

Defining climatic parameters for selecting winter maintenance strategies for roads

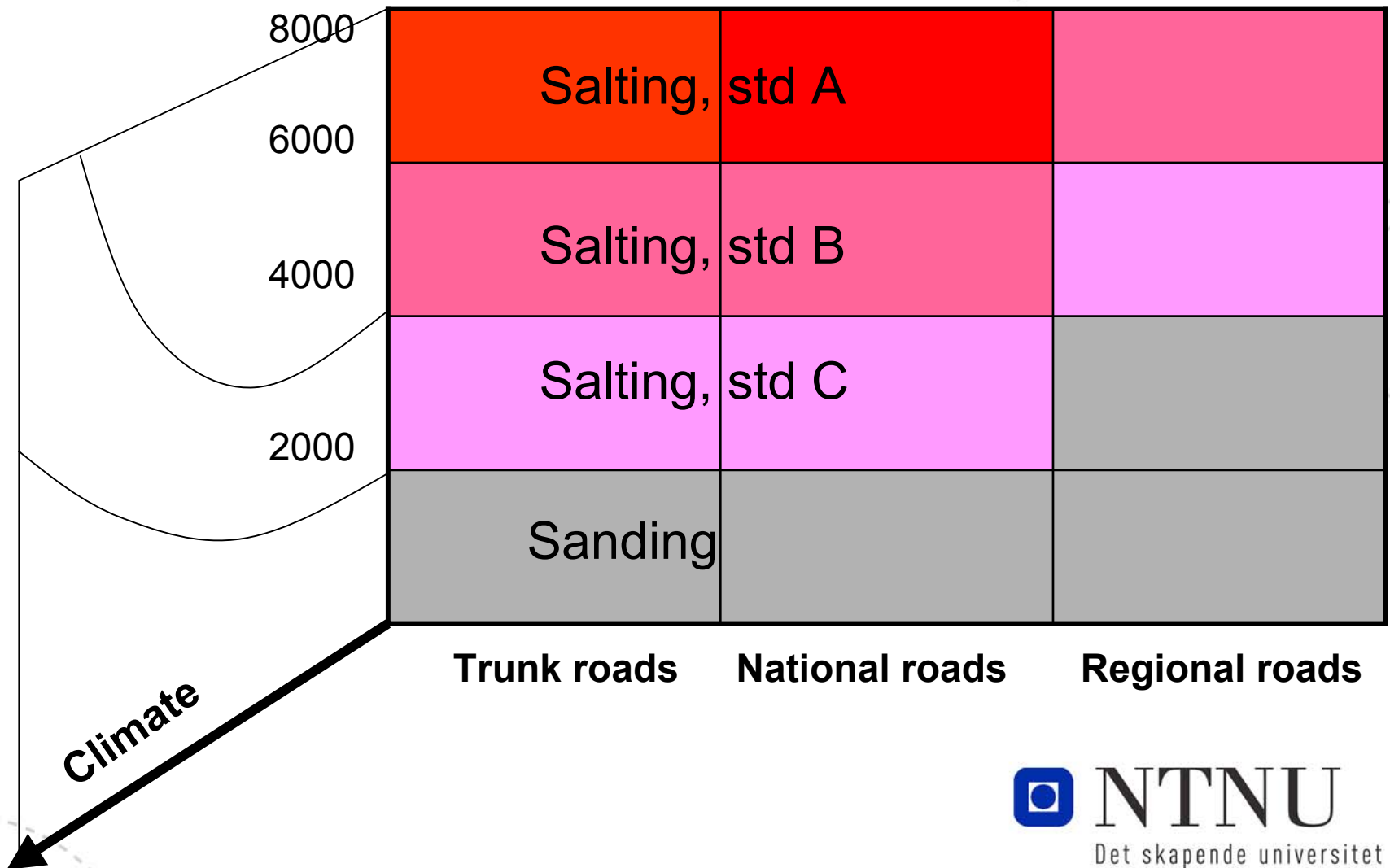
Professor Harald Norem

Norwegian University of Science and Technology
Public Roads Administration of Norway

Aims of the study at VTI

- To analyse the relationships between winterrelated accidents, climatic conditions and the selected strategies for the winter maintenance
- To establish climatic parameters that define whether use of salt or sand are favourable or not.
- To propose criterias, based on the climatic parameters, that may be useful in selecting the strategy for the winter maintenance

