

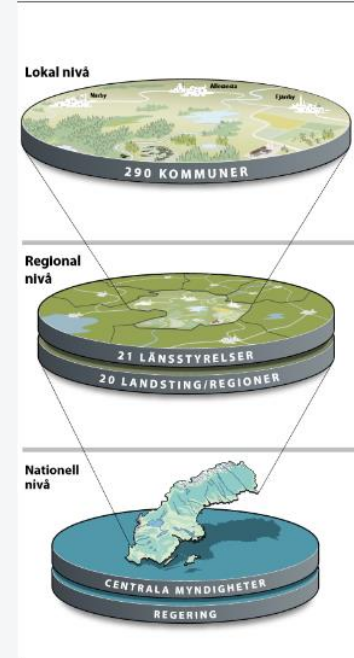


EUMETCAL WEBINAIRE 2024-01-18

**IMPACT BASED WARNINGS:  
-THE SWEDISH WAY**

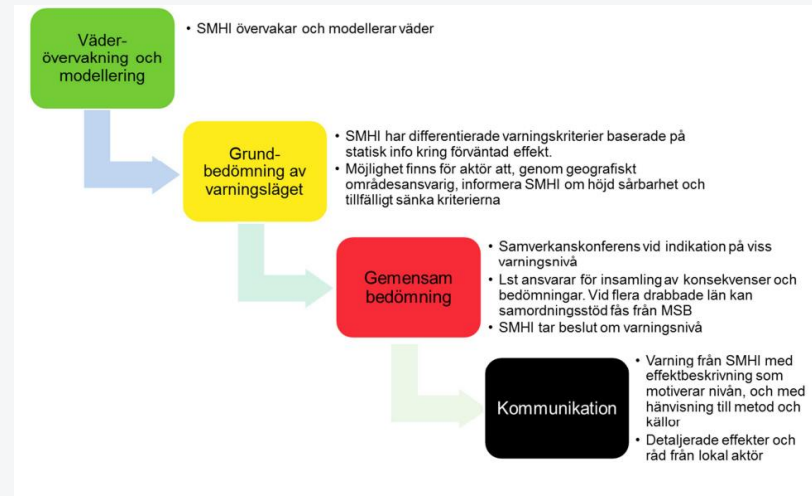
# Background

- Fundamentals of the Swedish crisis management system
  - Principle of responsibility (*Ansvarsprincipen*)
  - Principle of proximity (*Närhetsprincipen*)
  - Principle of consistency (*Likhetsprincipen*)
- Well established forums for national collaboration (*samverkan*)
- Weather warnings as an integrated part of this system, using existing platforms and principles!



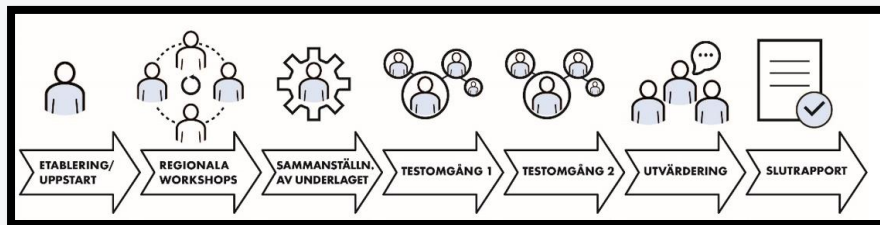
# Step 1: Is this a good idea for Sweden?

- Pre study in 2016
- Four authorities, four regional councils, two communes and one fire fighting association participated in the project.
- Inspiration from WMO Guidelines and UK Met Office
- Project delivered a concept, with a suggested course of action for further investigation.
- **All participants thought this was a good idea!**



## Step 2: Exploring the concept!

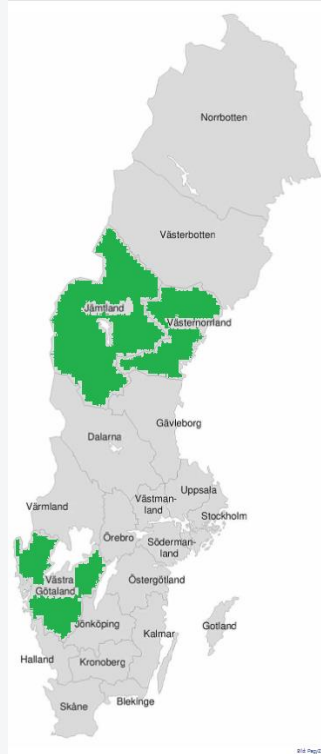
- Pilot study 2017 - 2018
- 4 authorities, the Police, 3 regional councils, 2 communes, 3 rescue services and the water regulation association (132 people involved!)
- UK Met Office and UK Flood forecasting centre as "mentors"
- Project delivered suggested processes for work flow (after 28 iterations!)
- Also stressed the importance of verification and regular evaluation of processes, impacts and thresholds ("learning by doing")



