



Staying Upright - Safer Personal Mobility

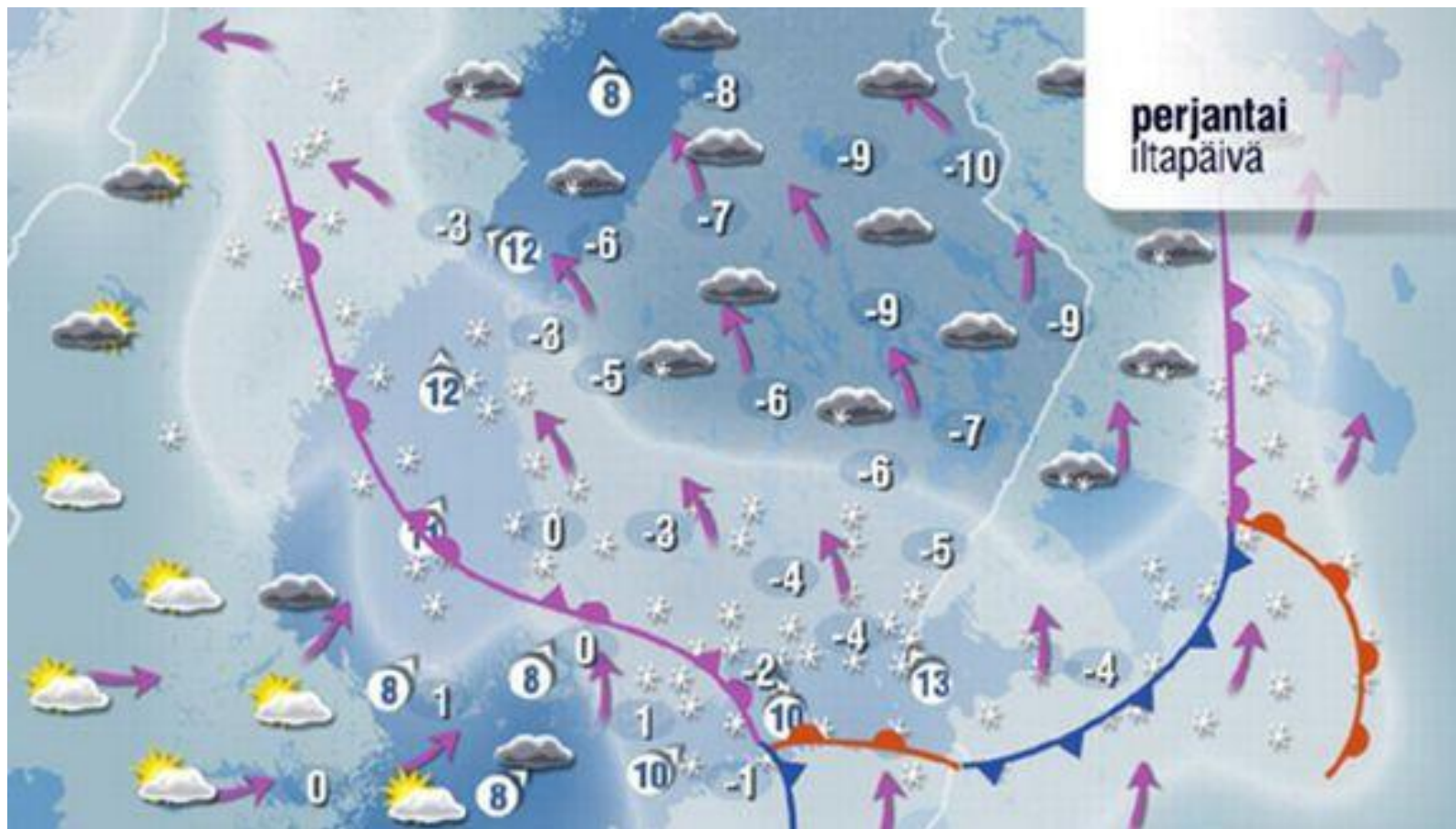
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Safer walking during winter time

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Typical weather map for Finland on winter time



