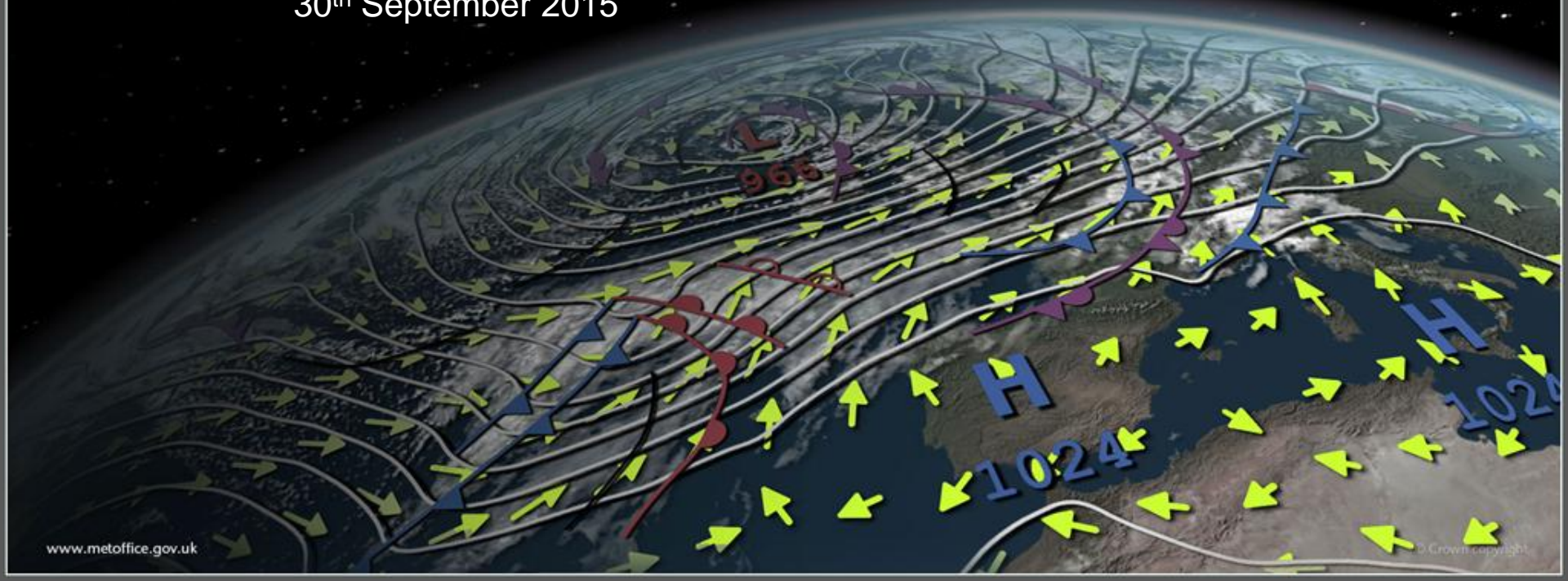


# Visualisation at the Met Office

Presented by Neil Armstrong, Deputy Chief Meteorologist

30<sup>th</sup> September 2015



# Introduction

- A quick introduction to the Met Office
- Visualisation tools used by operational meteorologists
- A closer look at Visual Weather
  - Map Editor
  - Feature Editor
  - Metmorph
- Future challenges
- Some operational WMS
  - RGB composites
  - Ensemble data



Met Office

# A quick introduction to the Met Office

~ 400 operational meteorologists

Ops Centre, Exeter



[www.metoffice.gov.uk](http://www.metoffice.gov.uk)

