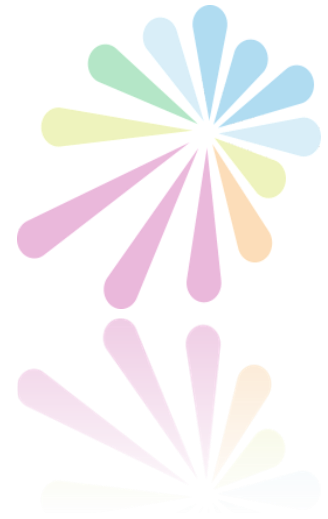




APSE Winter Maintenance Forum 2019



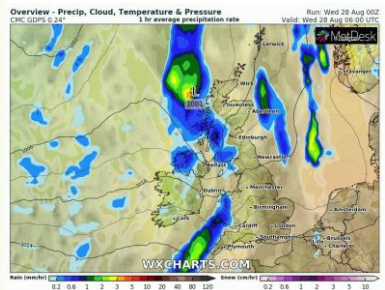
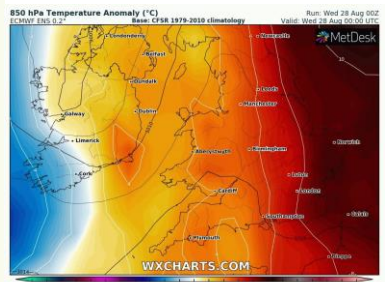
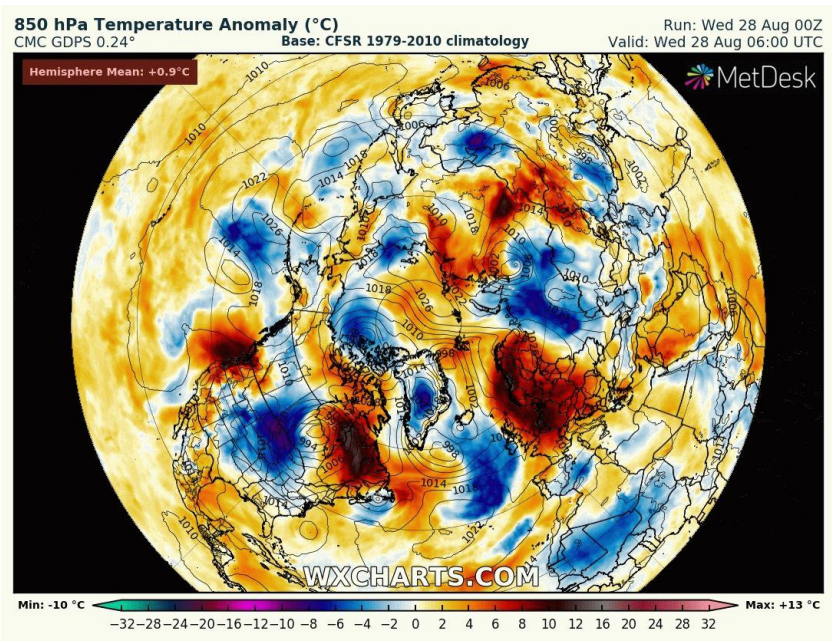
Content

- **What data do forecasters need?**
- **What data do highway authorities need?**
- **How does all this fit in to a risk based approach to decision making?**



