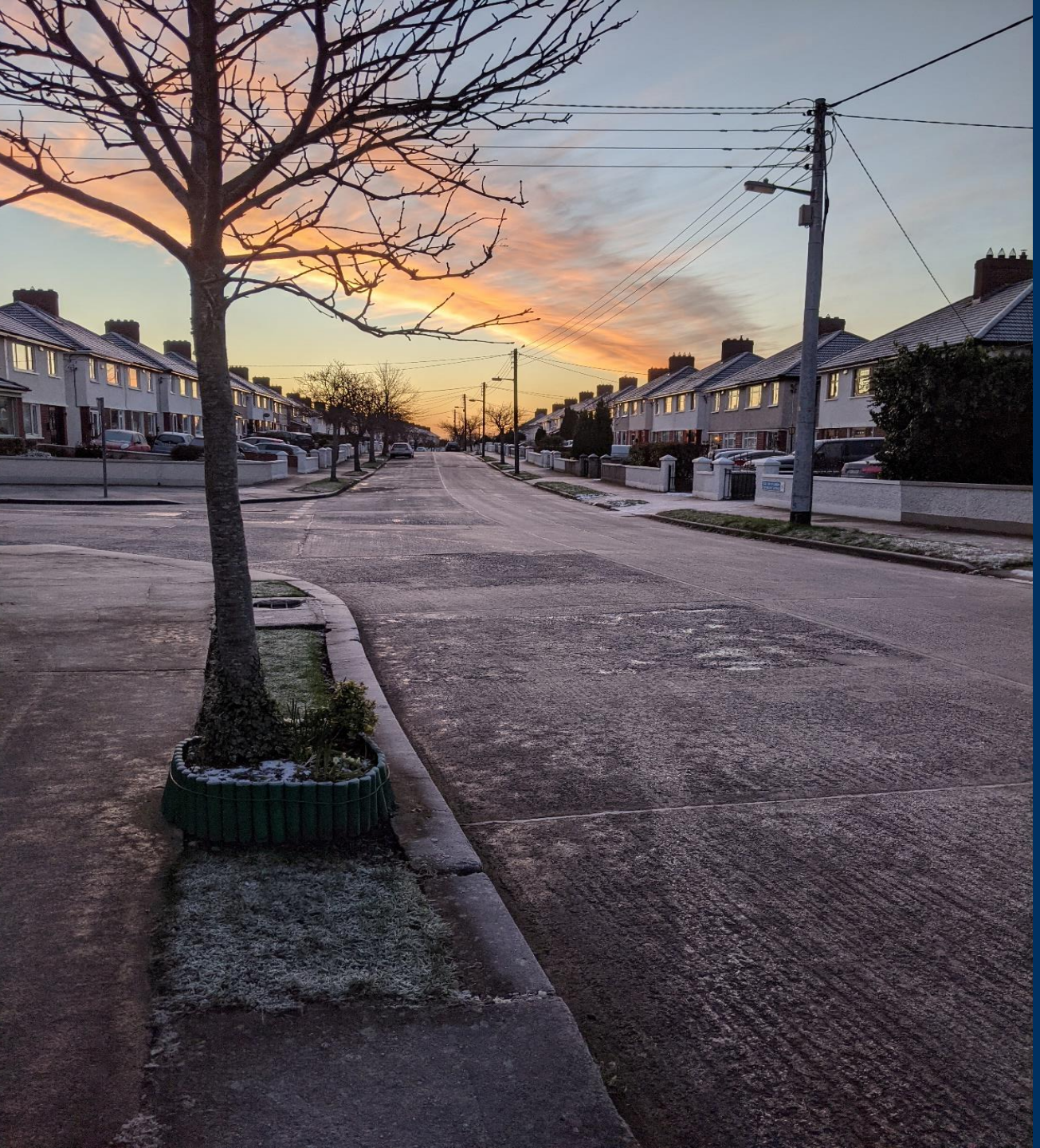
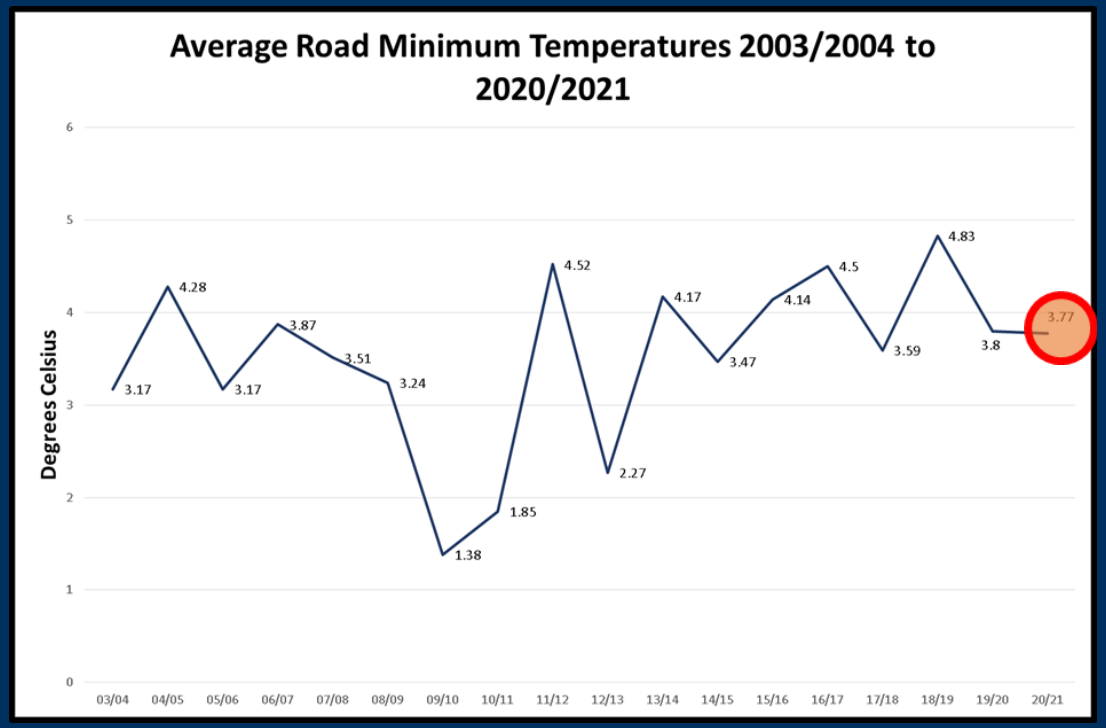


The Winter of 2020/21

A Cold & Frosty Sunrise, January 25th 2020

An average roadice season overall - but with contrasts

- 9th mildest / 10th coldest average road minimum temperature in the 18 year series
- Average Road Minimum Temperature of 3.77 °C
- Marginally lower (0.03 °C) than last year, the 2019/2020 season
- 1.06 °C lower than the previous year, 2018/2019 which remains the mildest season in the record.



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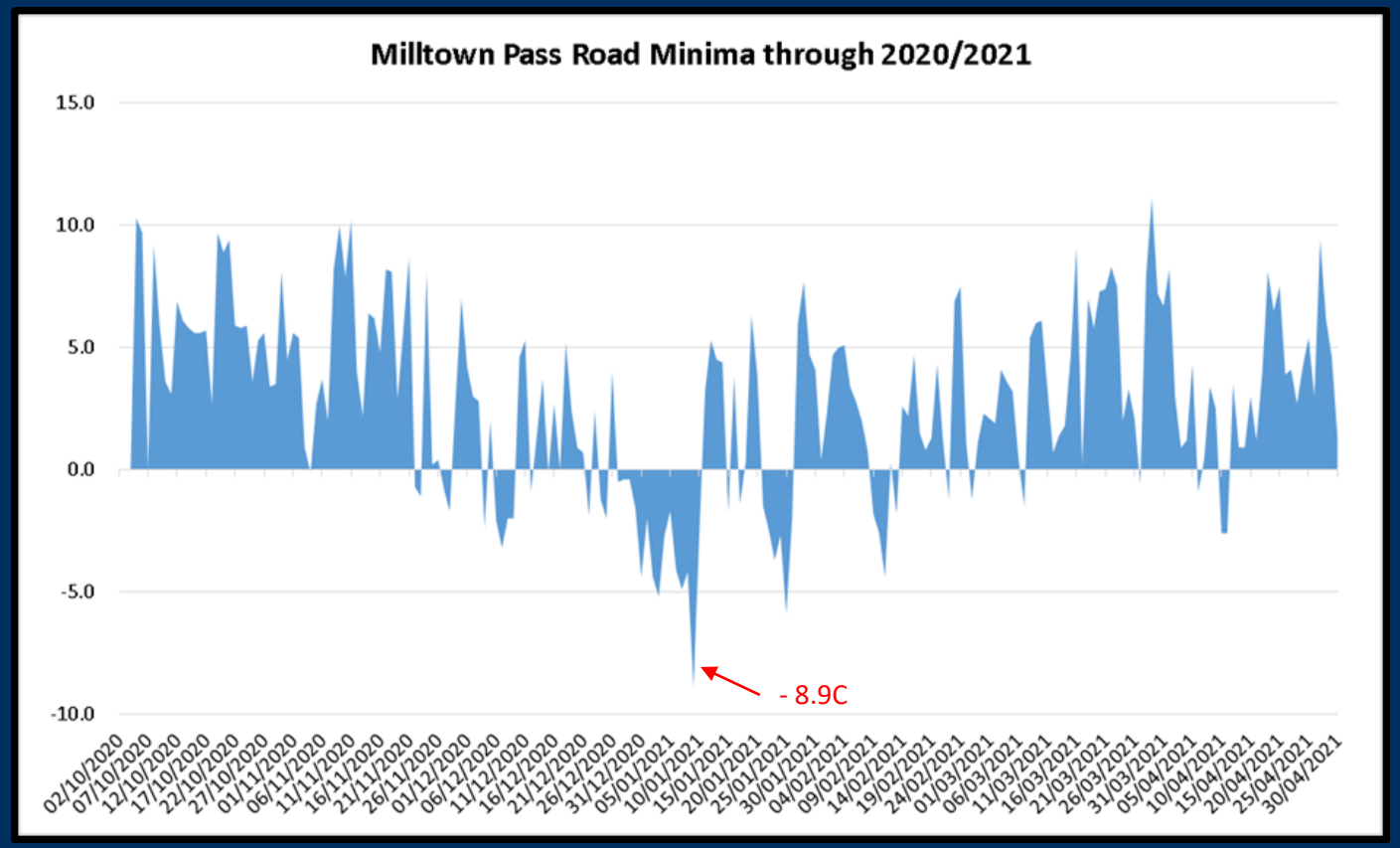
Largest number of stations to date