Deployed to over 30  
frontline stations

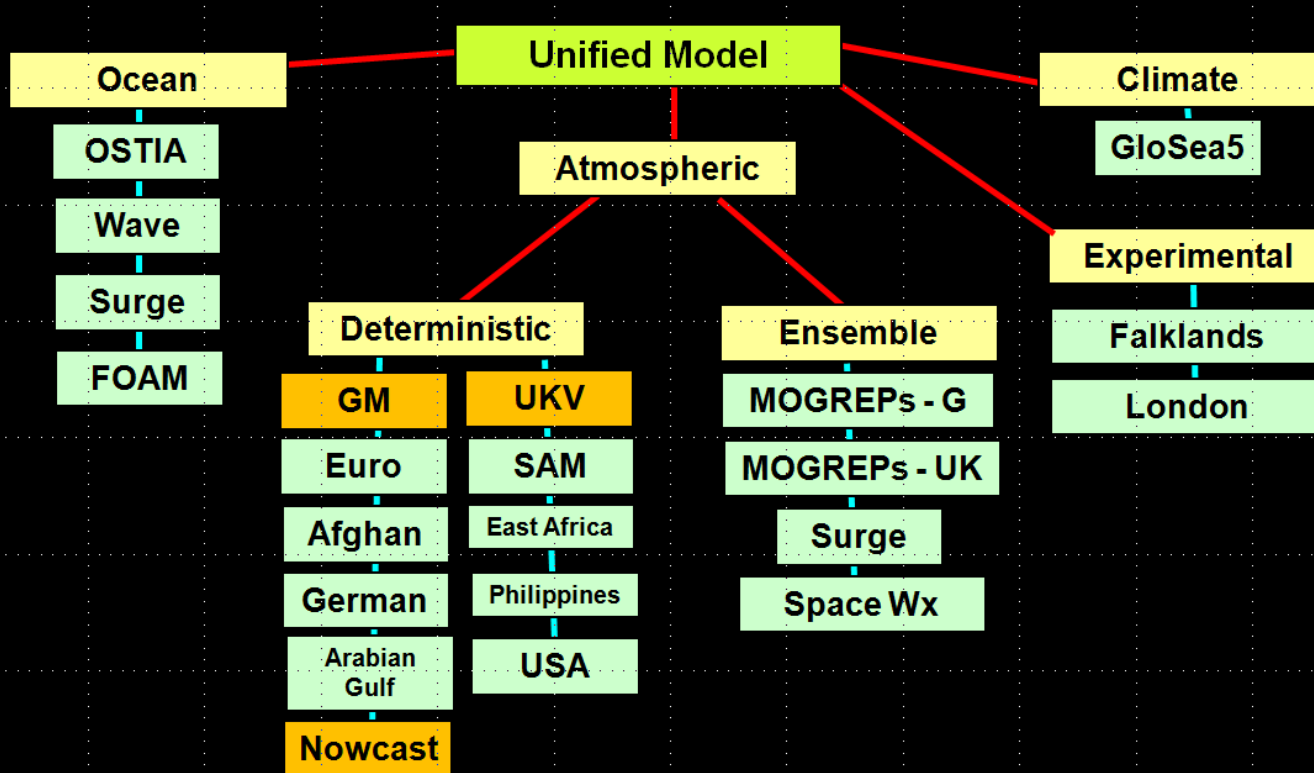


including frontline military  
bases and offshore sites



© Crown copyright

# A quick introduction to the Met Office NWP Suite





# A quick introduction to the Met Office

**Everyday ....**

**100 million** (around 300 GB) observations

Operational Models produce **4 TB** of products

Climate Research produce **52 TB** of data

Of that around 155 GB goes to Visual Weather servers



Met Office

# Visualisation tools used by operational meteorologists

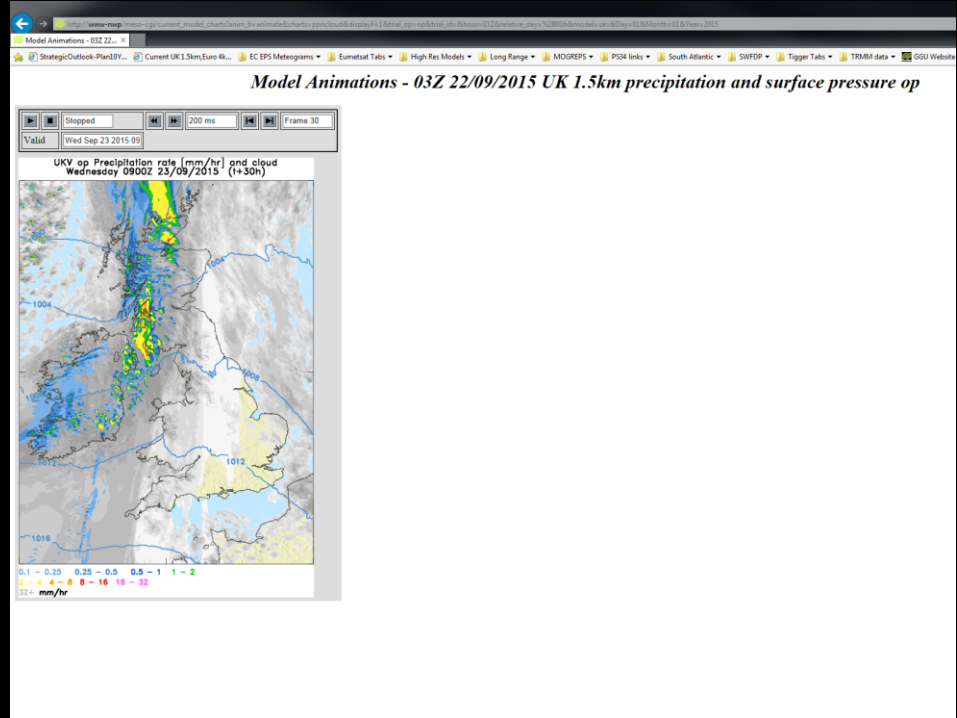
- Web based browsers



Met Office

# Visualisation tools used by operational meteorologists

- Web based

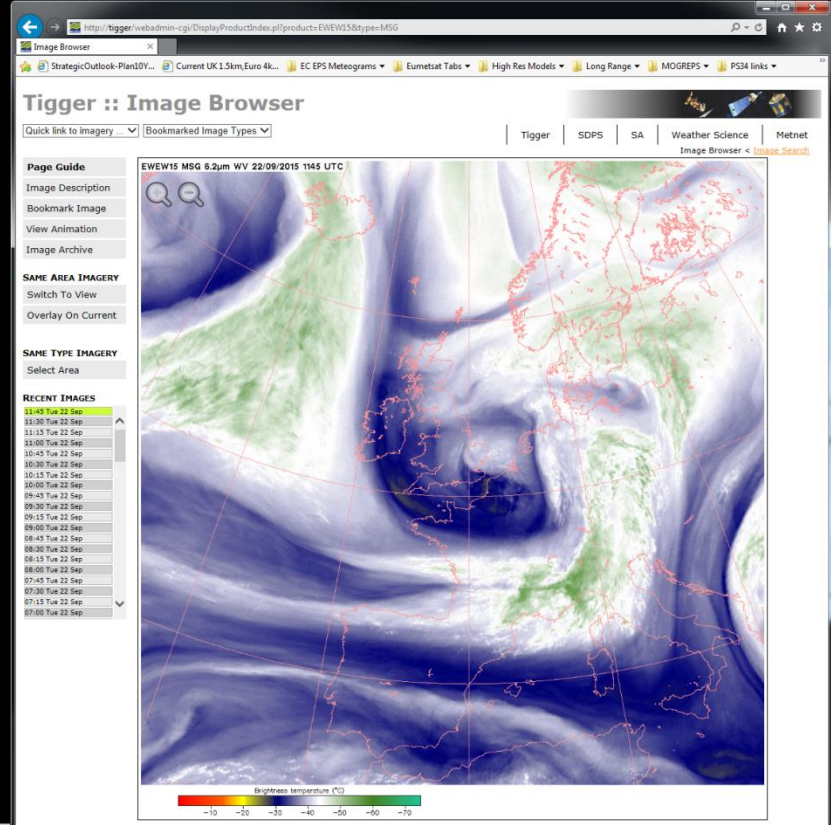




Met Office

# Visualisation tools used by operational meteorologists

- Web based



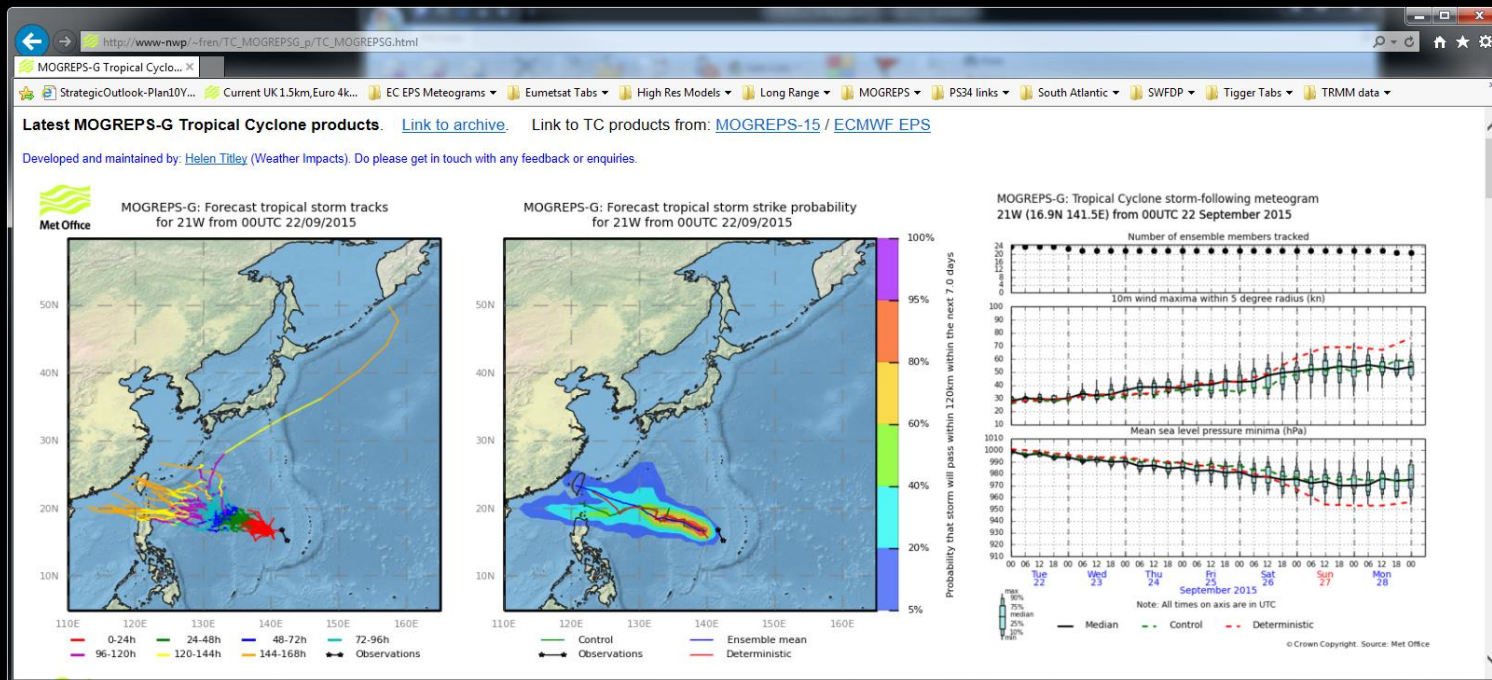




Met Office

# Visualisation tools used by operational meteorologists

- Web based browsers





Met Office

# Visualisation tools used by operational meteorologists

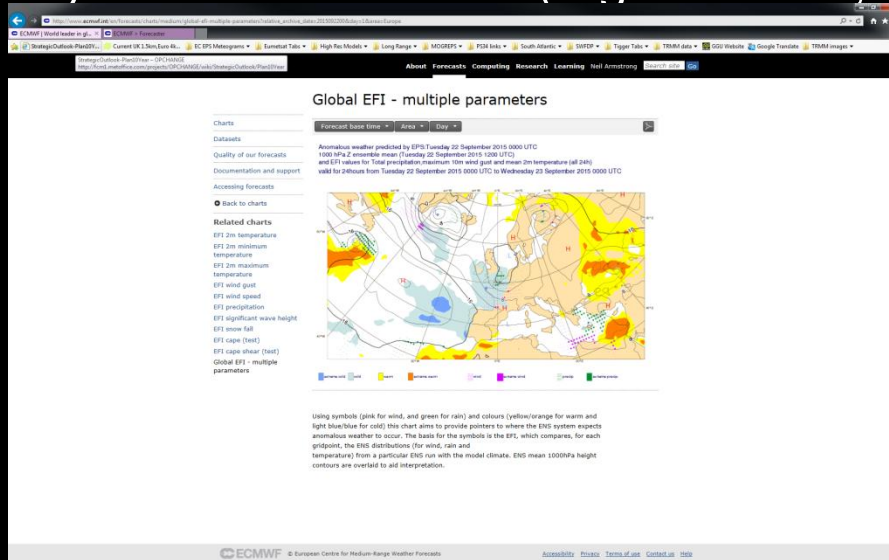
- Web based browsers
- Third party visualisation tools (e.g. ecCharts)



Met Office

# Visualisation tools used by operational meteorologists

- Web based browsers
- Third party visualisation tools (e.g. ECMWF, ecCharts)

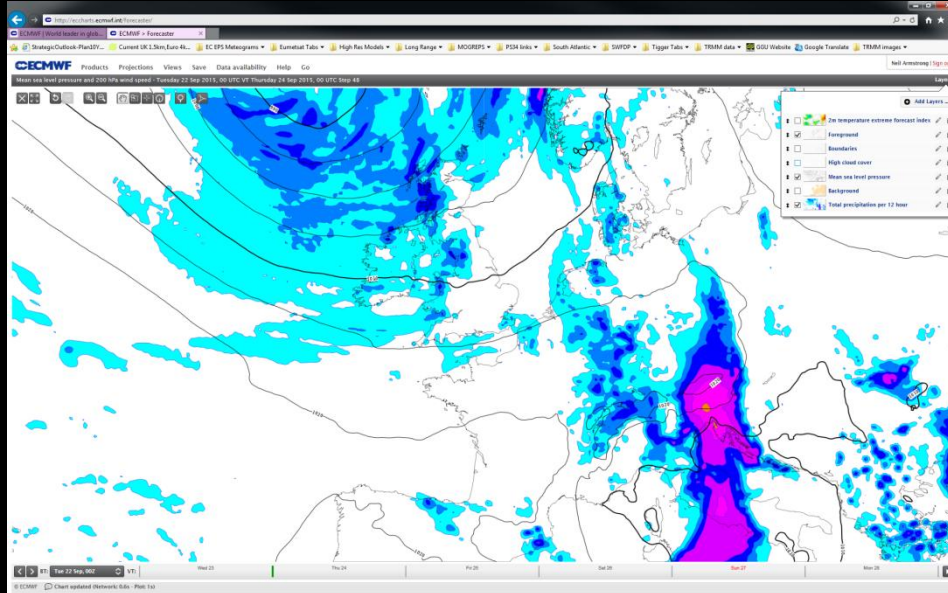




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# Visualisation tools used by operational meteorologists

- Web based browsers
- Third party visualisation tools (e.g. ECMWF, ecCharts)





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# Visualisation tools used by operational meteorologists

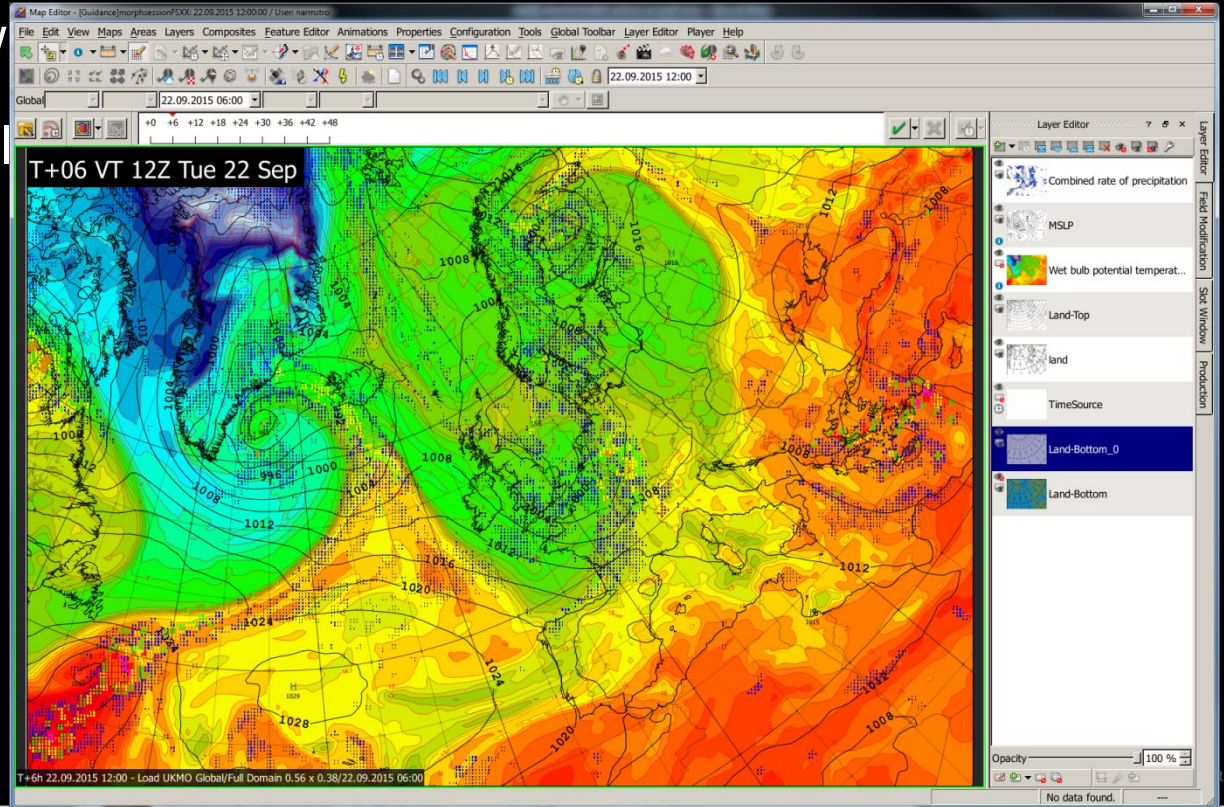
- Web based browsers
- Third party visualisation tools (e.g. ecCharts)
- Visual Weather (and Browsing Weather, Online Weather, Namis X)



