The decreasing importance of road weather forecasts

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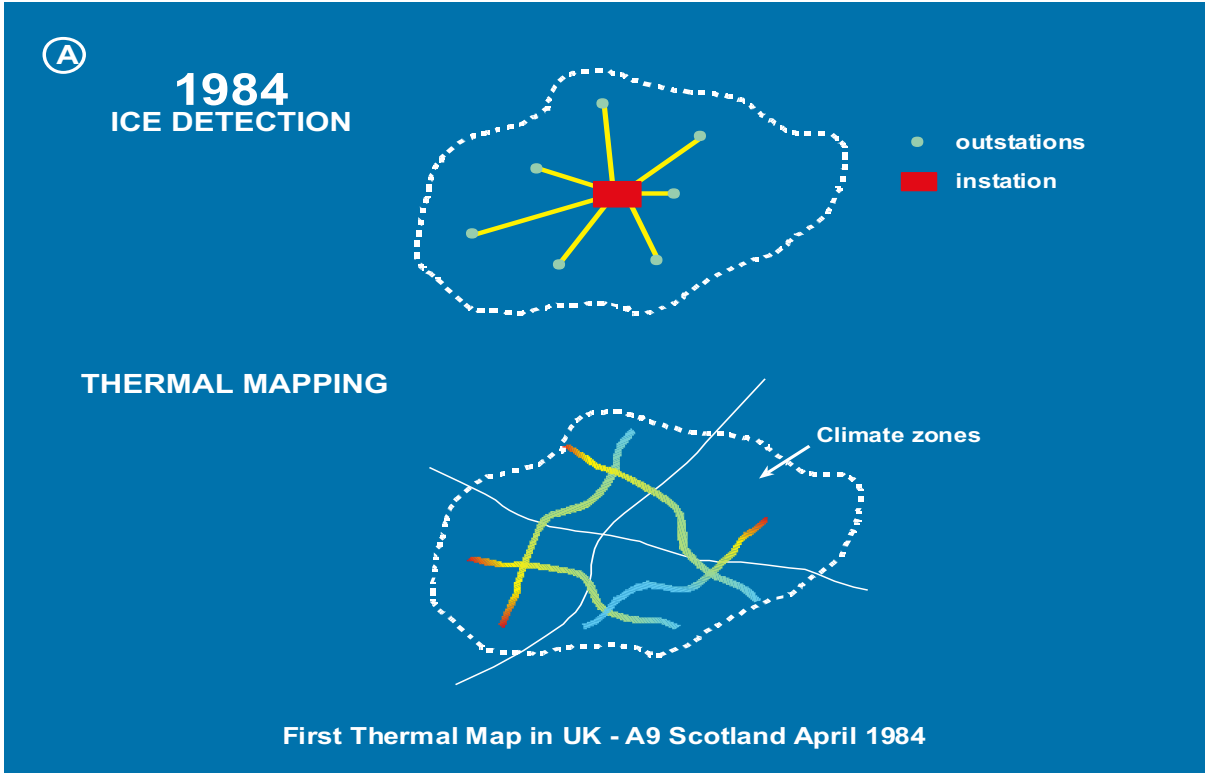
The importance of road weather forecasts

- Estimated UK spend is £1500m+ in a normal winter
- Salt corrodes £200m+ of structures each year
- Disruption in Winter 2010/11 was estimated to cost the economy over £600m per day.
- Cost:Benefit is estimated at 1:9

- Where would be without road weather forecasts?

40 years ago

1980s
1990s
2000s
2010s
2020s
2030s
2040s



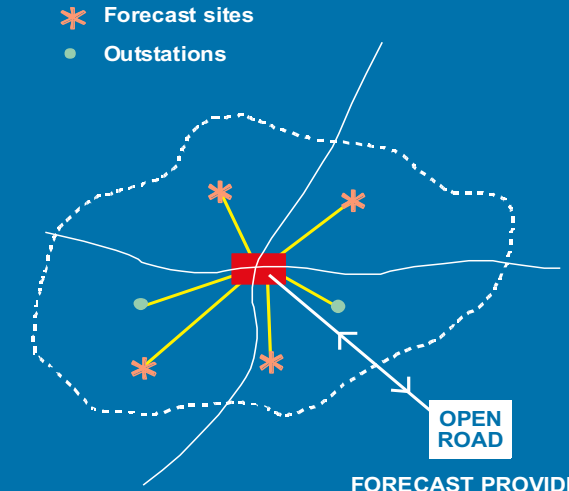
40 years ago

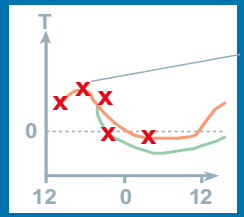
1980s	
1990s	
2000s	
2010s	
2020s	
2030s	
2040s	