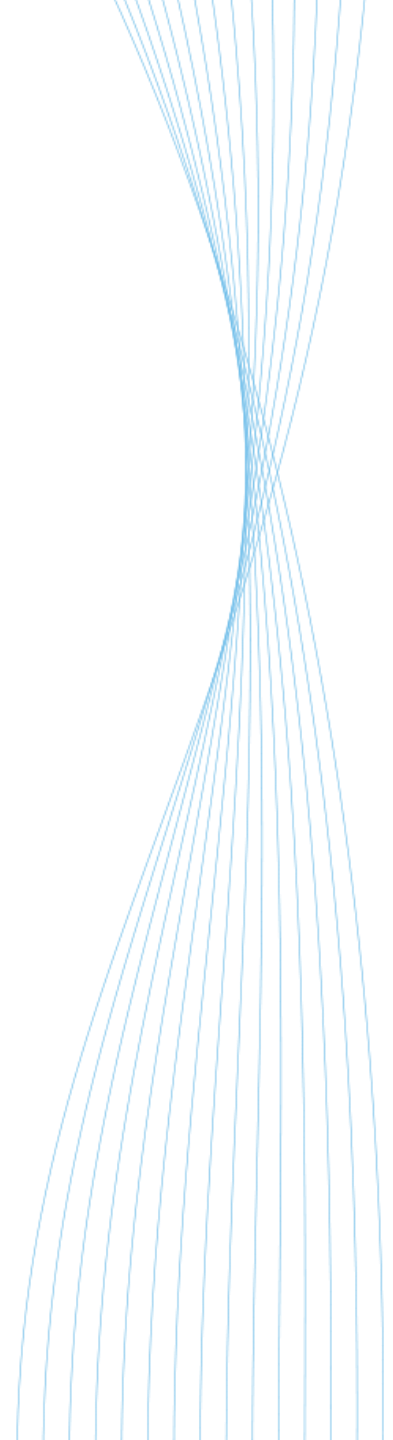


Slippery





Very slippery



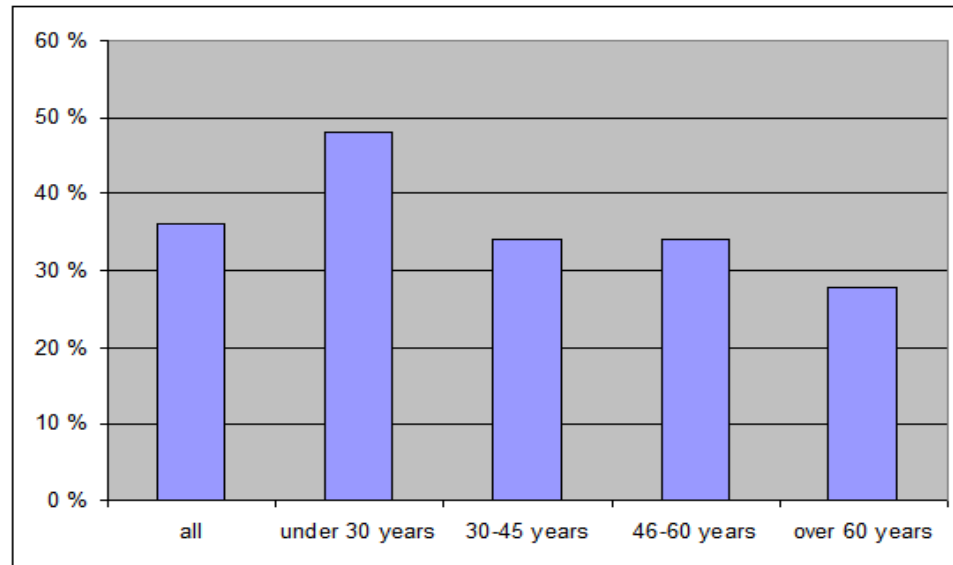


Extremely slippery





Wintertime slipping statistics – age distribution



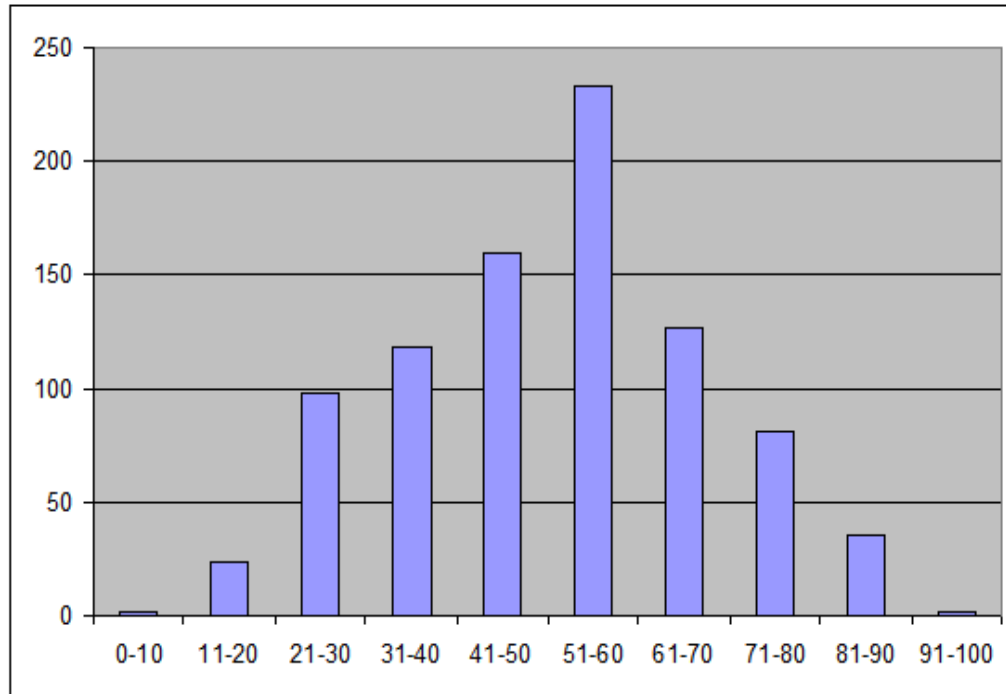
The age distribution of the slipping injuries

Slip injuries use to happen for everybody regardless of age and genre.