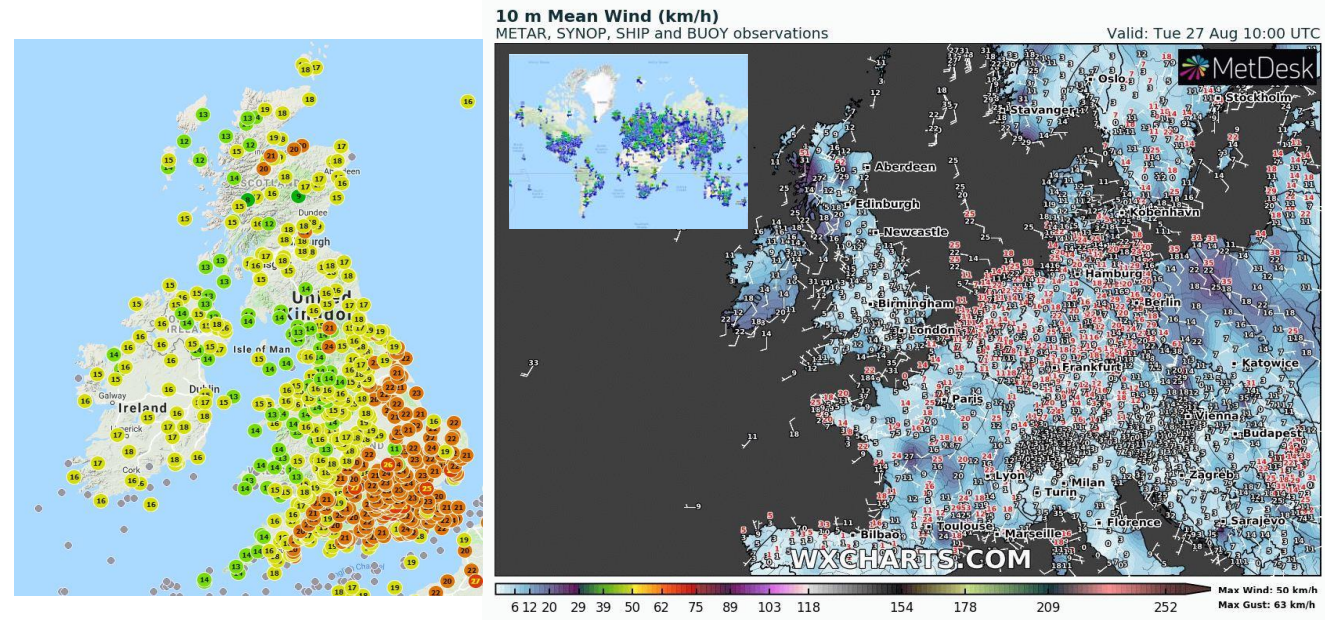
Data for forecasters

Model Data



UKMO, GFS, GEFS, ECMWF HRES, ECMWF ENS
GDPS, ICON-EU, ARPEGE, HIRLAM, AROME,
HARMONIE, NAM-NEST, HRRR, CWC, DWD
KNMI

Observations

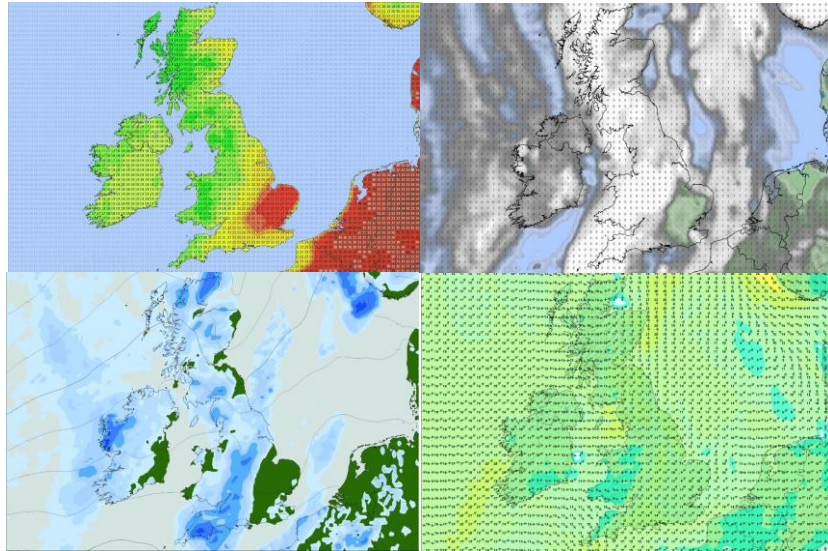


METAR, SYNOP, SHIP, BUOY, WIND FARMS,
RWIS, SATELLITE, RADAR, SOCIAL MEDIA
AMATEUR NETWORKS, VEHICLES, LIGHTNING
And other client specific sources

