

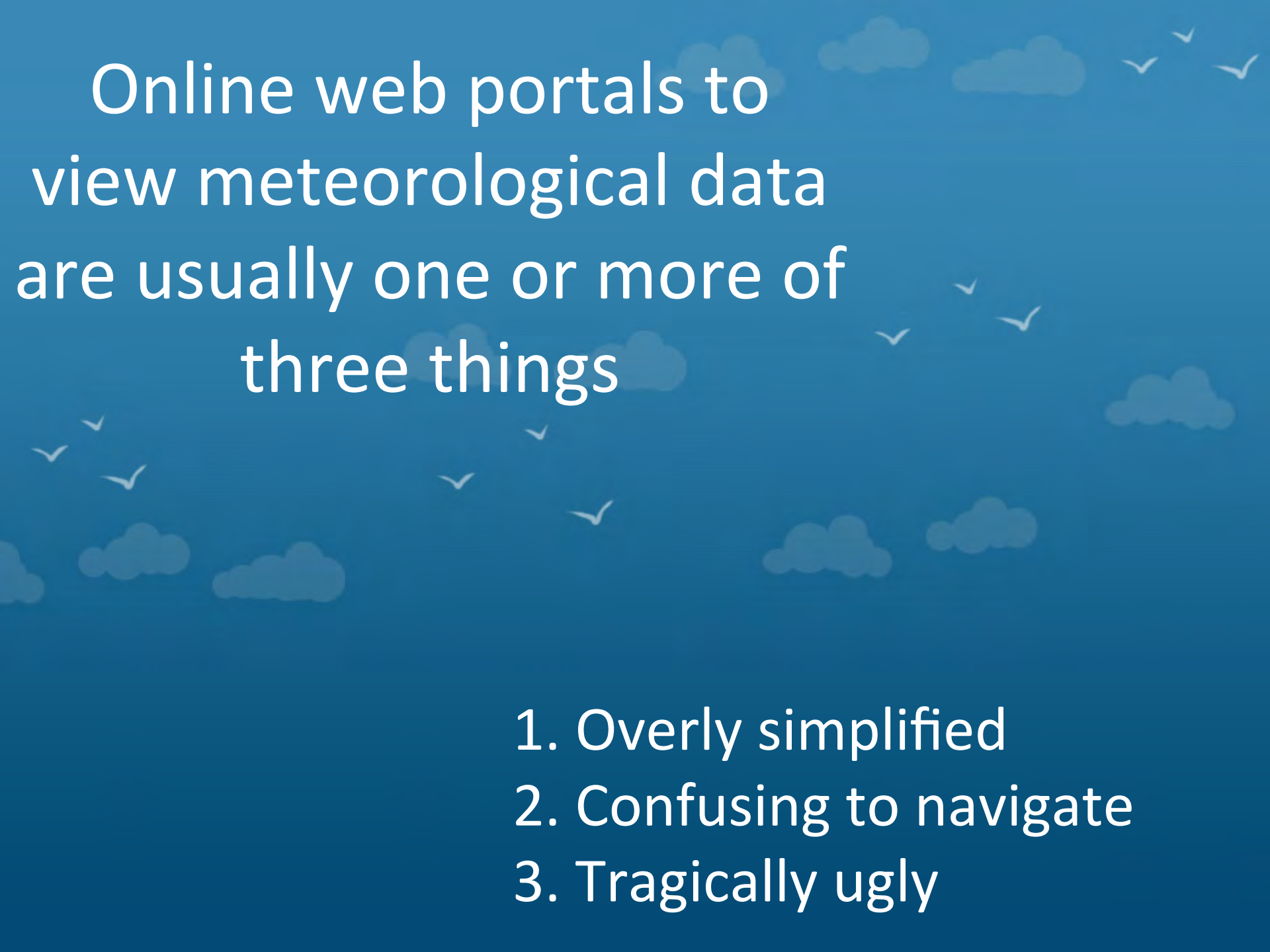
The visualisation of



Jonathan G Fairman, Jr
David Schultz, Stuart Anderson,
Douglas Lowe, Gordon McFiggans,
Elsa Lee, Ryo Seo-Zindy

RMetS Meeting: The Visualisation of
Meteorological Data
30 September 2015

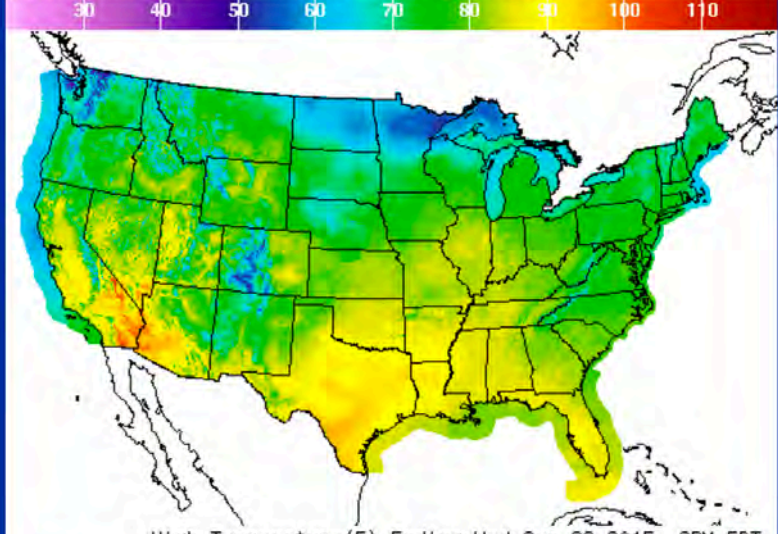




Online web portals to
view meteorological data
are usually one or more of
three things

1. Overly simplified
2. Confusing to navigate
3. Tragically ugly

[Go to State / Region](#) |
 [Click On Map Below To Zoom In](#)



High Temperature(F) Ending Wed Sep 23 2015 8PM EDT
(Thu Sep 24 2015 00Z)

National Digital Forecast Database
15z issuance Graphic created-Sep 23 11:30AM EDT



[Alaska](#) |
 [Hawaii](#) |
 [Guam](#) |
 [Puerto Rico/Virgin Islands](#)

Mouse over or click on the times below to change the above graphic.
 Max/Min Temp: | [Today](#) | [Tonight](#) | [Thu](#) | [Thu Night](#) | [Fri](#) |

Additional Graphical Forecast Elements:

Chance of Precipitation	Weather	Temperature
Wind Speed & Direction	Precipitation Amount	Sky Cover

Alaska High Temp.	Hawaii High Temp.	Puerto Rico High Temp.

US National Weather Service

Graphical.weather.gov

New GFS 0.25° resolution **New** Cluster GFS ENS

New Event probability P

Region - GFS

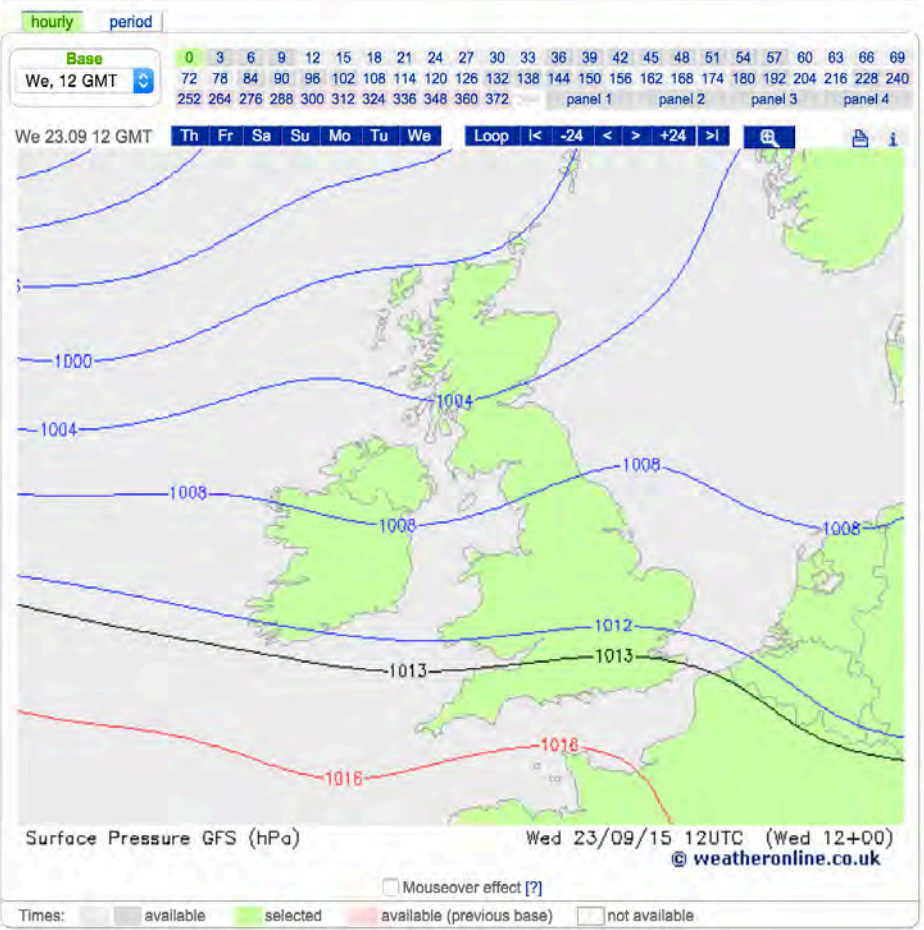
Overview Subregion

Europe	Benelux
Africa	Caspian Sea
North America	Europe East-Central
Central America	Europe NW
South America	Europe central
Oceania	Europe east
East Asia	France
North Asia	Greece
South Asia	Iraq
Southeast Asia	Italy
	Japan
	Mediterranean
World	Mediterranean east
Northern Hemisphere	New Zealand
Southern Hemisphere	Poland
South America/Antarctic	Russia
	Scandinavia
	Spain
	Turkey
	USA (Contiguous)
	United Kingdom