3 Scandinavian guidelines for selecting the standard for the winter maintenance



Existing strategies for friction control

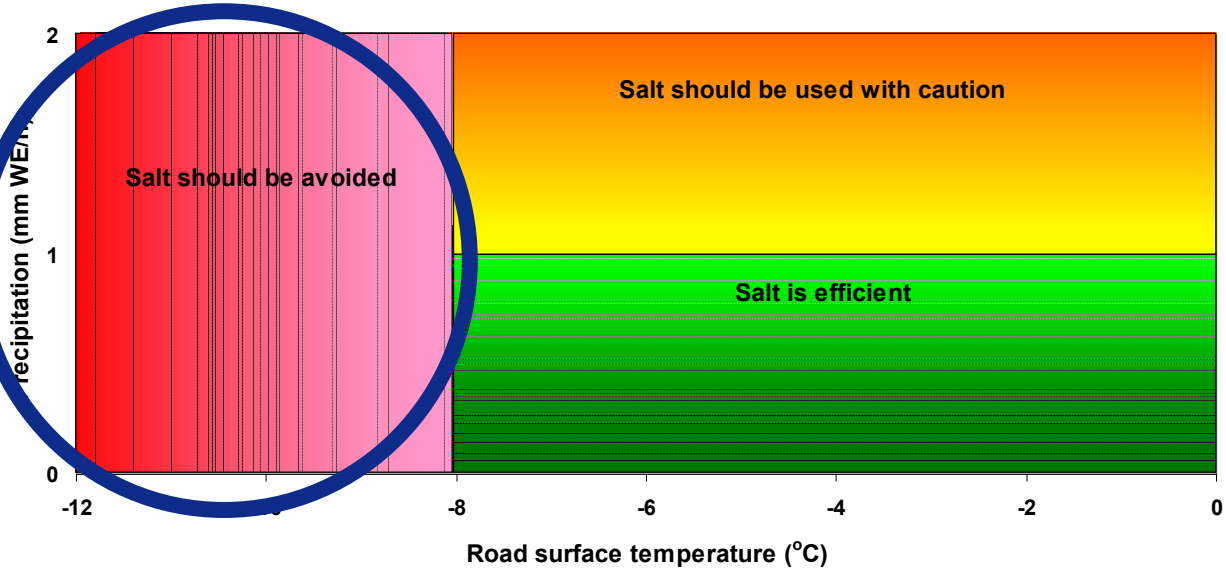
Salting



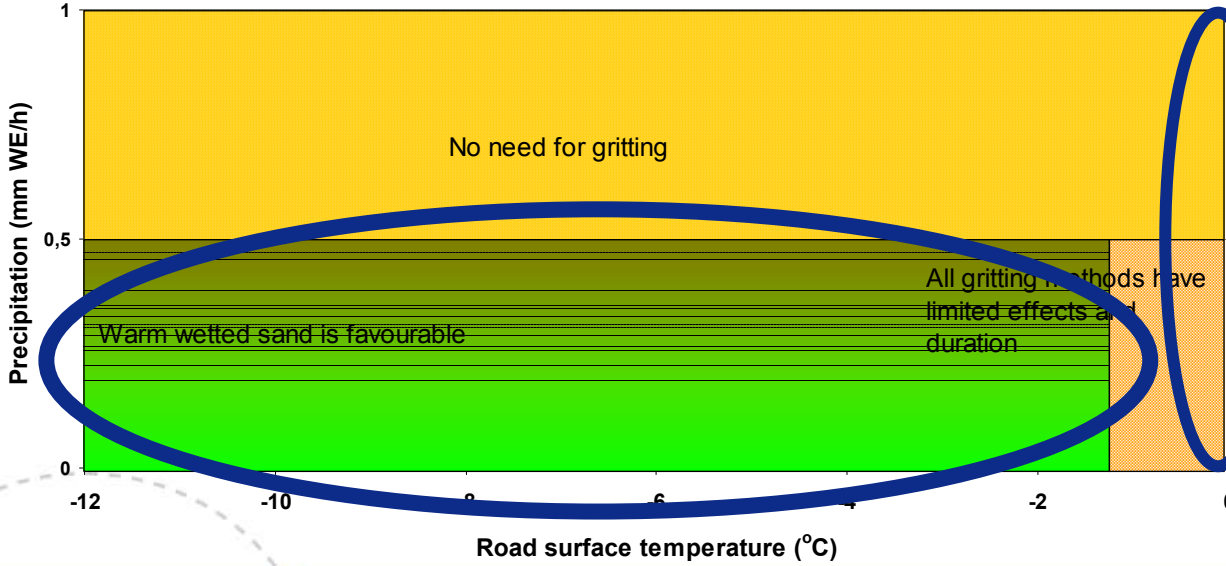
Warm wetted sand method



Effectiveness of salt/warm wetted sand related to temperatures and precipitation



Climates favourable/