Met Office

# Visualisation tools used by operational meteorologists

- Web based browser
- Third party visualisation
- Visual Weather





Met Office

# Visualisation tools used by operational meteorologists

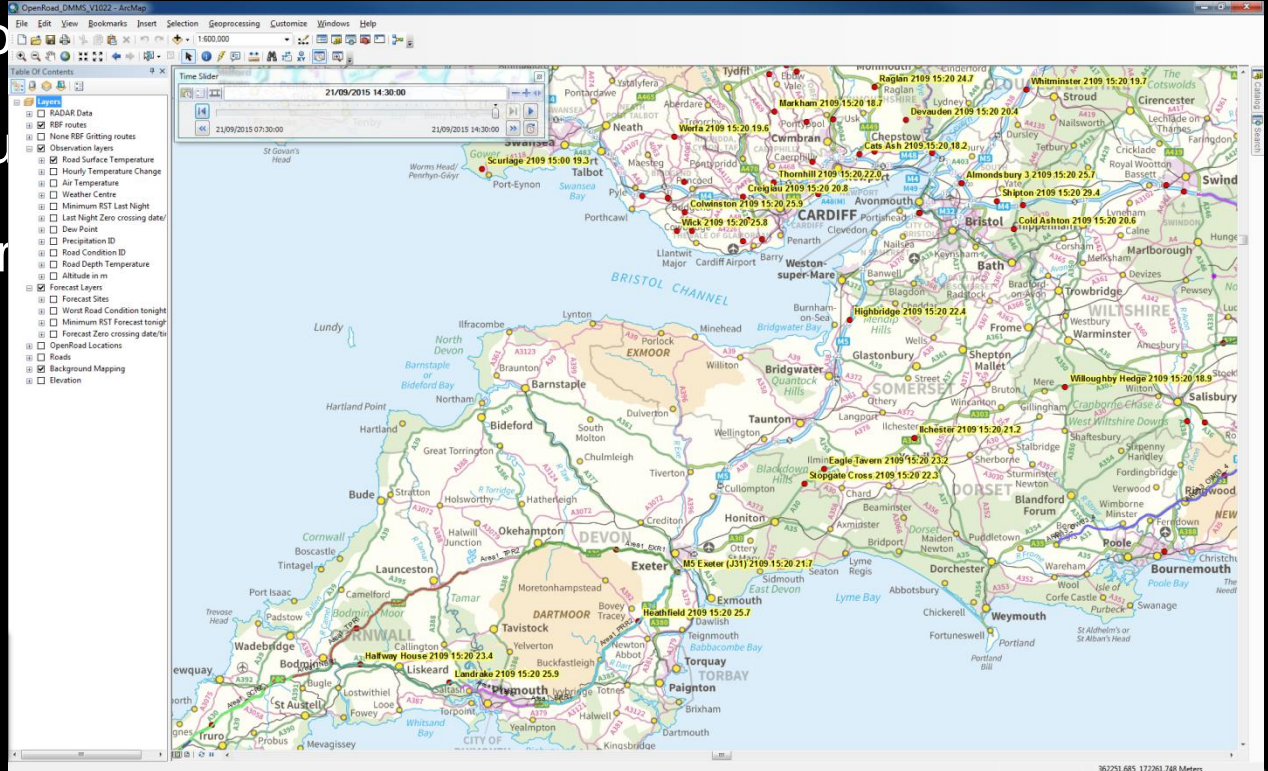
- Web based browsers
- Third party visualisation tools (e.g. ecCharts)
- Visual Weather
- ArcGis



Met Office

# Visualisation tools used by operational meteorologists

- Web based browser
- Third party visualisation tools
- Visual Weather
- ArcGis



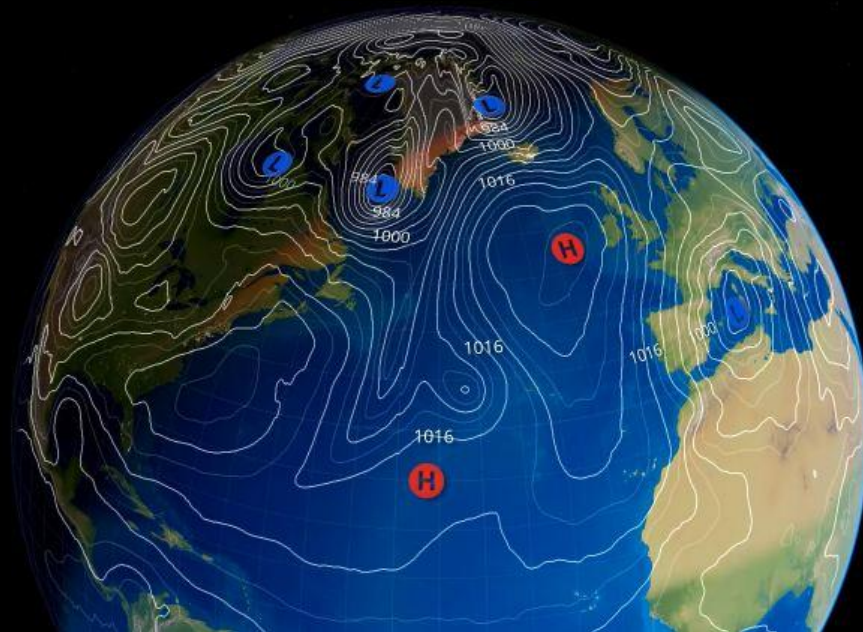




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# Visualisation tools used by operational meteorologists

- Web based browsers
- Third party visualisation tool
- Visual Weather
- ArcGis
- WeatherEye / Visual Cortex