Young persons (under 30 years) use to slip more often than older persons



Age distribution of medical attention due to slip accidents (winter)

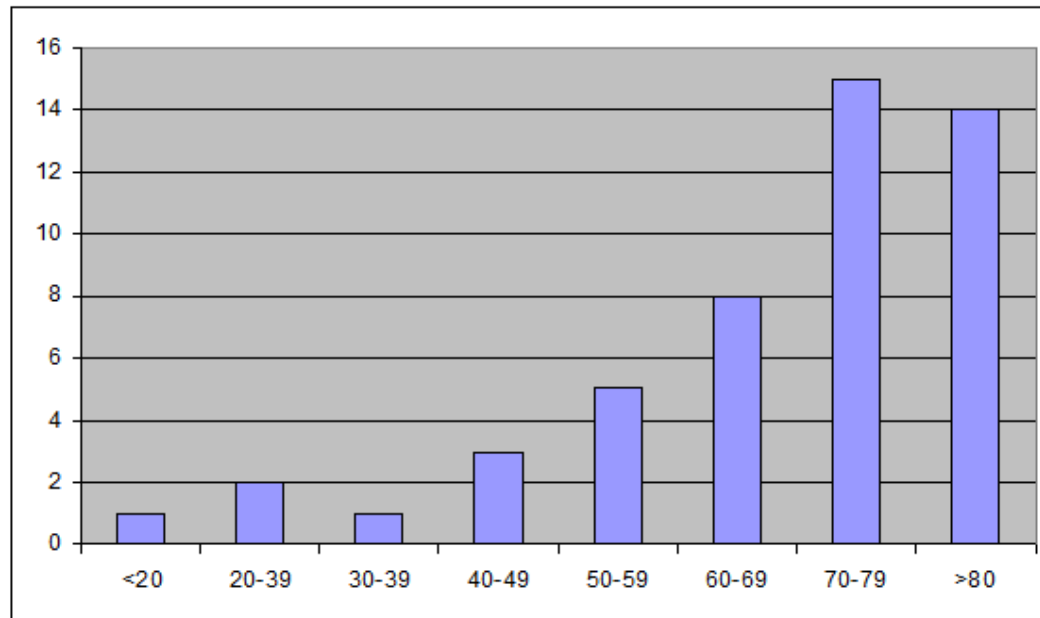


The number of slipping accident patients and different age ranges in Helsinki (Töölö) Hospital Emergency on years 2003-2006

People between ages 40 and 70 need most often medical attention.



Age distribution of patients with hip fracture due to slip accidents



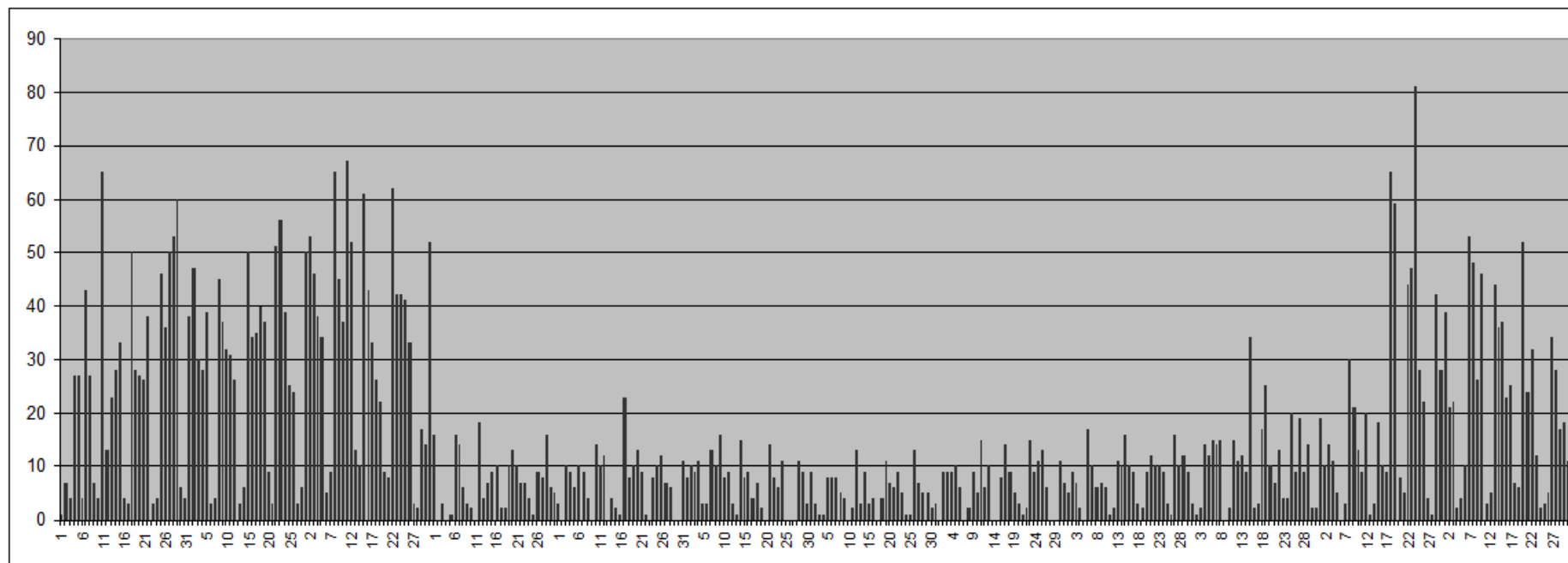
The number of slip accident patients and different age ranges with hip fracture due to slipping accidents in Töölö Hospital Emergency on years 2003-2004

Slip accidents are the most harmful for elderly people because they may get hip or other fracture more often than younger people when falling and the consequences of the injuries may lead to failing constitution.