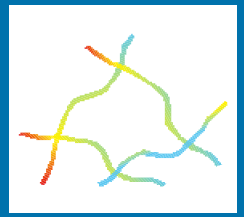
"*Road surface temperatures are expected to fall below zero at 2 a.m. and ice is expected to form on most of the roads in the region.*"

1980s
1990s
2000s
2010s
2020s
2030s
2040s

Ⓑ 1986 ICE PREDICTION







Forecast
Thermal Maps

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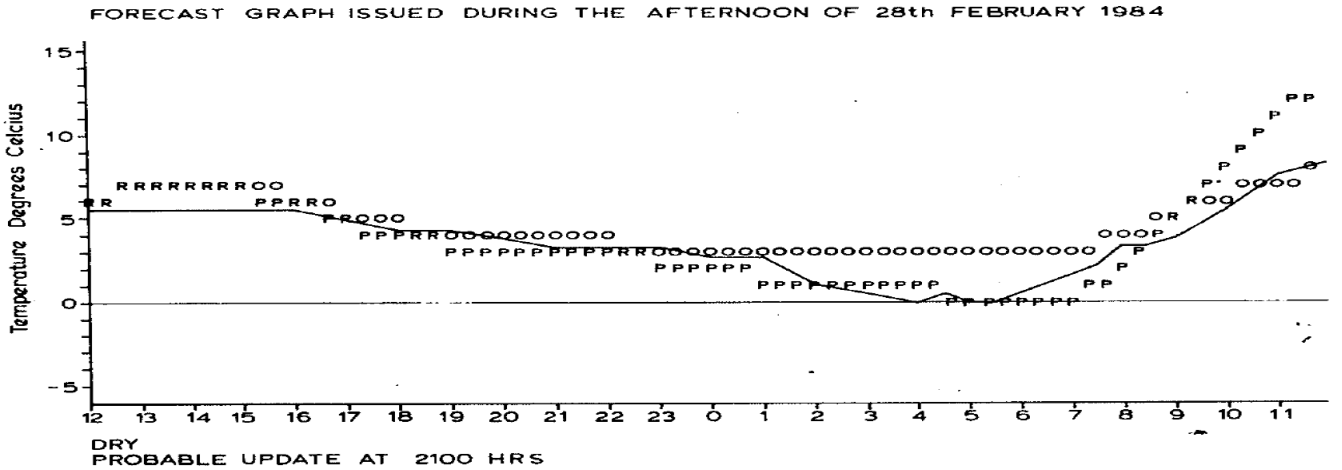
Probabilistic Forecasting (1980s style)

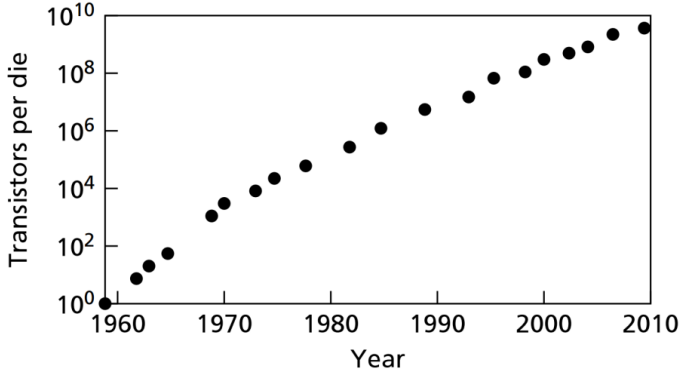
1980s
1990s
2000s
2010s
2020s
2030s
2040s