Met Office

# Visual Weather – Main Panel

IBL Visual Weather 3.4.22 - narmstro@eld564

System Settings Online Maps Help

UTC: Tue Sep 22 13:01 2015  
Local: Tue Sep 22 14:01 2015

native:exxvmvw07.metoffice.gov.uk, Native database is working

4 - Falklands 4 - Indian 5 - Others My shortcuts Start-up

Current user  
All personal alerts

24hr Rainfall Accumulation Broadscale multi-map Cloud Verification Get TRMM

Multi-model comparison NWP Fields Rainfall accumulations Sat Pics

TRMM\_Rainfall World Wx

System is running: 3 days



Met Office

# Visual Weather – Main Panel

IBL Visual Weather 3.4.22 - narmstro@eld564

System Settings Online Maps Help

UTC: Tue Sep 29  
Local: Tue Sep 29

1 Modifying E

- ASXX
- Briefi
- Metmorph
- Char
- NCMViewer
- NV
- wi
- tep

Message Viewer

Route Forecast

Message Editor

Map Editor

Feature Editor

Image Player

Report Monitor

TAF Monitor

Meteo Chart

Message Editor Monitor

Equation Editor

Forecaster

Personal Task Manager

Field Diagnostics

Batch OSA

Storm Tides

Feature Digitizer

Field Cutter

office.gov.uk, Native database is working

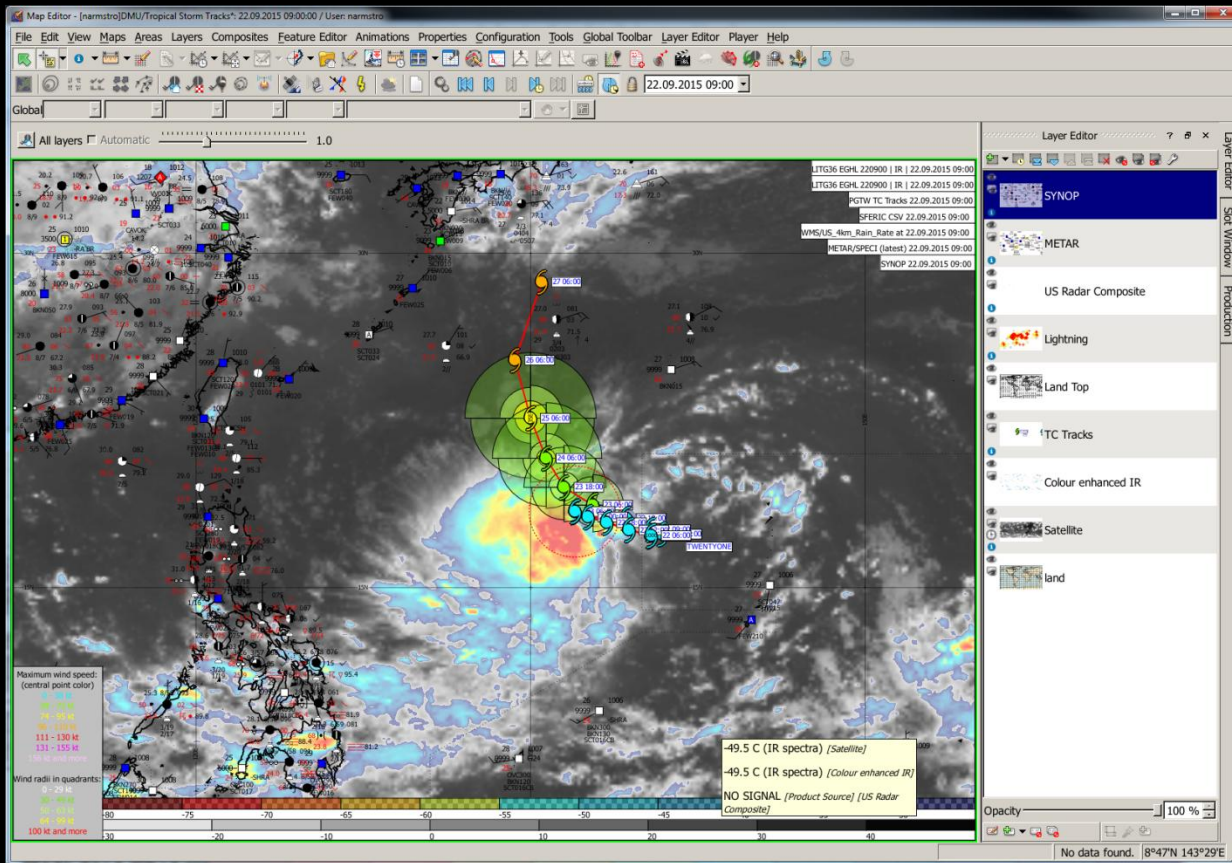
Current user  
All personal alerts

System is running: 4 hours



Met Office

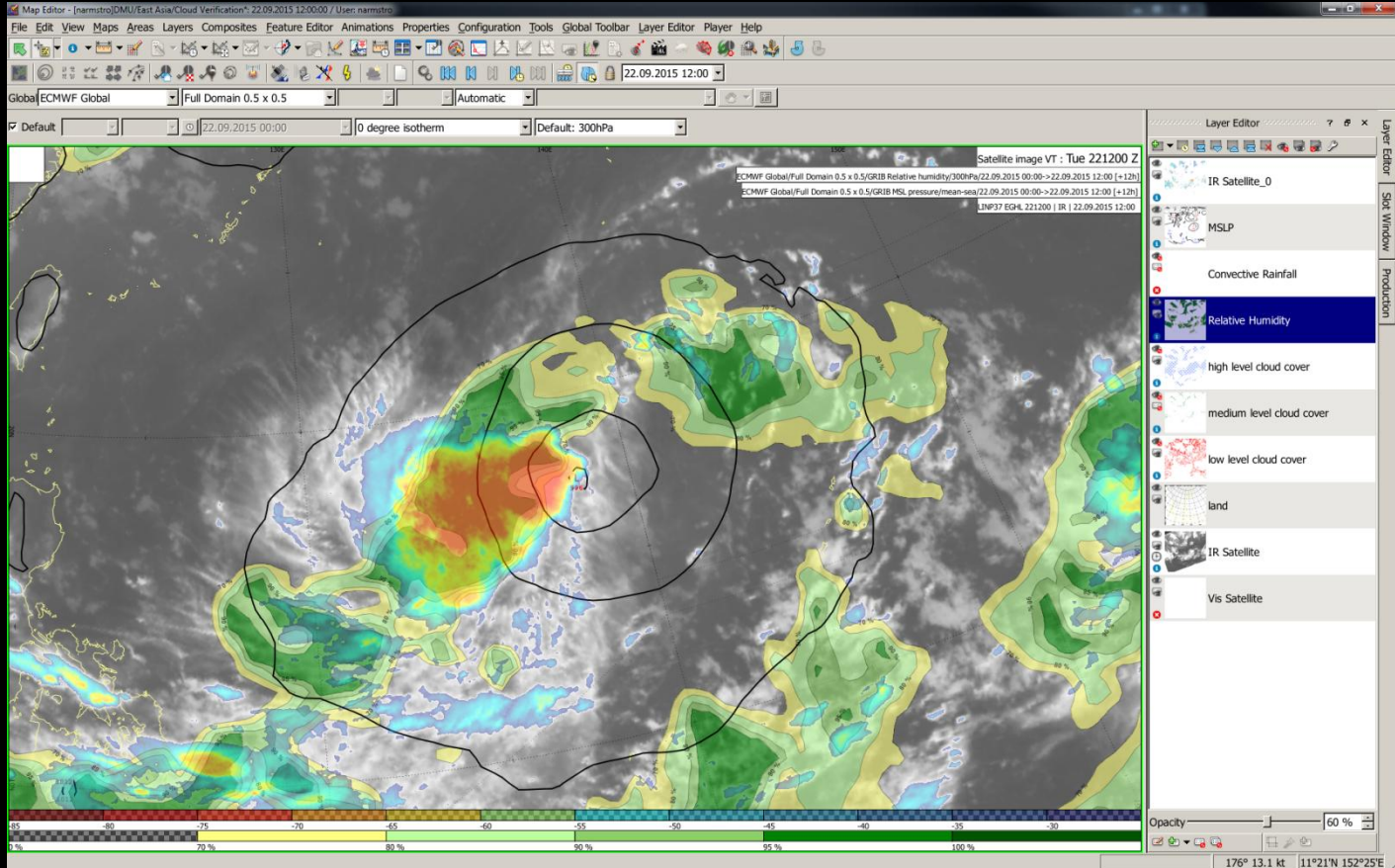
# Visual Weather – Map Editor





Met Office

# Visual Weather – Map Editor

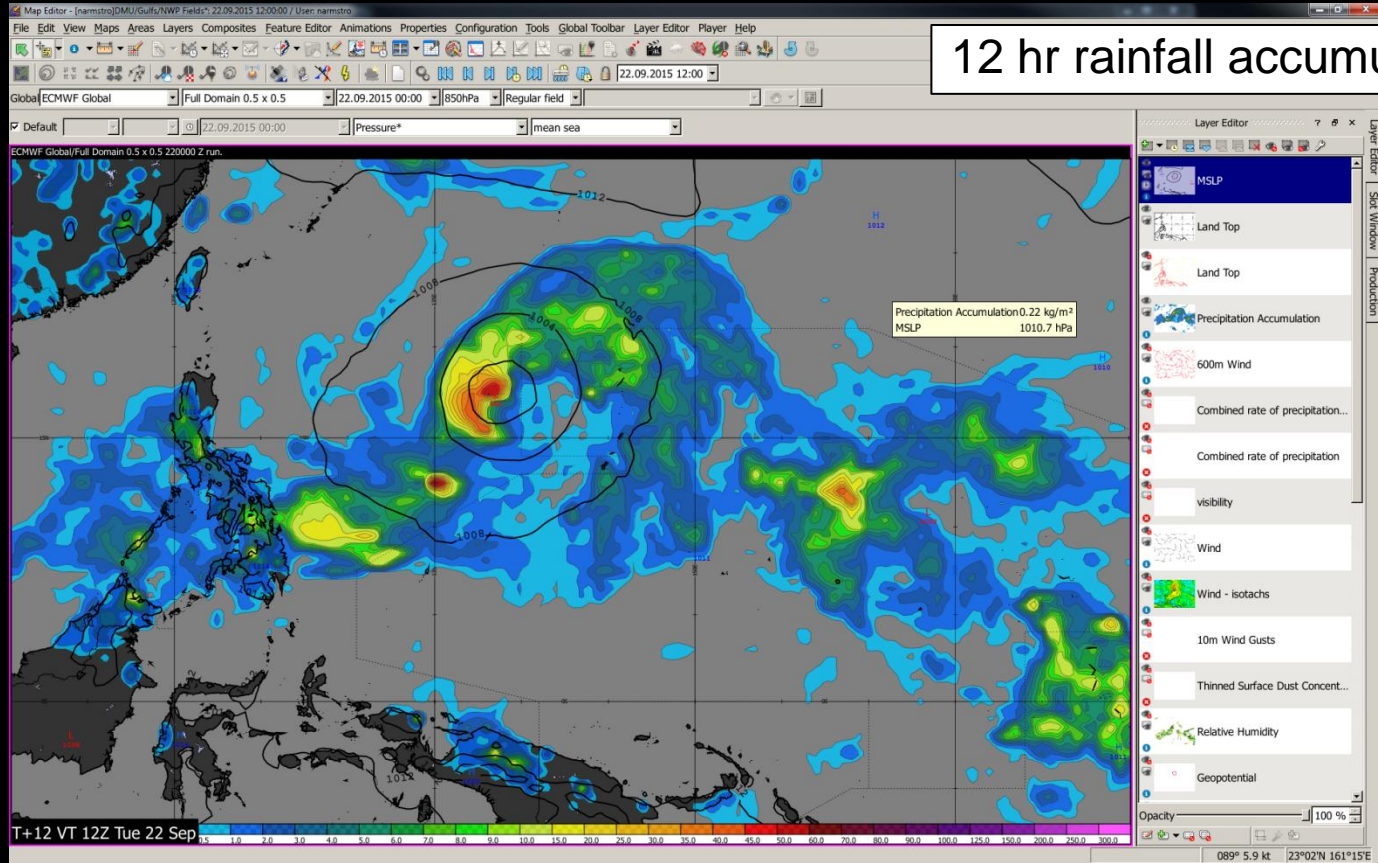




Met Office

# Visual Weather – Map Editor

12 hr rainfall accumulation

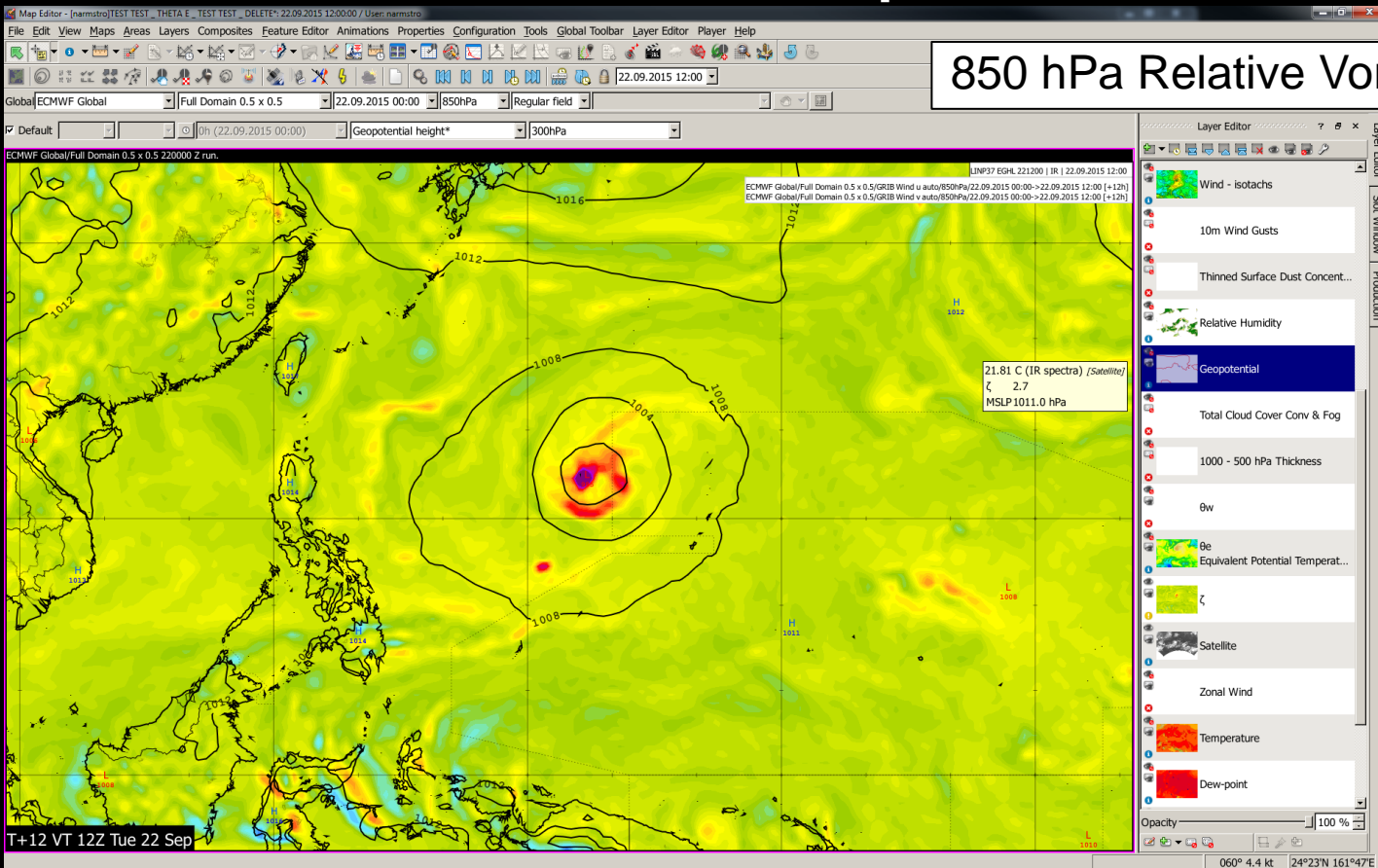




Met Office

# Visual Weather – Map Editor

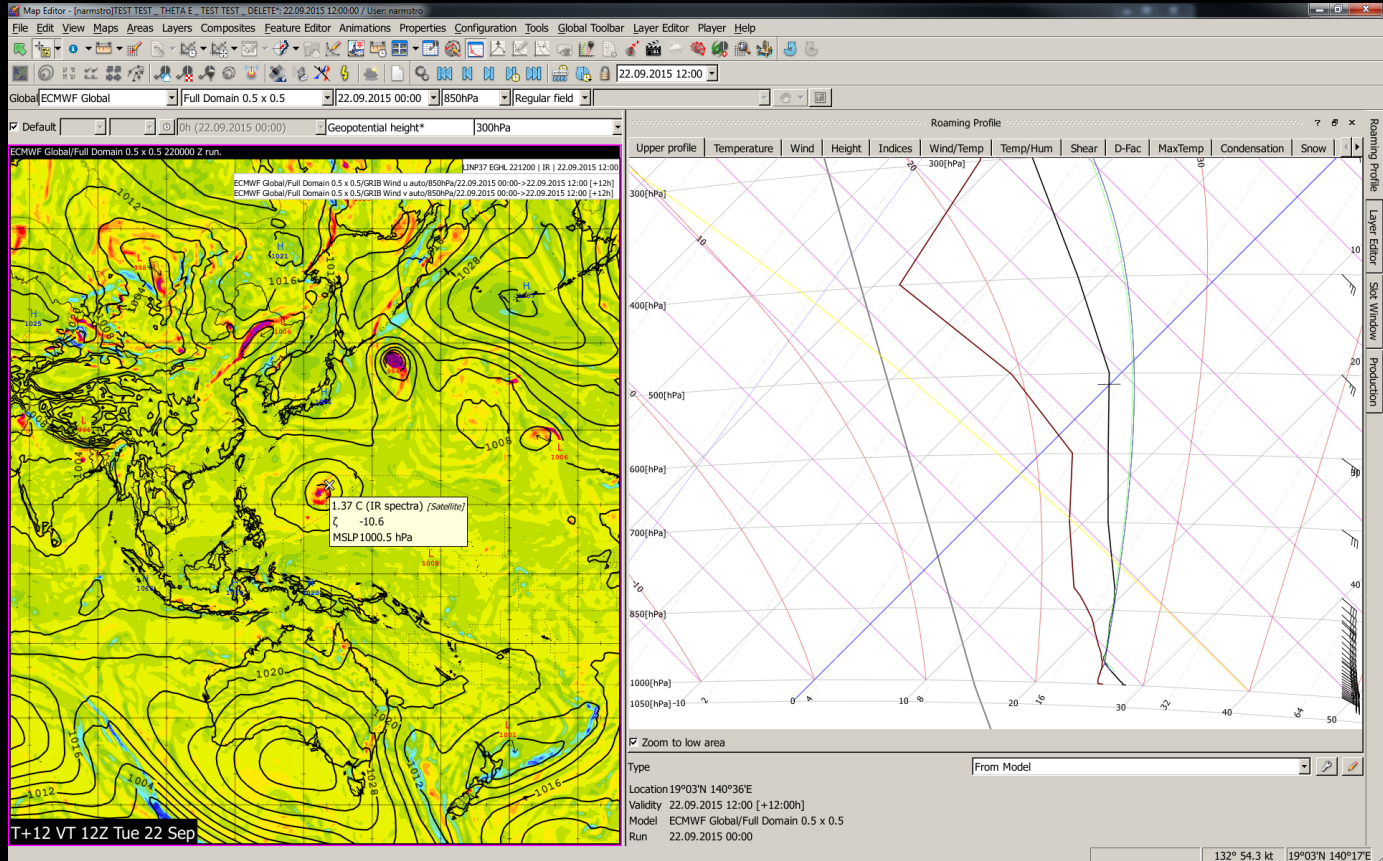
850 hPa Relative Vorticity





Met Office

# Visual Weather – Map Editor







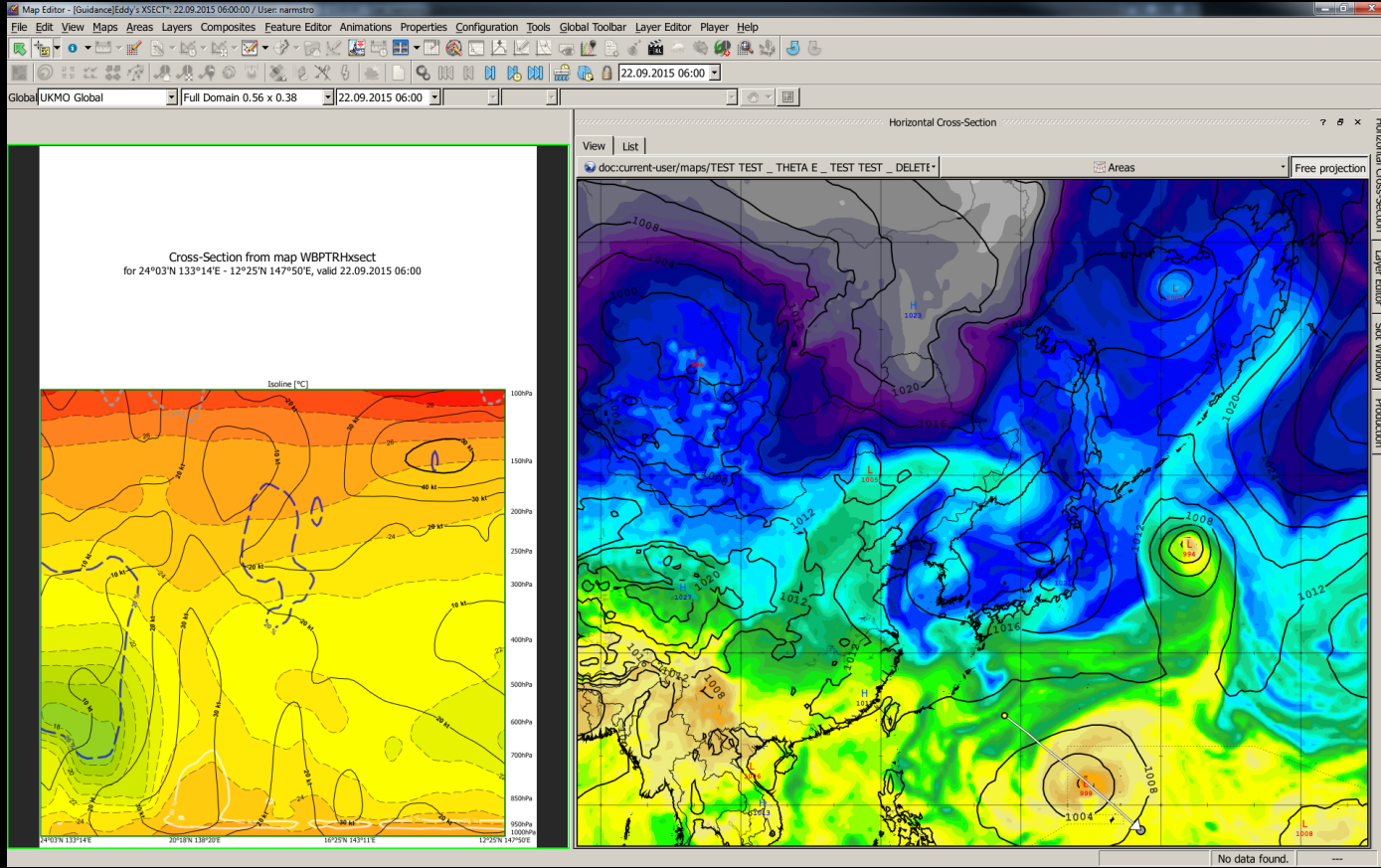
Met Office

# Visual Weather – Map Editor



Met Office

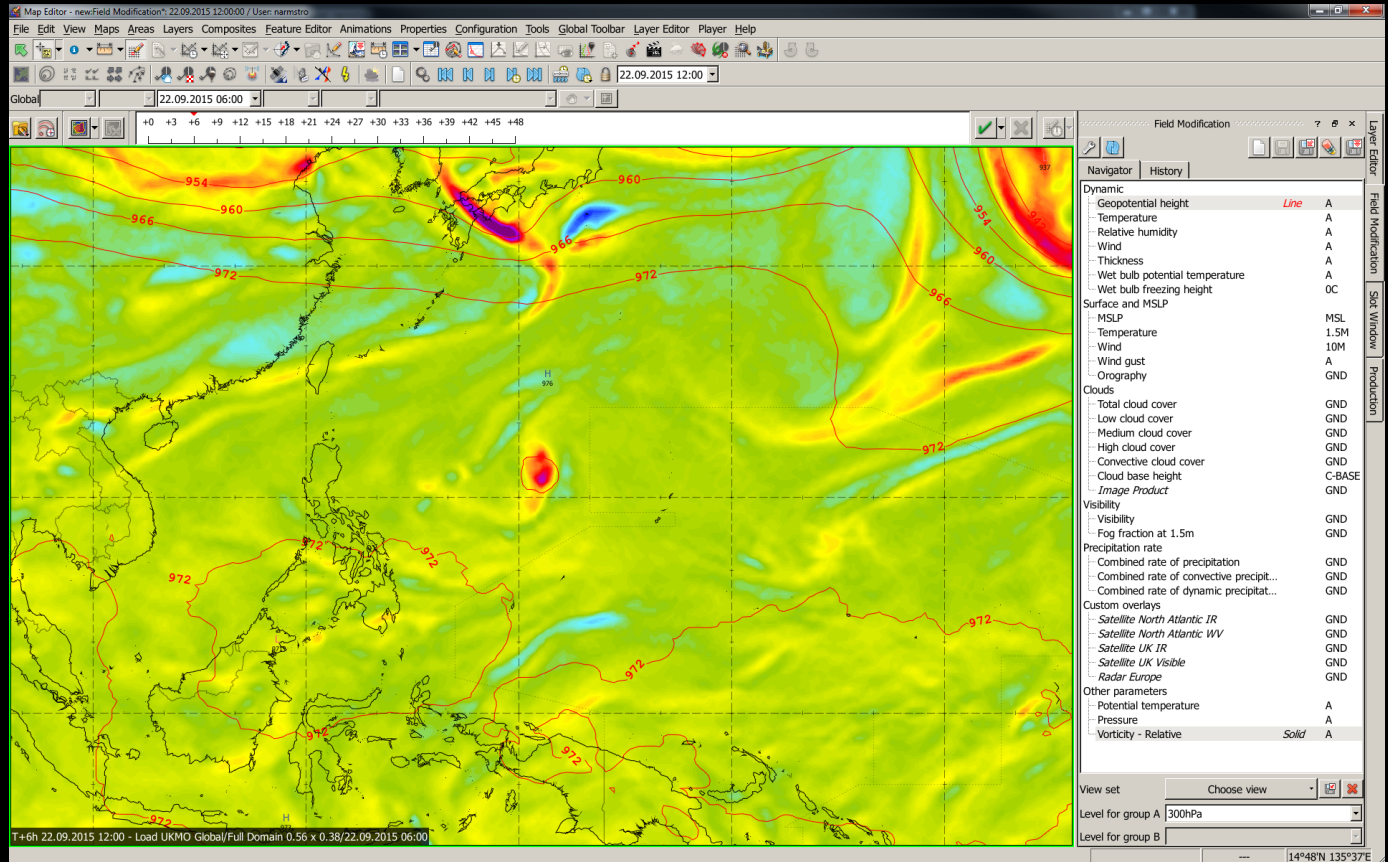
# Visual Weather – Map Editor





Met Office

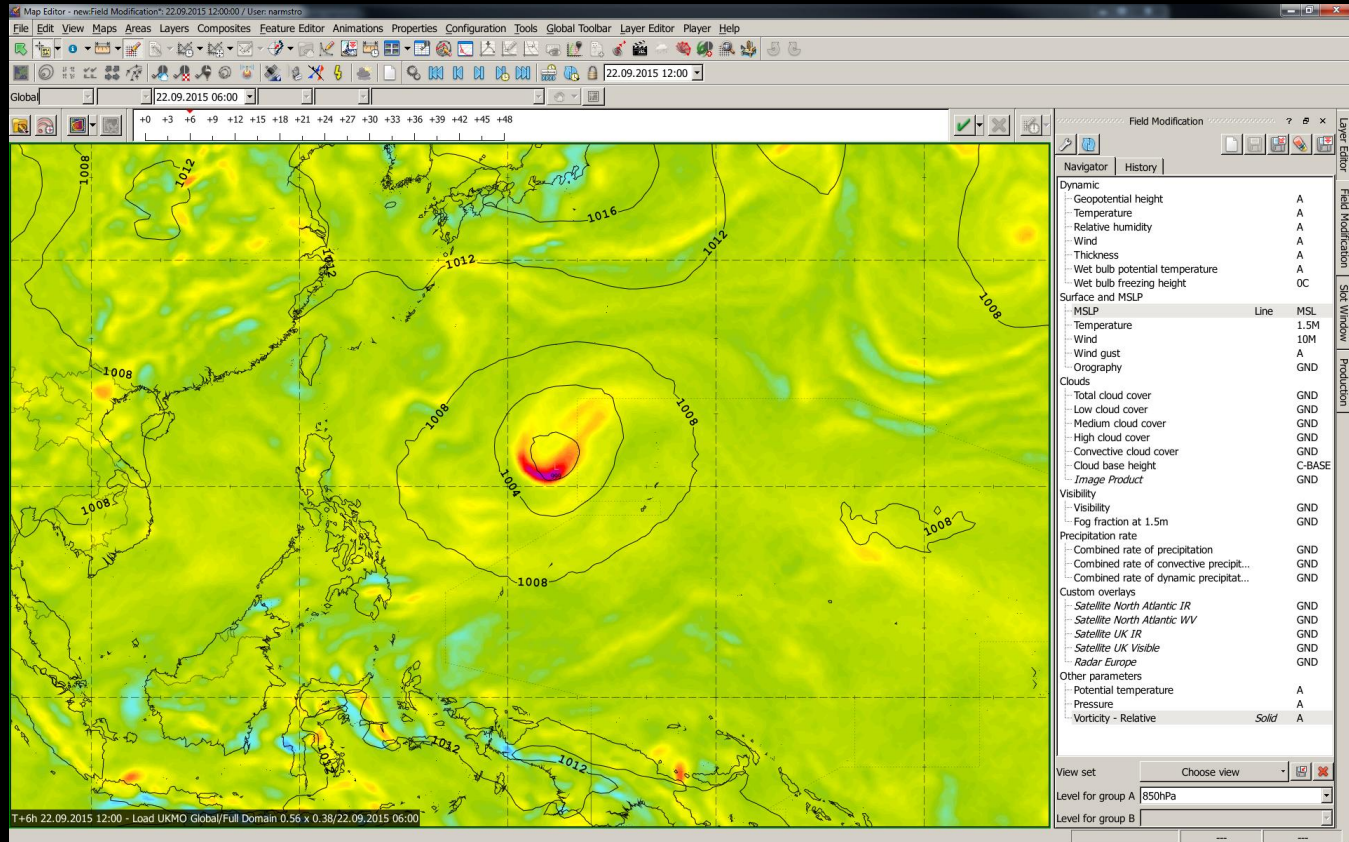
# Visual Weather - Metmorph





Met Office

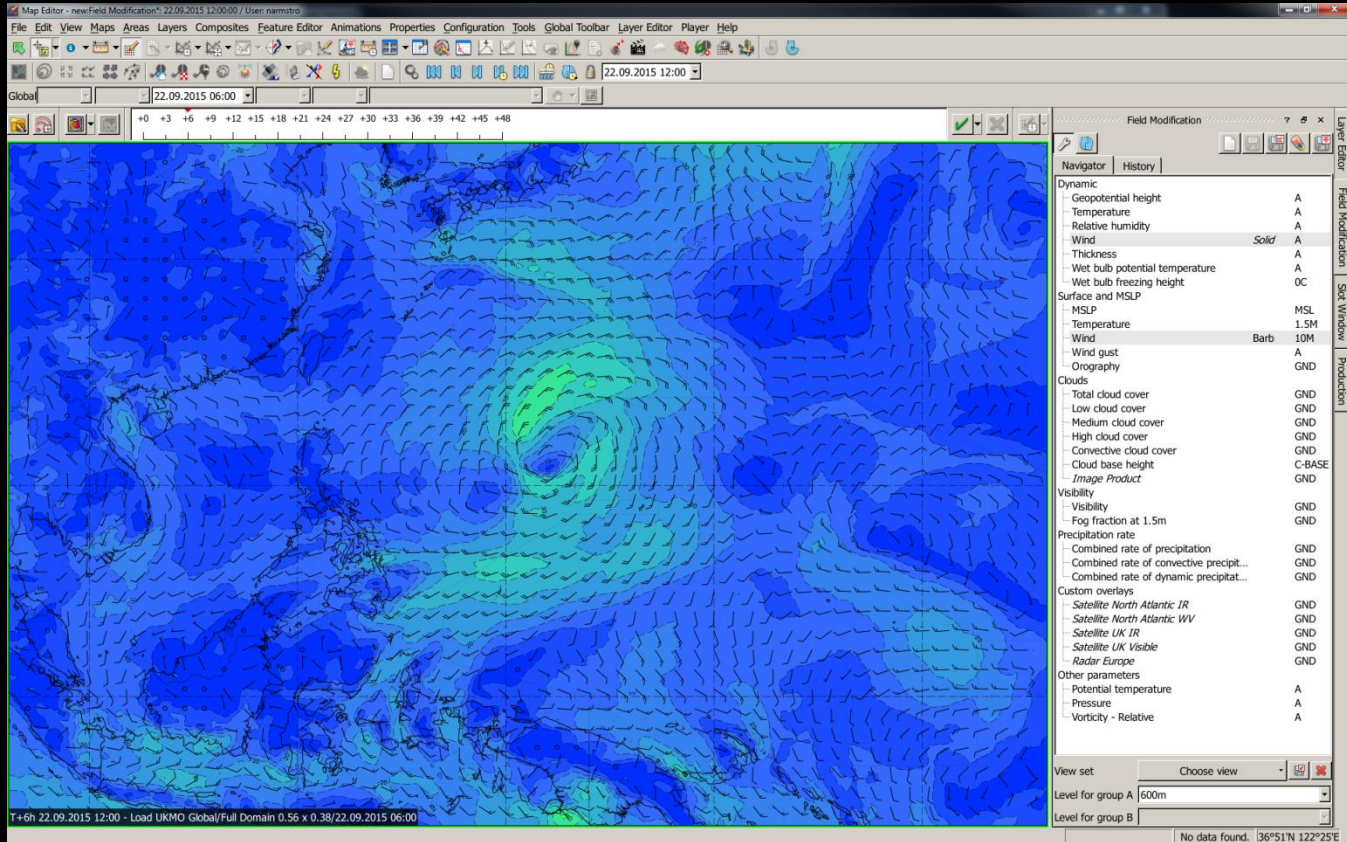