Data for a surface temperature forecast

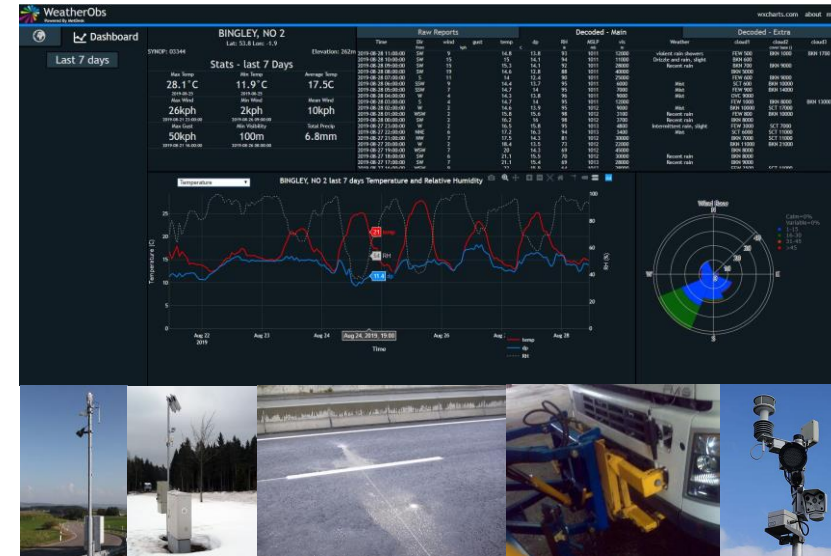


Model Data



Cloud, Dew Point, Air Temperature, Precipitation, Wind speed, Weather Type

Observations

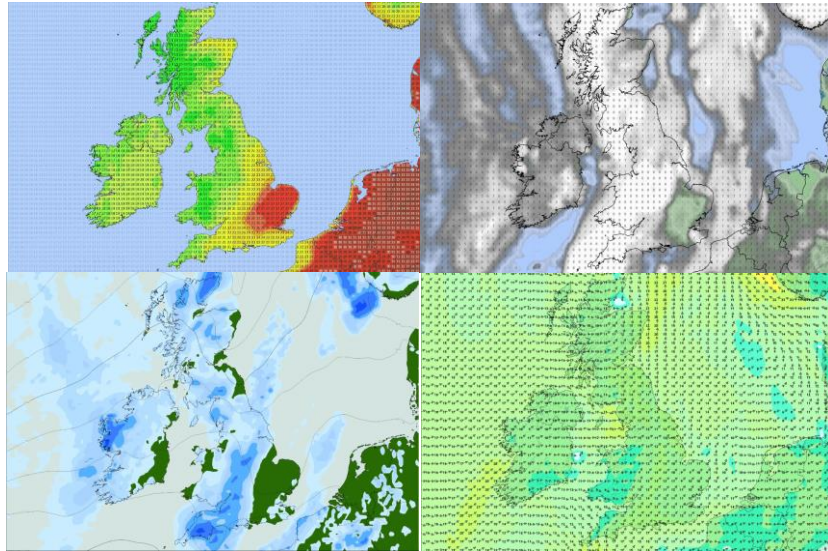


Pavement Surface Temperature, Deep Temperature, Air Temperature, Dew Point, Surface Condition, Wind speed, Precipitation Amount/Type

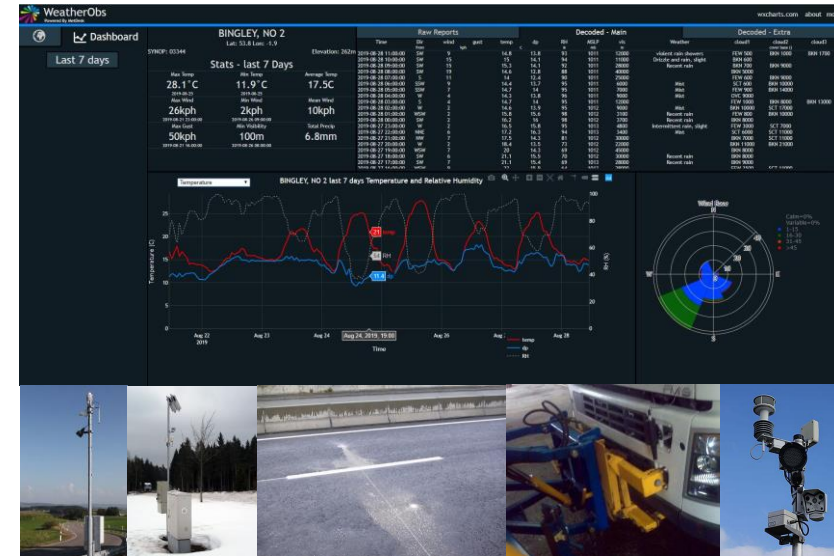
Data for a surface temperature forecast



End Point



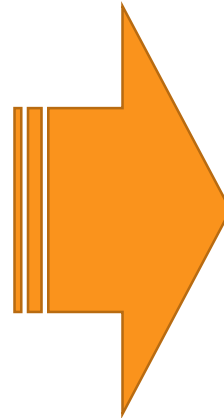
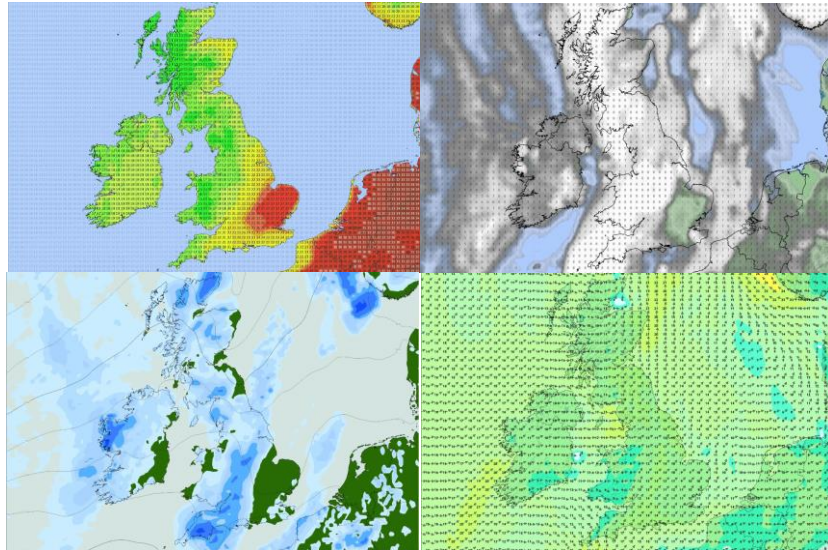
Starting Point



Data for a surface temperature forecast



End Point



Minimum Pavement Temperature

Time of the minimum Temperature

Length of time below zero

Worst hazard (hoar frost, ice, snow etc.)