- The statistical analysis was performed across 102 stations, representing the largest number of stations to date
- Analysis was carried out on 101 stations last year.

MET éireann

The lowest road temperature of the season was -8.9 °C.



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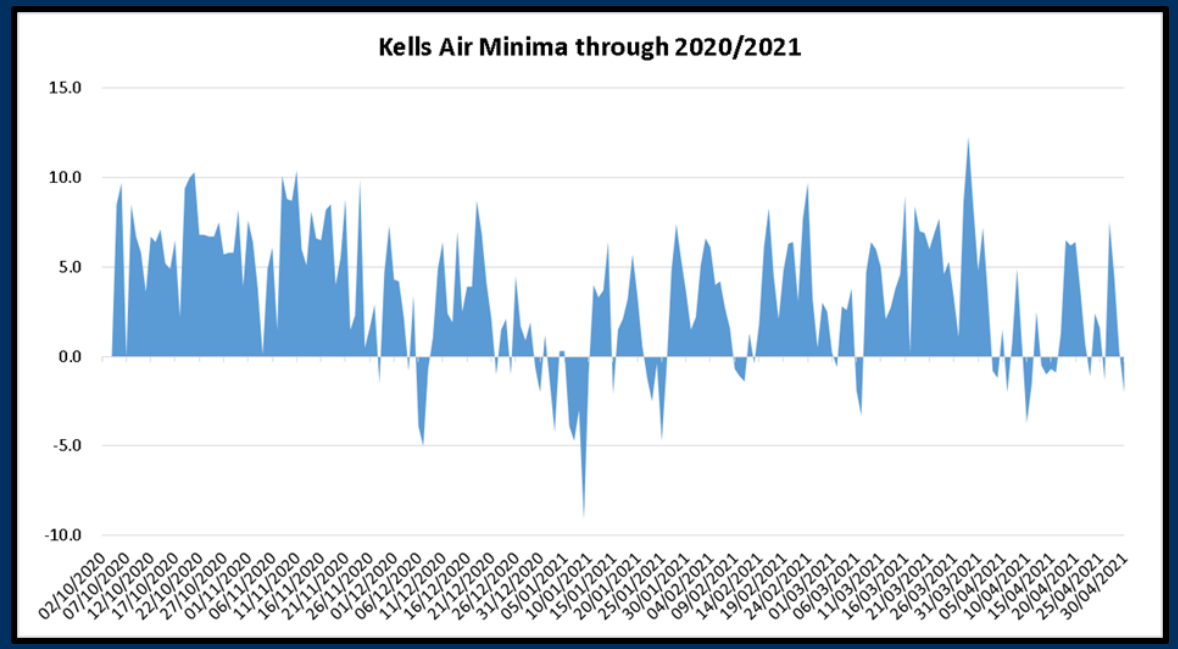
Coldest night for Road & Air temperature

- 9th January 2021
- Lowest Road Surface Temperature was -8.9 °C recorded at Milltown Pass in Co. Westmeath
- Lowest Air Temperature -9.0 °C was reported at Kells Co. Meath



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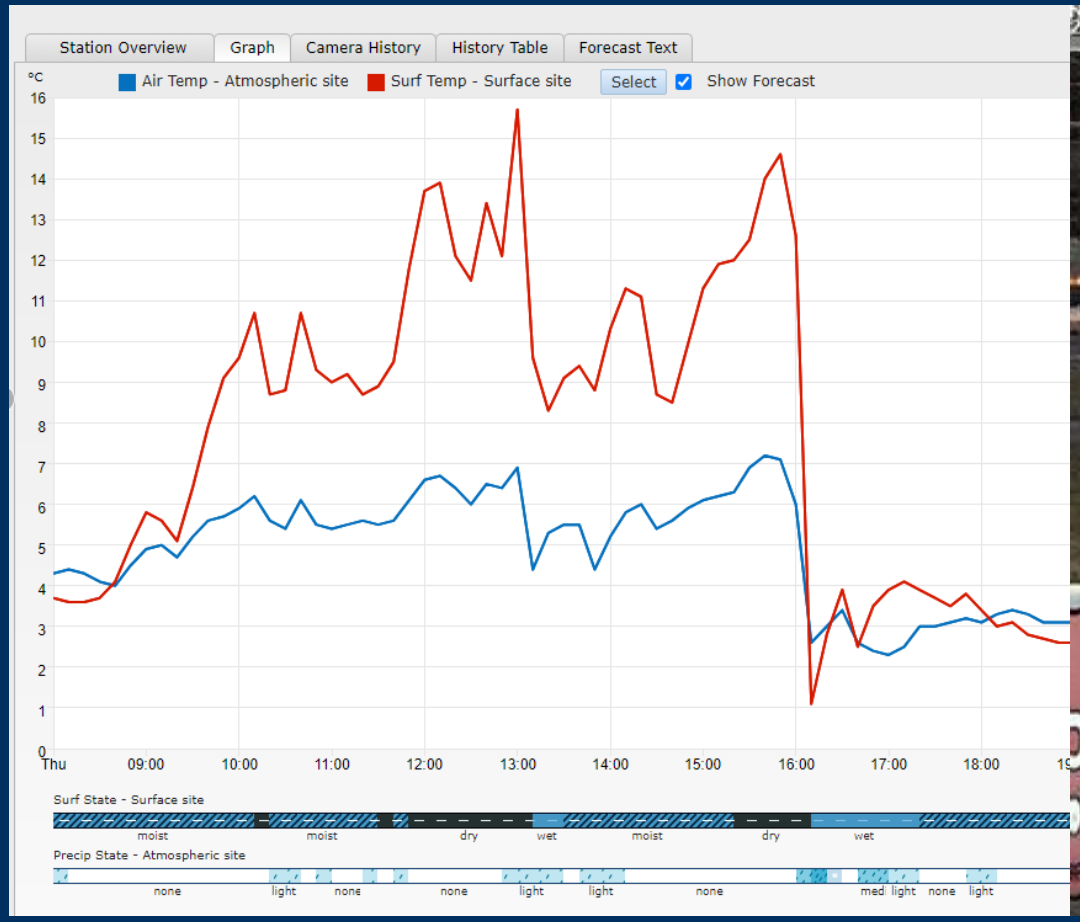
The Season of 2020/2021