The cost of one hip operation is 20 000 – 40 000 euros



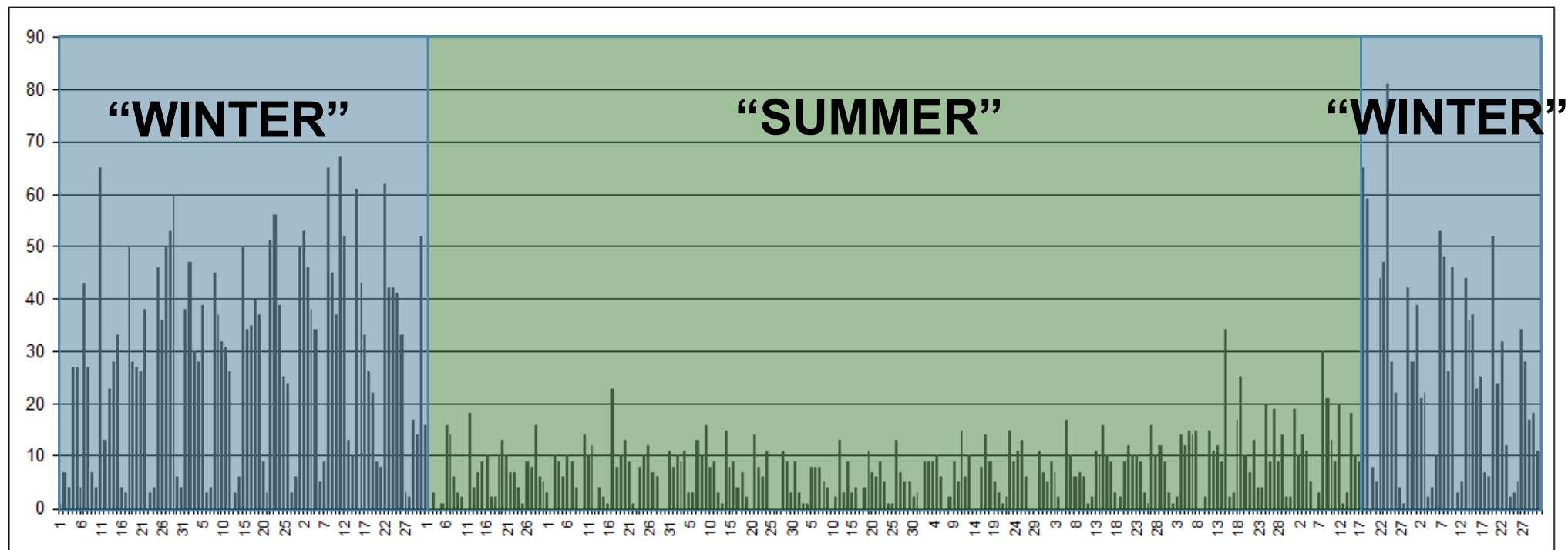
Slipping statistics



Number of pedestrian slipping injuries happened on the way from home to work or vice versa. Data includes injuries happened on Uusimaa province between 1.1.2010 and 31.12.2010. Source of data: Federation of Accident Insurance Institutions.