not favourable for salt

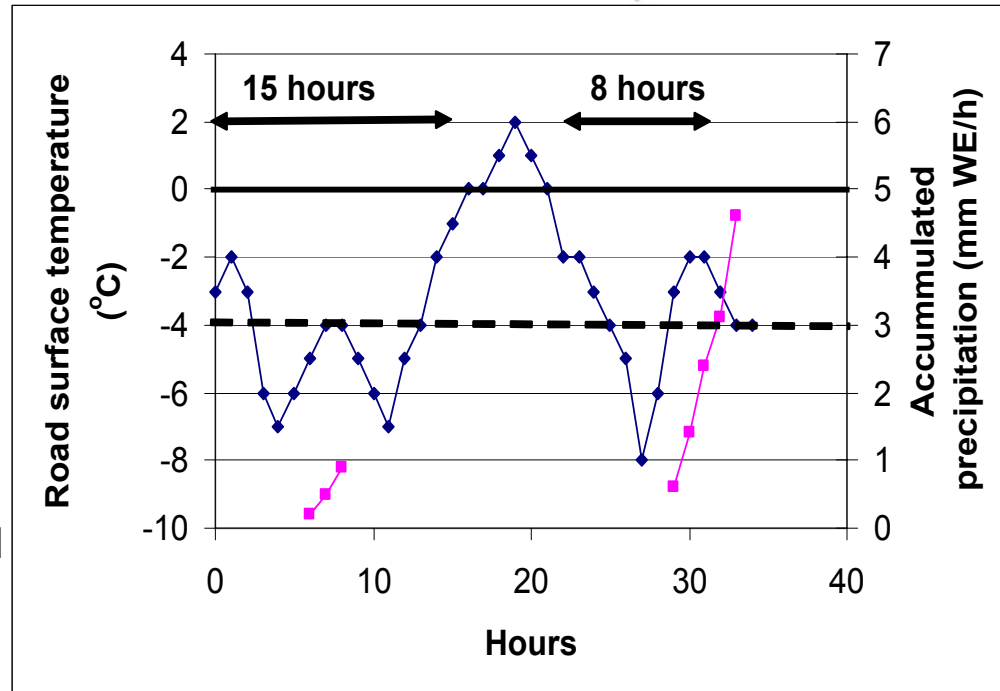


Climates favourable/
not favourable for warm
wetted sand

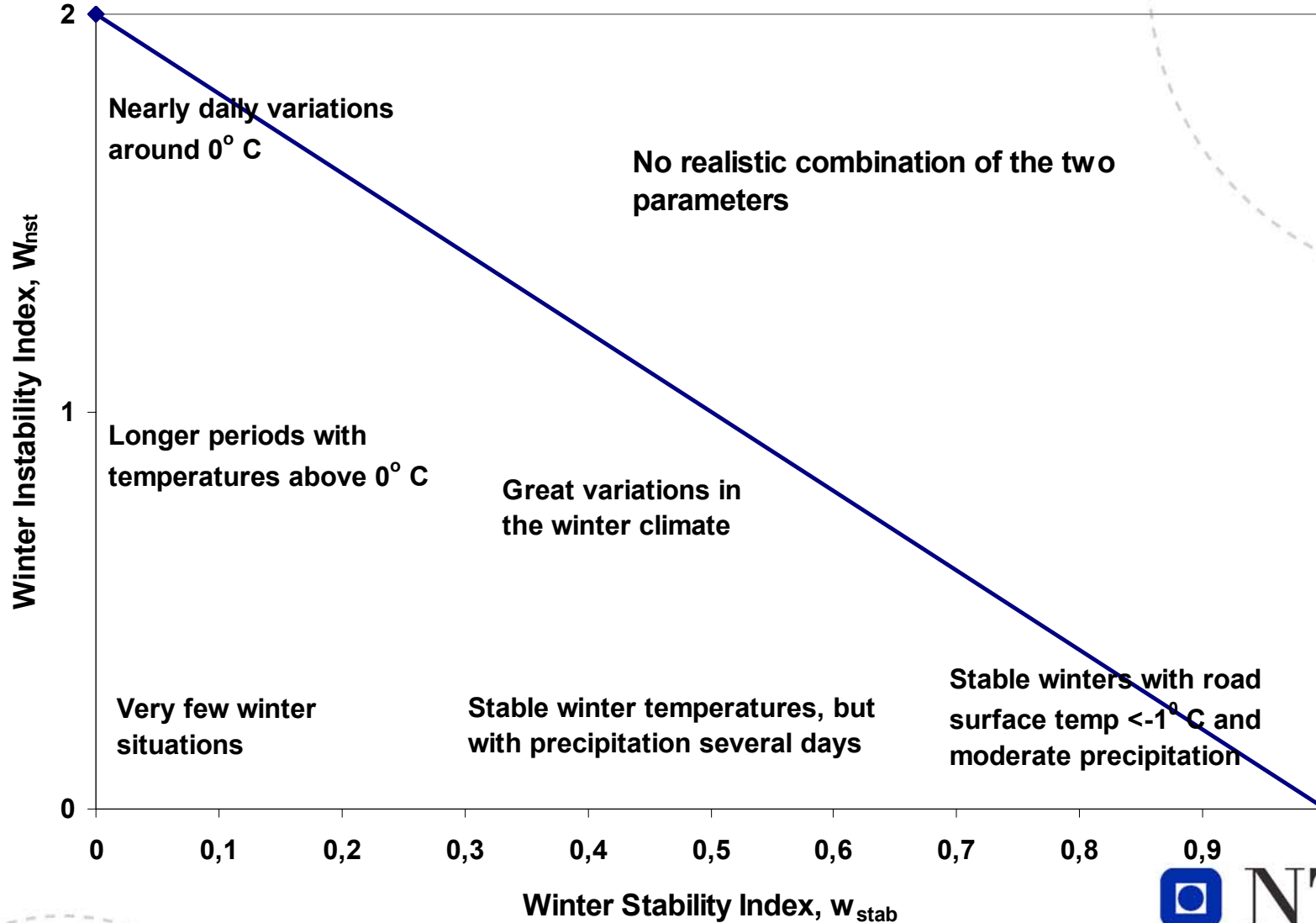


Definition of the climatic parameters describing whether salt or warm wetted sand are favourable/not favourable

- **Winter severity Index**
 - Hours with road surface temperatures $< -8^{\circ}\text{C}$ /total number of hours