Snow Lying at Mullingar Meteorological Station on January 24th 2021

MET éireann

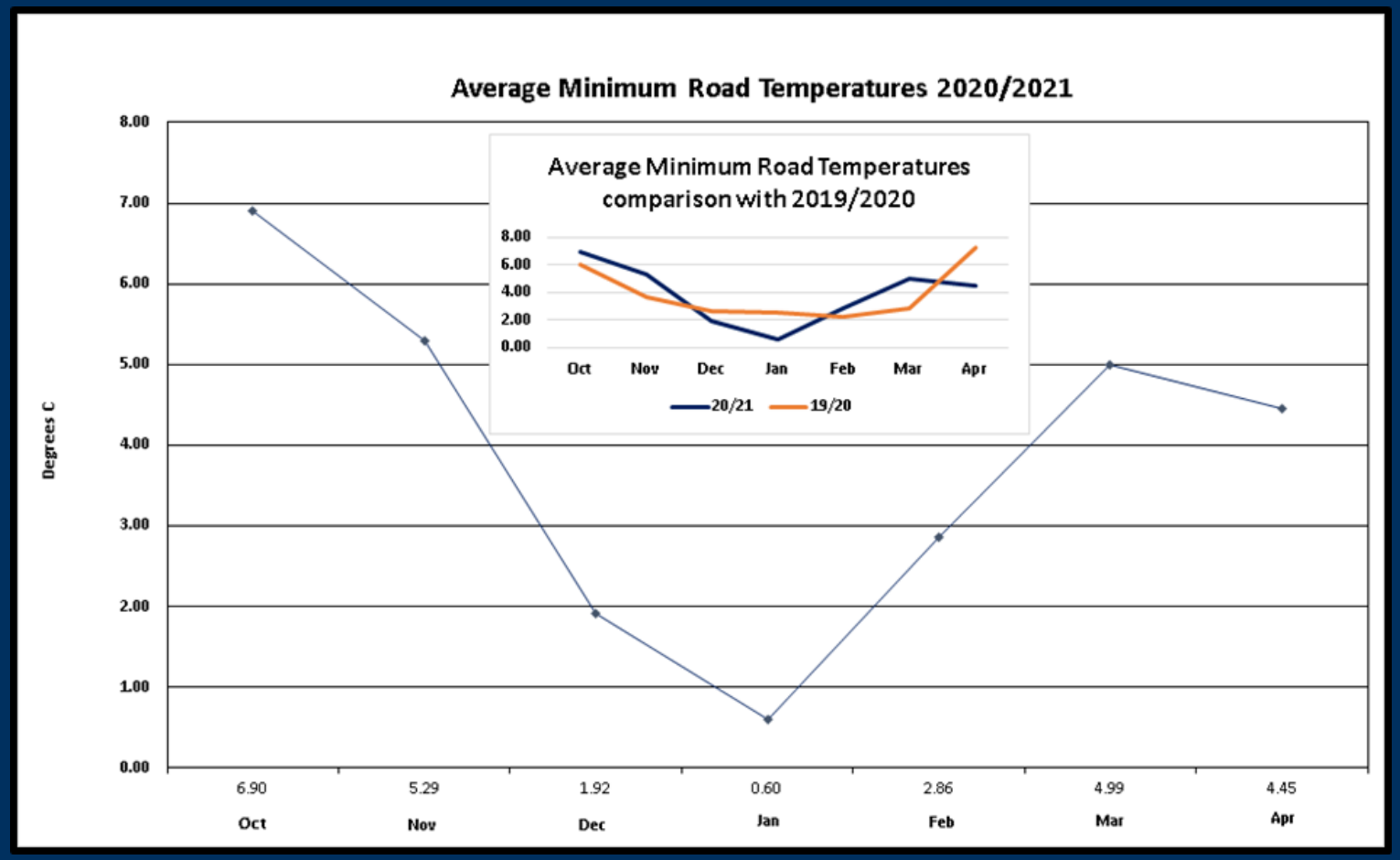
The Season of 2020/2021



MET éireann

Road Surface Temperature Profile in Red (Air Temp in Blue) showing a 14°C drop around 1600 during a hail shower on March 11th at Granard, County Longford

How did that translate to RSTs?



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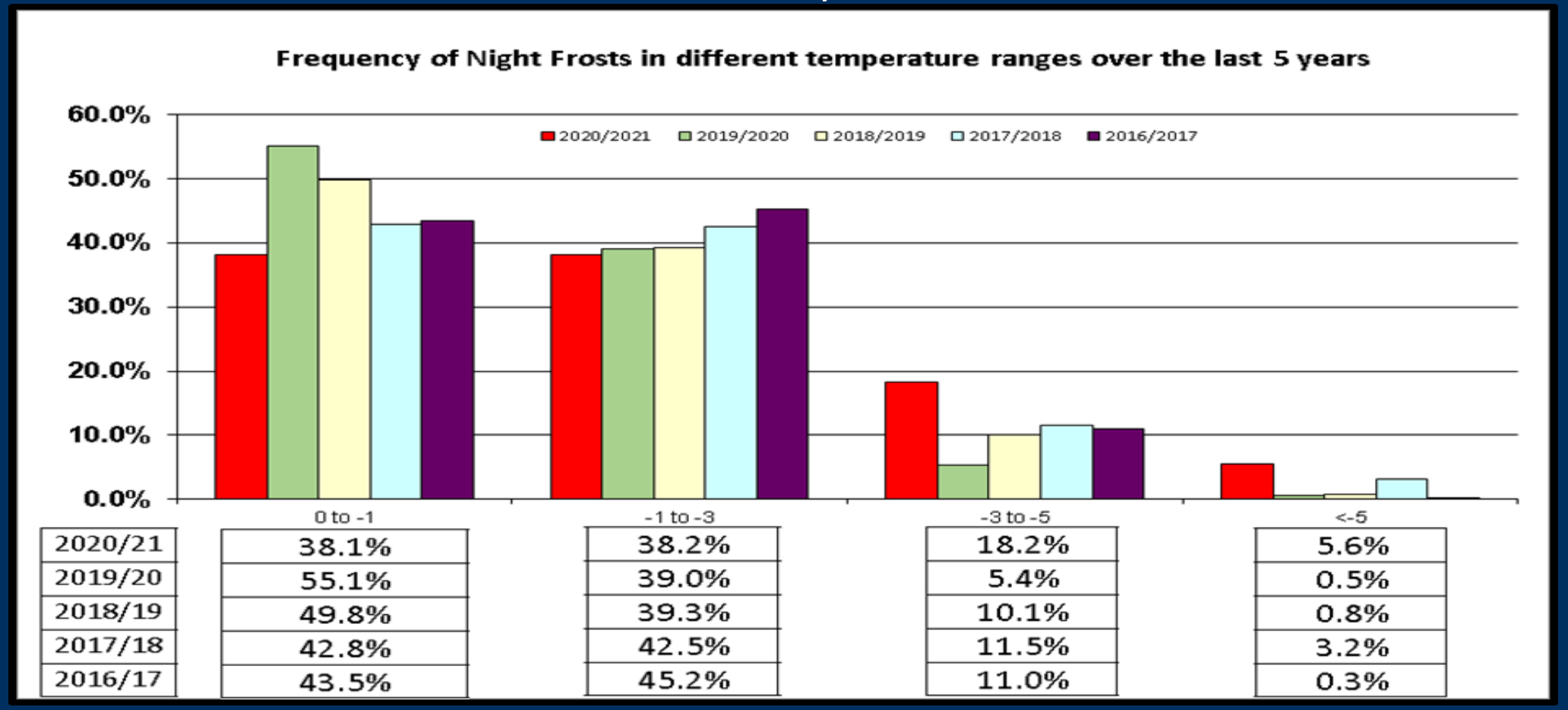
Frequency of Night Frosts in different temperature ranges over the last 5 years



	0 to -1	-1 to -3	-3 to -5	<-5
2020/21	38.1%	38.2%	18.2%	5.6%
2019/20	55.1%	39.0%	5.4%	0.5%
2018/19	49.8%	39.3%	10.1%	0.8%
2017/18	42.8%	42.5%	11.5%	3.2%
2016/17	43.5%	45.2%	11.0%	0.3%

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Instances of Frost ... Coldest Sites

- The average percentage frost across the 102 stations examined for 2020/2021 was 16.6%
- Lough Mourne, Co. Donegal returned the highest PERCENTAGE of night frosts with 27.3% equating to 48 frost Nights.
- Baltinglass, Co. Wicklow had the highest NUMBER of night frosts with 54 frost nights equating to 26.1% percentage frosts.
- Comparing to last year 2019/2020: Emyvale Co Monaghan had the highest percentage and number of frost nights with 31.2% or 63 frost nights. This year Emyvale recorded 25.2% or 52 frost nights.

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Instances of Frost … Mildest Sites

- The mildest station was once again Waterville, Co Kerry which reported 6.8% equating to 14 nights (3 in December and 11 in January). Last year Waterville recorded 2.4% or 5 night frosts during the entire season.
- Limerick Tunnel (Co. Limerick), Cahir (M8, Co. Tipperary), Balbriggan (M1), Toll Plaza (M8, Co. Cork), Curraheen (N40, Co. Cork), Bunratty (N18, Co. Clare) and Rathkeale Bypass (Co. Limerick) reported less than 10% of night frosts. They all had between 15 & 20 Frost Nights with the highest proportion in January.