Length of time for worst hazard

Data for a surface temperature forecast



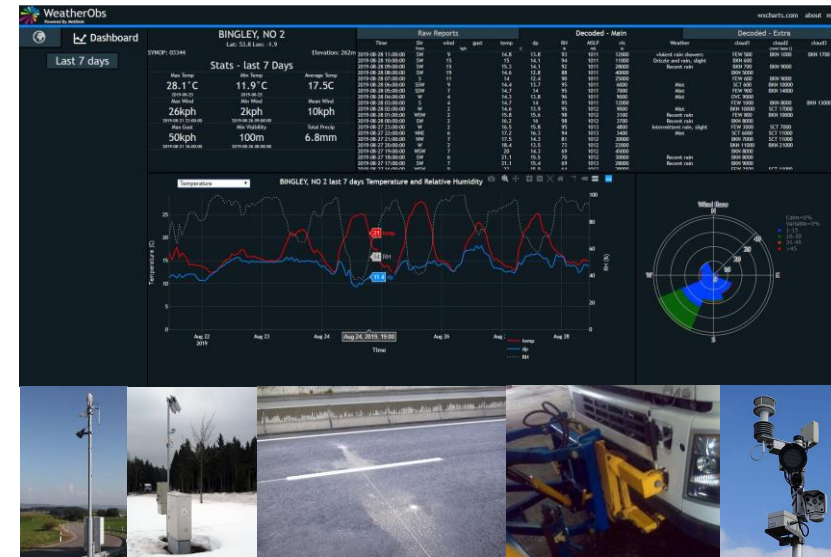
Starting Point

Latest surface temp observations

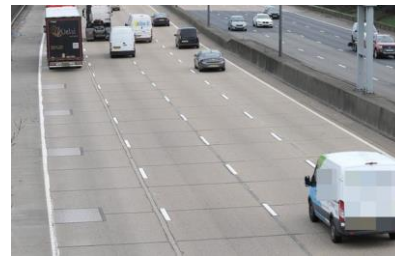
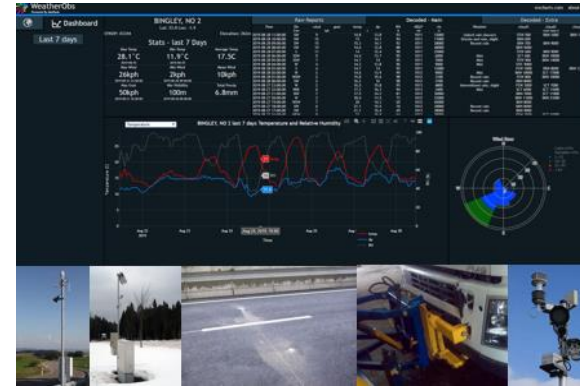
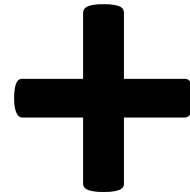
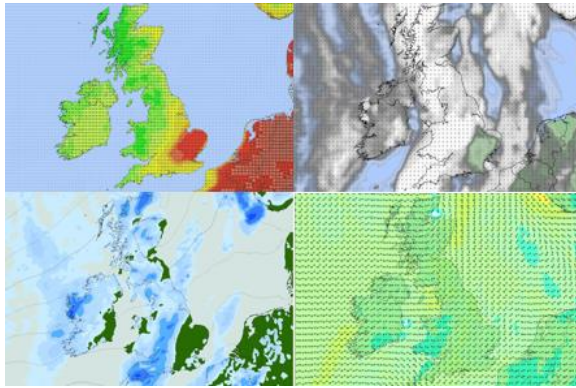
Latest radar