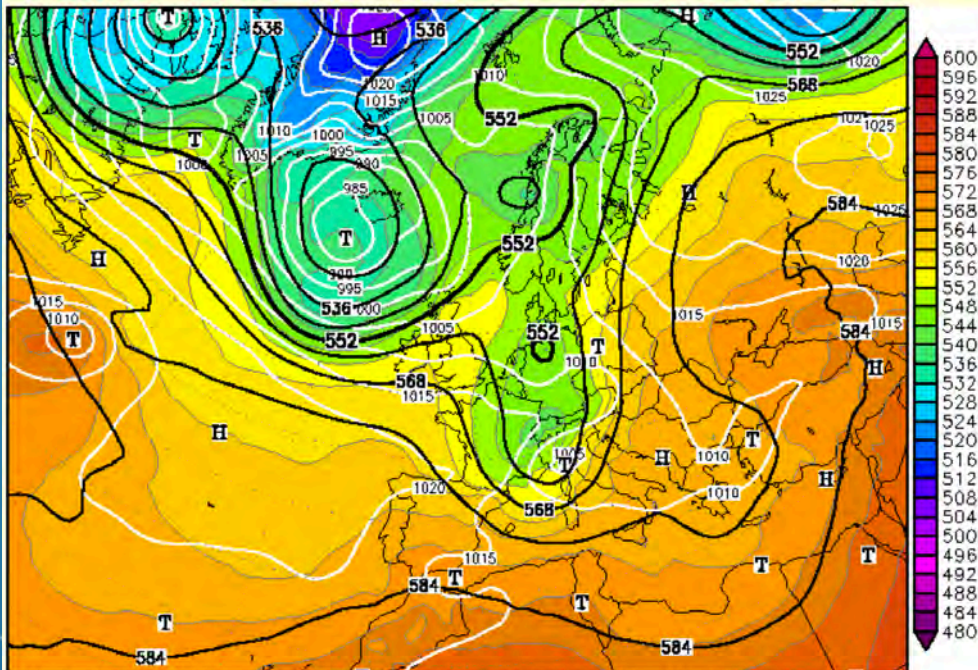
Parameter - GFS

Panel parameter	Air mass
Z500/Rain (+SLP)/Z850	Freezing level
Prec 6h/Wind 10m/950	
Cloud (high,middle,low)	Humidity/Visibility
	Dew point
Pressure	RH 925 hPa
Surface pressure Δt	RH 850 hPa
SLP tendency	RH 700 hPa
V-Adv. 850 hPa	RH 300 hPa
V-Adv. 500 hPa	RH 2m
Theta-e 850hPa	RH 0-300 m
Theta-e 700hPa	RH 600-3000 m
Theta-W 850hPa	RH 3000-6000 m
Wet bulb zero level	Visibility
Thck 850-1000 hPa	
Thck 700-1000 hPa	Precipitation/Clouds
Thck 500-1000hPa	Precipitation
	Precipitation (6h)
Upper level	Precipitation (12h)
Height/Temp. 925 hPa	Precipitation accum.
SLP/Temp. 850 hPa	Rain/Snowfall rate
Height/Temp. 850 hPa	Snow accu.
Height/Temp. 700 hPa	Weather type
Height/Temp. 500 hPa	Cloud base (low)
	Cloud cover (low)
	Cloud cover (middle)
	Cloud cover (high)
	Cloud cover (total)
	Cloud layer
Wind	
Surface wind	Temperature
Isotachs (kph)	Temperature (2m) Δt
Isotachs (mph)	Temperature High (2m)
Wind 950 hPa	Temperature Low (2m)
Wind 900 hPa	
Wind 850 hPa	
Wind 700 hPa	
Wind 500 hPa	
Max. wind velocity Δt	Soil

Model				Ensemble				Analysis		Soundings	
GFS	ECMWF	EURO4	KNMI*	RHMC	NAM	GFS ENS	GEFS TS	Index*	Temps		
GFS 0.25*	YRNO	EURO4 h	ICON*	JMA	CFS	CMC ENS	CMC TS	Fronts	GFS		
CMC			COAMPS®		MOD	ECMWF	ECMWF TS	SIG			
NAVGM								SST			



Very confusing and complicated



500 hPa Geopotential [gpdam], Bodendruck [hPa], relative Topographie H500-H1000 [gpdam]
 Mittwoch, 23-09-2015 12 UTC (GFS) (Analyse) © www.wetter3.de

Init: Mi, 23-09-2015 12 UTC Termin: < > <- >

Gebiet: Europa 500 hPa Bodendruck, ReTop

700 hPa relative Feuchte
 850 hPa Temperatur
 Niederschlagssumme 3/6/12h
 850 hPa pseudopot. Temperatur
 Trajektorien (HB, P, KA, M)
 500 hPa Vertikalbewegung
 850 hPa Wind, rel. Vorticity
 500 hPa Wind, rel. Vorticity
 300 hPa Wind, rel. Vorticity
 500 hPa Vorticityadvektion
 300 hPa Vorticityadvektion
 Schichtdickenadvektion
 850 hPa Temperaturadvektion
 300 hPa Wind, Divergenz
 Theta=320K IPV
 850 hPa FQn, Frontalzonen
 500 hPa FQ, Geopotential
 850 hPa Frontogeneseparameter
 Frontalz., Vertikalbew., Bodendr.
 500 hPa (|Vmod|-|Vgeo|)/|Vgeo|
 Gesamtbewoelkung
 Grenzsichtbewoelkung
 Tiefe Bewoelkung
 Mittelhohe Bewoelkung
 Hohe Bewoelkung
 2 m Temperatur
 2 m Taupunkt
 2 m Extremtemperaturen
 Modellwetter ZE
 12 - 15 - 17.5

500hPa Geopotential Height, Surface Level Pressure, Relative Topography H500-H1000
 zum Tutorial zu den Karten mit 0.25 x 0.25° zu den Trajektorien

Welcome
 back to
 1998!

Beautiful, but only qualitative

- Temperature
- Precipitation
- Cloud Cover
- Wind
- Tropical Storm
- Pressure
- Social



Web visualisation challenges

1. Easy to use interface
2. Quantitative data
3. Research-quality graphics
4. Allow students to make their own connections

We think that we've done this with ManUniCast

Funded by HEA GEES Subject Centre and
Faculty eLearning Team at Manchester



Teaching Innovation

in the Faculty of Engineering & Physical
Sciences

EPS
ELEARNING

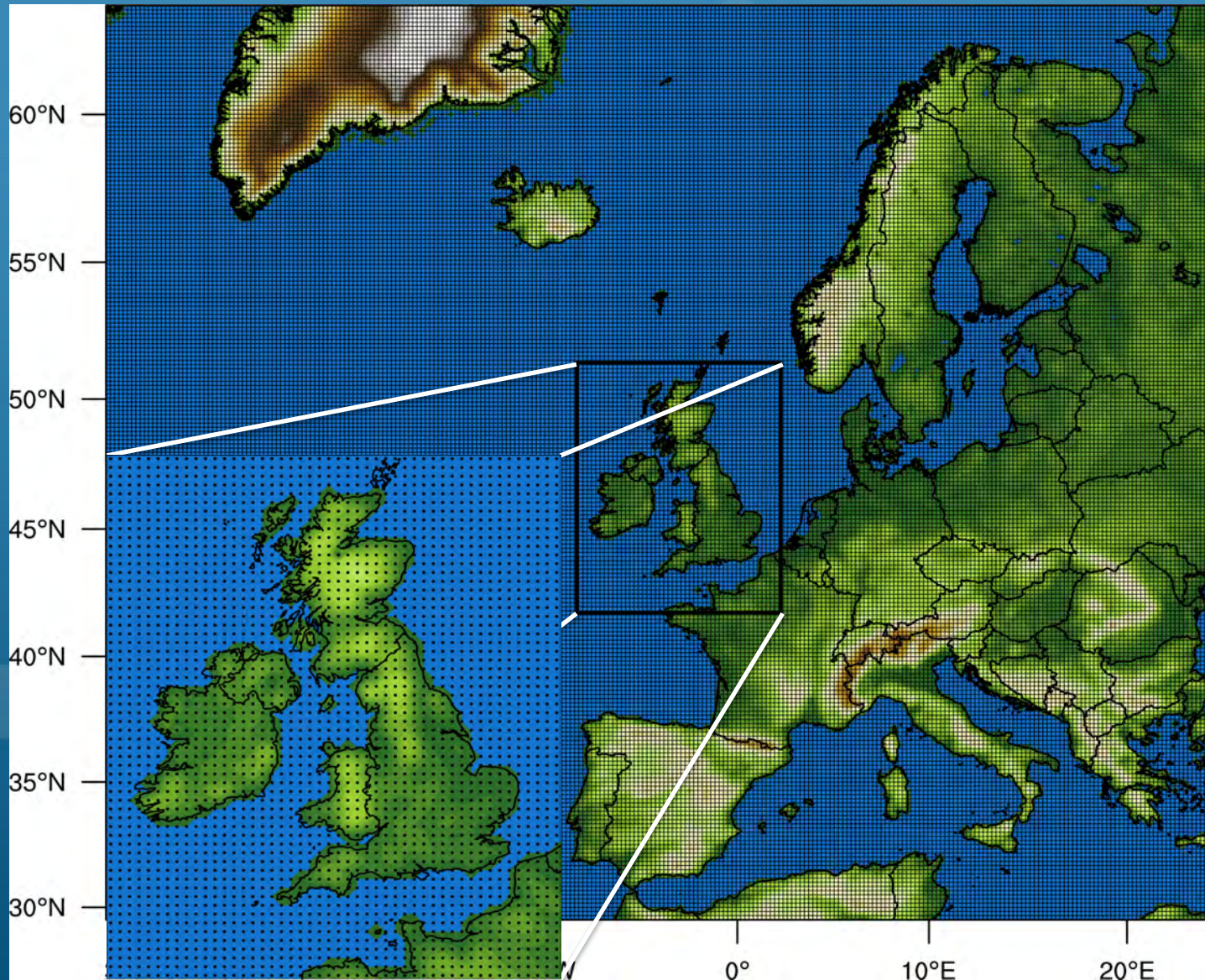


Geography,
Earth and
Environmental
Sciences (GEES)