# Visual Weather - Metmorph





Met Office

# Visual Weather - Metmorph





Met Office

# Visual Weather - Metmorph

The screenshot displays the Metmorph software interface. The main window shows a weather map with wind vectors and a color-coded pressure field. A 'Field Modification' panel is open on the right, listing various parameters and their units. A 'Dynamic Field Change' dialog box is also visible in the top left corner of the map area.

**Field Modification Panel:**

- Dynamic
  - Geopotential height A
  - Temperature A
  - Relative humidity A
  - Wind Solid A
  - Thickness A
  - Wet bulb potential temperature A
  - Wet bulb freezing height 0C
- Surface and MSLP
  - MSLP MSL
  - Temperature 1.5M
  - Wind Barb 10M
  - Wind gust A
  - Orography GND
- Clouds
  - Total cloud cover GND
  - Low cloud cover GND
  - Medium cloud cover GND
  - High cloud cover GND
  - Convective cloud cover GND
  - Cloud base height C-BASE
  - Image Product GND
- Visibility
  - Visibility GND
  - Fog fraction at 1.5m GND
- Precipitation rate
  - Combined rate of precipitation GND
  - Combined rate of convective precipit... GND
  - Combined rate of dynamic precipit... GND
- Custom overlays
  - Satellite North Atlantic IR GND
  - Satellite North Atlantic WV GND
  - Satellite UK IR GND
  - Satellite UK Visible GND
  - Radar Europe GND
- Other parameters
  - Potential temperature A
  - Pressure A
  - Vorticity - Relative A

**Dynamic Field Change Dialog:**

- Parameter: PV
- Transformation: Variable radius
- Level: Surface
- Vertical influence: Equal at all levels
- Value change: -16.0, 0.0
- Compensation: 0%

**Map Data:**

- Wind: 25.5 kt
- Wind: 228° 19 kt
- Land-Topsea-level

**View set:** Choose view

**Level for group A:** 600m

**Level for group B:** No data found. 9°22'N 141°29'E

**Status Bar:** T+6h 22.09.2015 12:00 - Load UKMO Global/Full Domain 0.56 x 0.38/22.09.2015 06:00



Met Office