Latest satellite

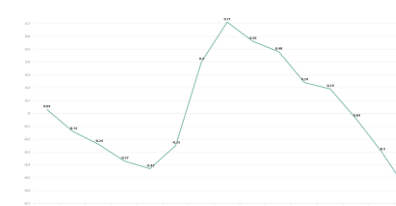
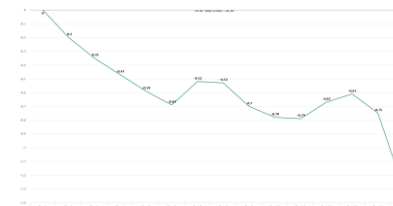
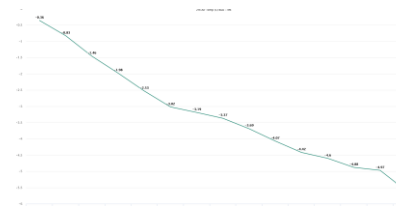
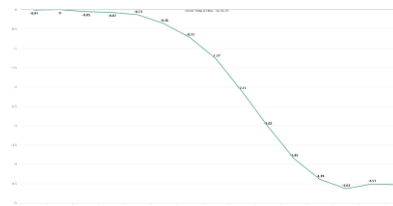
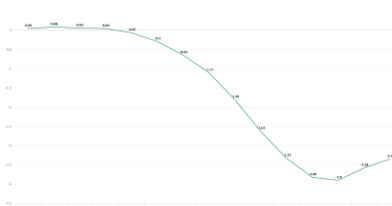
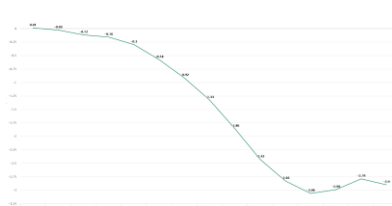
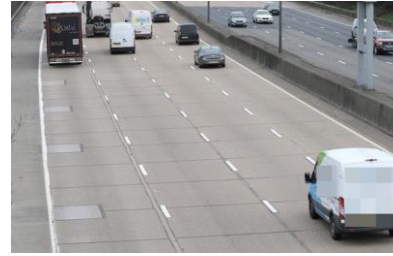
Latest synoptic observations



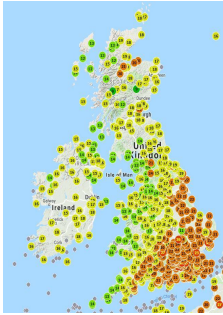
Each forecast provider has its own unique surface temperature model



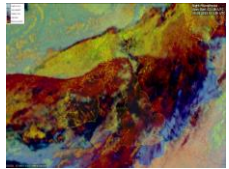
Each forecast provider has its own unique surface temperature model



Data for Monitoring (Deviations to forecast)



Reliable, quality controlled observations



High resolution Satellite images



High resolution radar imagery

Precipitation type and amount with forecast element

**Forecast (Current and Final)
Site
Route/Sub-Route
Domain**

Client Actions

Client Operations

Update criteria

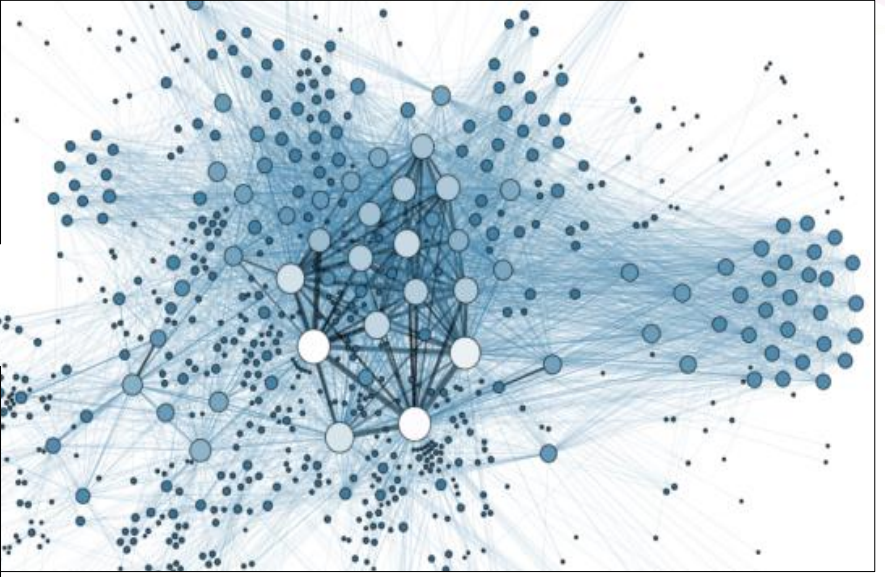
Communication Protocol



Data for Highway Authorities



Data for Highway Authorities



Data for Highway Authorities



		Predicted Road Conditions		
Road Surface Temperature	Precipitation	Wet	Wet Patches	Dry
May fall below 1°C	No rain No hoar frost No fog		Salt before frost (see note a)	No action likely.
Expected to fall below 1°C	No rain No hoar frost No fog	Salt before frost	Monitor weather. (see note a)	
	Expected hoar frost Expected fog		Salt before frost (see note b)	
	Expected rain BEFORE freezing	Salt after rain stops (see note c)		
	Expected rain DURING freezing	Salt before frost, as required during rain and again after rain stops (see note d)		
	POSSIBLE rain POSSIBLE hoar frost POSSIBLE fog	Salt before frost	Monitor weather conditions	
EXPECTED snow		Salt before snow fall		
The decision to undertake precautionary treatments should, if appropriate, be adjusted to take account of residual salt or surface moisture. All decisions require continuous monitoring and review.				