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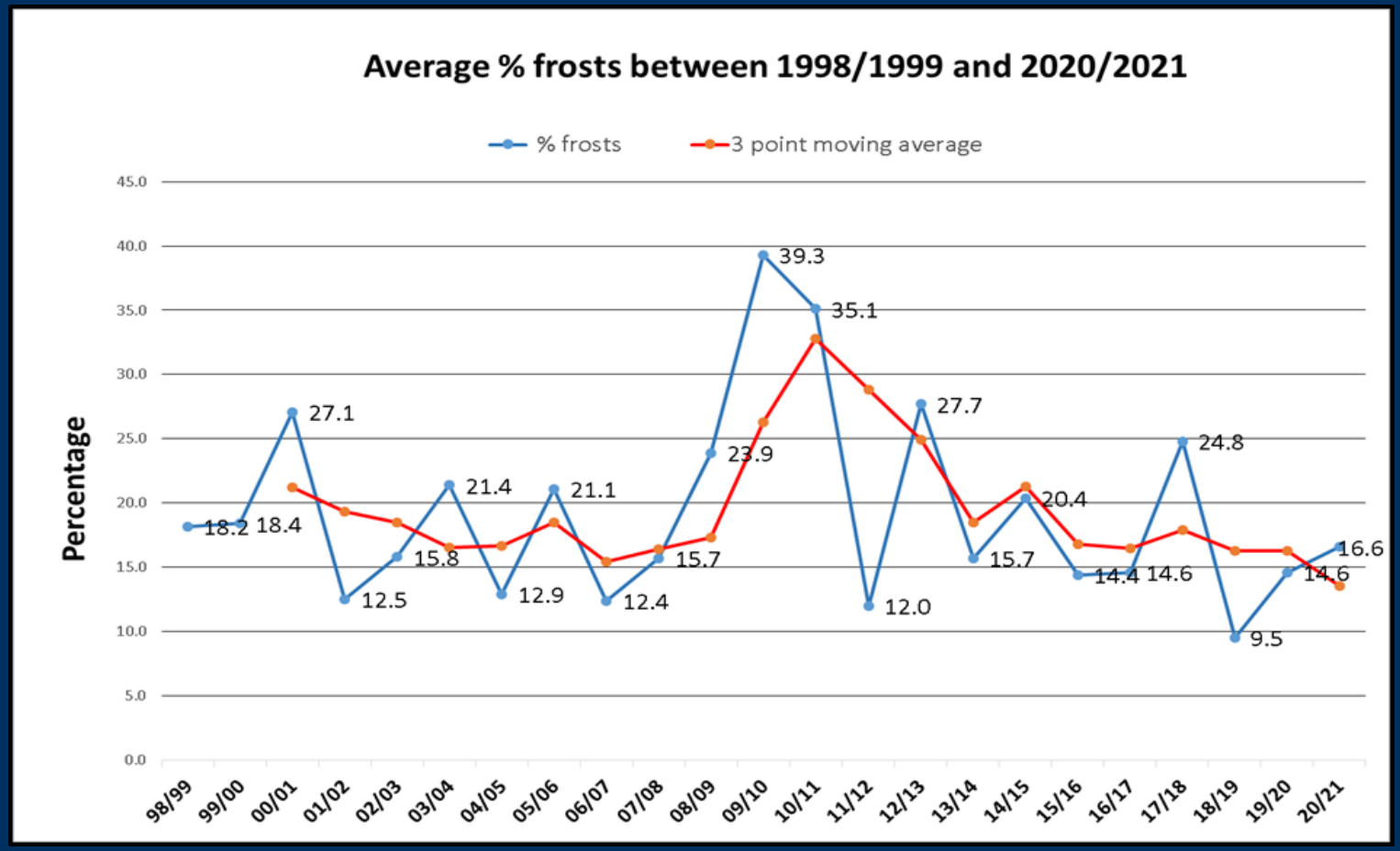
Graph of % frosts



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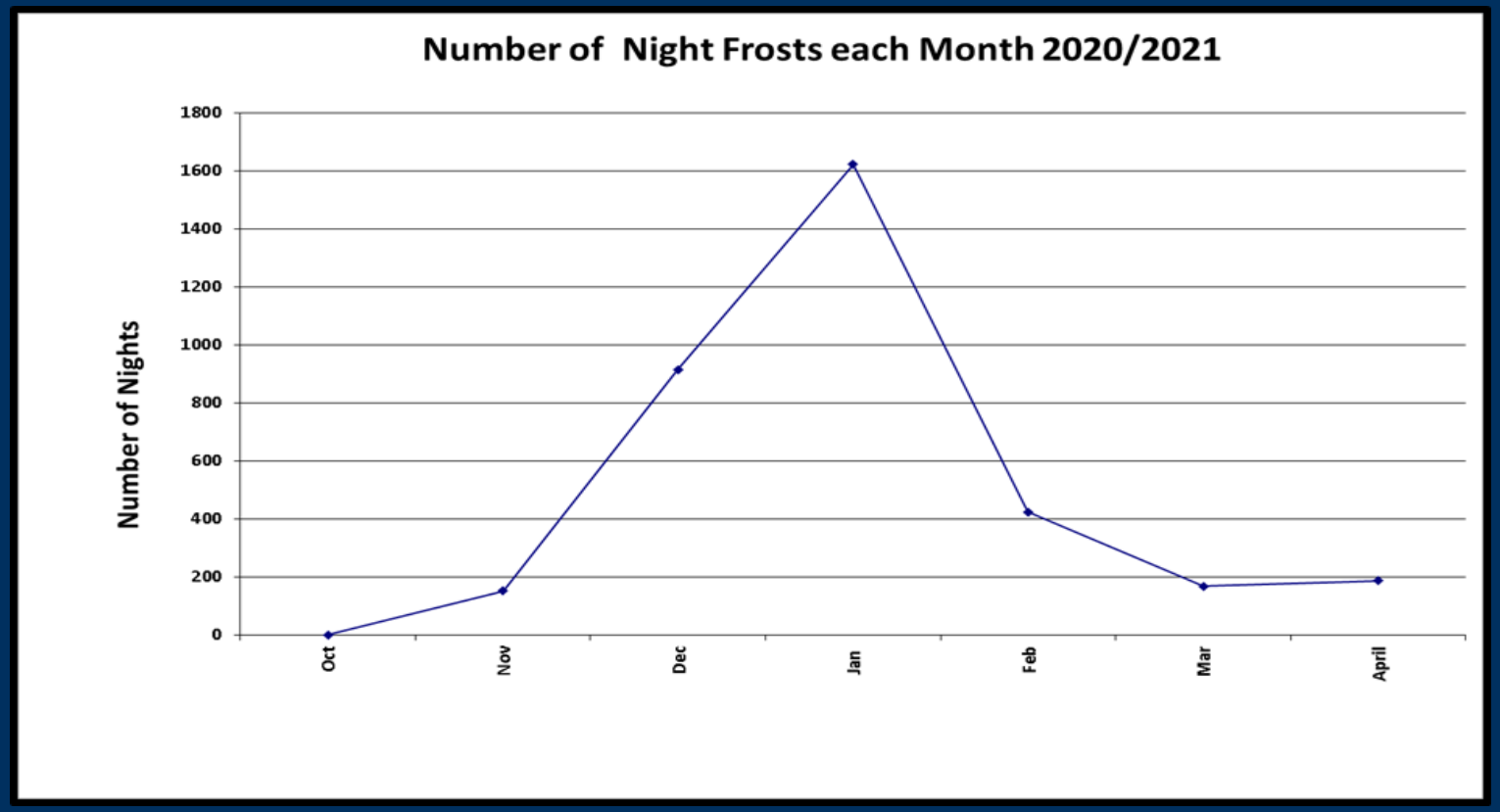
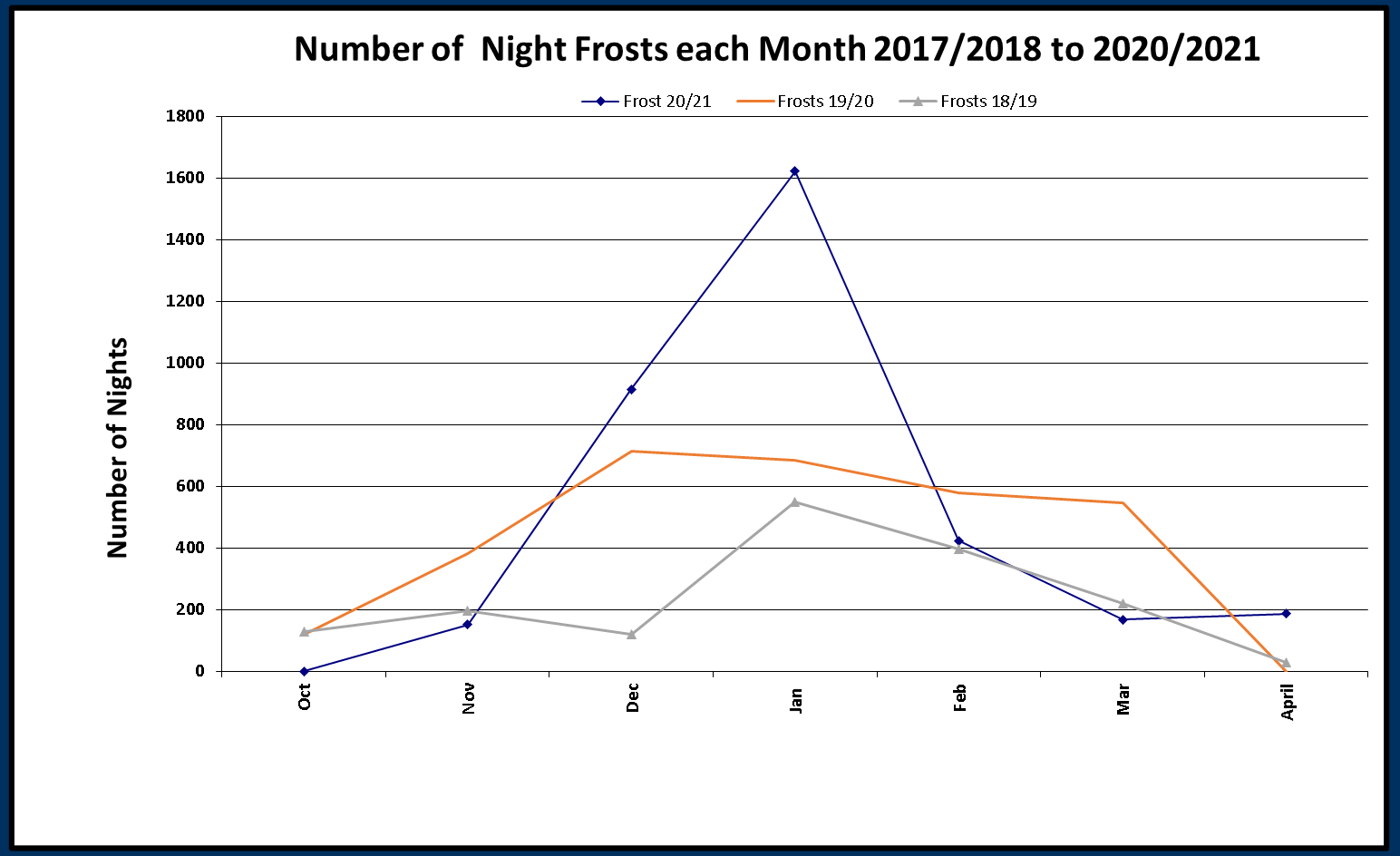
Monthly Breakdown of frosts across the Network