# Visual Weather - Metmorph

The screenshot displays the Metmorph software interface. The main window shows a weather map with a low-pressure system (cyclone) over the North Atlantic, indicated by a green and yellow center with concentric isobars. The map is overlaid with a vector field representing wind direction and speed. The interface includes a menu bar (File, Edit, View, Maps, Areas, Layers, Composites, Feature Editor, Animations, Properties, Configuration, Tools, Global Toolbar, Layer Editor, Player, Help), a toolbar, and a status bar at the bottom showing coordinates and time: "T+6h 22.09.2015 12:00 - Move PV/Surface 16°21'N 138°31'E->16°38'N 137°57'E-16.0 at +6h".

The 'Dynamical Field Change' dialog box is open, showing the following settings:

- Parameter: PV
- Transformation: Variable radius
- Level: Surface
- Vertical influence: Equal at all levels
- Value change: -16.0
- Compensation: 0%

The 'Field Modification' panel on the right lists various parameters and their units:

Parameter	Unit
Dynamic	
- Geopotential height	A
- Temperature	A
- Relative humidity	A
- Wind	Solid
- Thickness	A
- Wet bulb potential temperature	A
- Wet bulb freezing height	OC
Surface and MSLP	
- MSLP	MSL
- Temperature	1.5M
- Wind	Barb
- Wind gust	A
- Orography	GND
Clouds	
- Total cloud cover	GND
- Low cloud cover	GND
- Medium cloud cover	GND
- High cloud cover	GND
- Convective cloud cover	GND
- Cloud base height	C-BASE
- Image Product	GND
Visibility	
- Visibility	GND
- Fog fraction at 1.5m	GND
Precipitation rate	
- Combined rate of precipitation	GND
- Combined rate of convective precipit...	GND
- Combined rate of dynamic precipitat...	GND
Custom overlays	
- Satellite North Atlantic IR	GND
- Satellite North Atlantic WV	GND
- Satellite UK IR	GND
- Satellite UK Visible	GND
- Radar Europe	GND
Other parameters	
- Potential temperature	A
- Pressure	A
- Vorticity - Relative	A

The 'Field Modification' panel also includes a 'View set' dropdown menu set to 'Choose view', and a 'Level for group A' dropdown menu set to '600m'. The status bar at the bottom right indicates 'No data found.'.



