NWSRG
NATIONAL WINTER SERVICE RESEARCH GROUP

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How Climate Assessments have helped practitioners apply the NWSRG Guidance (Section 12) in relation to Weather Forecasting

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6th November 2024

Dedicated to advancing understanding of best practice for winter service delivery

Overview

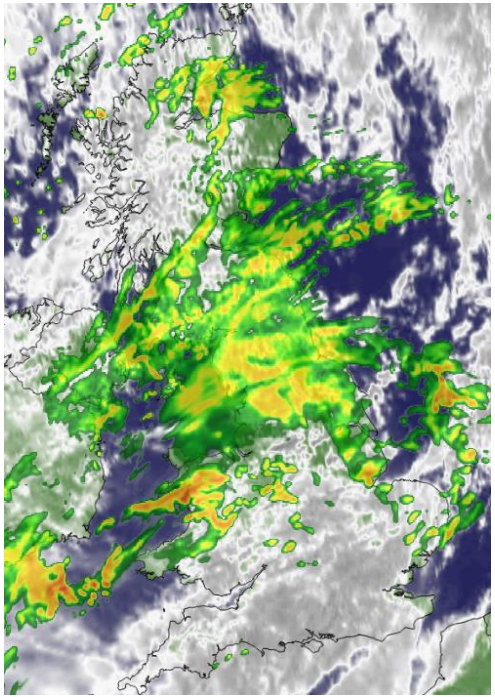
- NWSRG Guidance – Section 12
- Providing a data-led climatological, topographical and meteorological review of a network
- Deciding the most suitable approach
- Case studies:
  - Highland Council – Weather Station Review
  - Stirling Council – Domain Review

NWSRG Guidance – Section 12

The most important variable in road network risk is the weather.

…therefore…

The most important tool is weather forecasts.



NWSRG Guidance – Section 12

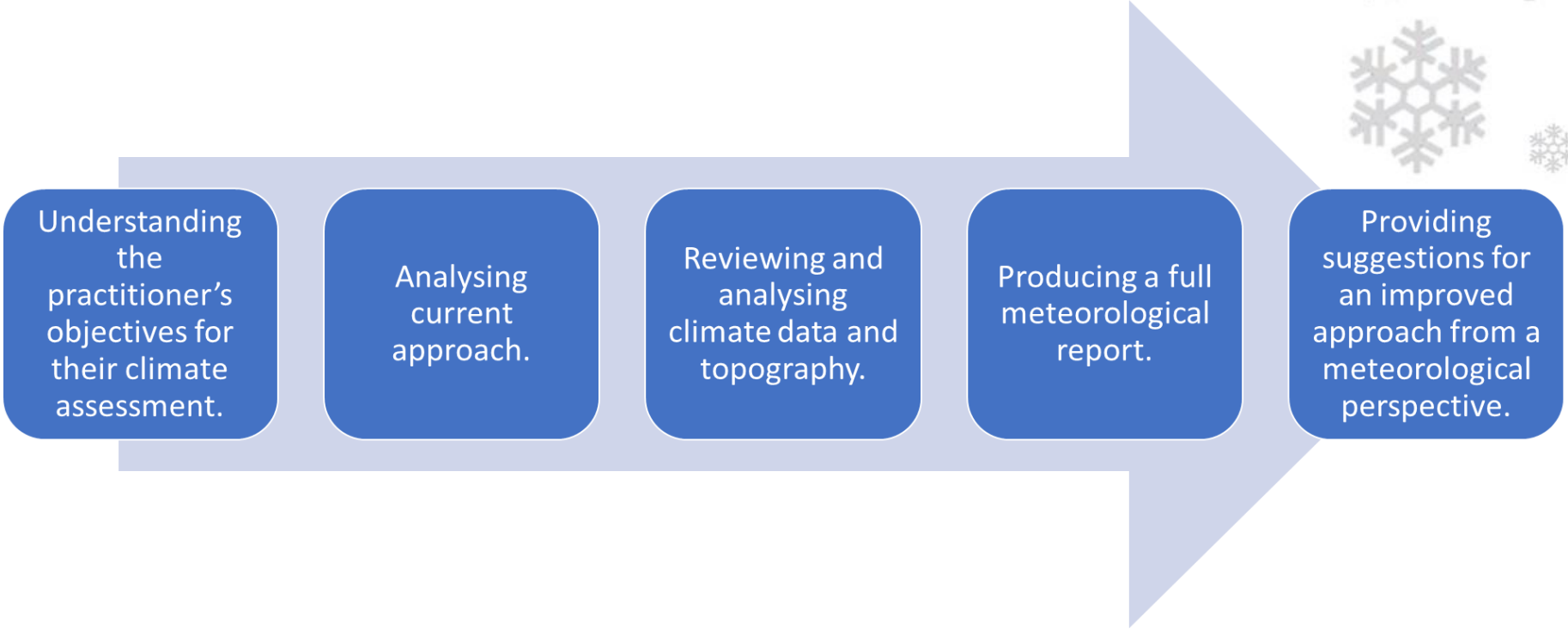
- Are the most appropriate weather forecasting services being procured?
- Has increasing the resolution of the forecasts been considered?
- What is the most effective approach for your network?