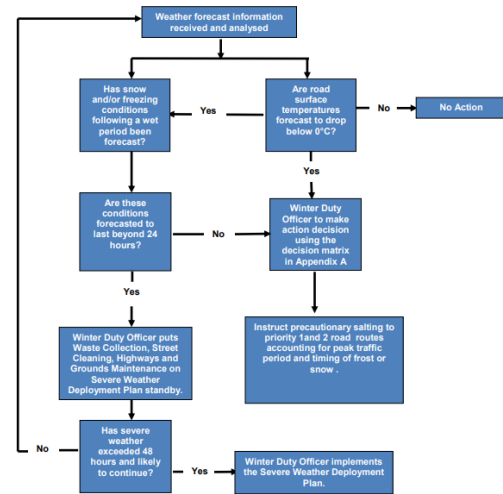
Key pieces of information:

1. Forecast Road Surface Temperature
2. Forecast road condition/hazard
3. Forecast timing of RST/Conditions
4. **Likelihood/Possibility**

Monitoring (some form of observations)

Current conditions – residual salt (observations?
Scouting/inspections?)

Fitting the forecast into a risk based approach



Forecast issued: 21st January 2015 12:05:41 GMT
 Forecast period: Thursday 21/01/15 12:00 to Friday 23/01/15 12:00
 Forecast by: Forecast DGT
 Forecast DTG: 0258:00:37

Headline VISIBILITY BELOW ZERO: SNOW SHOWING MOVING IN FROM THE EAST

General Synopsis
 Dry today with light south and south westerly winds. Cloudy this evening and overnight for snow with lesser showers pushing in from the North. Sea across the eastern area. Dry but the morning brought with some light drizzle. B275 below sea level.

Snow Summary
 Snow showers moving in from the North. Sea height and affecting eastern areas. A slight settling of sea on possible here. Dry conditions in the west.

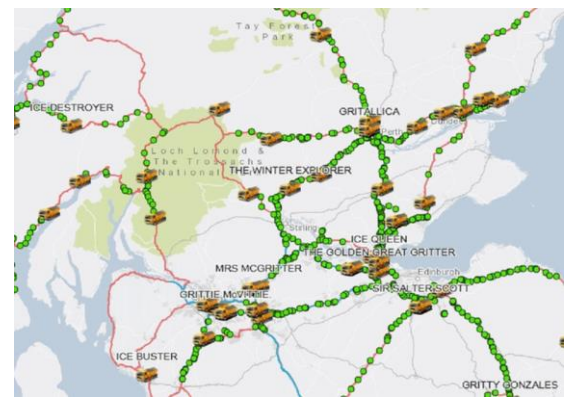
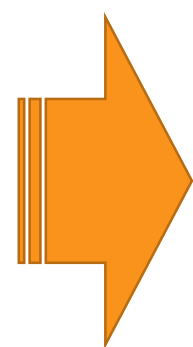
3-5 Day Outlook
 Look for Friday with another few hours of snow showers falling in the western area during the afternoon but these should peter out by evening with lighter clear spells overnight. B275 will be below sea level overnight with a further snow shower moving in from the North. Sea across the eastern area. Dry but the morning brought with some light drizzle. B275 below sea level.

Station	Date	Forecast	Temp	Wind	Cloud	Wet	Wet Patches	Dry	Wet	Wet Patches	Dry	Wet	Wet Patches	Dry	Wet	Wet Patches	Dry	Wet	Wet Patches	Dry
Proctor	21st Jan	0-1	1-4	1-4	0-1	0-1	0-1	0-1	0-1	0-1	0-1	0-1	0-1	0-1	0-1	0-1	0-1	0-1	0-1	0-1
Proctor	22nd Jan	0-1	1-4	1-4	0-1	0-1	0-1	0-1	0-1	0-1	0-1	0-1	0-1	0-1	0-1	0-1	0-1	0-1	0-1	0-1
Proctor	23rd Jan	0-1	1-4	1-4	0-1	0-1	0-1	0-1	0-1	0-1	0-1	0-1	0-1	0-1	0-1	0-1	0-1	0-1	0-1	0-1



Road Surface Temperature	Precipitation	Predicted Road Conditions		
		Wet	Wet Patches	Dry
May fall below 1°C	No rain No hoar frost No fog		Salt before frost (see note a)	No action likely. (see note a)
Expected to fall below 1°C	No rain No hoar frost No fog	Salt before frost	Salt before frost (see note b)	Monitor weather. (see note a)
	Expected hoar frost			
	Expected rain BEFORE freezing	Salt after rain stops (see note c)		
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	POSSIBLE rain POSSIBLE hoar frost POSSIBLE fog	Salt before frost		Monitor weather conditions
EXPECTED snow		Salt before snow fall		

The decision to undertake precautionary treatments should, if appropriate, be adjusted to take account of residual salt or surface moisture.
 All decisions require continuous monitoring and review.