# Pilot study parameters

Pilot regions chosen to represent different aspects such as:

- Mountain areas
- Urban communities
- Rural communities
- Coastal communities
- Large river
- Seasonal tourism
- National infrastructure



Pilot warning types were chosen to represent different challenges:

- Snow
- Wind
- High river discharge
- High sea levels

# Step 3: Implementation

- Implementation project 2019 – 2021
- Involved ALL regional councils and authorities involved in crisis management

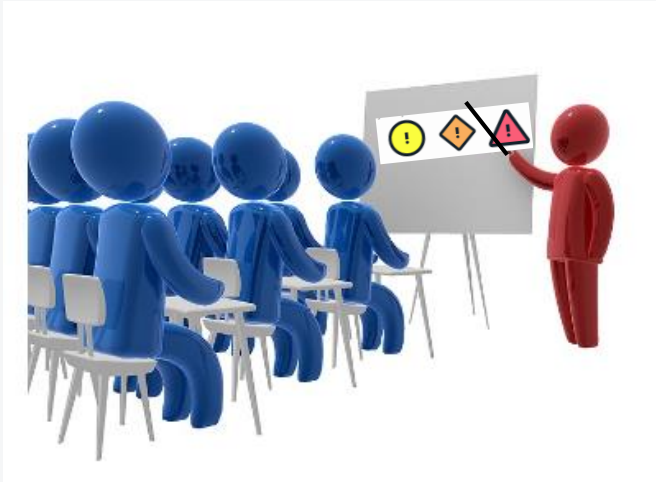
## Focus on

- Refining the work flows
- Evaluating all warning types and all regions
- Methods for evaluation
- Designing the "product"
- Technical systems development
- Guidelines for authorities
- Communication and training



# Training

Implementing a new part of a national crisis management system takes a lot of effort and training!



- During the implementation project we held:
  - 4 national training sessions
  - 32 regional training sessions
  - 8 national exercises, plus about 20 regional or local exercises.
- 2600 people had gone through training!
- Video training material for "learning at home"

# Communicating the change

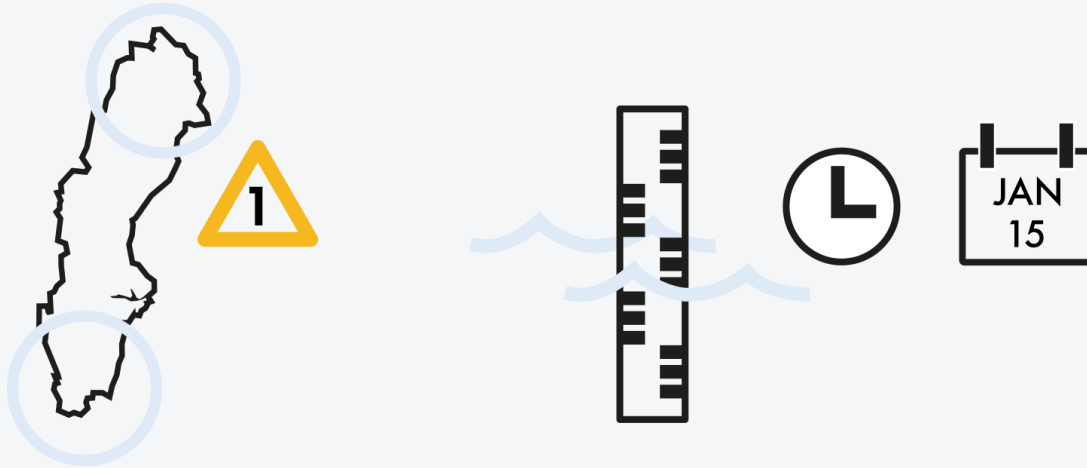
- Planned 3 phased communication campaign between jan – oct 2021
- Graphic designs and statements prepared.
- More than 1 million Facebook accounts were reached by our social media campaign
- Approx 200 articles produced
- 750 external media appearances between 1 januari – 12 november 2021