Comparing that to last couple of years….



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Marginal Nights – when RSTs of less than 2°C were observed.

- 2020/2021 recorded 3,106 marginal nights – 14.9% of nights in the season were considered “marginal” – in the 0 to +2°C range
- This represents a significantly lower number of marginal nights that last year which recorded 3,951 or 19% of nights in the marginal range.

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Statistical Analysis of 2019/2020 Season

- The analysis was performed between October 1st 2020 and April 30th 2021
- A total of 212 days across 102 sites
- 20,891 observational days
- The season returned 3,465 site frosts – resulting in an average of 34 frost days per station across the network.

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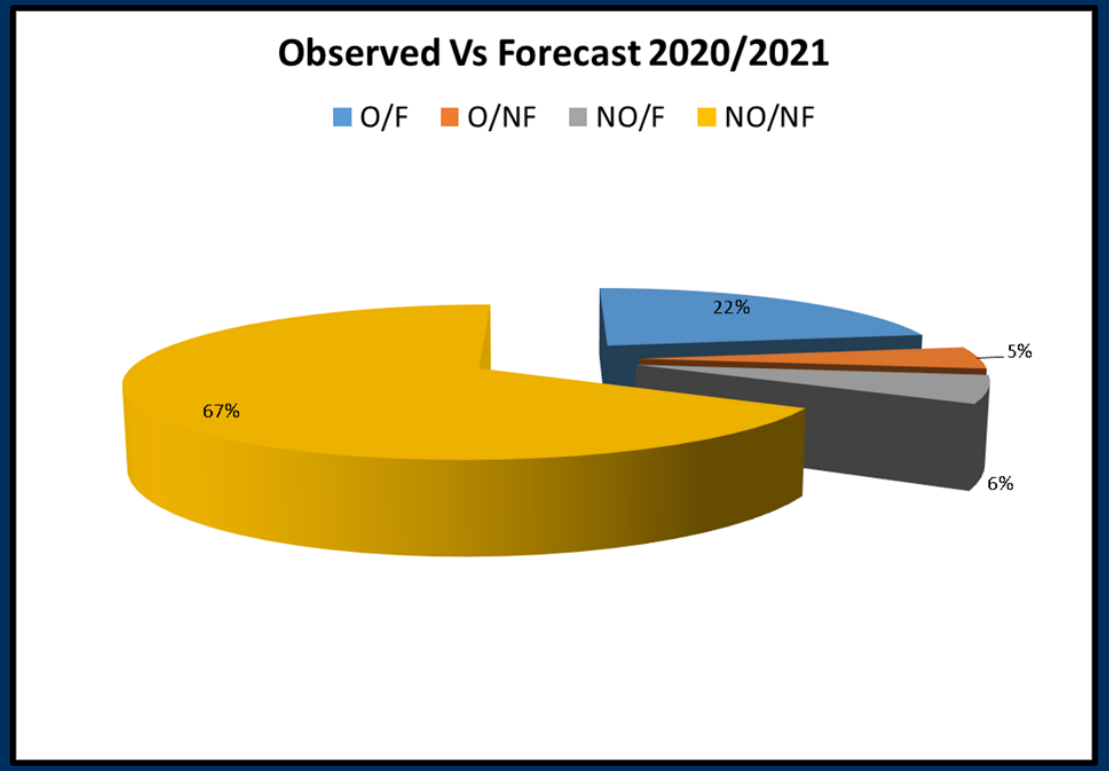
The Statistical Analysis was executed only on "Critical Site Days"



- Critical Site Days refer to days when the RST < 5 °C
- There were 12,763 Critical Days or 61.1% of valid days during the period
- On 3,106 or 14.9% of all valid nights, the minimum RST lay between 0 and 2 °C – marginal nights