WRF- ARW 2 nested weather grids

20 km
grid over
Europe

4 km grid
over UK

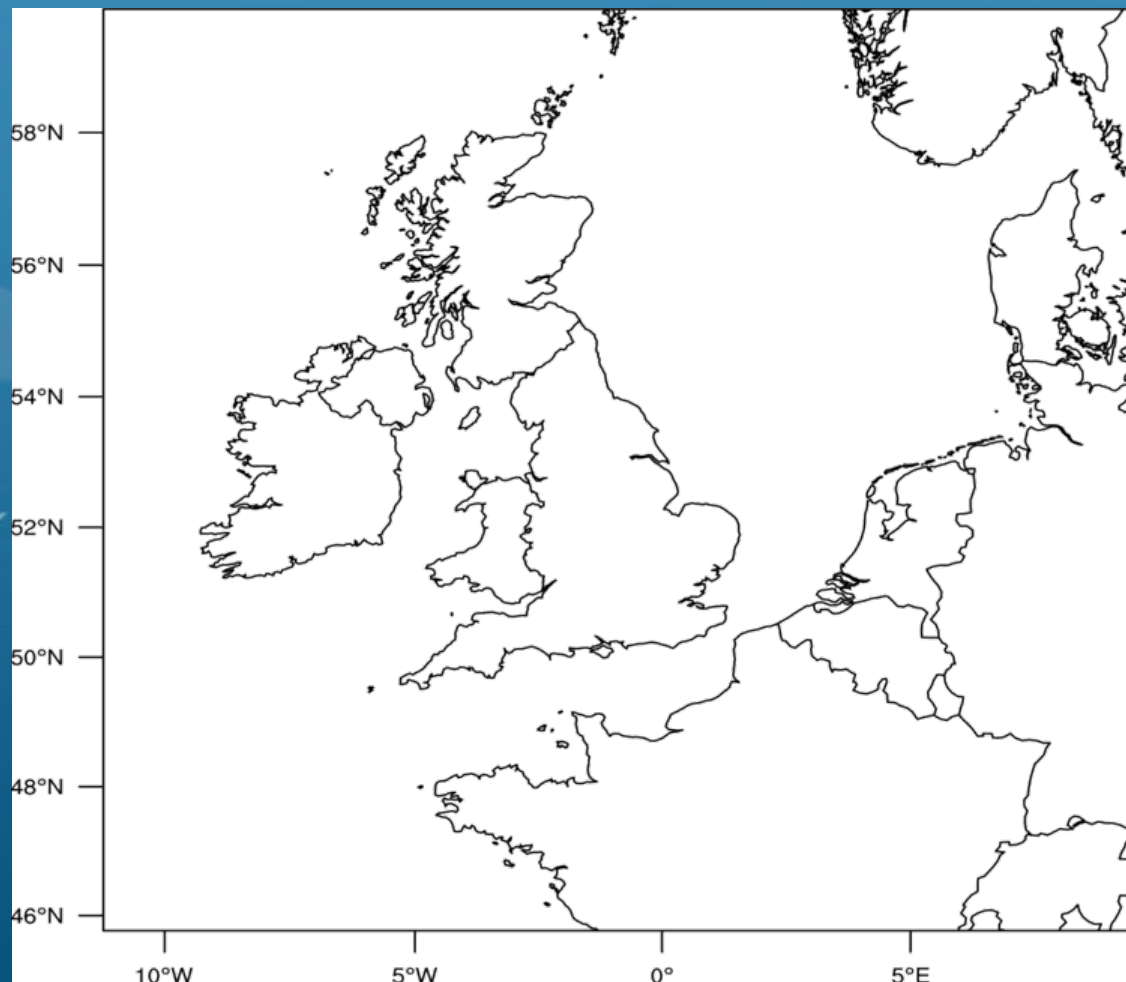


Initialised at 1800 UTC daily from GFS, 54 hour forecast

WRF-Chem

1 air quality
domain

12 km
spacing




Welcome to **ManUniCast**, a teaching and learning portal for weather and air quality forecasting. ManUniCast supports the teaching in the [School of Earth, Atmospheric and Environmental Science](#) at the University of Manchester and also educates the public about how weather and air-quality (including atmospheric composition and air pollution) forecasts are made.

Our ManUniCast App for iPhones and iPads is available on the App Store



Top tip: Change "t=today" in the URL to always download the latest forecast. Useful for browser bookmarks.

1 Select Date

2 Choose Domain

A map of Europe with a weather overlay, labeled 'European Weather'.

A map of the United Kingdom with a weather overlay, labeled 'UK Weather'.

A map of the United Kingdom with an air quality overlay, labeled 'UK Air Quality'.

3 Pick Product

Welcome to **ManUniCast**, a teaching and learning portal for weather and air quality forecasting. ManUniCast supports the teaching in the [School of Earth, Atmospheric and Environmental Science](#) at the University of Manchester and also educates the public about how weather and air-quality (including atmospheric composition and air pollution) forecasts are made.

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Top tip: Change "t=today" in the URL to always download the latest forecast. Useful for browser bookmarks.

1 Select Date



2 Choose Domain



3 Pick Product



- Maximum simulated radar reflectivity
- Mixing ratio at 2 m
- Planetary Boundary Layer Height
- Potential Vorticity at 320 K
- Precipitable water
- Radar-derived rain rate
- Relative humidity at 2 m
- Sea level pressure
- Simulated radar reflectivity at 1 km AGL
- Simulated satellite imagery
- Temperature at 2m (filled contours)
- Temperature at 2m (line contours)

We are currently in the process of extending our weather forecasts to 78 hours forecasts become available!

European Weather 2D/3D Plot

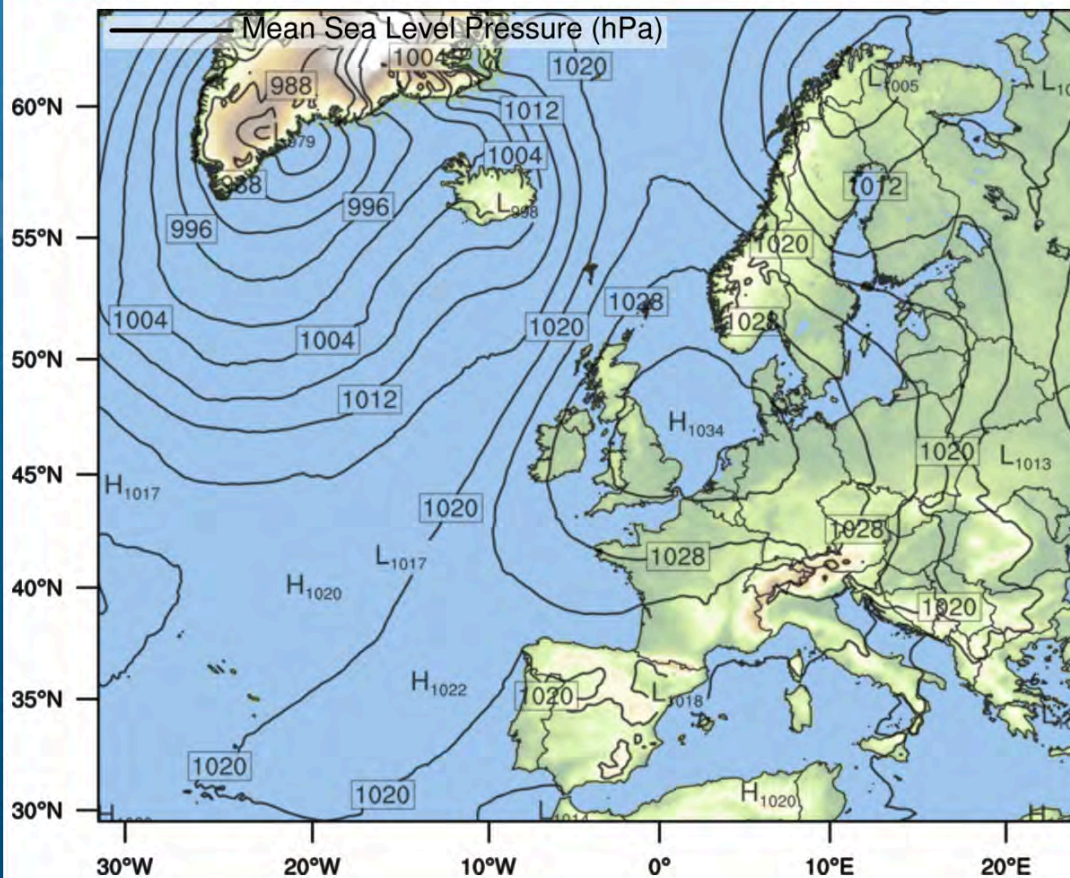


New plot

2300 UTC Sat 26 Sep 2015, 53 h



Options



Switch Domain



Image Layers



Select map overlay

Sea level pressure
sea level (0 m)