Met Office

# Visual Weather – Feature Editor

Map Editor - document-user\layers\composite\Satellite\composites\FalSe Colour 321:22.09.2015 12:00:00 / User: namstro

File Edit View Maps Areas Layers Composites Feature Editor Animations Properties Configuration Tools Global Toolbar Layer Editor Player Help

Global

Current dbase: ADHOC  
22.09.2015 12:00 +00:00

Feature Editor

Features

Edit jet Edit fleche 20kt change 10kt change

Speed	80 kt
	80 85 90 95 100
	110 120 130 140 150
	160 170 180 190 200
	210 220 230 240 250

Level: XXX

Top: XXX

Base: XXX

Visualisation:

Automatic

Force change bar

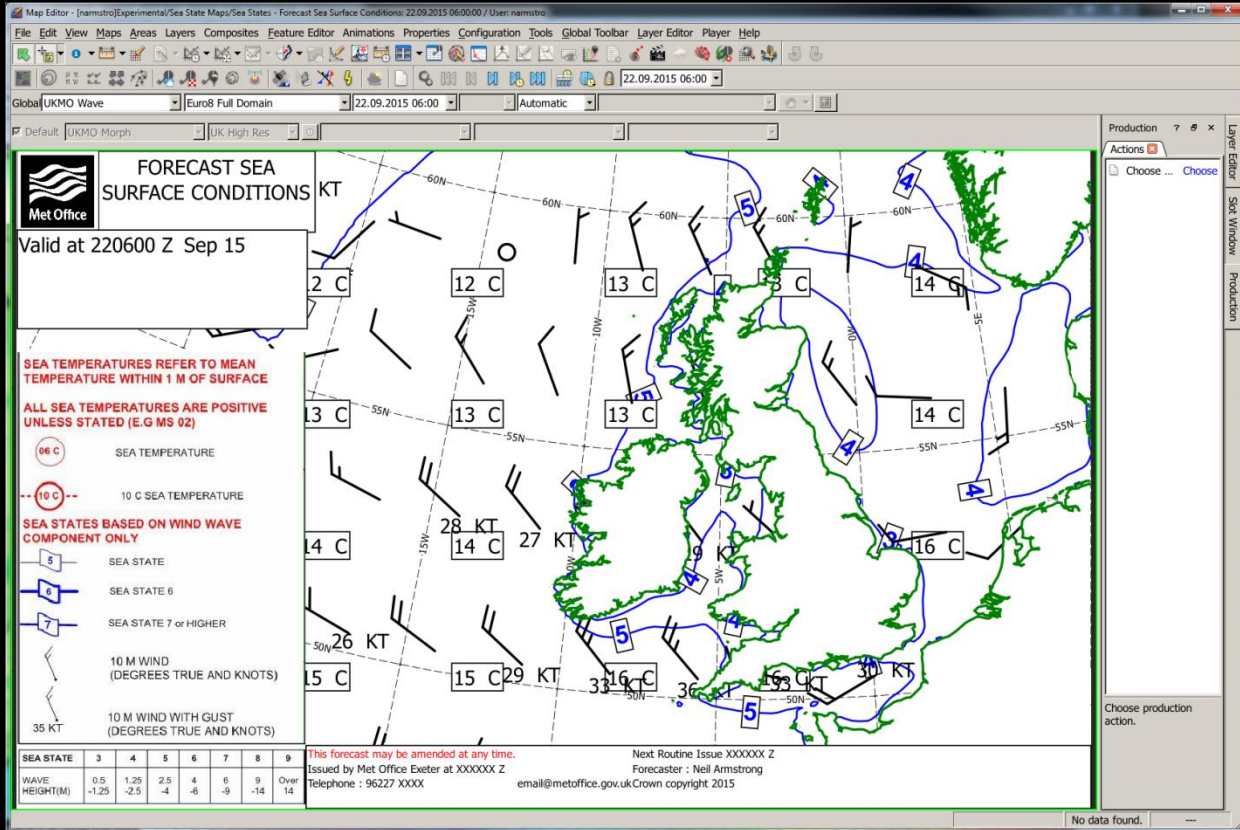
2947N 172°13E





Met Office

# Visual Weather – Map Editor





Met Office

# Visual Weather – Map Editor

The screenshot shows the 'Map Editor' application window. The main map area displays a weather map with a color scale from red to green. A 'Layer Options' dialog box is open, showing the following configuration:

- Template: Temperature/Solid Surface
- Colour model: Colour
- Source: Advanced Processing
- Advanced tab selected
- Level set: (empty)
- Function:  $\text{alternative} \left( \text{default} \left( \text{Default: UKMO Euro/Full Domain} \right. \right. \left. \left. \begin{matrix} *22.09.2015\ 06:00 \\ \square, 99999 \square \end{matrix} \right) \left[ \text{m} \right] - \text{grid} \left( 500148 \square, \text{center, run, } 0 \square, 2000001 \square, -1 \square, \text{projection} \right) \left[ \text{m} \right] < 1000 \left[ \text{m} \right], 1 \square, \text{alternative} \left( \text{Default: UKMO Euro/Full Domain} \right. \right. \left. \left. \begin{matrix} *22.09.2015\ 06:00 \\ \text{Visibility} \\ \text{ground}^* / +0h \end{matrix} \right) \left[ \text{m} \right] < 5000 \left[ \text{m} \right], 1 \square, \text{altern} \right.$
- Buttons: Edit function, Double-click here to edit function, Clear function
- Footer: Logged Messages, OK, Help, Apply, Cancel



Met Office

# Visual Weather - meteochart

Meteo Chart - docgroups/VW\_Guidance/meteochart/Sudden Stratospheric Warming Forecast

File Edit Format Chart View Analysis Help

ECMWF Global Full Domain 0.5 x 0.5 22.09.2015 00:00 0 degree isotherm F-0h 22.09.2015 12:50 31 1000 hPa

Area	0 h	12 h	24 h	36 h	48 h	60 h	72 h	84 h	96 h	108 h	120 h	132 h	144 h	156 h	168 h	180 h	192 h	204 h	01
SSW	-20	-19	-20	-19	-21	-20	-22	-20	-22	-21	-21	-19	-19	-17	-19	-19	-20	-20	-22
SSW	-33	-32	-33	-33	-33	-32	-33	-33	-34	-33	-33	-32	-32	-30	-30	-30	-32	-31	-34
SSW	-40	-39	-40	-39	-40	-40	-40	-40	-40	-40	-39	-38	-37	-37	-37	-37	-38	-38	-40
SSW	-47	-46	-47	-47	-47	-47	-48	-47	-48	-47	-48	-47	-47	-46	-46	-45	-46	-46	-47
SSW	-51	-50	-51	-51	-51	-51	-52	-52	-52	-52	-52	-51	-52	-51	-51	-51	-51	-51	-52
SSW	-53	-53	-54	-54	-54	-55	-55	-55	-55	-55	-55	-55	-55	-55	-55	-55	-55	-55	-56
SSW	-56	-56	-56	-57	-57	-58	-58	-58	-58	-58	-59	-58	-59	-58	-59	-59	-59	-59	-59
SSW	-56	-56	-56	-57	-57	-57	-58	-58	-58	-58	-58	-58	-58	-58	-58	-58	-59	-59	-59
SSW	-54	-54	-55	-55	-55	-55	-55	-55	-55	-55	-55	-55	-56	-56	-56	-56	-56	-56	-57
SSW	-52	-53	-53	-53	-53	-53	-52	-52	-53	-53	-53	-53	-54	-54	-54	-54	-54	-54	-54
SSW	-51	-51	-51	-51	-51	-51	Press CTRL to display details		-50	-50	-51	-51	-51	-52	-52	-52	-52	-52	-52
SSW	-50	-50	-50	-50	-49	-49	-48	-48	-48	-48	-49	-49	-50	-51	-51	-51	-51	-50	-50
SSW	-50	-50	-51	-51	-50	-49	-48	-48	-48	-48	-49	-49	-51	-52	-55	-55	-55	-54	-52
SSW	-52	-53	-53	-52	-51	-50	-49	-49	-49	-51	-53	-53	-55	-55	-56	-56	-56	-56	-56
SSW	-51	-52	-51	-50	-50	-49	-49	-48	-49	-51	-52	-53	-53	-53	-52	-52	-53	-54	-54

Temperature / 24hr Temperature Change /



Met Office

# Future Challenges

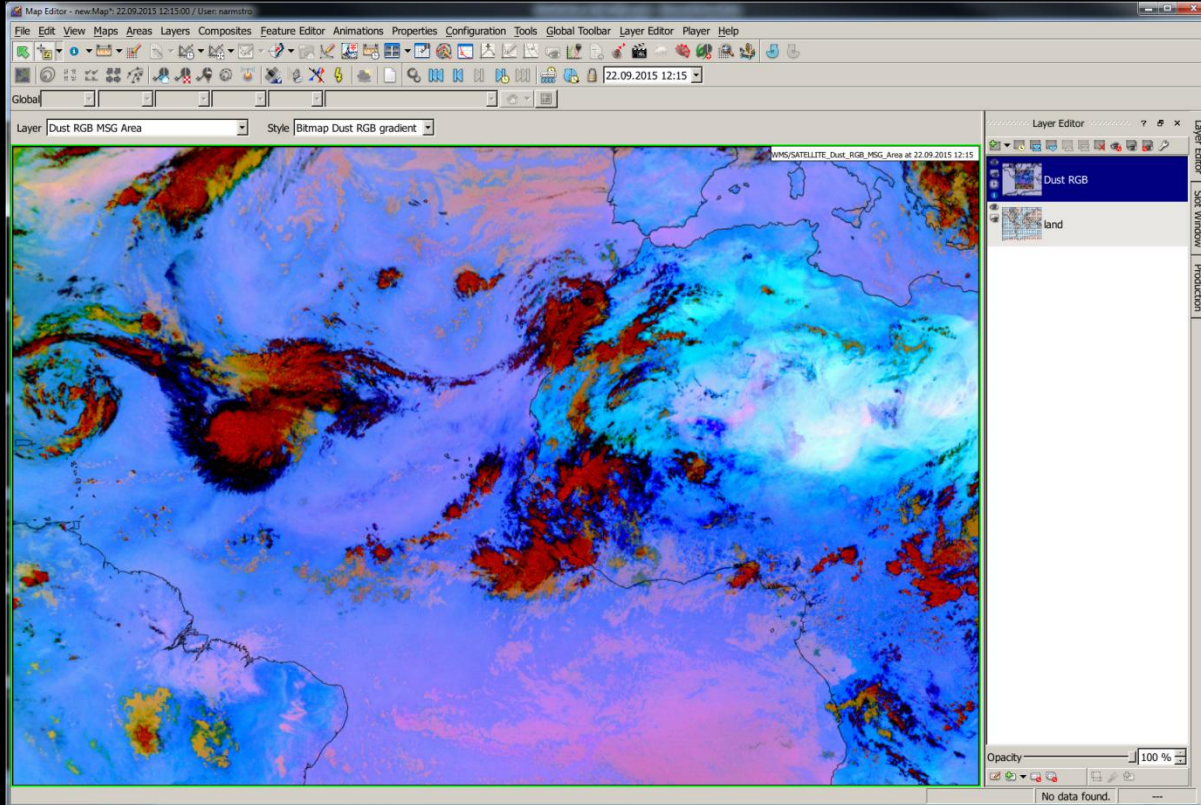
- **New Cray Supercomputers fully operational by Winter 2017**
- **Improvements to NWP** (by end of 2018)
  - GM to around 10-12KM; 120 or 140 vertical levels
  - UKV to 1KM with hourly runs to T+54 (2 runs per day to T+120) 120 or 140 vertical levels over an expanded domain
- **Data volumes will be massive**
  - By April 2017 estimate an 4-fold increase in data volumes to 24 Terabytes from operational models! (~ 407 Blurays per day!!)
  - Of this 11 Terabytes will be MOGREPs-UK (currently 0.88TB)