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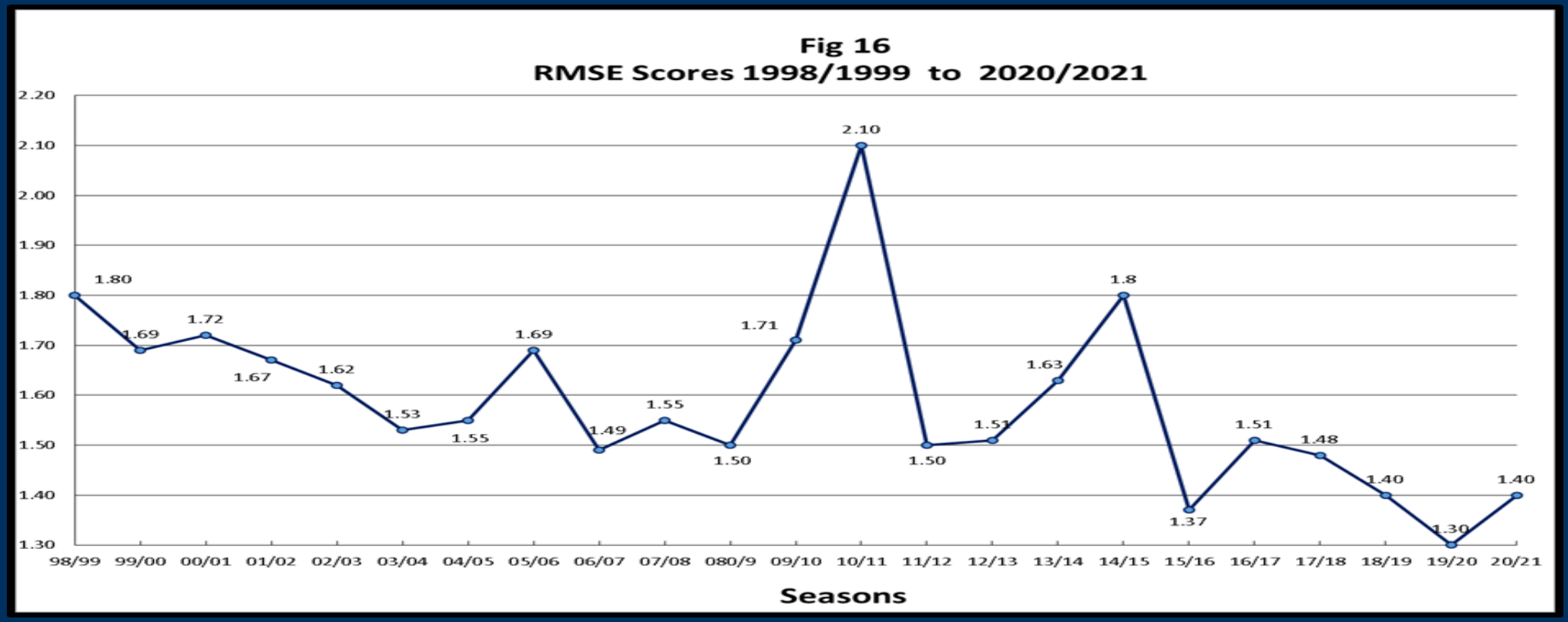
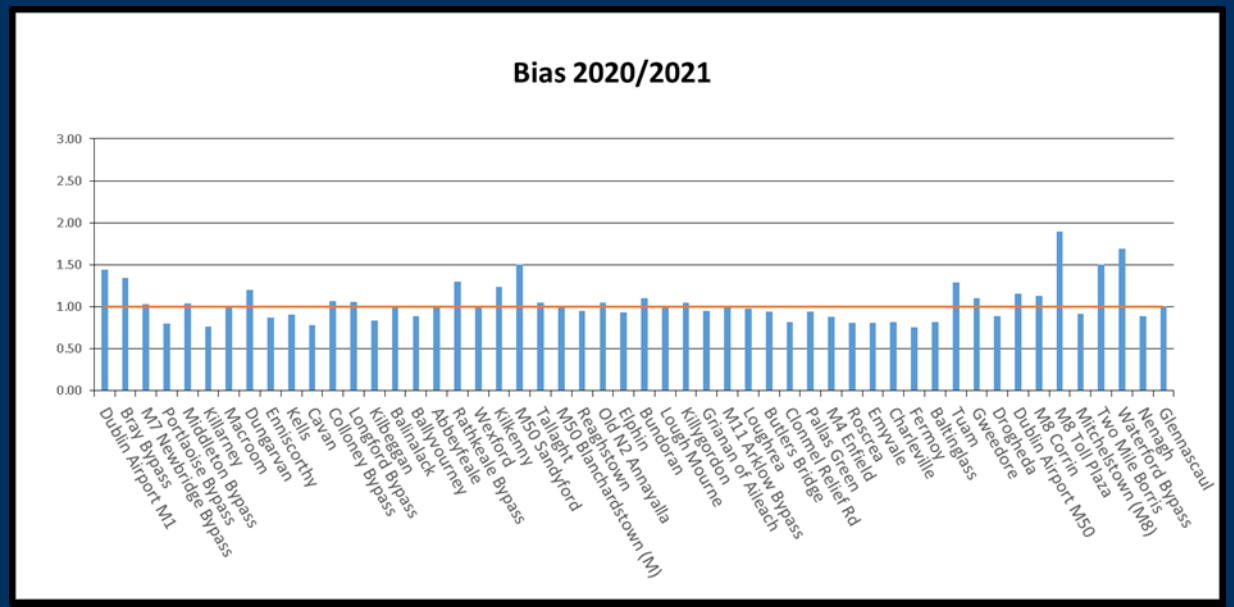
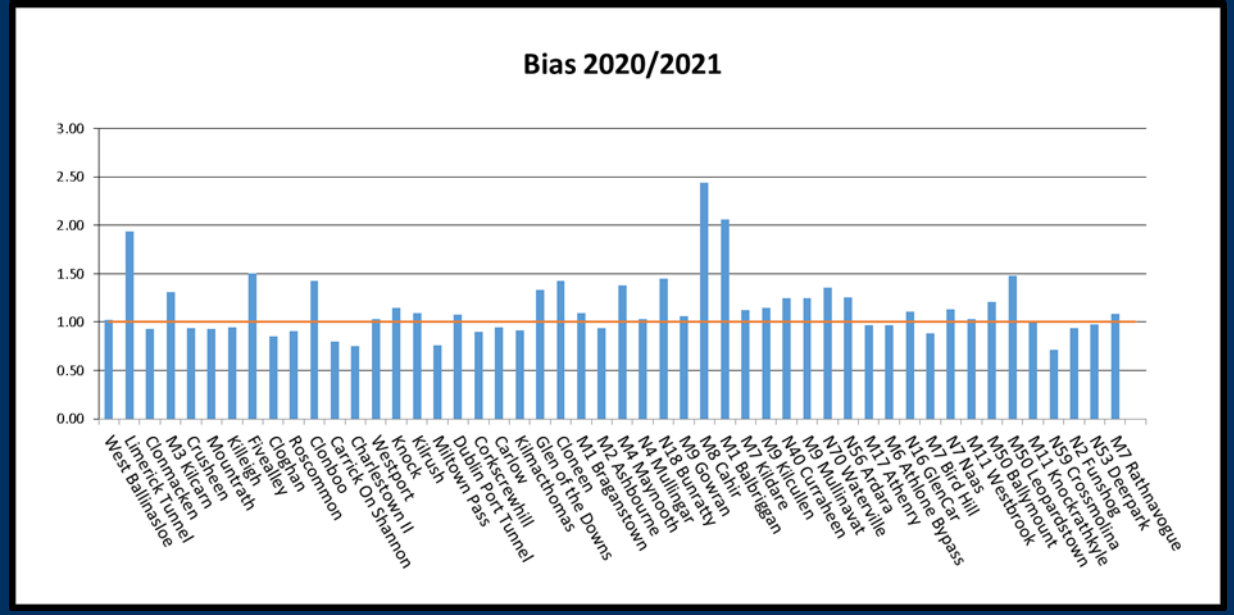
Statistically how did the forecast perform?



Bias

- The average bias across the 102 stations was 1.09 (optimal value is 1)
- 51 stations had a bias >1 (over forecasting of frost)
- 42 stations had a bias <1 (under forecasting of frost)
- 9 stations had no bias = 1





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Summary of statistical results

- Percentage Correct = 89.2%
- Probability of Detection (POD) = 83.5%
- True Skill Statistic = 75.3%
- False Alarm Rate (FAR) = 8.2%
- Critical Success Indicator (CSI) = 67.6%
- Mean Square error (MSE) = 78%
- Mean Error = -0.07

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Factors not captured in the Statistical Analysis

- No evaluation of tabular hazard matrix and text
- No assessment of the consultancy service
- No validation was made of the thermal maps

(On marginal nights , the thermal maps will generally produce lower temperatures (often below zero) over a contiguous sections of road)

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Winter Roadice Service provided by Met Éireann

A brief overview

MET éireann

Two Main Products

- Forecast Curves
- The Tabular Forecast

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Forecast Curves

- The Forecast Curves are a marriage between the Vaisala ICEBreak Model and the Weather Models that Met Éireann provides
- Each Day, the forecaster actively selects which weather model is performing best that day and inputs that information into the ICEBreak model to produce the curves
- There are 2 weather models to choose from:

- HARMONIE
- ECMWF

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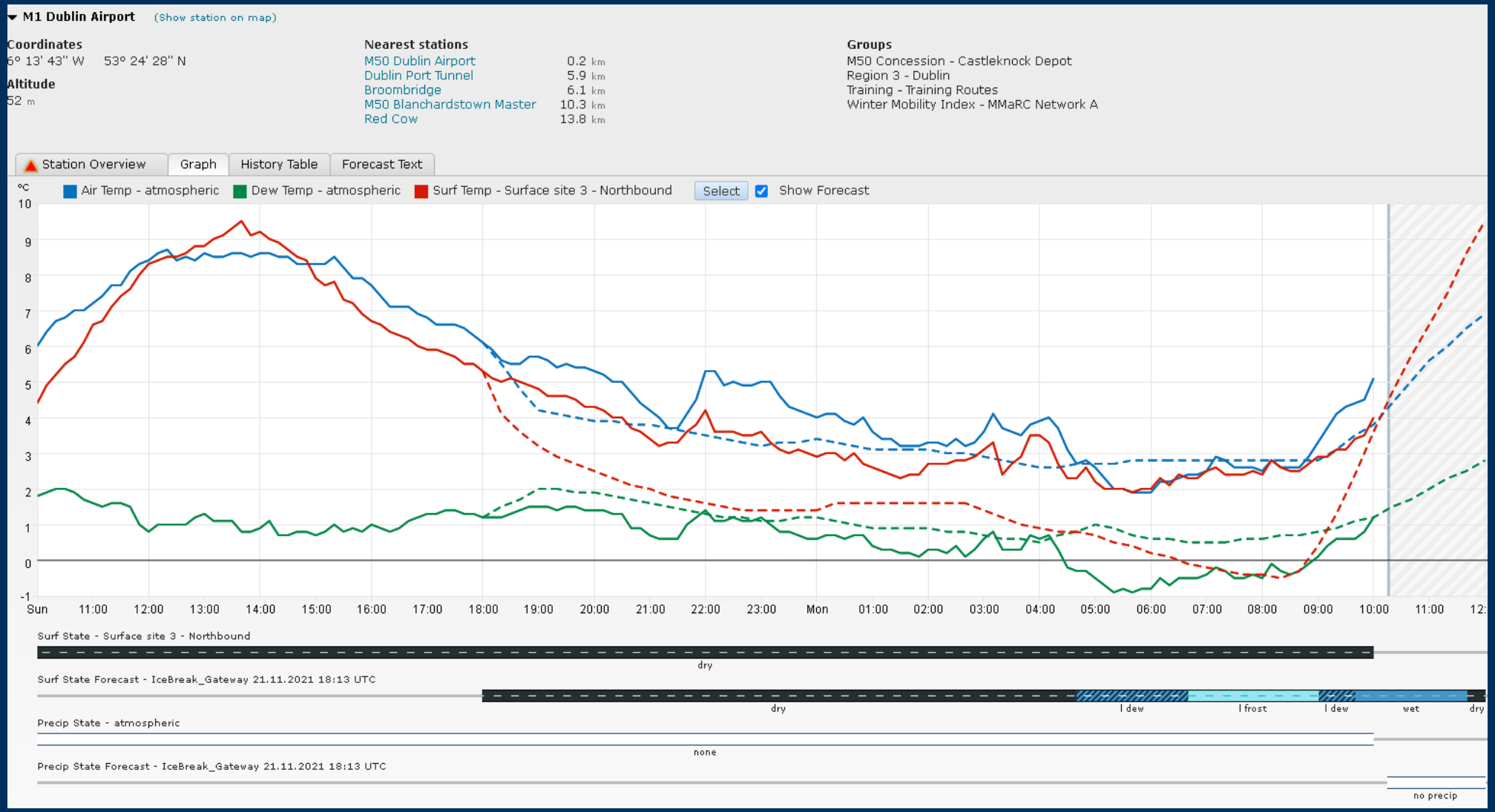
M1 Dublin Airport
(Show station on map)
Coordinates
6° 13' 43" W 53° 24' 28" N
Altitude
52 m
Nearest stations
M50 Dublin Airport 0.2 km
Dublin Port Tunnel 5.9 km
Broombridge 6.1 km
M50 Blanchardstown Master 10.3 km
Red Cow 13.8 km
Groups
M50 Concession - Castleknock Depot
Region 3 - Dublin
Training - Training Routes
Winter Mobility Index - MMaRC Network A
Station Overview
Graph
History Table
Forecast Text
°C
Air Temp - atmospheric
Dew Temp - atmospheric
Surf Temp - Surface site 3 - Northbound
Select
Show Forecast
10
9
8
7
6
5
4
3
2
1
0
-1
Sun
11:00
12:00
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Surf State - Surface site 3 - Northbound
dry
Surf State Forecast - IceBreak_Gateway 21.11.2021 18:13 UTC
dry
l dew
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l dew
wet
dry
Precip State - atmospheric
none
Precip State Forecast - IceBreak_Gateway 21.11.2021 18:13 UTC
no precip