75

Select base map



Thu 24

Fri 25

6:00

12:00

18:00

Sat 26

6:00

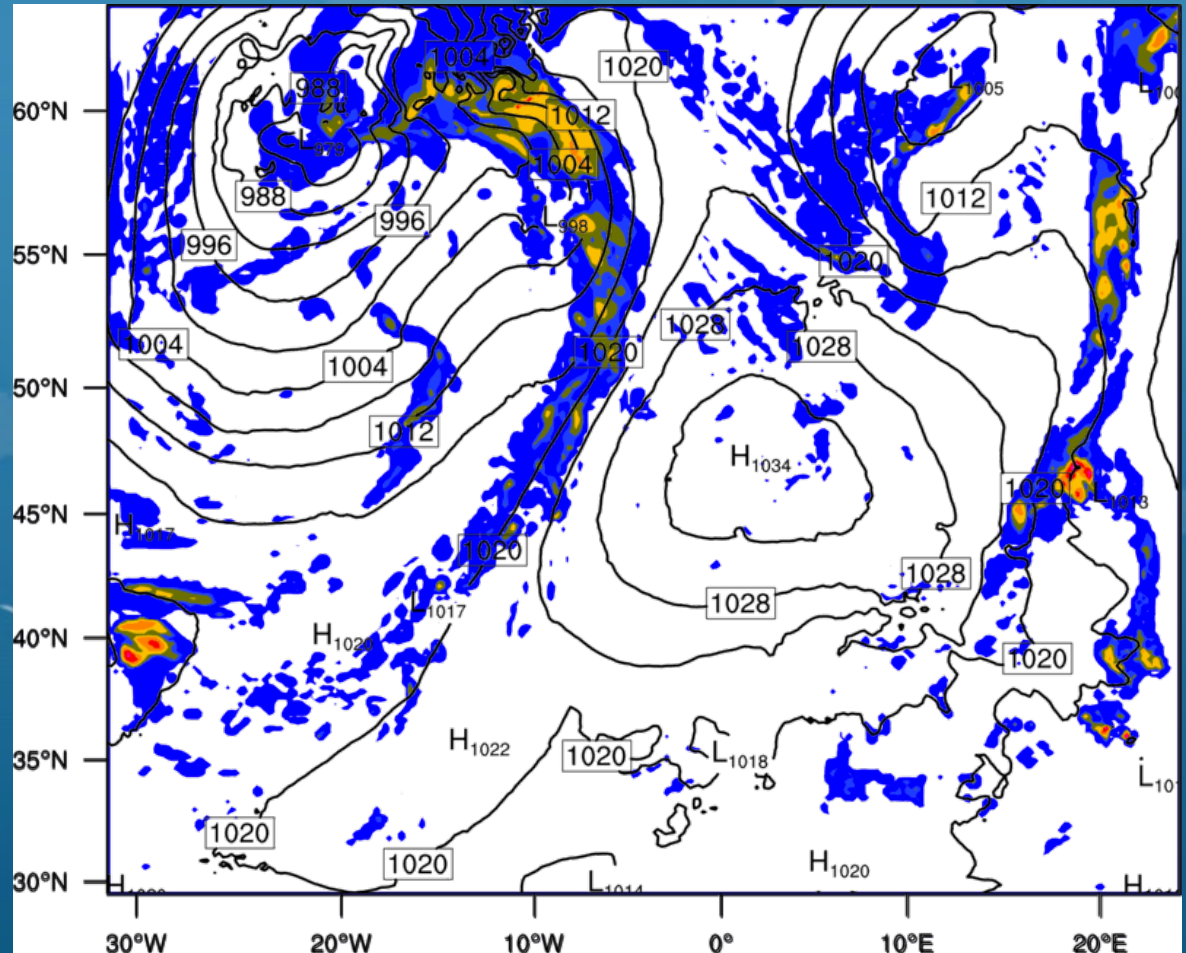
12:00

18:00

Sun 27



Graphics creation from NCL (NCAR Command Language)



Each image is a transparent PNG – meaning that they are very small in file size, high quality, and can be layered easily

European Weather 2D/3D Plot

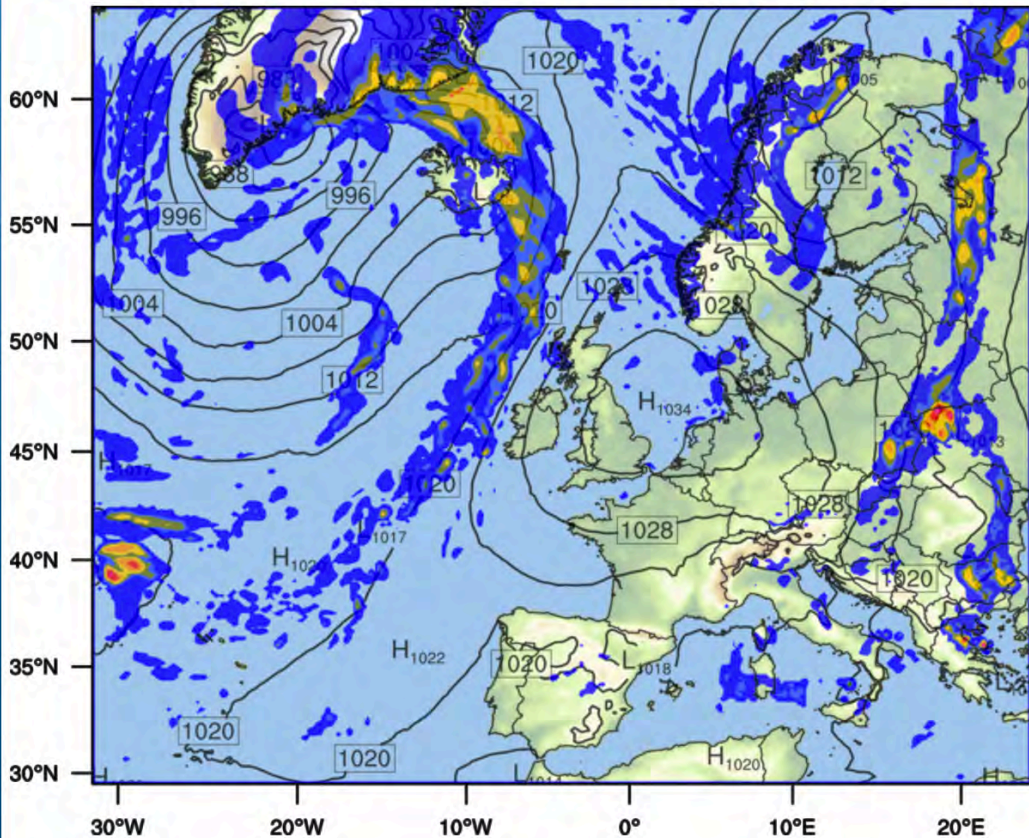


New plot

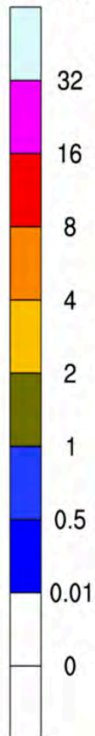
2300 UTC Sat 26 Sep 2015, 53 h



Options



(mm/hr)



Switch Domain



Image Layers

Search Products...

Add Close

Select map overlay

Radar-derived rain rate

1 km

75

Sea level pressure

sea level (0 m)

