link <https://www.ngdc.noaa.gov/stp/solar/solardataservices.html> which takes you to the Solar Data Services page where there are further links to the data available.

The link <https://www.ngdc.noaa.gov/stp/solar/sibintro.html> takes you to the Solar Indices Bulletin which does not seem to have been updated since October 2007. The FTP access provides more recent updates but the last one published is August 2014.

Note: There seems to be some doubt as to whether this service will be resumed in the future as no Solar Indices Bulletins have been produced for over a year.

HF Propagation Predictions – Part 1 by G3YTU

NATURAL RESOURCES CANADA

The link <http://www.spaceweather.gc.ca/solarflux/sx-en.php> takes you to the Space Weather Centre, Solar Radio Flux page where you can read the latest values measured and also the archived data for daily values and monthly averages.

Note: There do not appear to be any measured or predicted smoothed mean values of solar radio flux which are required for most HF Predictions Programs.

NORTHWEST RESEARCH ASSOCIATES, INC. SPACE WEATHER SERVICES

The link <http://spawx.nwra.com/spawx/spawx.html> takes you to the Space Weather Indices page of the NorthWest Research Associates (NWRA) Space Weather Services where you can find details of solar and ionospheric indices.

SSN_e – Effective Sunspot Number

NWRA produce forecasts of SSN_e from foF2 data from the National Oceanic and Atmospheric Administration (NOAA) Space Weather Prediction Centre (SWPC) at <http://www.swpc.noaa.gov/>

SSN_f – Solar Radio Flux Sunspot Number

NWRA provide a formula to calculate a Sunspot Number from the daily noon value of the Solar Radio Flux measured at a wavelength of 10.7cm (2800 MHz) by the Penticton Radio Observatory in Canada at <http://spawx.nwra.com/spawx/comp.html>

LABORATOIRE D'ETUDES SPATIALES ET D'INSTRUMENTATION EN ASTROPHYSIQUE L'OBSERVATOIRE DE PARIS

Cycle Eruptions et Rayonnement Cosmique au Lesia (CERCLe)

The link <https://previ.obspm.fr/index.php?page=forecasts> takes you to the Paris Observatory where you can find details of the Sunspot Index RI12 and the 10-centimeter flux F10.7 for long-term forecasting.

INTERNATIONAL TELECOMMUNICATIONS UNION (ITU) RADIOCOMMUNICATIONS BUREAU

The link <http://www.itu.int/en/ITU-R/study-groups/rsg3/Pages/rsg3-indices.aspx> takes you to the International Telecommunications Union (ITU) Radiocommunication Bureau Circular of Basic Indices for Ionospheric Propagation in Word document format.

The circular is based on data supplied by the Solar Influences Data analysis Centre (SIDC, Brussels), the National Geophysical Data Center, Boulder, Colorado and the National Research Council, near Penticton, British Columbia, Canada.

AUSTRALIAN GOVERNMENT SPACE WEATHER SERVICES IONOSPHERIC PREDICTION SERVICE (IPS)

SUNSPOT NUMBERS

The link <http://www.sws.bom.gov.au/Solar/1/6> takes you to the Space Weather Services, Solar Conditions, Monthly Sunspot Numbers page where you can find details of the observed and predicted values of the Smoothed Sunspot Number and Equivalent 10.7 CM Solar Radio Flux based on the observed Monthly Mean Sunspot Numbers from SILSO, Royal Observatory of Belgium.

The predicted Smoothed Sunspot Number can be used for HF Predictions such as VOACAP that require a 12 Month Running Mean value.

IONOSPHERIC INDEX T

The Space Weather Services, Ionospheric Prediction Service (IPS) Online Prediction Tools previously described use the Ionospheric Index T which is automatically provided from within the predictions themselves. However, you may wish to find out more about this index at the following pages on the Space Weather Services website.

Note: The Real Time T Index takes account of the changes to the ionosphere due to solar events and should be used with caution and perhaps only where the propagation path or circuit is within the same area shown on the T Index Map for the given value of the Real Time T Index. Please check the Help pages for the T Index to read more about this topic.

T Index - Monthly and Real Time

The link http://www.sws.bom.gov.au/HF_Systems/6/4 takes you to a page which describes the Monthly T Indices and the Real Time T Indices both of which can be used in the Online Prediction Tools. If you click on the highlighted T Index Product you will see further pages of information.

The Monthly T Indices are used when you are producing a prediction for future use and the Real Time T Indices are used when you will be using the prediction results immediately.

T Index Map

The link http://www.sws.bom.gov.au/HF_Systems/6/9 takes you to a page which has a world map showing the difference between current observed hourly conditions and predicted monthly conditions for the global ionosphere. Depressions and enhancements are shown by the use of a colour key on the map with reference to the predicted monthly T index. The map is centred on Australasia and the U.K. is on the left and right hand edges of the map.

HELP?

If you need help with any of the HF Propagation Predictions described in this article, please check the website of the originator first to see if there is any information which provides you with a solution or contact me at g3ytu@msars.org.uk and I will try and help.