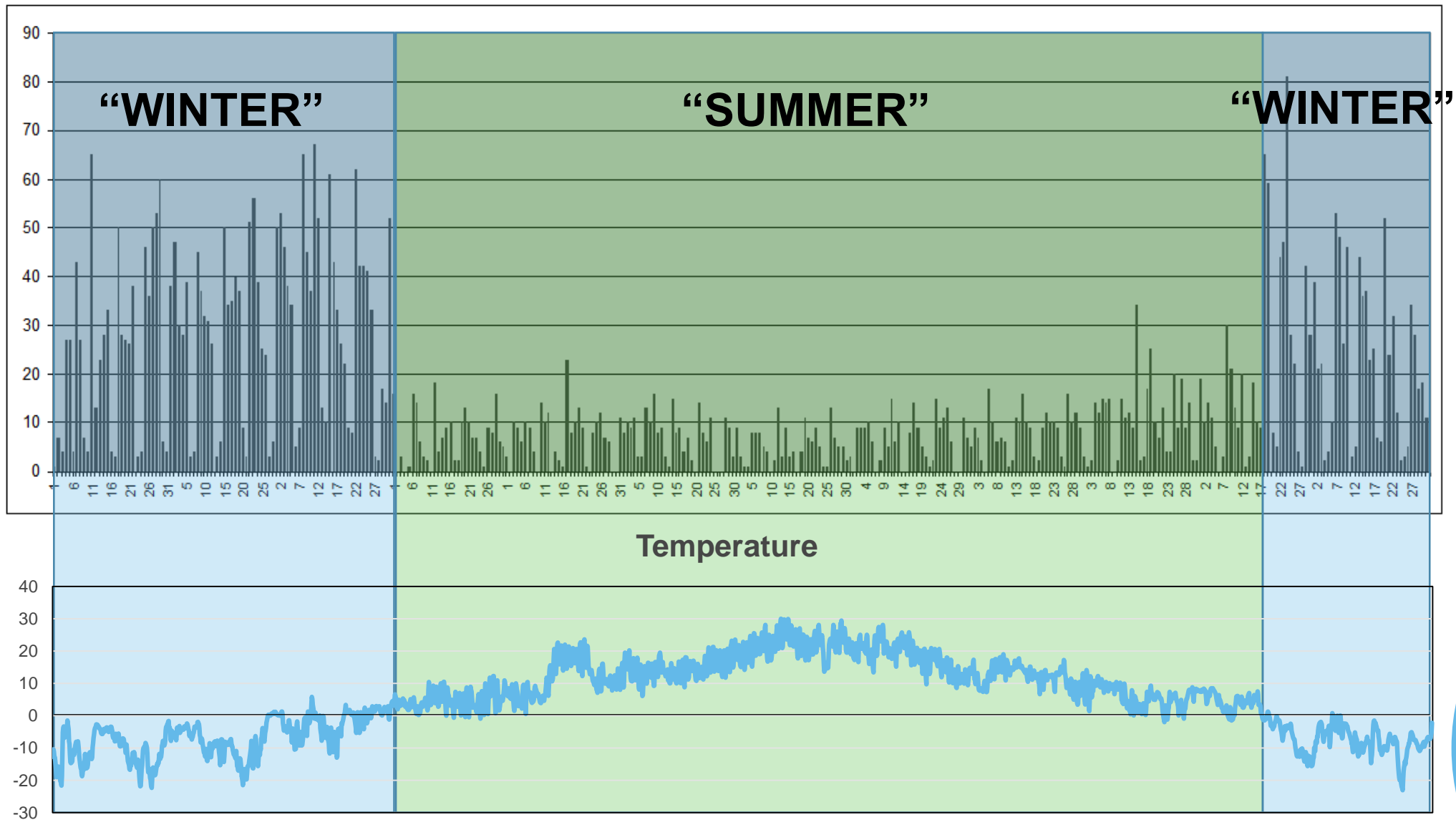
Slipping statistics



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Slipping statistics – Temperature correlation





Numbers and costs of annual slip accidents

- During wintertime occur about 50 000 pedestrian slipping accidents with serious consequences
 - Incidence of 1/100 in Finnish population
 - 2/3 of the accidents happen when pavement is icy and/or snowy
- 5000 bedpatient, totally 30 000 days annually
- Slip accidents cost about 420 million euros per year
 - According to another study the costs are 2400 million €
 - Including costs in health care, lost-workdays and welfare

→ Lots of potential available to reduce the amount of accidents and costs





Walkway maintenance in Finland

- Salt used only on critical places (like stairs, somewhere on most busiest routes)
- No clear rules for maintenance, e.g. snow removal, roughening or sanding (compare: very tight rules for highway maintenance)
 - Different rules in different cities
- Streets and roadways are maintained before pedestrian walkways in many cities





How to reduce the number of slipping accidents?

1. **Improve winter maintenance of walkways**
2. **Awareness of slipperiness**
 - timing and route of walking
 - way of travelling (walking, public transport, car)
 - decision of travelling
3. **Foot wear with good grip**
 - shoes with good grip, non-slip device

Warnings of slippery pavement conditions would help both pedestrians and winter maintenance work





Friction measurement devices

FMI has tested two devices to measure slipperiness on walkways



Vaisala DSC111 optical sensor

- Developed to measure the friction on highways
- 4 devices on Helsinki area to measure the friction of walkways



Slipmeter developed by Finnish Institute of Occupational Health

- For case studies



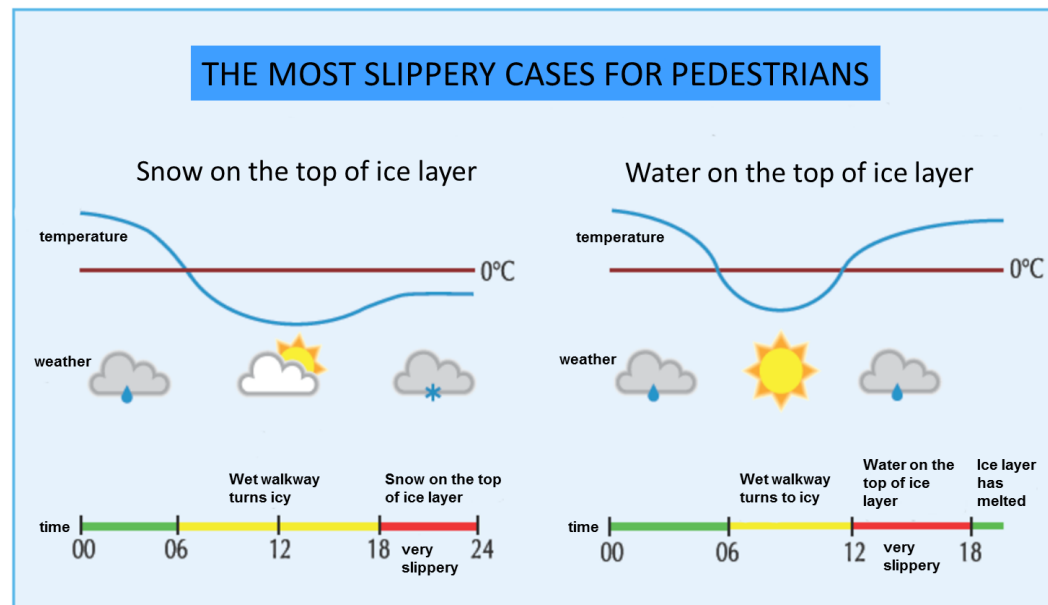
Modelling road weather / pavement condition