	12	13	14	15	16	17	18	19	20	21	22	23	00	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23	00
RST (c)	0.0	0.5	0.1	-0.7	-1.6	-2.5	-3.3	-3.7	-3.9	-3.8	-3.9	-3.9	-3.8	-3.6	-3.3	-3.0	-2.7	-2.4	-2.2	-2.1	-2.2	-2.4	-1.0	1.5	3.2	3.8	3.6	2.6	1.7	0.8	0.0	-0.5	-0.7	-0.7	-0.4	-0.4	-0.8
Air Temp (c)	-0.1	0.0	-0.1	-0.7	-1.8	-2.9	-3.5	-3.8	-3.8	-3.7	-3.8	-3.7	-3.6	-3.5	-3.1	-2.9	-2.5	-2.2	-2.0	-1.8	-2.0	-2.2	-1.2	-0.2	0.8	1.5	1.8	1.7	1.4	1.0	0.2	-0.3	-0.4	-0.3	-0.2	-0.5	-0.9
Weather Type	I	W	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	S	S	S	S	I	I	W	W	W	D	D	D	D	D	D	D	D	D	D	S
Hoar Frost	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N
Ice	Y	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	Y	Y	Y	Y	Y	Y	N	N	N	N	N	N	N	N	N	N	N	N	N	Y
Snow Accum. (cm)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.2	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Wind Speed (mph)	12	12	11	10	8	7	6	5	5	4	4	4	4	4	4	4	5	5	5	6	6	7	8	8	9	11	11	11	11	12	12	11	11	11	11	9	7
Visibility (km)	27	28	30	30	25	19	16	14	14	15	16	20	21	21	22	23	20	14	9	14	13	13	15	18	29	33	35	27	28	26	25	26	19	18	17	18	19
Precipitation (mm)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.2	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1
Dew Point (C)	-6.0	-5.8	-5.6	-5.1	-4.7	-4.8	-4.9	-5.1	-5.1	-5.0	-4.9	-4.9	-4.9	-4.8	-4.8	-4.8	-5.0	-4.2	-3.6	-3.3	-3.3	-2.6	-2.1	-2.0	-1.8	-1.8	-1.8	-1.8	-1.9	-1.9	-2.0	-2.1	-2.0	-1.9	-2.2	-2.3	-2.4

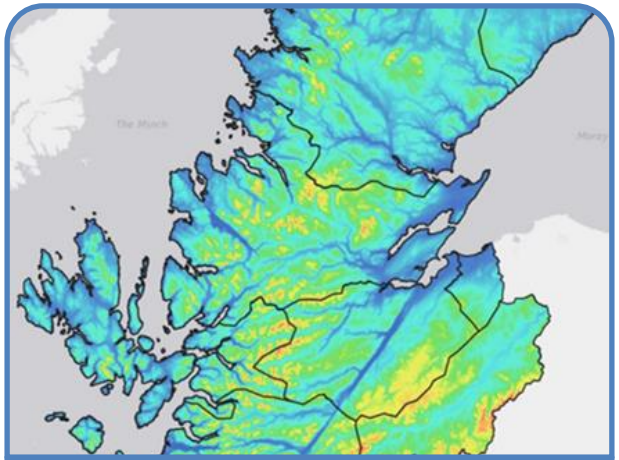
Data-led climatological, topographical and meteorological review of a network

- Identify a network's geographical and climatological features and impacts.
- Assess potential for vulnerable locations across a network.
- Support effective decision making, risk management and mitigation.
- Focus resources on areas at greater risk of weather-related hazards.