75

Select base map



Thu 24

Fri 25

6:00

12:00

18:00

Sat 26

6:00

12:00

18:00

Sun 27

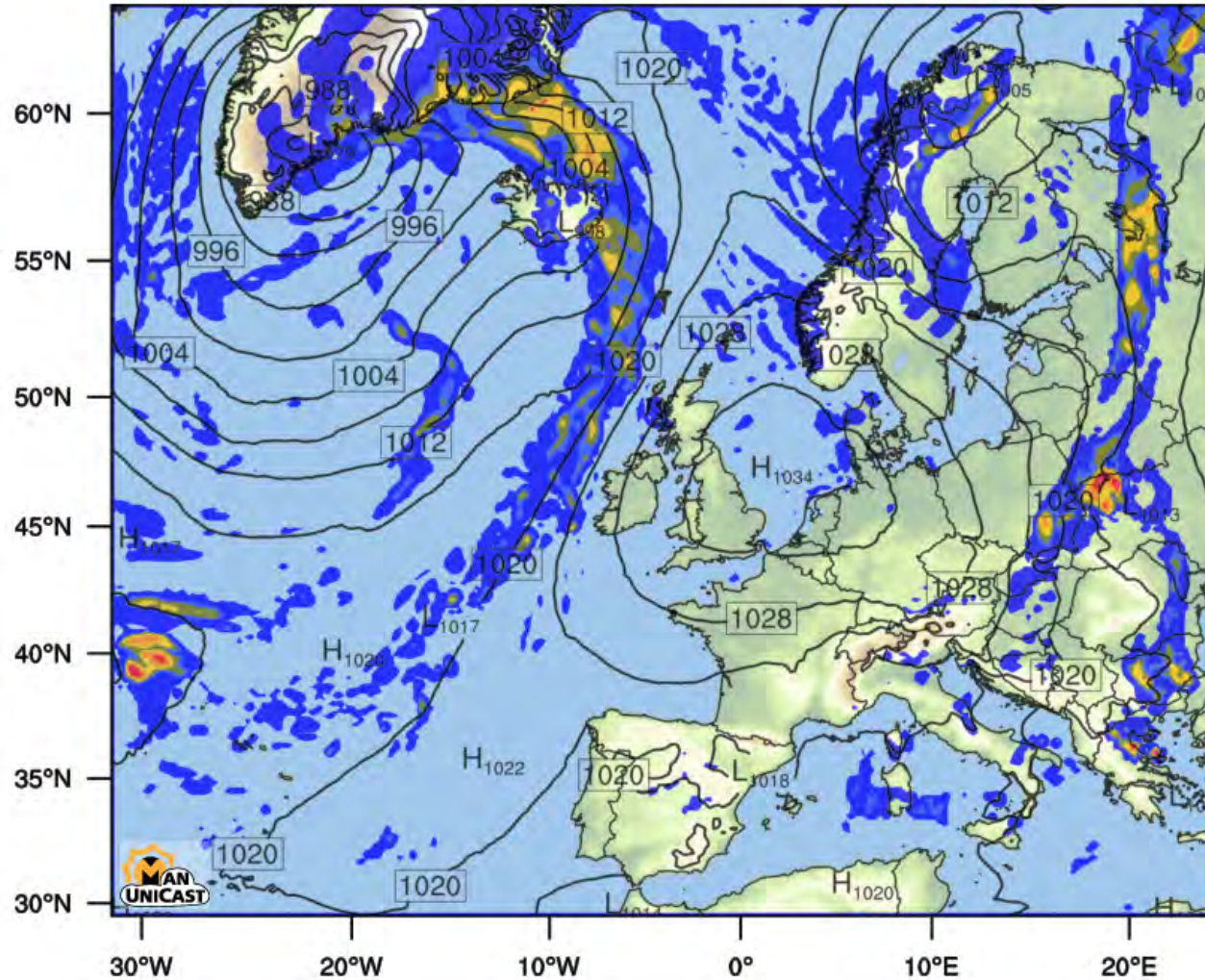


Dynamic image generation from layered image, immediately ready to be used for presentations

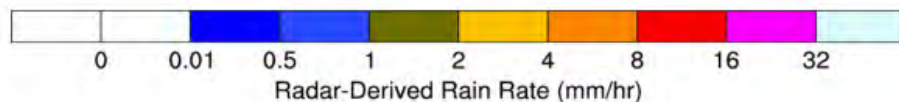
European Weather at 2300 UTC Sat 26 Sep 2015, 53 h

Sea level pressure at sea level (0 m)

Radar-derived rain rate at 1 km



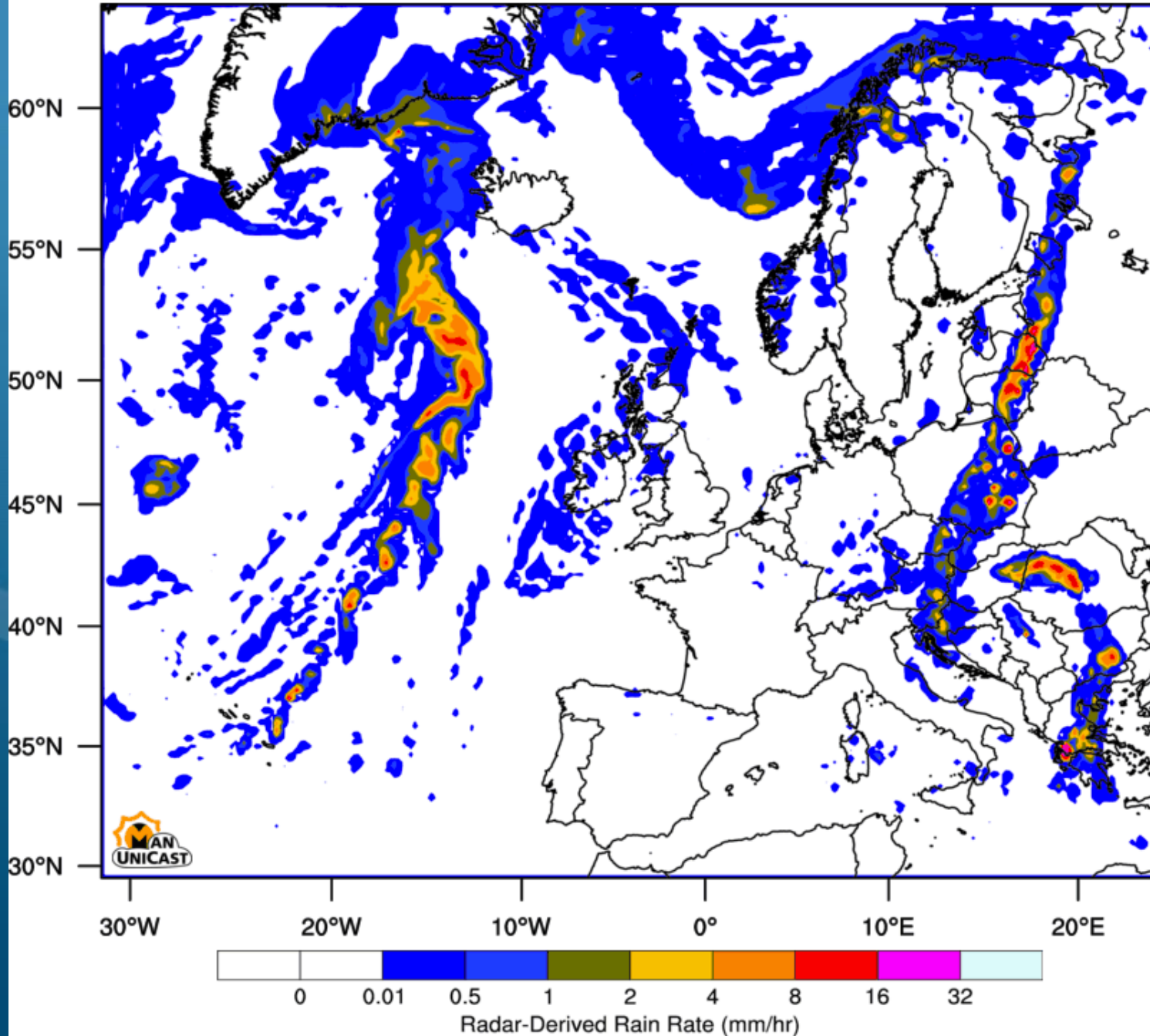
— Mean Sea Level Pressure (hPa)



European Weather at 0100 UTC Sat 26 Sep 2015

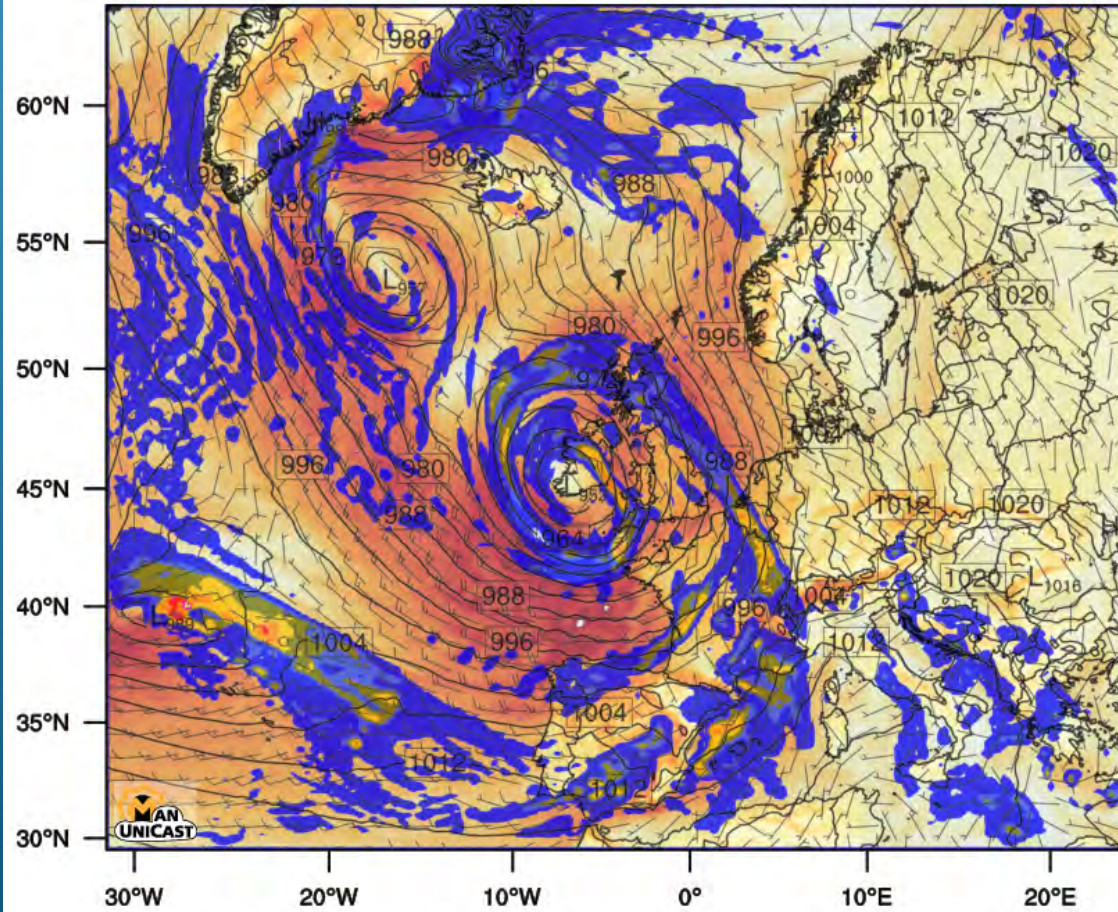
Radar Derived Rain Rate

Animations of individual fields available as well

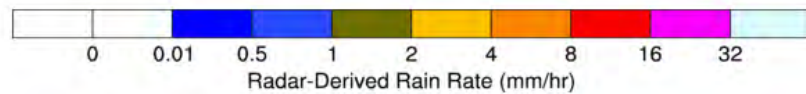


European Weather at 0600 UTC Wed 5 Feb 2014, 12 h

Wind vectors at 10 m
Sea level pressure at sea level (0 m)
Radar-derived rain rate at 1 km
Wind speed at 10 m



—— Mean Sea Level Pressure (hPa)



Archive of
past events
dating back
to autumn of
2013

Various viewing options for the UK domain

1 Select Date

25/09/2015



2 Choose Domain



3 Pick Product

Maps

Cross-sections

Skew-Ts

Meteograms

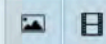
Search Products...