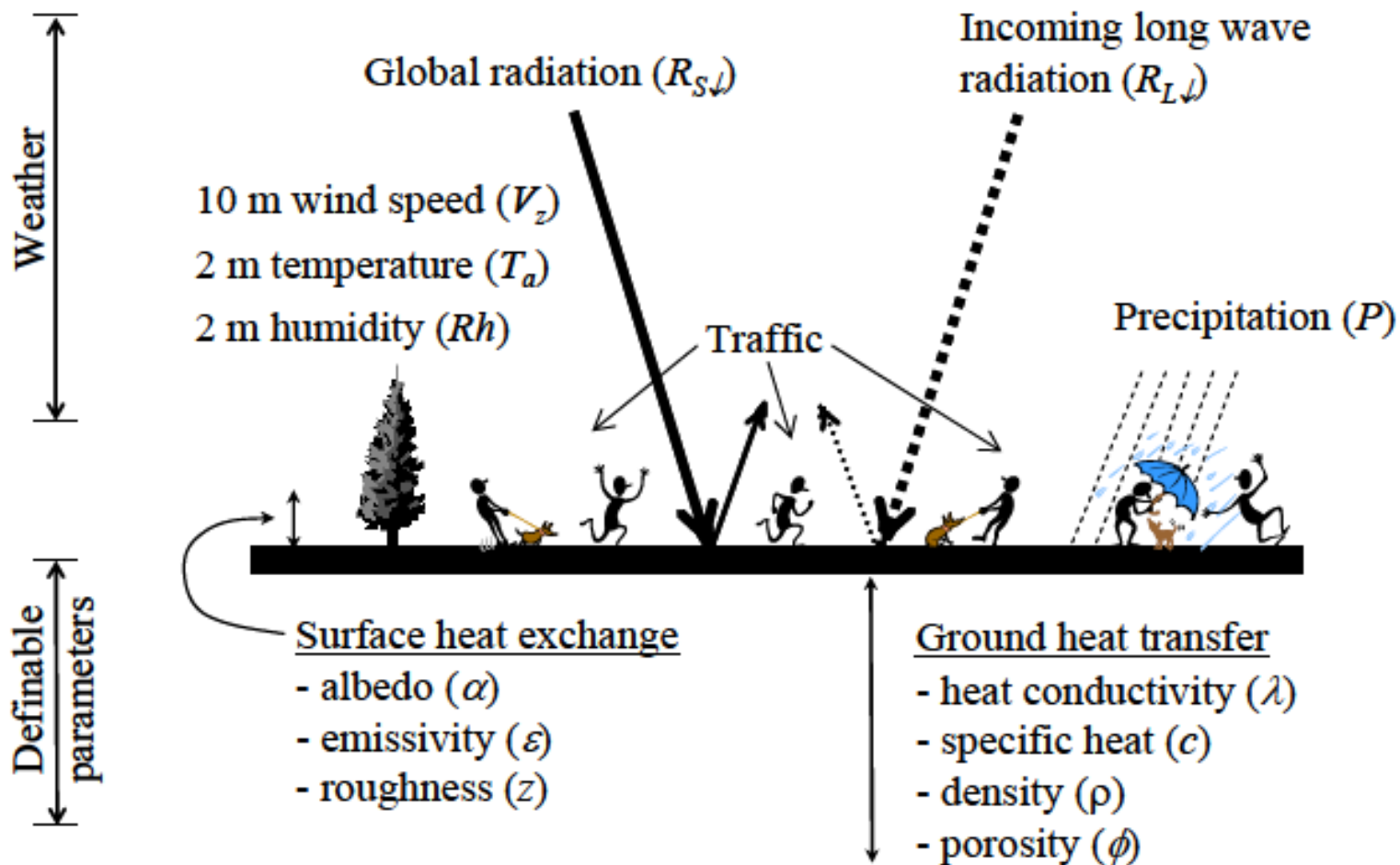
Slippery walkway condition

- Car traffic has typically problems in case of snowfall → low visibility and reduced friction
- New snow means usually good grip for pedestrians (if no ice below the snow)
- The most difficult walkway conditions are:





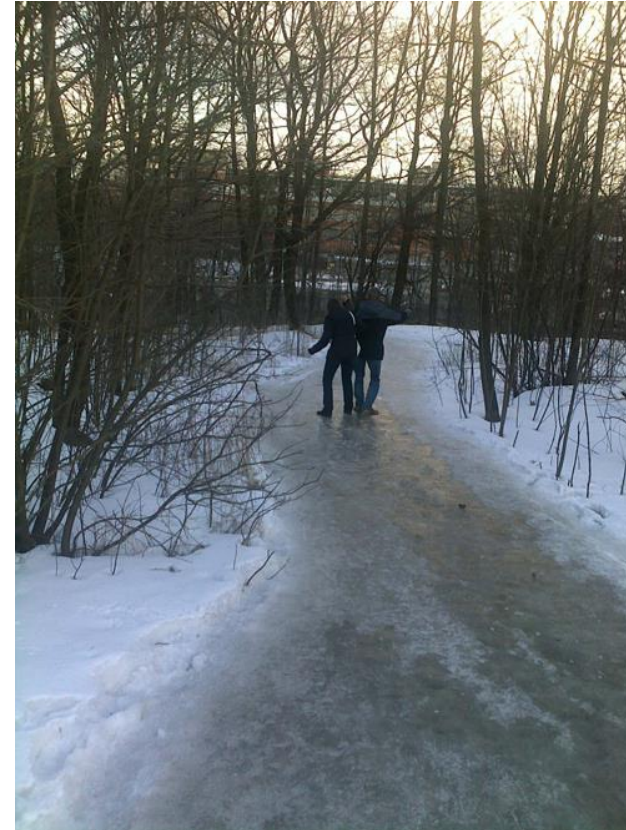
FMI's walkway condition model





Slipperiness index

- Past, present and forecasted weather
 - Observation part: input weather observations (4 days)
 - Forecast part: input numerical weather prediction model (2 days)
- Model have storages for water, snow, ice and frost
 - Weather has an impact for storages
 - Storages are interacted with each other
 - Two types of model run: ice on the surface and no ice on the surface
- Output: **Slipperiness index**
 - **normal**
 - **slippery**
 - **very slippery ← warnings are given**





Slipperiness classification

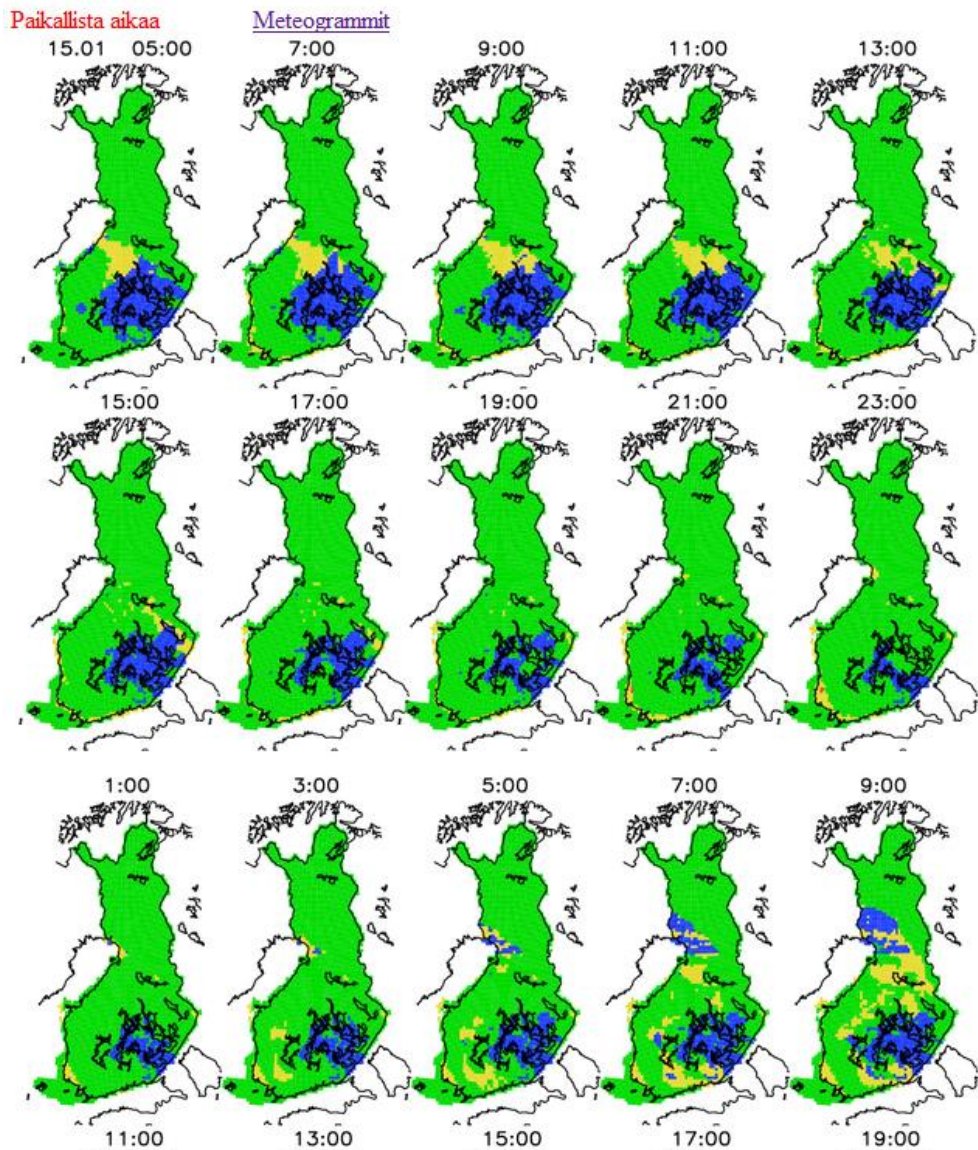
5 different slipperiness classes

1.	No slipperiness	normal
2.	Slippery	difficult
3.	Packed snow	
4.	Water above the ice layer	very
5.	Snow above the ice layer	difficult