- **Winter Stability Index**
 - Number of 24 hour periods with temperatures below -1°C and less than 3mm precipitation in 6hrs/total number of days
- **Winter Instability Index**
 - Number of fluctuations around 0°C /total number of days



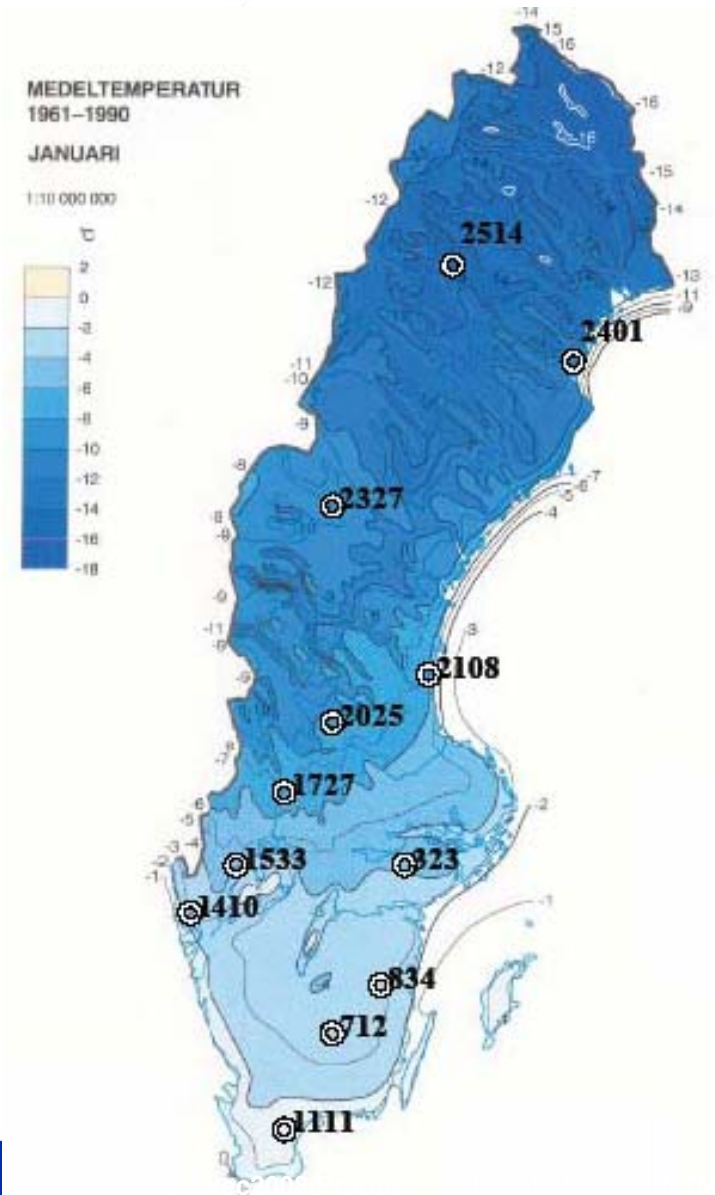
Characteristic climates described by the parameters