Deterministic Forecasts

1980s	
1990s	
2000s	
2010s	
2020s	
2030s	
2040s	

- It was the best we could do
  - 30 mins to run a forecast for one site

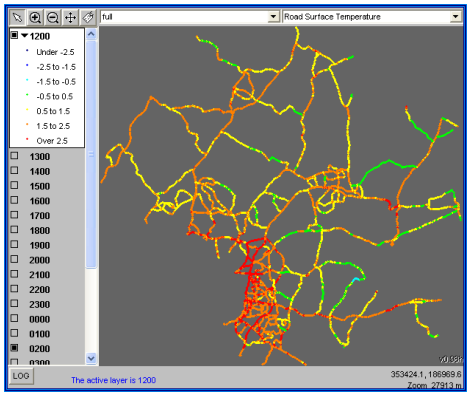


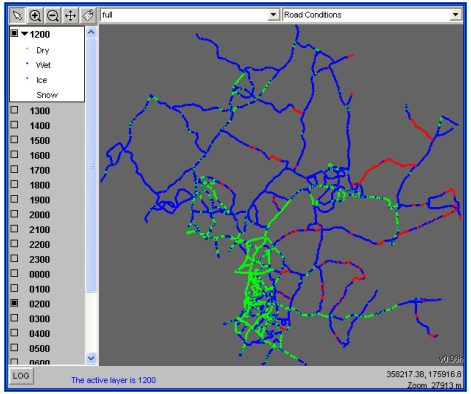
- Despite increasing computer power, road weather forecasts have remained deterministic in nature but...
- ...large advances in mesoscale models which drive the downscaling

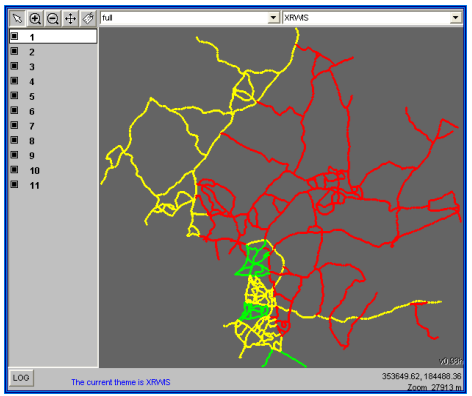
20 years ago

1980s
1990s
2000s
2010s
2020s
2030s
2040s

- Increasing computer power was instead been used by the winter road maintenance community in other ways:
  - Salting Route Optimisation }
  - Decision Support Systems } Selective Salting
  - Route Based Forecasting }







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Now

- Despite all the technologies, selective salting is still not happening
- In an age of litigation, users are very wary about relying on model output to this level.

- Observations remain key…

Wintersense

1980s	
1990s	
2000s	
2010s	
2020s	
2030s	
2040s	

- Low-cost option for RST measurement that has the potential to be deployed at the same resolution as a route based forecast
  - Based on the Internet of Things
  - Game Changing in network densification and confidence building

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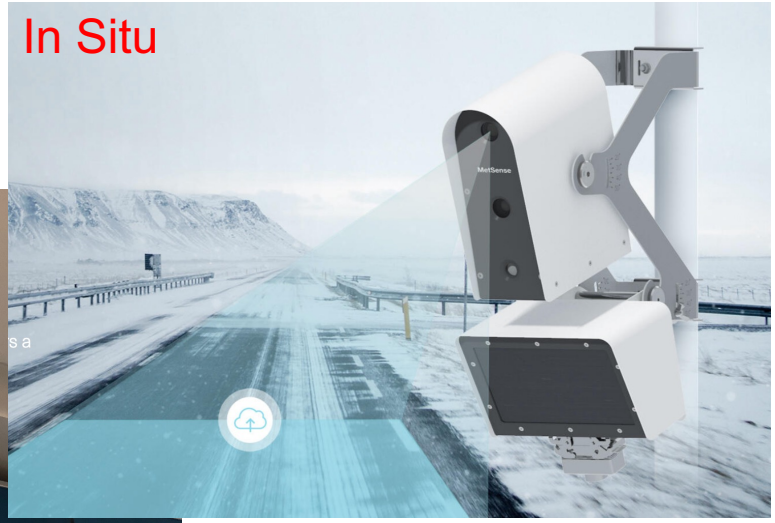
Many other sophisticated sensing options…