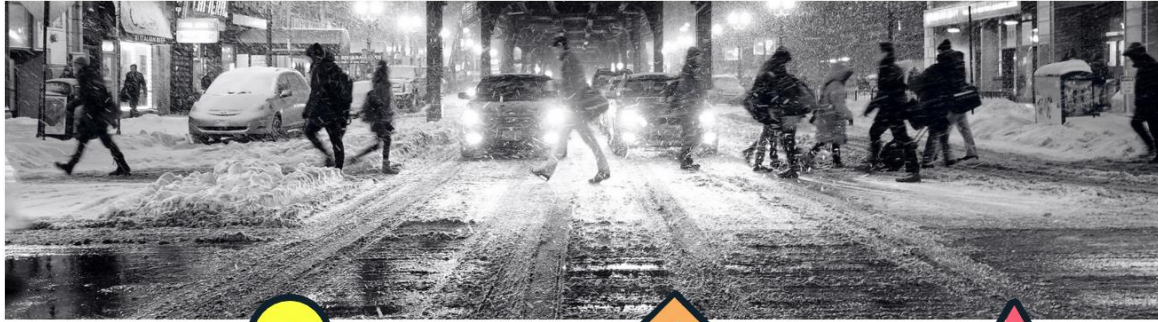
# Issue a warning when and where it is needed...

**SMHI**



- Regional thresholds
- Risk factors
- Impact examples

# Our warning levels



## YELLOW WARNING

### What should you do?

- Take extra care – especially in places or situations more sensitive to changing weather conditions.
- Take appropriate preventive measures if you live or spend time in an exposed area, or if you belong to a group at risk.

### Weather conditions may result in

- Consequences for the community.
- Certain risks to the public.
- Certain damage to property and the environment.
- Disruptions to some societal functions.



## ORANGE WARNING

### What should you do?

- Avoid exposure to the weather conditions.
- Take appropriate preventive measures to minimize the impact on the environment, life and property.

### Weather conditions may result in

- Serious consequences for the community.
- Danger to the public.
- Serious damage to property and the environment.
- Disruptions to societal functions.



## RED WARNING

### What should you do?

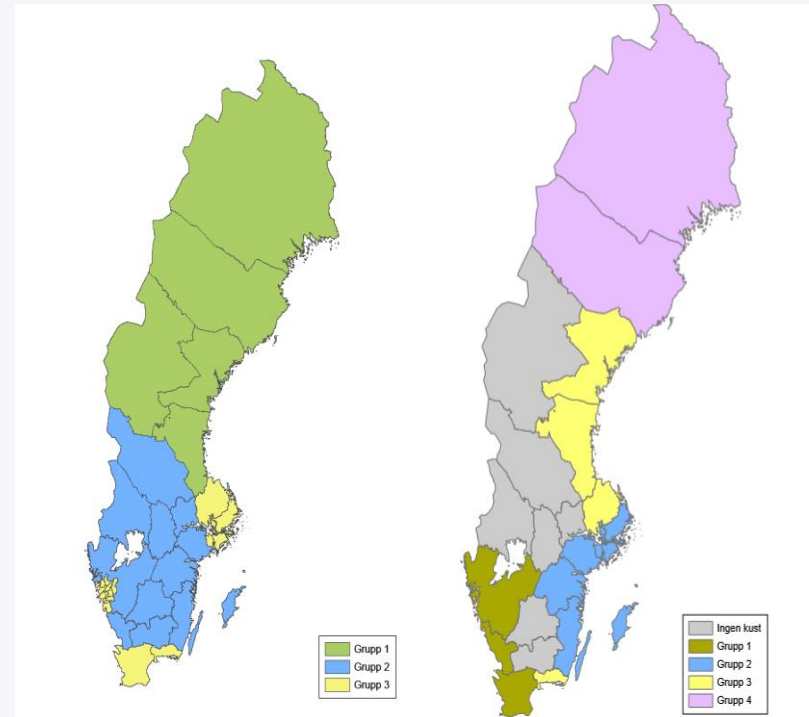
- Avoid all exposure to the weather conditions.
- Take preventive measures to minimize the impact on the environment, life and property.

### Weather conditions may result in

- Severe consequences for the community.
- Great danger to the public.
- Severe damage to property and the environment.
- Extensive disruptions to societal functions.

# Regional thresholds

- Thresholds are used to **initiate the process**
- Specified for each warning type based on:
  - Statistics
  - Previous experiences
  - Level of vulnerability (geographical differences)



Snow

Sea level

# Risk factors

- Risk factors are conditions that may enhance or reduce potential impacts of the weather situation.
- Risk factors exist on national, regional and local scales.
- Time of year/day and previous/following weather conditions are generally applied for most warning types.
- Other factors more type-specific

## Risk factors for wind

An unusual wind direction (for the area) may increase the risk of falling trees.

Wet ground may increase the risk of falling trees.

Frozen ground may reduce the risk of falling trees.