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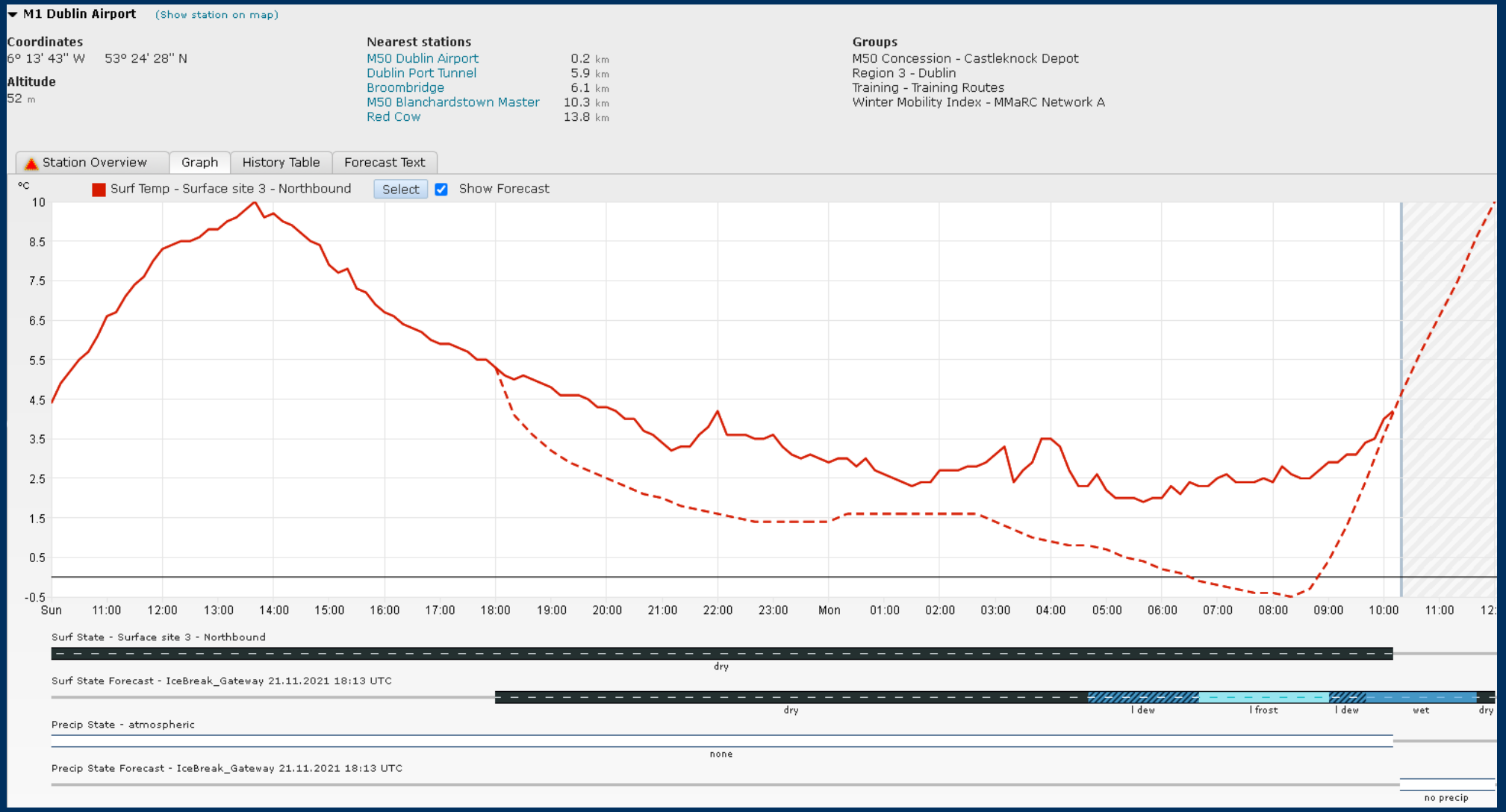
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°C
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Select
Show Forecast
10
8.5
7.5
6.5
5.5
4.5
3.5
2.5
1.5
0.5
-0.5
Sun
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11:00
Surf State - Surface site 3 - Northbound
dry
Surf State Forecast - IceBreak_Gateway 21.11.2021 18:13 UTC
dry
l dew
l frost
l dew
wet
dry
Precip State - atmospheric
none
Precip State Forecast - IceBreak_Gateway 21.11.2021 18:13 UTC
no precip

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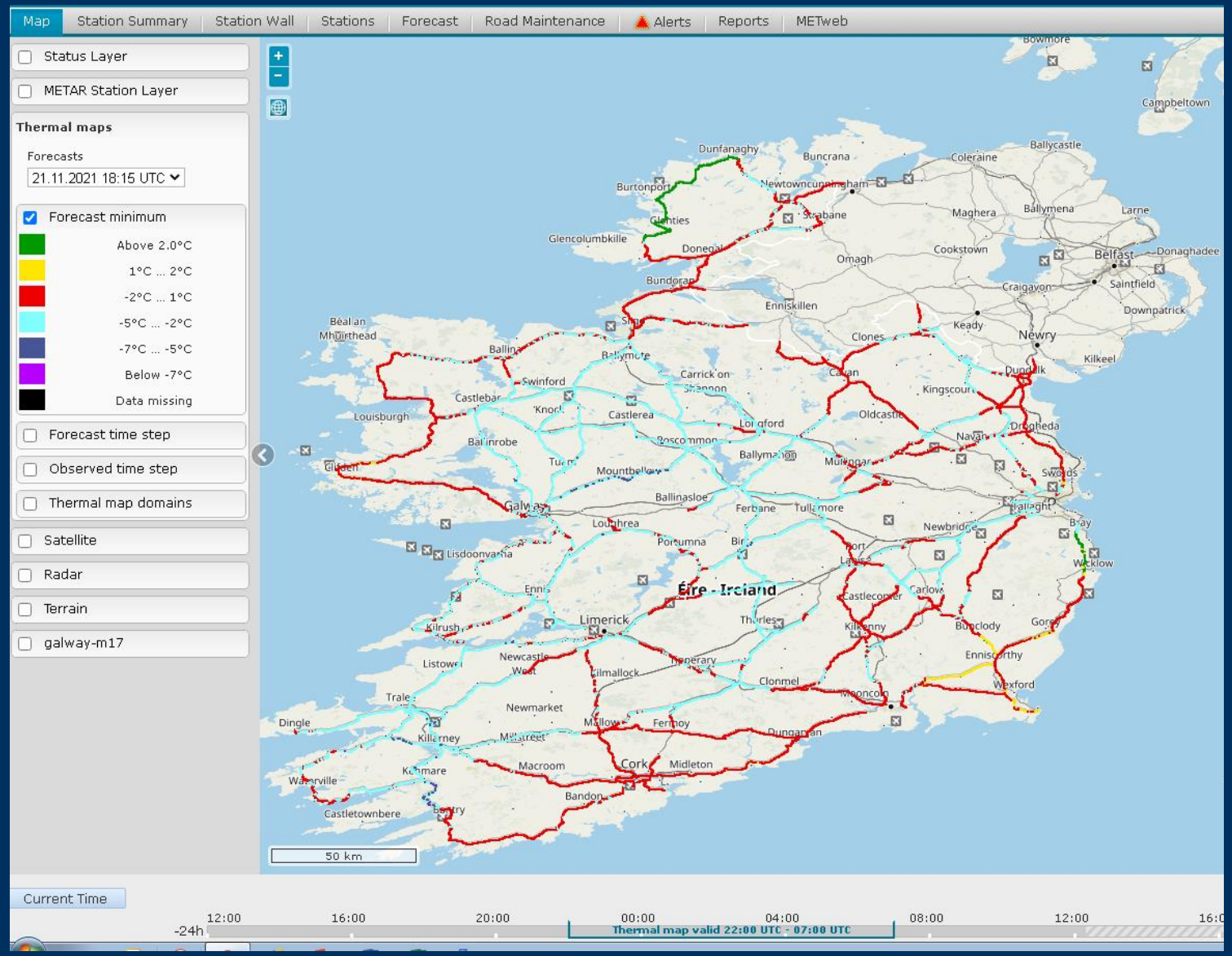
Thermal Map