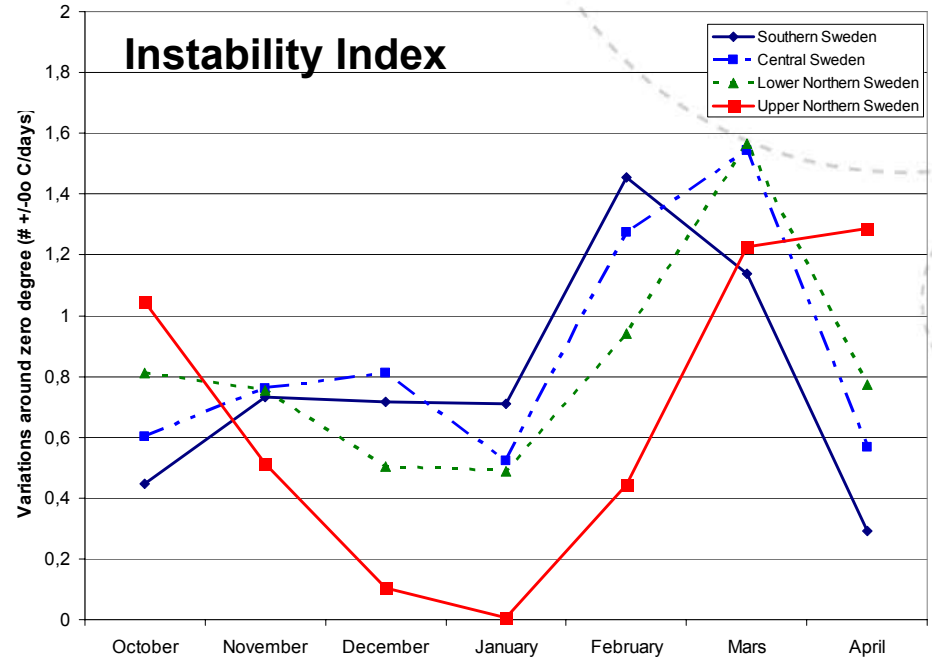
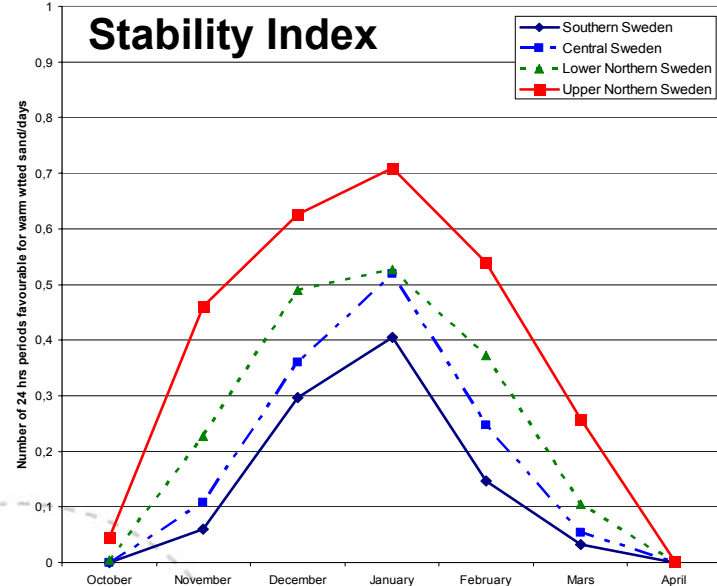
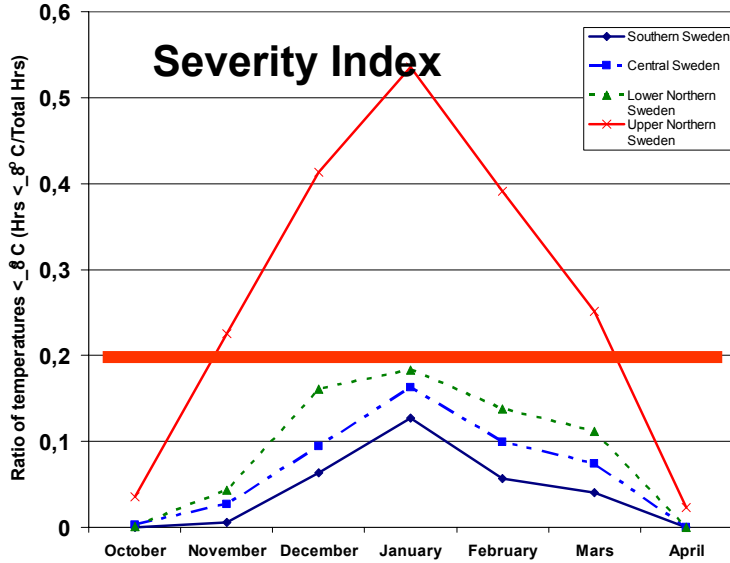
NTNU