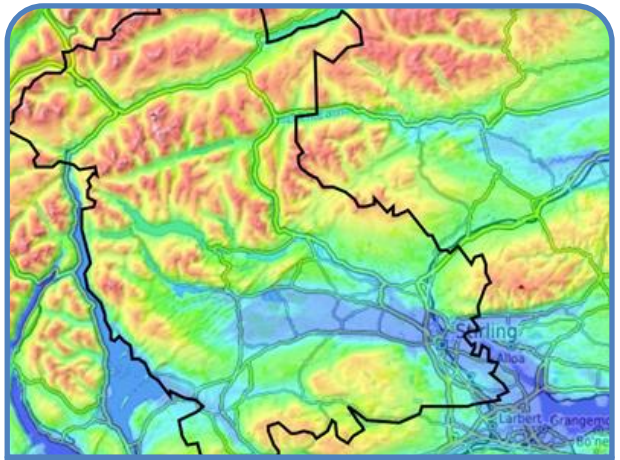
Most suitable approach for a network



Case Studies



The Highland Council



Stirling Council

Case Study – The Highland Council

Current Approach

Route-based

Purpose of Study

Review current need and potential viability of further weather stations to enhance reliability and resilience.

Case Study – The Highland Council

Climatological and Topographical Overview

8 regions with lots of variation.

Greatest risk of winter hazards often on higher ground…

…except for on cold, calm nights - Katabatic flow.

Frost hollows.

Skye and Lochalsh sees highest mean air temperatures during the winter (2°C) .

Badenoch and Strathspey sees mean air temperatures below zero during the winter.

Most precipitation in the West. Lochaber sees the greatest amount with up to 1,300mm during the winter.

Average no. winter ground frosts between 35-70. Nairn and Badenoch and Strathspey seeing a slightly higher frequency.

Average no. lying snow days in the Cairngorms is > 60. Most of the network sees < 40 days, with western areas falling below 20.

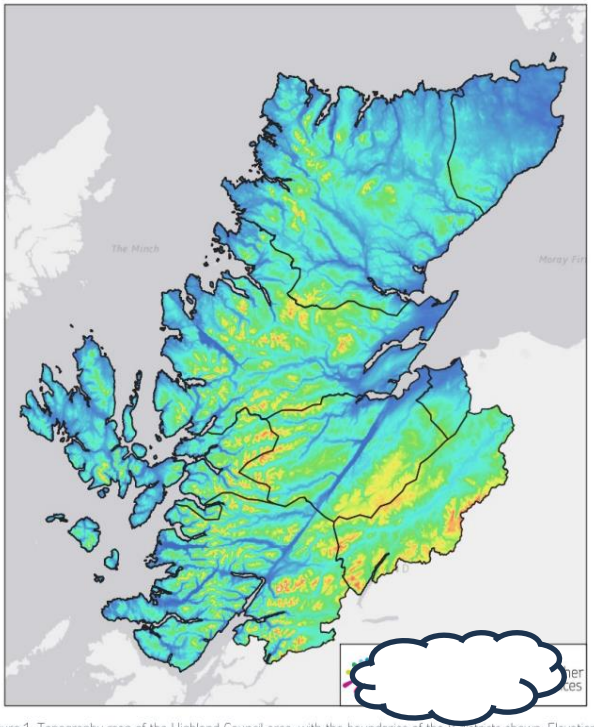


Figure 1: Topography map of the Highland Council area, with the boundaries of the 8 districts shown. Elevation is displayed, with lower altitudes represented by blue, and higher ground as oranges and reds.