- Technique to translate “point” forecasts into forecasts for the entire road
- Instrumented vehicle drives the road under different weather conditions
  - Clear, calm nights
  - Cloudy, windy night
  - Clear windy nights etc etc…



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Road Temperature Curves

- If we could produce perfect forecast road temperature curves (and perfect forecasts of frost / ice) – there would be no need for any other information.
- But…
  - Weather is a chaotic system
  - Forecasts are rarely perfect
  - Cloud Cover is a major uncertainty
  - That's why the Tabular Forecast is there

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The Tabular Forecast

- Readiness Colour: Green, Yellow, Orange or Red
- Forecaster Commentary
- Summary of likely risks with confidence levels
- General Text Forecast of Expected Conditions

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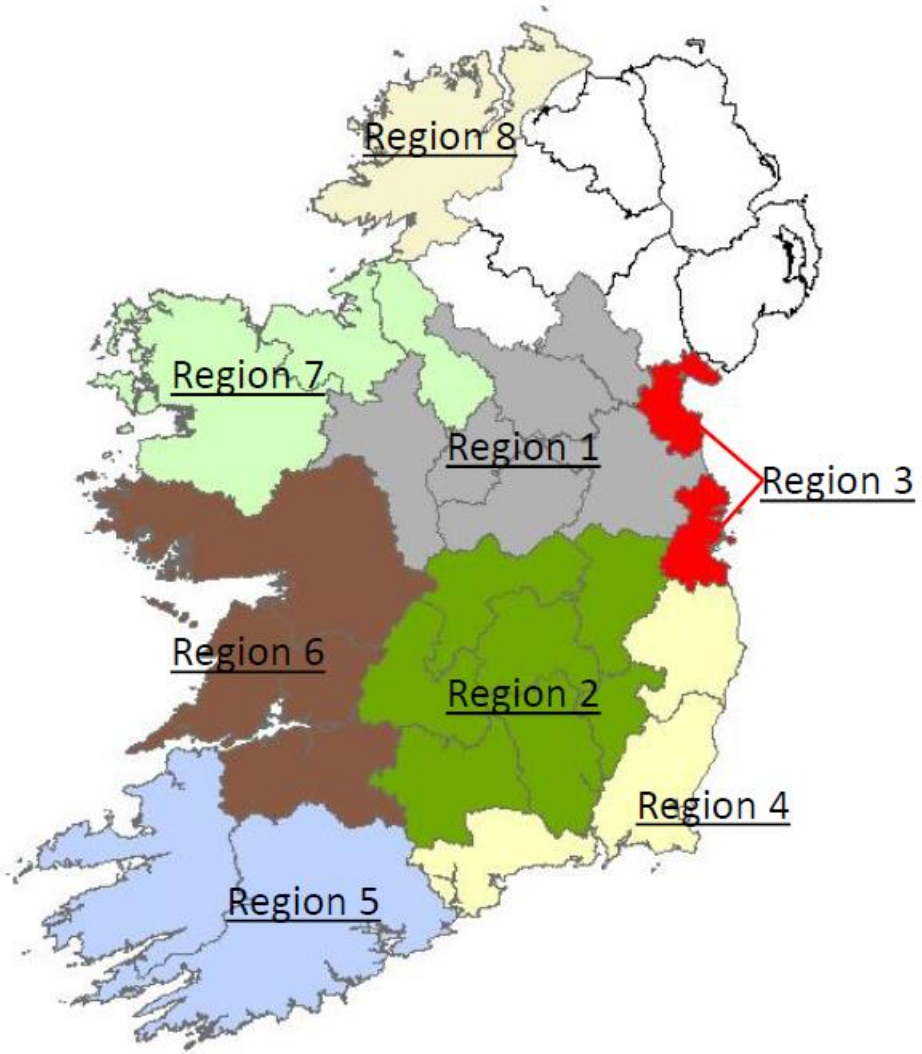
Regions for Road Ice Tabular Forecasts



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Forecaster Commentary: Assessment of Site-Specific Data
A slight risk of frost locally tonight; monitoring is advised. Risk is mainly in parts of Monaghan and Cavan, otherwise frost is not expected. Model run may be overforecasting mist and fog in places so RSTs may fall lower than forecast.

Readiness Colour	YELLOW

Hazard Summary

Element	Y/N	Confidence	Details
Ice	N	M	Ice is unlikely as temperatures are unlikely to be cold enough for long enough.
Hoar Frost	Y	L	A marginal risk of frost forming in Cavan and Monaghan towards morning.
Snow	N	H	
Hail	N	H	
Fog	Y	M	Patches of mist and fog forming overnight as breezes are light.
Strong Wind	N	H	
Rain	Y	M	Showers through the period, isolated through tonight and into tomorrow morning.

Minimum Temperature Summary

	Temp (C)	Time Temp First Falls Below Zero
Air	2 to 4	
All Roads	0 to +3	
Urban Roads	1 to 3	

24 Hour Weather Summary

Today: Today will be mainly cloudy with scattered showers, though some sunny spells will develop through the afternoon. Highest temperatures of 7 to 9 degrees in a light southerly breeze, veering westerly later.

Tonight: Tonight will stay mostly cloudy with occasional clear spells. Most areas will be dry with just isolated showers. Patches of mist and fog will form in a light westerly breeze. A very slight risk of frost locally in the north of the region, with lowest air temperatures of 2 to 4 degrees.

Tomorrow: Tomorrow will bring a mix of cloud and sunny spells again. The morning will be largely dry but scattered showers will develop through the afternoon and evening. Highest temperatures of 6 or 7 degrees in a light westerly breeze, gradually veering easterly through the day.

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Readiness Colour – what does it mean?

- Yellow 
  - Slight/Low* risk of frost or ice at prone locations within the region
  - Cannot fully guarantee green, so monitoring is advised
  - *As a rough guide, slight means <33% chance
- Orange 
  - A significant* or elevated risk of frost/ice.
  - RSTs are very close to zero at a number of locations in the region the graphs are dipping below zero for short periods
  - *significant in this context would indicate 33 – 70% chance
- Red 
  - Frost/Ice is certainly expected.
  - A significant number of the graphs are below zero for a significant amount of time
  - 70 – 100% Chance.

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Forecaster Commentary

- Not a forecast but a commentary on the forecast
- Can give information on the confidence level which the forecaster has
- Can point out possible difficulties – like variable cloud cover or the possibility of fog instead of frost.

Forecaster Commentary: Assessment of Site-Specific Data
Slight risk of frost forming locally overnight tonight. Generally cloudy conditions will keep RSTs above freezing in many areas but where clear spells do occur, RSTs will fall close to or below freezing. Where the model does not capture the clear spells fully, RSTs may fall below the forecast curves.

Readiness Colour	YELLOW

Forecaster Commentary: Assessment of Site-Specific Data
There is uncertainty regarding the timing of the arrival of a warm front. Should it come in later, RSTs will drop lower than curves would suggest. Monitoring of the curves is therefore advised.

Readiness Colour	ORANGE

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How does it look for this Winter?

- The overall signal from the models is still for a mild winter with average rainfall.
- However, last year at this time the models were forecasting a very mild winter also and we ended up having a cooler than average December and January due to a disrupted stratospheric polar vortex (SPV) and a sudden stratospheric warming (SSW) in early January.
- La Nina, as we currently have and had last winter, generally favours cooler and drier early winter, mild and wetter late winter without a SSW. This year we also have an easterly QBO, which can then lead to the breakdown of the SPV.
- We may have an SSW this winter, either in December or January, however the seasonal models cannot predict this with any degree of accuracy, hence the models are showing a mild outlook.
- The updated winter forecast in December will probably be for a mild winter overall, as the models are showing, but with the caveat that if we do have a SSW, the following month or two have a much greater chance of being cooler than average - like what happened last winter.

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Latest Monthly Forecast

- 26th Nov – 2nd Dec: Changeable with spells of rain and strong winds at times. Fluctuating temperatures. Potential for wintry precipitation this weekend followed by milder weather early next week.
- 3rd – 9th Dec: Milder than normal overall with low pressure dominating bringing rain and showers.
- 10th -16th Dec: Settling down with high pressure becoming more dominant. Below average precipitation. Temperatures near or slightly above average.
- 17th -23rd Dec: High pressure maintaining dominance. Temperatures near average. Precipitation below normal.

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Thank you for your attention.

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