Fitting the forecast into a risk based approach

1. Where are you treating? – domain, route, sub-route, specific locations?
 2. What are you doing about **bridges**, footways, cycleways?
 3. Operationally can these be treated in isolation i.e. selective treatment?
- Tells you the type of forecast you need



Fitting the forecast into a risk based approach



1. Where are you treating? – domain, route, sub-route, specific locations?
2. What are you doing about **bridges**, footways, cycleways?
3. Operationally can these be treated in isolation i.e. selective treatment?

- Tells you the type of forecast you need

4. How much time do you have to make the decision?

- Tells you how much information you need

Less information = Quicker, simpler decision and ability to have a later deadline

More information = more complex decision, pressure on deadlines and trade off on accuracy

Fitting the forecast into a risk based approach



1. Where are you treating? – domain, route, sub-route, specific locations?
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Less information = Quicker, simpler decision and ability to have a later deadline

More information = more complex decision, pressure on deadlines and trade off on accuracy

5. What is your process for handling uncertainty (**Likelihood/Possibility**)?

- Tells you how much interaction you should have with your forecaster

- Tells you whether you need to define % probability thresholds for treat/no treat

Fitting the forecast into a risk based approach



Uncertainty

Headline	A FEW SCATTERED SHOWERS WITH RSTs VERY MARGINAL TONIGHT.
Confidence	LOW

General Synopsis

Mainly dry this afternoon with sunny spells and occasional patchy cloud. Into this evening and overnight it will be cold with variable amounts of cloud will drifting in from the North Sea, bringing a few scattered showers. Whilst skies will remain generally cloudy for much of the night, a few occasional clear breaks may develop at times. RSTs becoming very marginal across the Wolds tonight, the odd icy patch forming cannot be ruled out. Further scattered showers continuing into tomorrow morning.

Snow Summary

Some of the showers may turn sleety at times tonight in any heavier bursts, especially across the Wolds, but no snow or accumulations are expected.