Case Study – The Highland Council
Current Weather Station Review - Sutherland

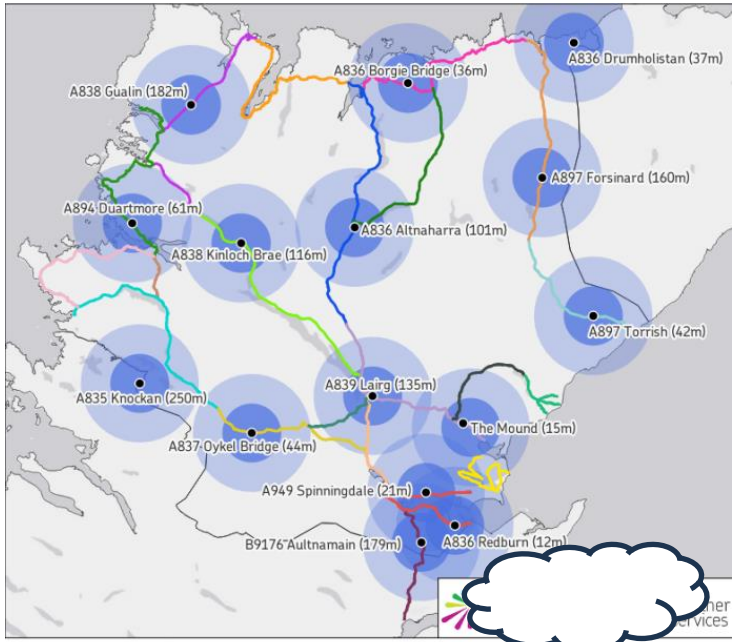


Figure 3: A map of the primary route network of Sutherland showing the position of the current weather stations.

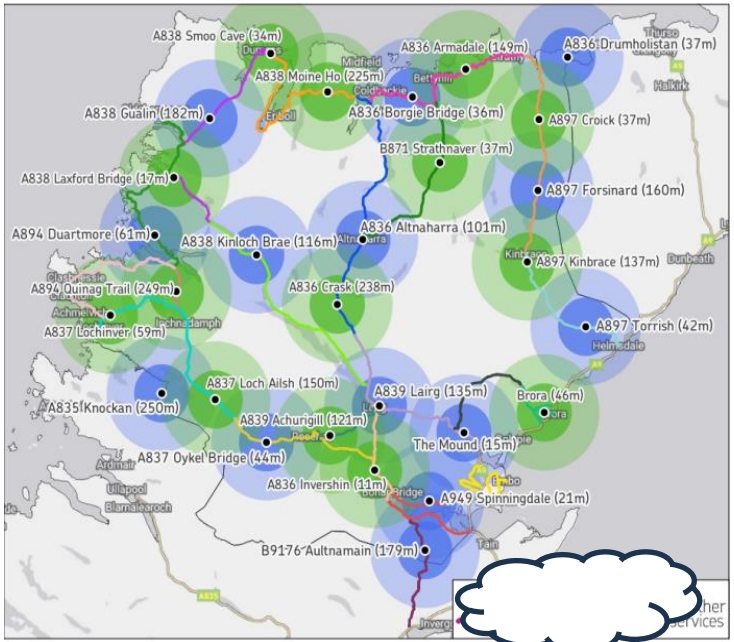


Figure 11: Sutherland's current and proposed weather station network.

Case Study – The Highland Council
Current Weather Station Review – Skye and Lochalsh

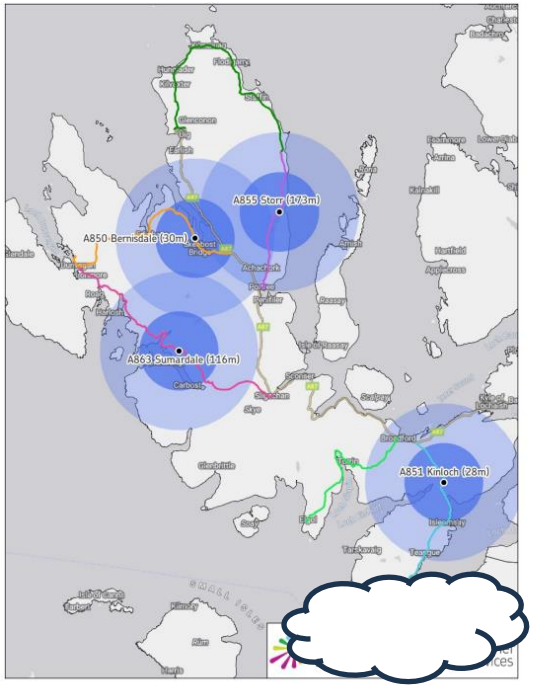


Figure 8: Locations of the current weather stations used in winter maintenance operations for Skye and Lochalsh.