View Product

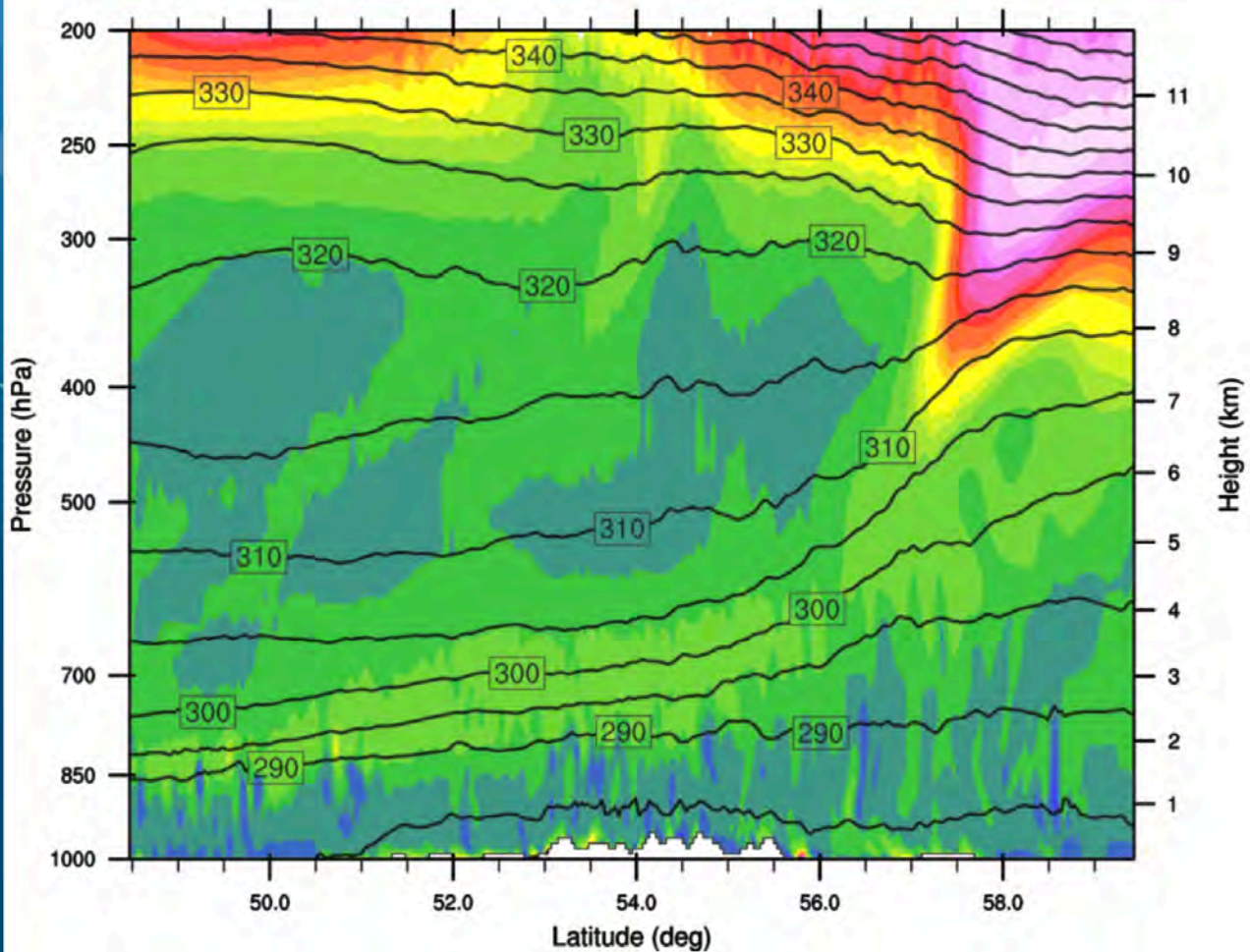
UK Weather Cross-section (S→N)

0600 UTC Fri 25 Sep 2015, 12 h

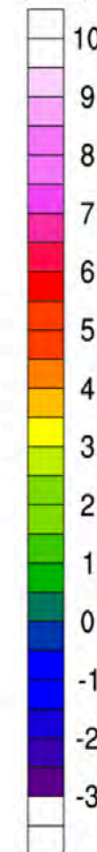


Options

New plot



(PVU)



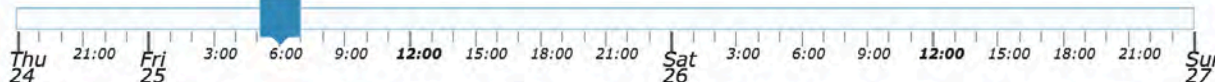
Switch Direction



Image Layers

Search Products...

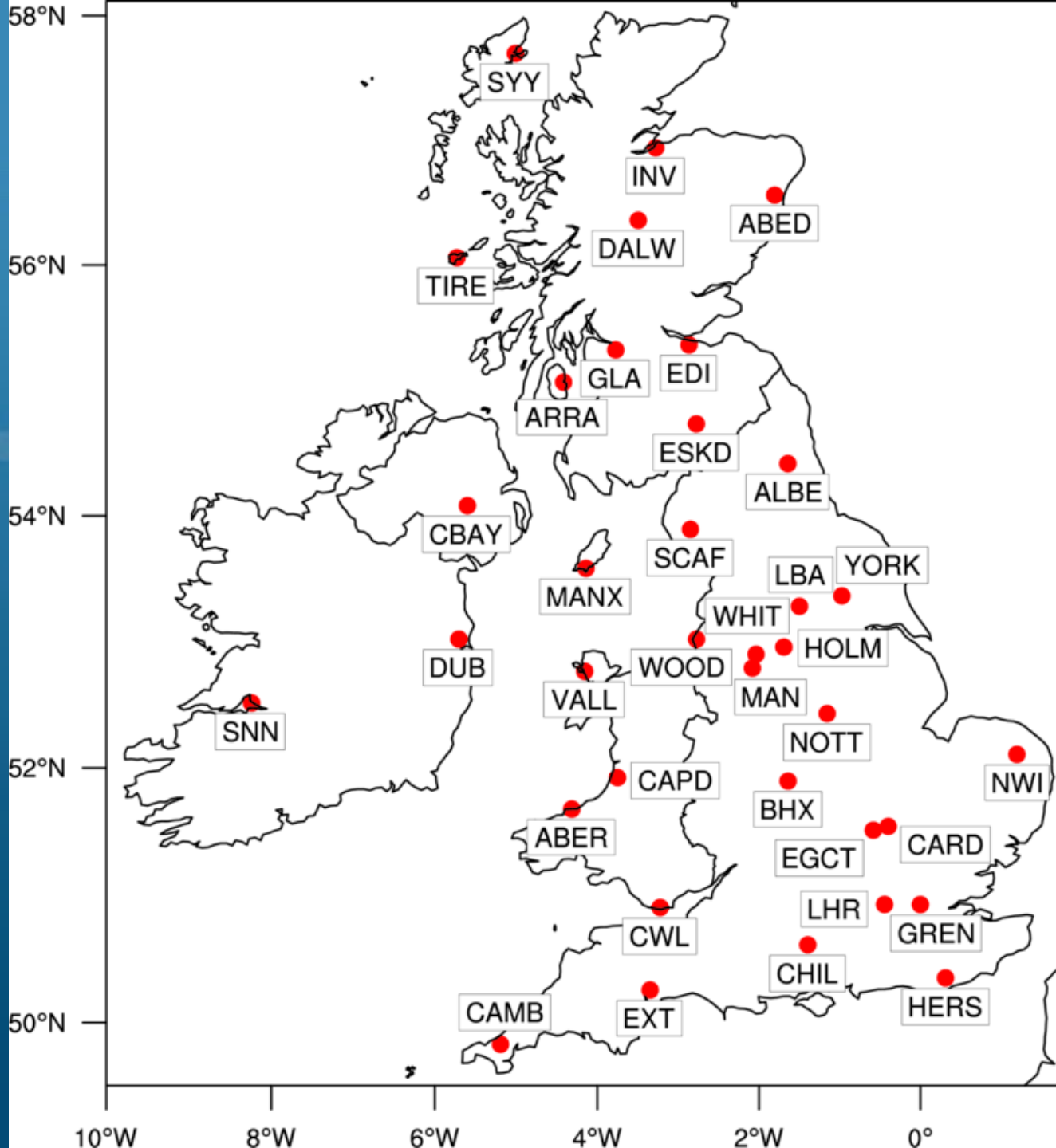
- Potential temperature S→N 75
- Potential vorticity S→N 75**