1980s	
1990s	
2000s	
2010s	
2020s	
2030s	
2040s	



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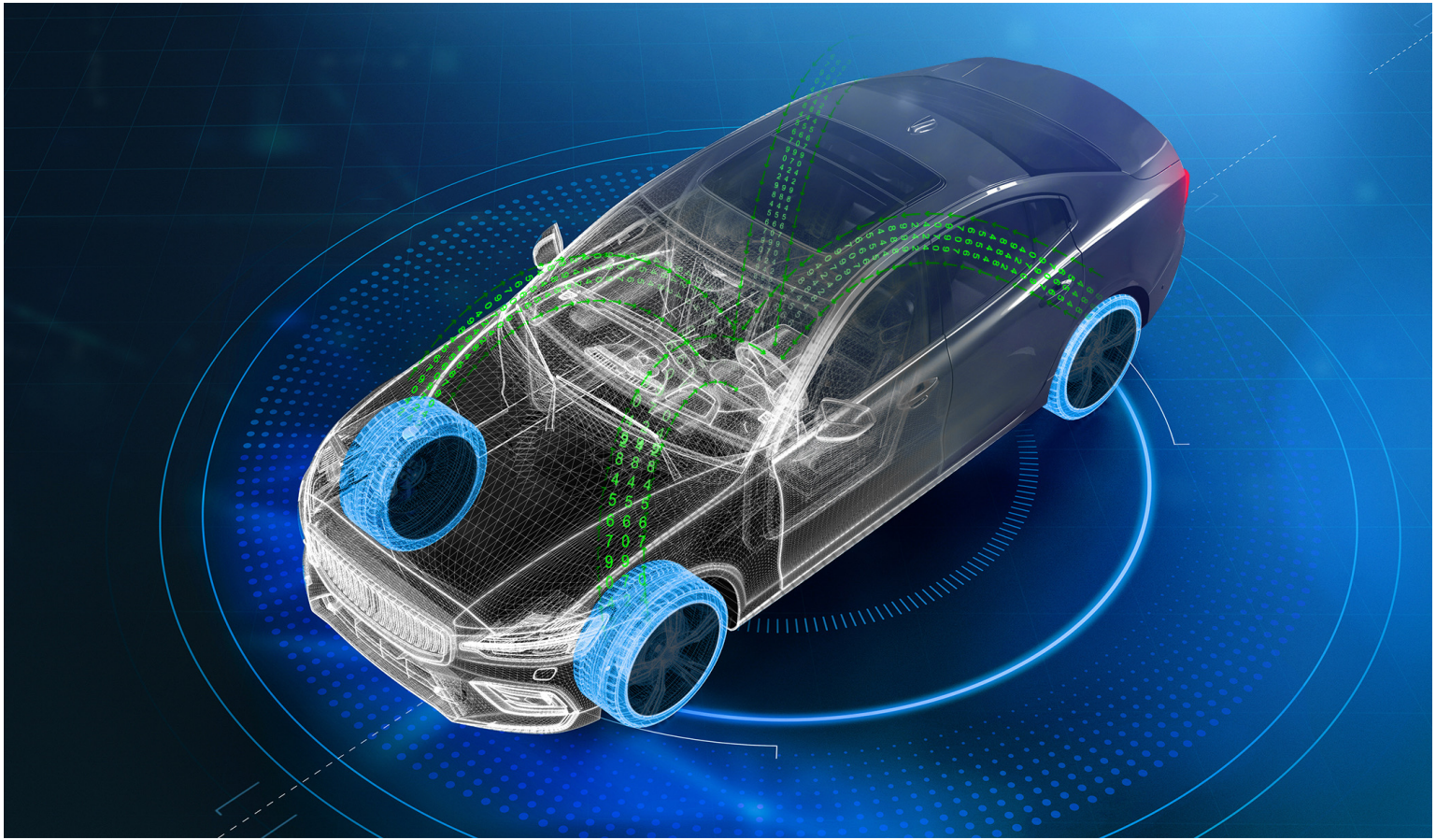
The rise of the connected vehicle…

1980s	
1990s	
2000s	
2010s	
2020s	
2030s	
2040s	



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The rise of AI

- All these new approaches are producing data at an unprecedented scale
- Not all the data is well structured
  - Lot of noise
- AI is unlocking the potential of this mass data collection
  - Nowcasting on the edge (IoT sensors)
  - Object recognition on sophisticated sensors
  - Making sense of Big Data collected from connected vehicles
- AI is already more than capable of replacing human weather forecasters…

- Has the pace of change ever been faster in the winter road maintenance sector?