Det skapende universitet

Dividing Sweden into 4 climatic zones



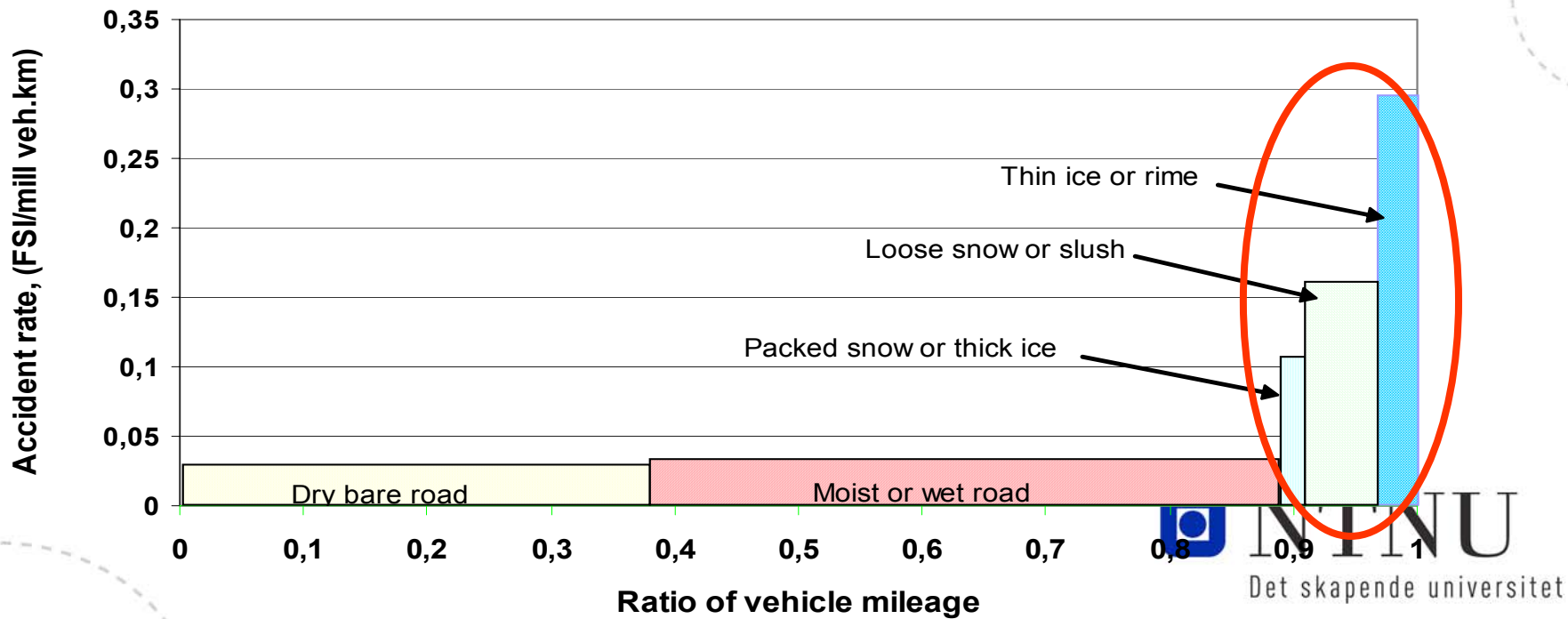
Monthly values for the winter indexes



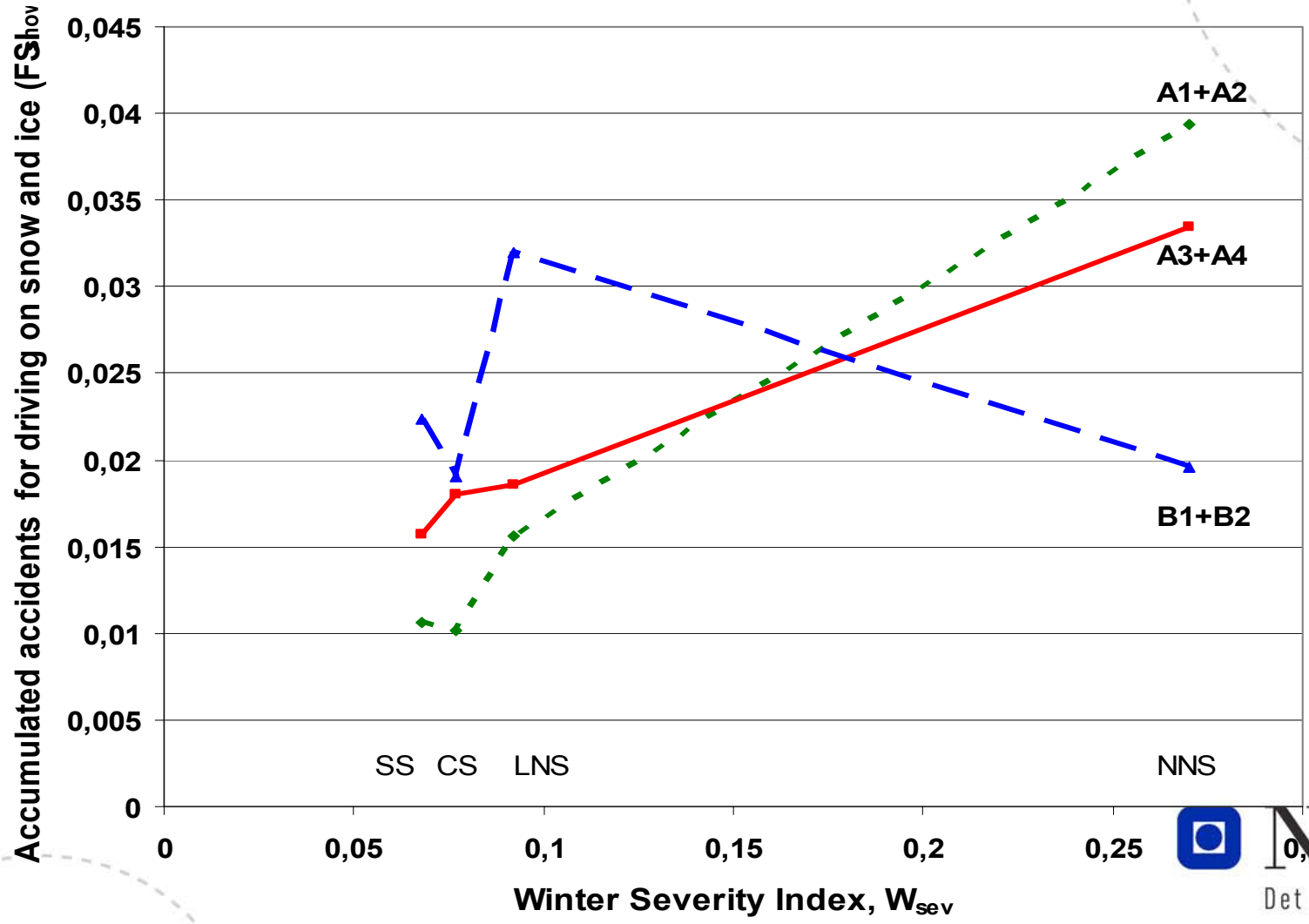
Recorded accident data

- The analyses are based on recorded fatalities and severely injuries, 1993/1997
- The accidents are divided into five road surface conditions, and four climatic regions
- VTI have calculated the vehicle mileage for each road condition and for the four climatic regions
- Based on the data material, road accident frequencies related to climatic zones and road conditions are calculated