Point Source
Information

Skew-Ts

Meteograms



UK Weather Chilbolton Observatory, Hampshire, England



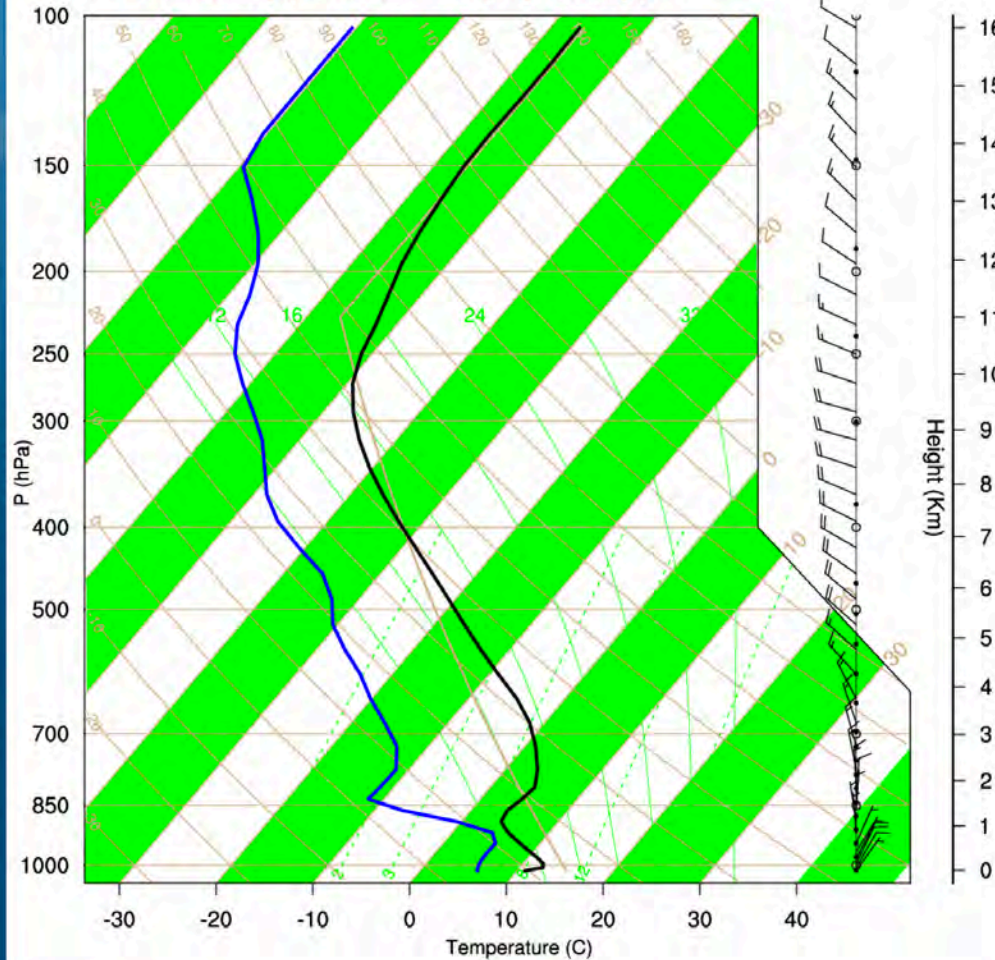
New plot

2000 UTC Fri 25 Sep 2015, 26 h



Options

Picl=910 Tlcl[C]=4 Shox=12 Pwat[cm]=1 Cape[J]= 0



Change Location

Chilbolton Observatory, Hampshire



Thu 24 Fri 25 6:00 12:00 18:00 Sat 26 6:00 12:00 18:00 Sun 27



UK Weather Meteogram



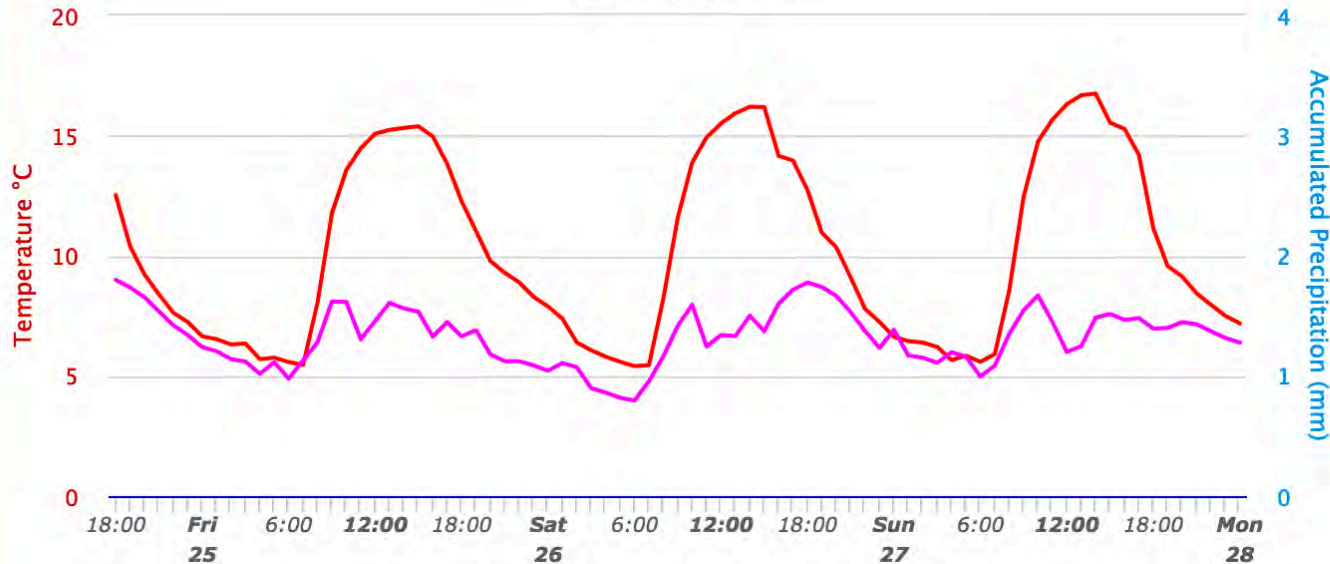
New plot



Options

Chilbolton Observatory, Hampshire, England

51.15° N, -1.44° W



Change Location

Chilbolton Observatory, Hampshire

Products

(Select series legends below to enable/disable their display)

- Temperature at 2m
- Dewpoint at 2m
- Accumulated Precipitation
- Relative Humidity at 2m
- Sea Level Pressure
- Wind speed at 10m
- ... Wind direction at 10m