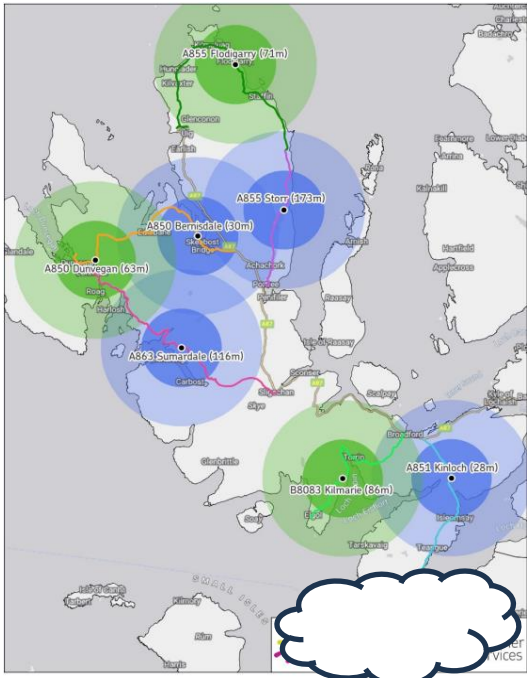


Figure 16: Current and proposed weather stations across the Skye and Lochalsh network.

Case Study – The Highland Council
Weather Station Types

Full Weather Stations

All information for both forecasting and monitoring.

Improved understanding of potential weather hazards.

30 Full Weather Stations proposed

Infill Stations

Lack of measurements from all parameters could result in inaccuracies in forecasting and monitoring.

Lower Financial cost where there is a lack of weather station coverage.

18 Infill Stations proposed

Case Study – The Highland Council
Relocation of Current Weather Stations

- Relocation due to unsuitable locations.
  - Limited sky view

Case Study – The Highland Council Conclusions

Highly diverse landscape with distinct climatological features.

Areas of the network with little/no coverage.

Some relocations recommended.

48 potential network additions.

Increasing efficiency, reliability and resilience.

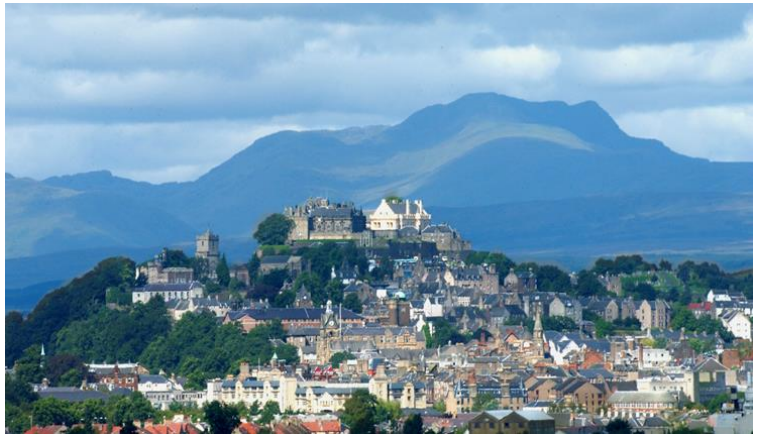
Case Study – Stirling Council

Current Approach

Two domains

Purpose of Study

Assessing the options for adding additional domains to improve operational and cost efficiency



Case Study – Stirling Council

Climatological and Topographical Overview

Large variety of different topography.

Altitudes of >1000m in the West and at sea level at the Forth river basin.

Areas of low altitude climatologically result in higher air temperatures.

Well populated lower ground has a warming influence.