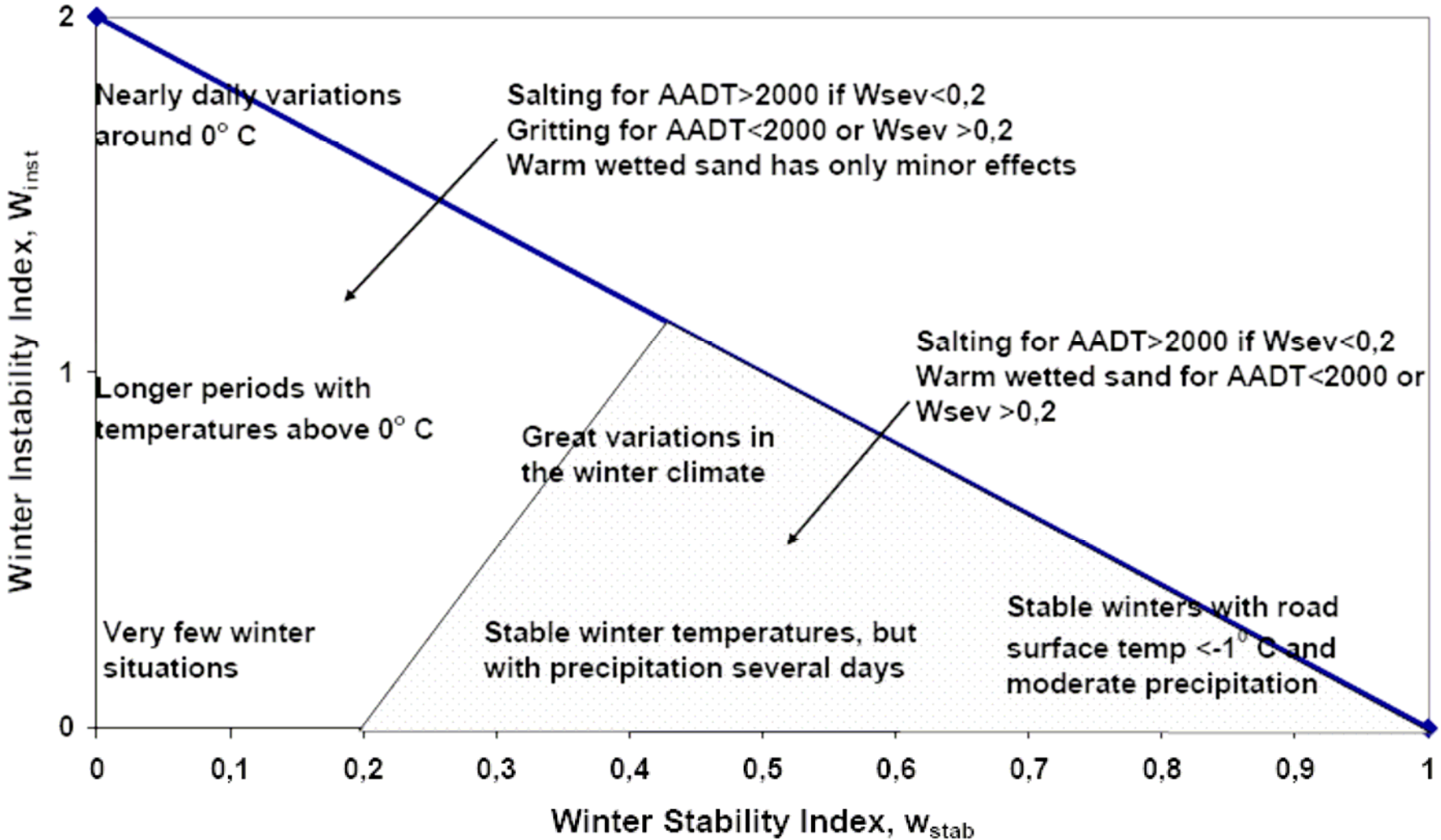
Accident rates for fatalities and seriously injured (FSI). Central Sweden and maintenance classes A3 and A4



Calculated accidents per mill. veh. km for driving on snow and ice covered roads



Recommendations for salt/warm wetted sand



Conclusions

- **The established climatic parameters are appropriate to describe whether salting or warm wetted sand are favourable or not in a given time period.**
- **Salt should be used with great caution if the frequency of road surface temperatures exceeds 20 % in the selected period**
- **Warm wetted sand is a realistic alternative to salt in stable, cold climates, where the probability to have the effect of the sanding action to last for more than 24 hours exceeds 20-30 %**
- **Salt is probably the only alternative on high speed roads in periods with high frequencies of fluctuations around 0° C**

Thank you for your attention

Monthly values for the indexes