- Warning given in case of classes 4 and 5
 - Normal walking is difficult and the risk of slipping accident increases
- Very slippery days typically 5-15 per winter

Model outputs

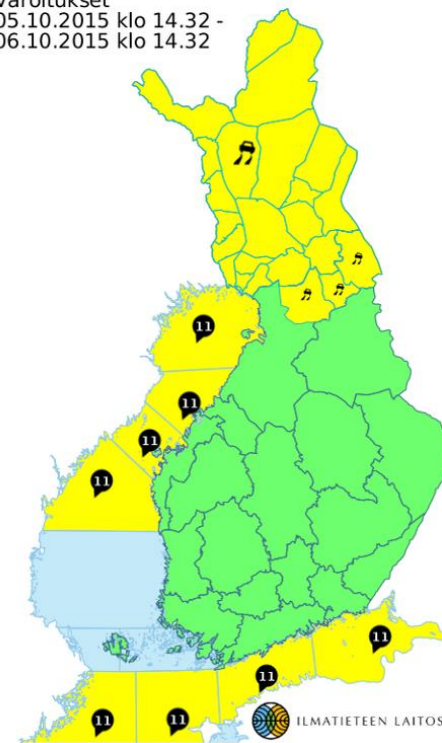


An example of FMI's
 walkway condition
 model output

- Normal
- Slippery
- Packed snow
- Water above ice
- Snow above ice

Varoitukset ja turvallisuus

Varoitukset
 05.10.2015 klo 14.32 -
 06.10.2015 klo 14.32



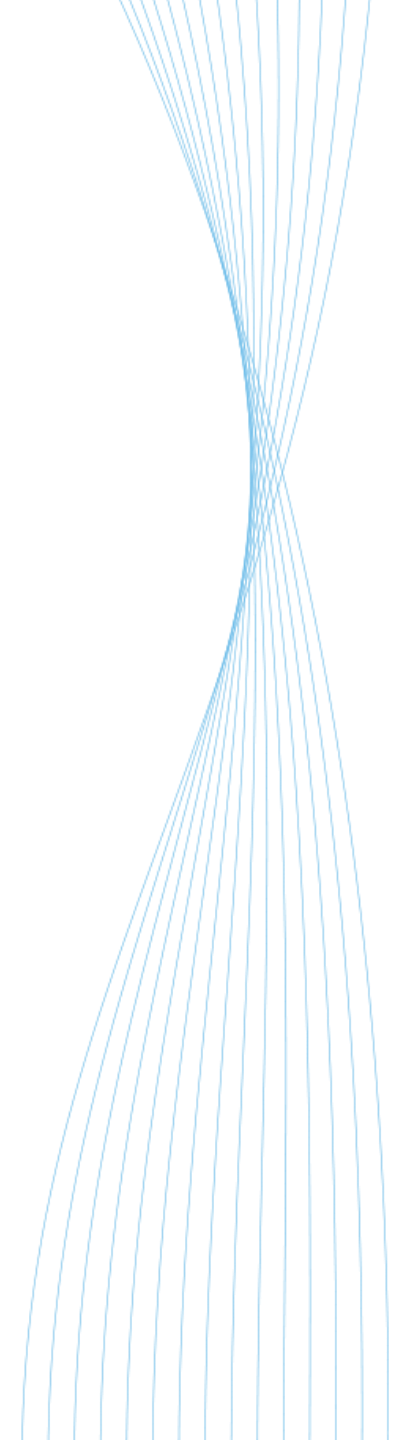
- rajui ukonilma
- tuulivaroitus maa-alueille
- sadevaroitus
- liikennesää
- jalankulkusää
- metsäpalovaroitus
- ruohikkopalovaara
- hellevaroitus
- pakkasvaroitus
- UV-tiedote
- tuulivaroitus merelle
- ukkospuusukia merialueilla
- varoitus korkeasta merivedenkorkeudesta
- varoitus alhaisesta merivedenkorkeudesta
- aallokkovaroitus
- jäätämisovaroitus
- useita varoituksia voimassa
- ei vaaraa aiheuttavaa säätä
- mahdollisesti vaarallinen
- vaarallinen
- hyvin vaarallinen

Warning map by Finnish
 Meteorological Institute



Services and applications

- FMI is giving warnings about slippery pavement condition
 - Warnings can be checked from FMI's internet site
 - Some local radio stations and TV news are reading warnings
 - SMS service
 - Available for cities and companies
 - SMS is sent automatically if very slippery pavement condition is expected
- Services for road maintenance companies
 - Information about snowfall, road surface temperature, friction etc





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**Thank You
for
Your Interest!**

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