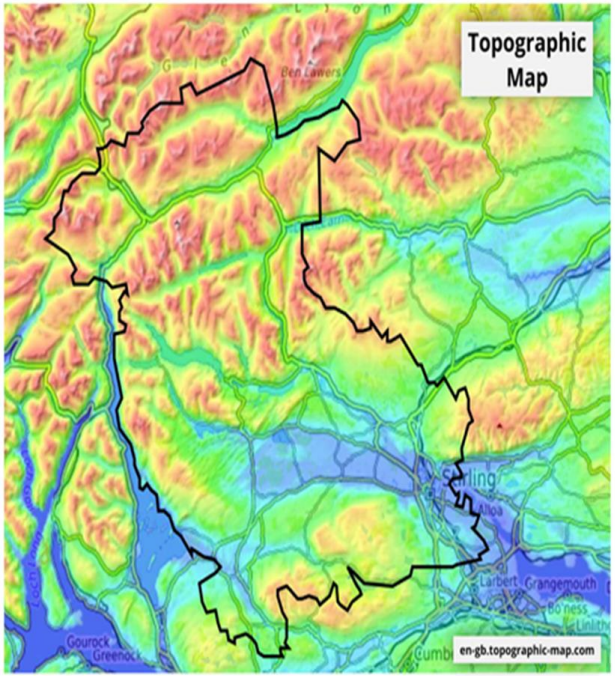
A drier and sunnier climate is seen in the South-East.

V shaped valleys are conductive to the pooling of cold air.

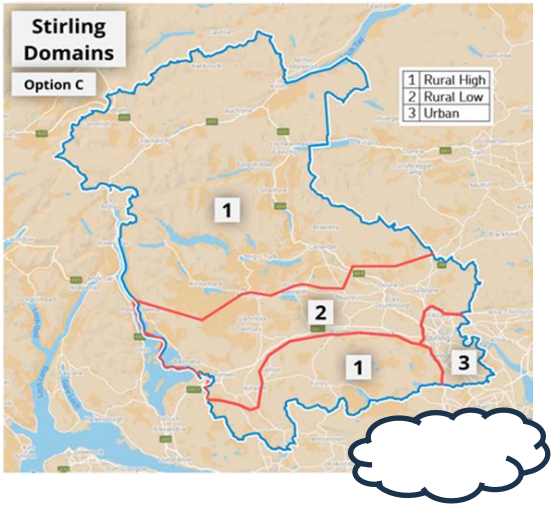
>300m of altitude variation of primary gritting routes.

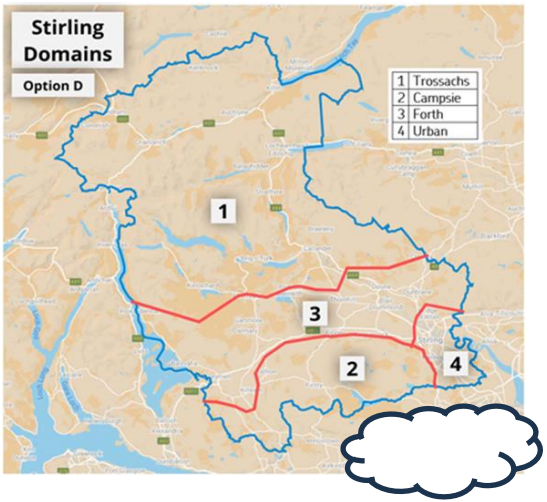
Average winter air temps between 2 and 4.5°C.

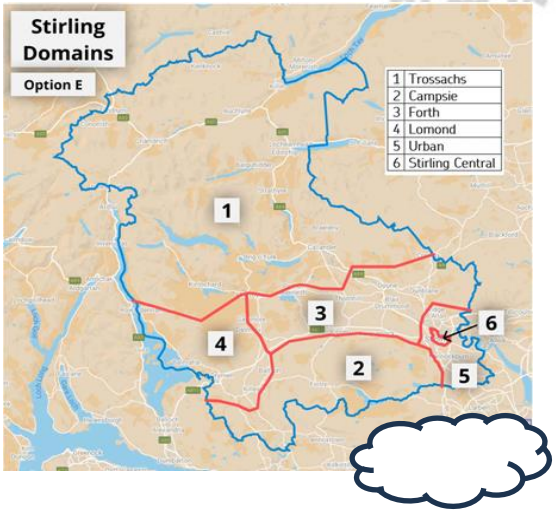
Average of 40-80 air frosts, and 10-40 snow days.



Case Study – Stirling Council Proposed Domain Approaches







Case Study – Stirling Council Conclusions

Varied climatic properties across the network.

Very well-suited to move to at least three domains.

Route-based forecasts potentially viable – Examination required.

Potential requirement for additional weather stations.

Summary

Each authority's objectives are unique and are analysed as such.

Every network has its own geographical features and impacts.

Identifying vulnerable locations could improve operational efficiency.

Climate Assessments aid the application of NWSRG guidance.

NWSRG
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