The elephant in the room

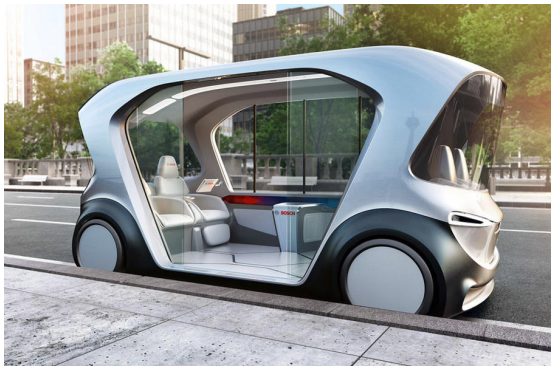
1980s	
1990s	
2000s	
2010s	
2020s	
2030s	
2040s	

- Are we collecting / developing middling technologies that are based on what we have needed for the last 40 years and not the next 40?
  - Nice tech, but how long is the shelf life?

Autonomous Vehicles

1980s
1990s
2000s
2010s
2020s
2030s
2040s

- Not a case of if, but when…
  - Change will be quick – like flipping a switch



- A lack of data will no longer be a problem
  - Every vehicle on the road will be a data goldmine
- Think how great the weather forecasts will be with all that to assimilate…
- …but, by this time weather forecasts will no longer exist.

Autonomous Gritters

- It isn't data from autonomous cars that will be transformative, it will be autonomous gritters.
- An autonomous gritter short circuits the entire system:
  - Collects it's own on-board road weather data
  - Takes real-time actions based on what it is sensing
  - No forecast required!
  - No decision maker required!
- The only reason weather forecasts are issued at midday is due to working time directives and forward planning
- A fleet of autonomous gritters can patrol 24/7 with no issues.

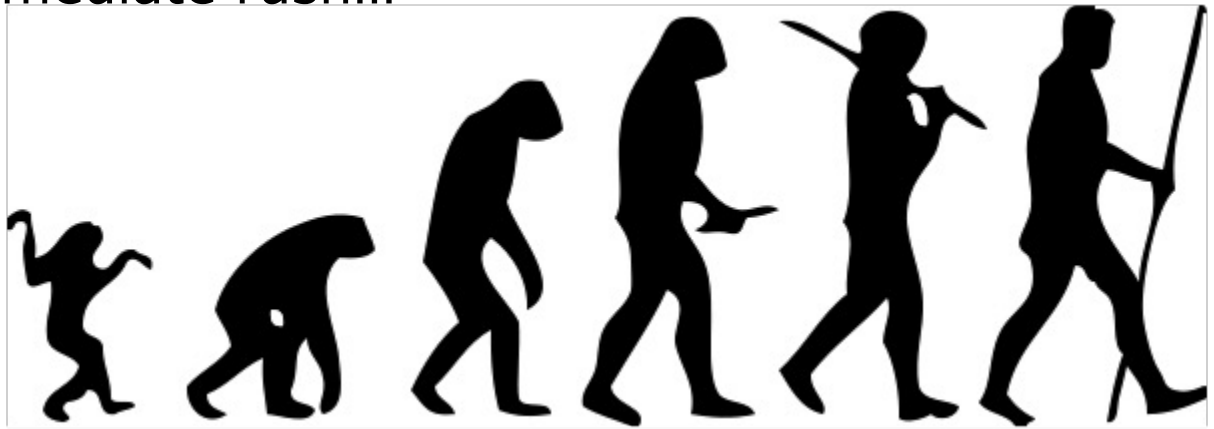
A new paradigm

- Very little of our current RWIS is needed
- We will have gone full circle back to ice detection of the early 1980's

- Research Targets:
- Still need to improve our mobile measurement capabilities
  - Low latency temperature / condition sensing
  - Residual Salt detection
- A network of in-situ sensors still needed:
  - Spot check /calibrate mobile sensors in real time
  - Early warning system to deploy the fleet

Conclusions

- We are embarking on a period of rapid change in the sector
- Counter-intuitive to think tomorrows technologies will take us back to approaches from 40 years ago!
- How best do we prepare for this now?
  - Existing approaches will do the job, so no immediate rush…



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