UK Weather Meteogram



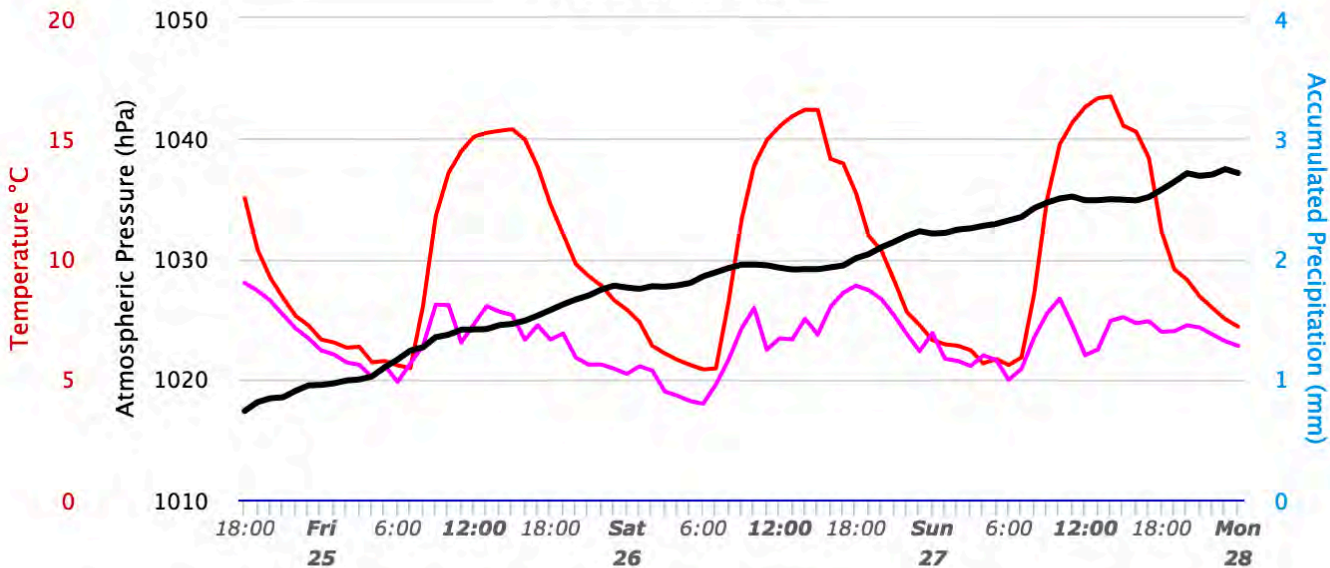
New plot



Options

Chilbolton Observatory, Hampshire, England

51.15° N, -1.44° W



Change Location

Chilbolton Observatory, Hampshire

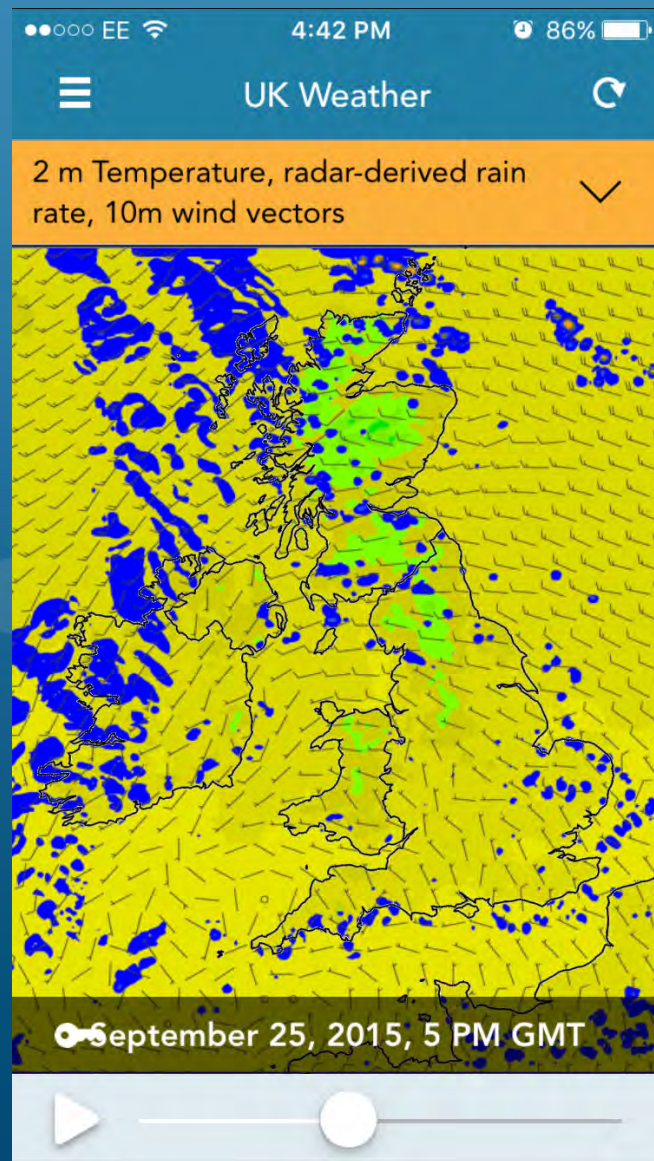
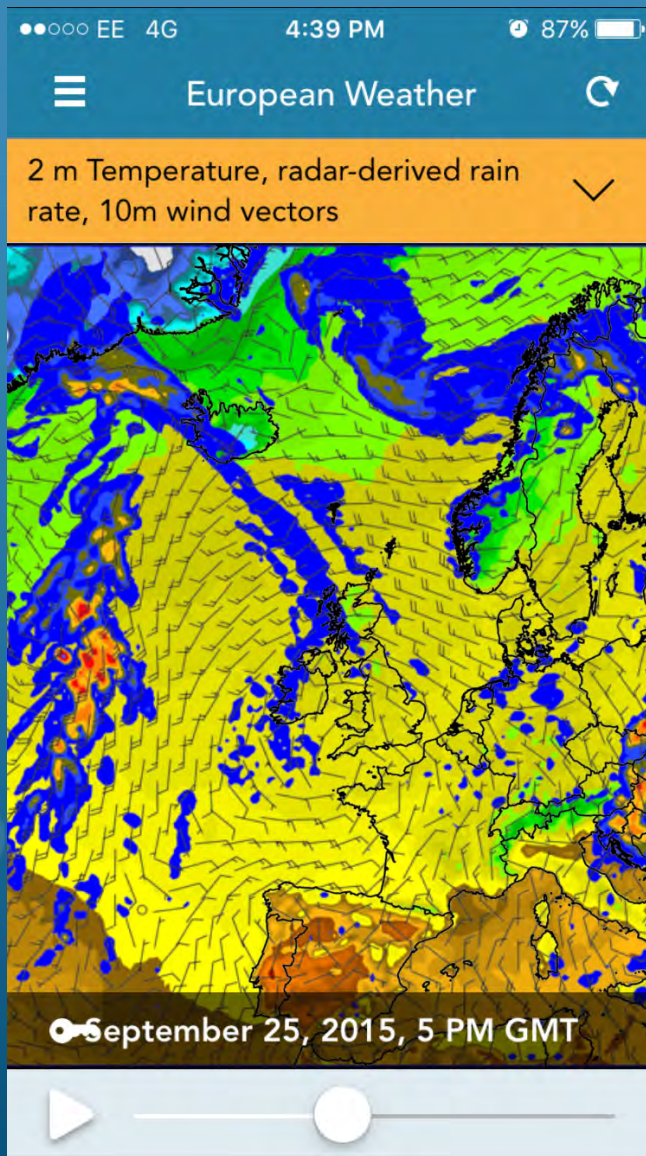
Overlay various fields onto line graphs (up to 78 hour forecasts)

Products

(Select series legends below to enable/disable their display)

- Temperature at 2m
- Dewpoint at 2m
- Accumulated Precipitation
- Relative Humidity at 2m
- Sea Level Pressure
- Wind speed at 10m
- ... Wind direction at 10m

iOS App



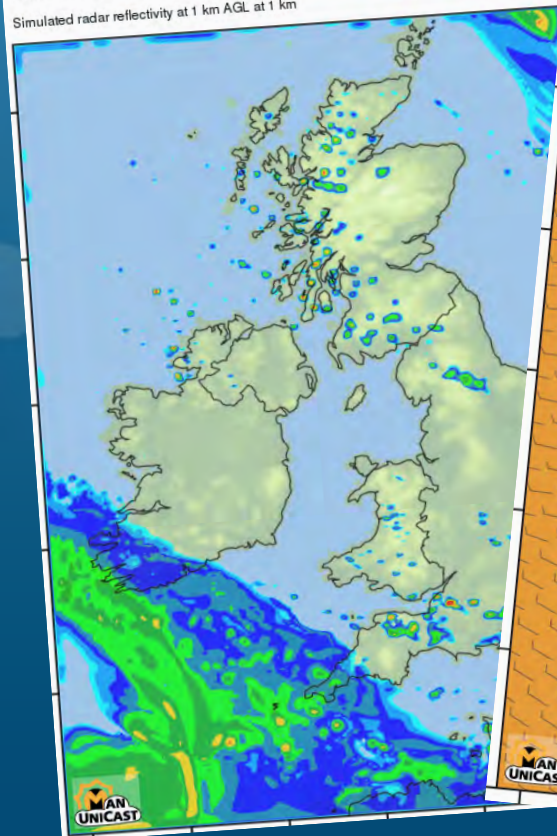


ManUniCast.com

Educational web site developed within the
School of Earth, Atmospheric and Environmental
Sciences

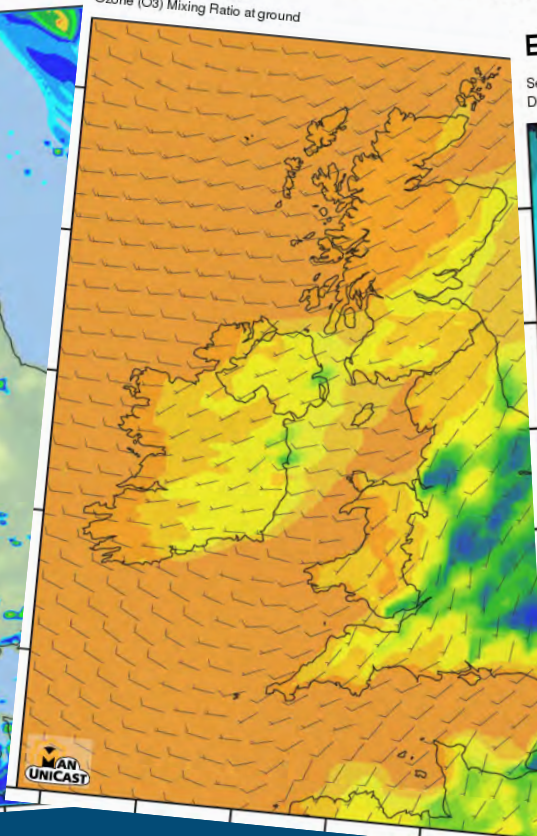
UK Weather at 1300 UTC Sun 3 Nov 2013, 43

Simulated radar reflectivity at 1 km AGL at 1 km



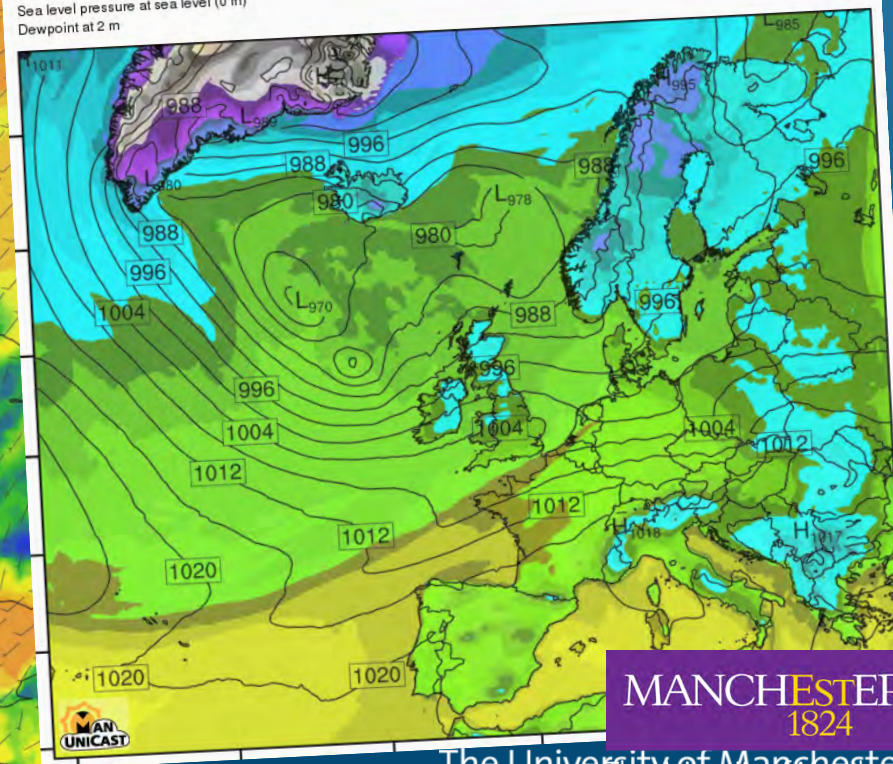
UK Air Quality at 0800 UTC Fri 8 Nov 2013, 38 h

Wind vectors (2D) at 10 m
Ozone (O₃) Mixing Ratio at ground



European Weather at 0600 UTC Thu 7 Nov 2013, 12 h

Sea level pressure at sea level (0 m)
Dewpoint at 2 m



MANCHESTER
1824

The University of Manchester