Fitting the forecast into a risk based approach

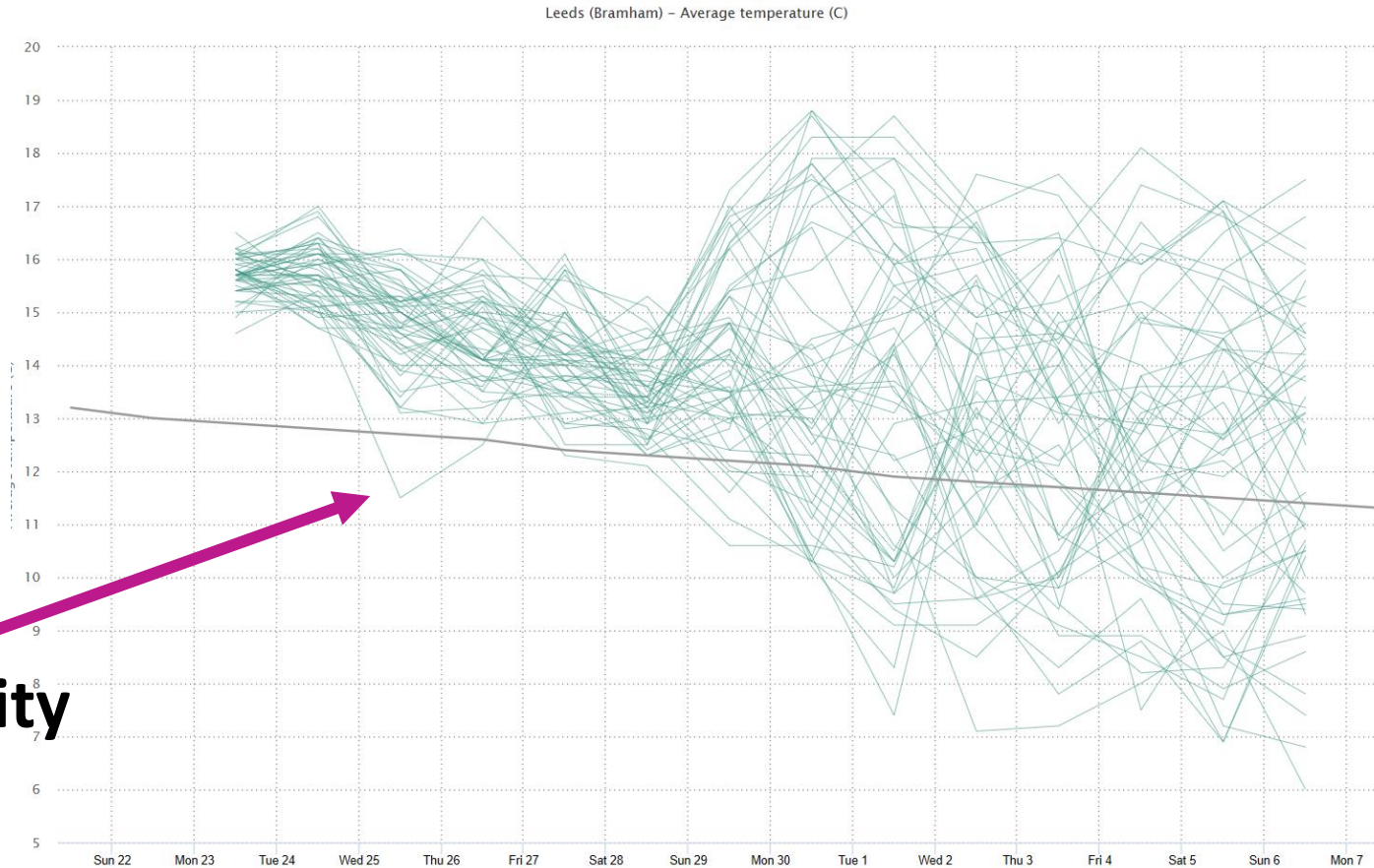


Uncertainty



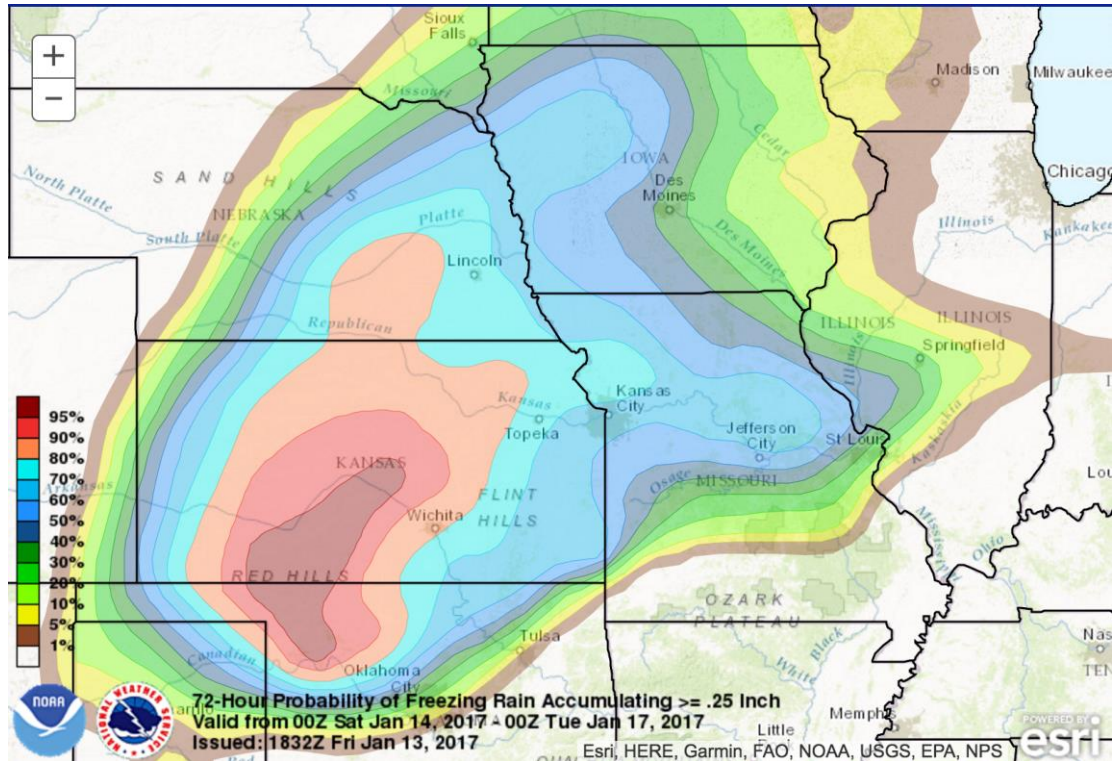
Fitting the forecast into a risk based approach

Uncertainty



2% probability

Fitting the forecast into a risk based approach



5% probability of snow

5% risk of ice

25% probability of snow

25% risk of ice

50% probability of snow

50% risk of ice

75% probability of snow

75% risk of ice

100% probability of snow

100% risk of ice

Summary

- 1. Data quality is important – to produce the forecast and to verify it**
- 2. Decide how much information you need for your decision**
- 3. Decide how you'll treat footways, cycleways, bridges – if at all**
- 4. Decide how you will deal with uncertainty in the forecast**
- 5. Be clear how the forecast fits in to the overall risk based approach**





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