**THE ONLY SOLUTION AT THE MOMENT IS WMS !!**



Met Office

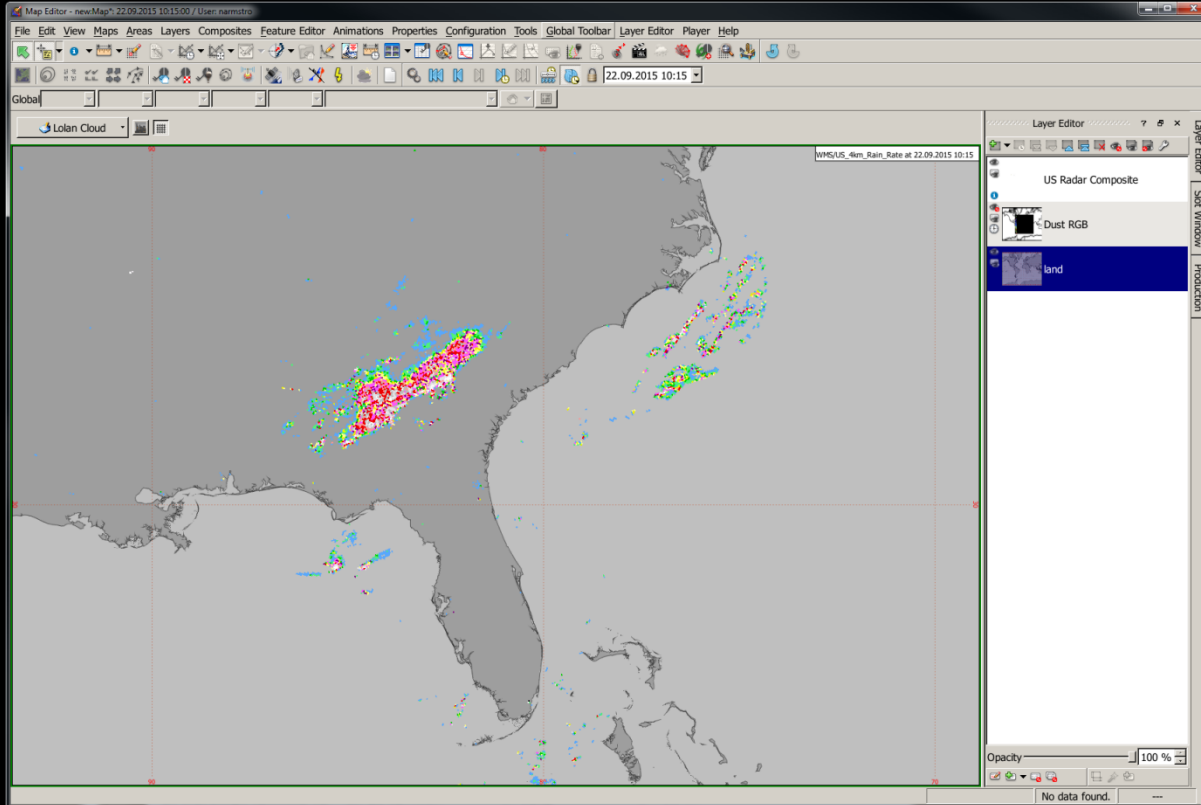
# Some operational WMS





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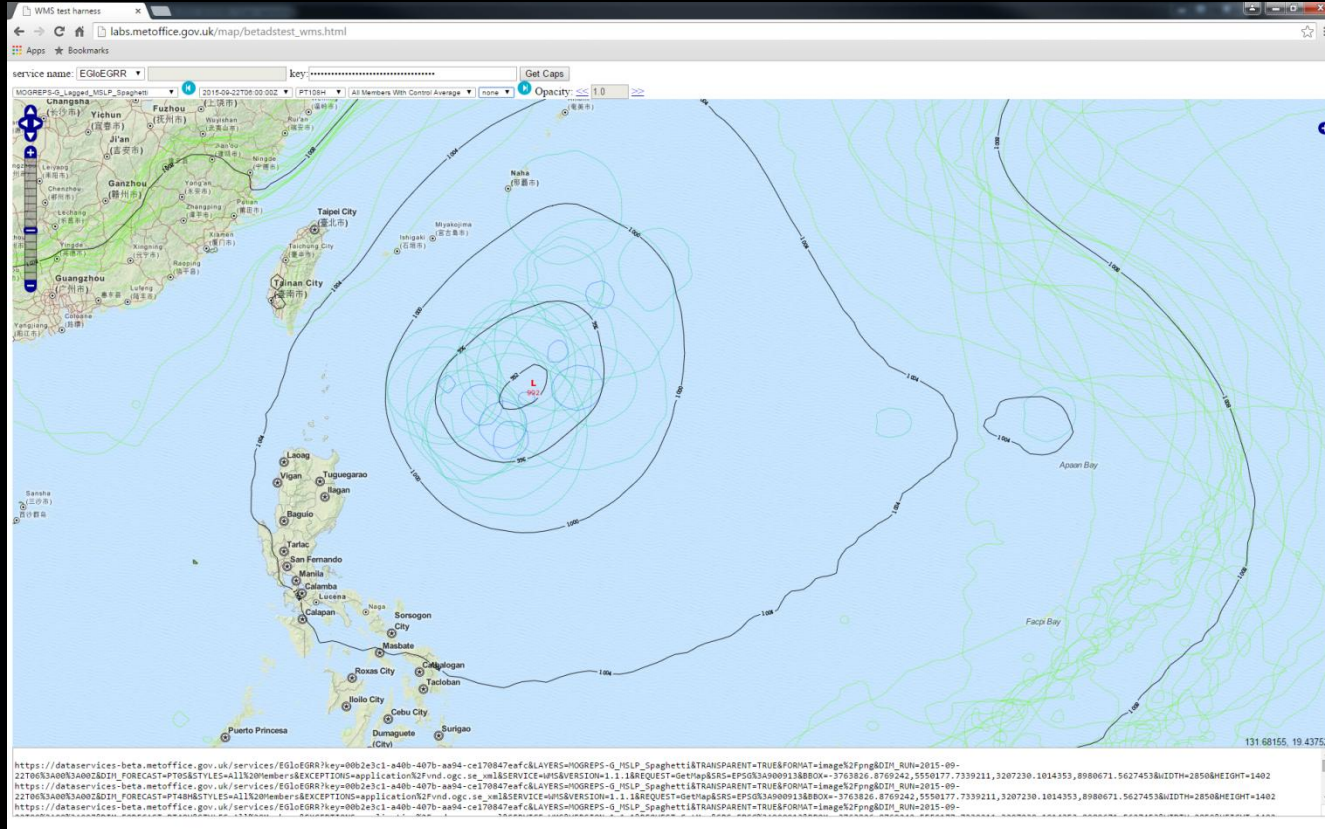
# Some operational WMS





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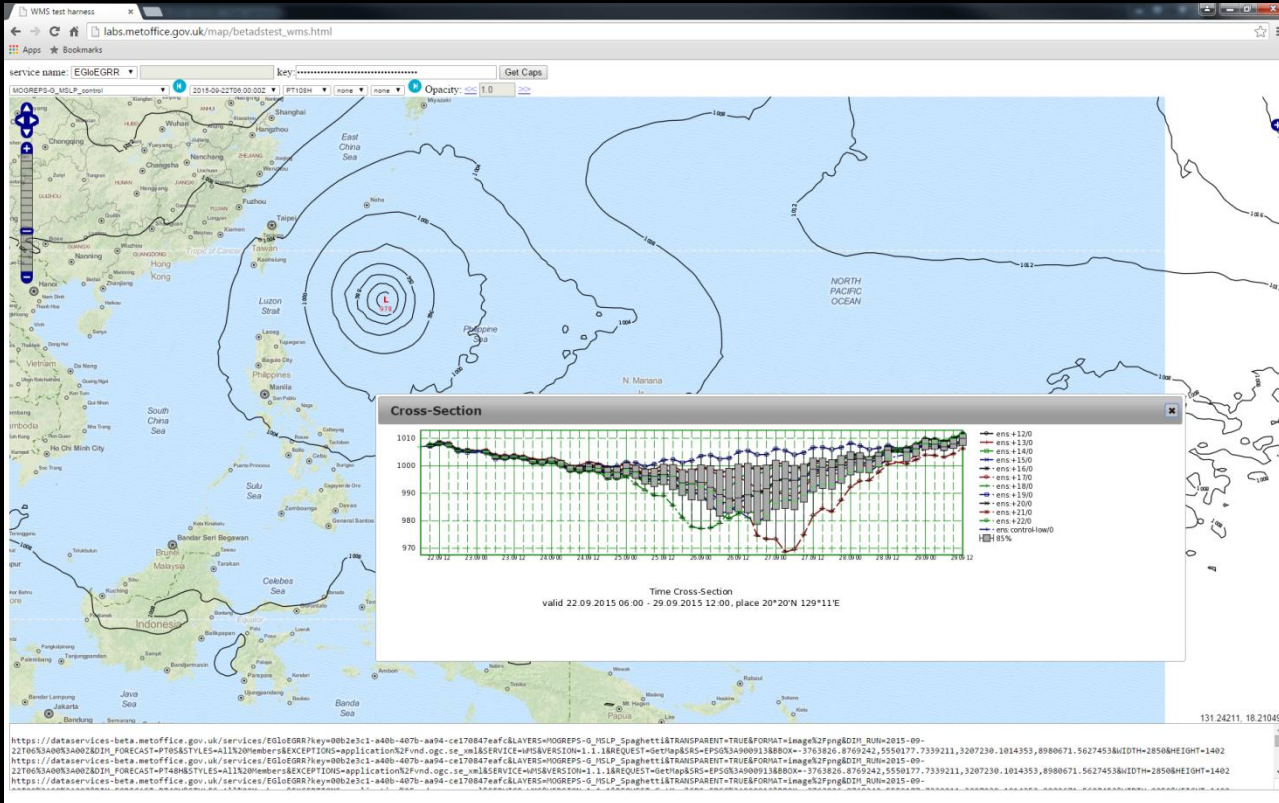
# Some operational WMS





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# Some operational WMS







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# Questions & Answers