## Risk factors for high sea levels

Wave conditions (wave height and direction)

Sea ice

High water discharge in rivers

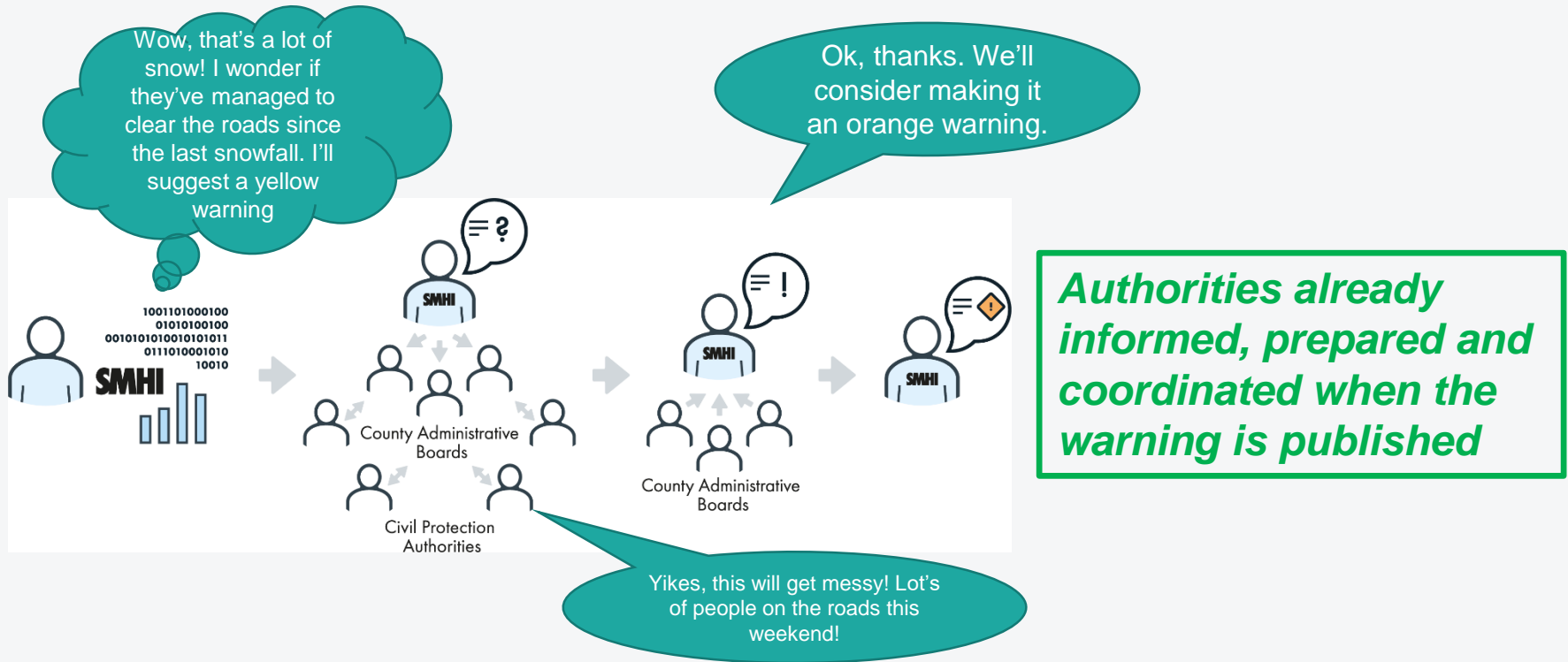
# Impact examples

- Pre formulated examples of impact for each warning type and level
- Choose the ones that are most appropriate for the current situation.

Rain	
Yellow	<ul style="list-style-type: none"> <li>• Traffic can be slower due to flooded roads.</li> <li>• Risk of, for example, basements, stormwater systems, roads and underpasses being flooded.</li> </ul>
Orange	<ul style="list-style-type: none"> <li>• Risk of blockages to the road and rail network due to extensive flooding.</li> <li>• Risk of delays in bus-, train- and air traffic as well as canceled departures.</li> <li>• Risk of extensive flooding that could cause property damage.</li> </ul>
Flooding	
Orange	<ul style="list-style-type: none"> <li>• Flooding of regional road infrastructure.</li> <li>• Risk for disruption to rail traffic due to flooding close to rail infrastructure.</li> <li>• Flooding of houses used for residential housing or commercial businesses.</li> <li>• Flooding of environmentally hazardous areas or contaminated land.</li> </ul>
Red	<ul style="list-style-type: none"> <li>• Flooding of national road and rail infrastructure.</li> <li>• Flooding of houses used for permanent housing or commercial businesses where trafficability is limited.</li> <li>• Widespread disruption to communities due to flooding of buildings.</li> </ul>

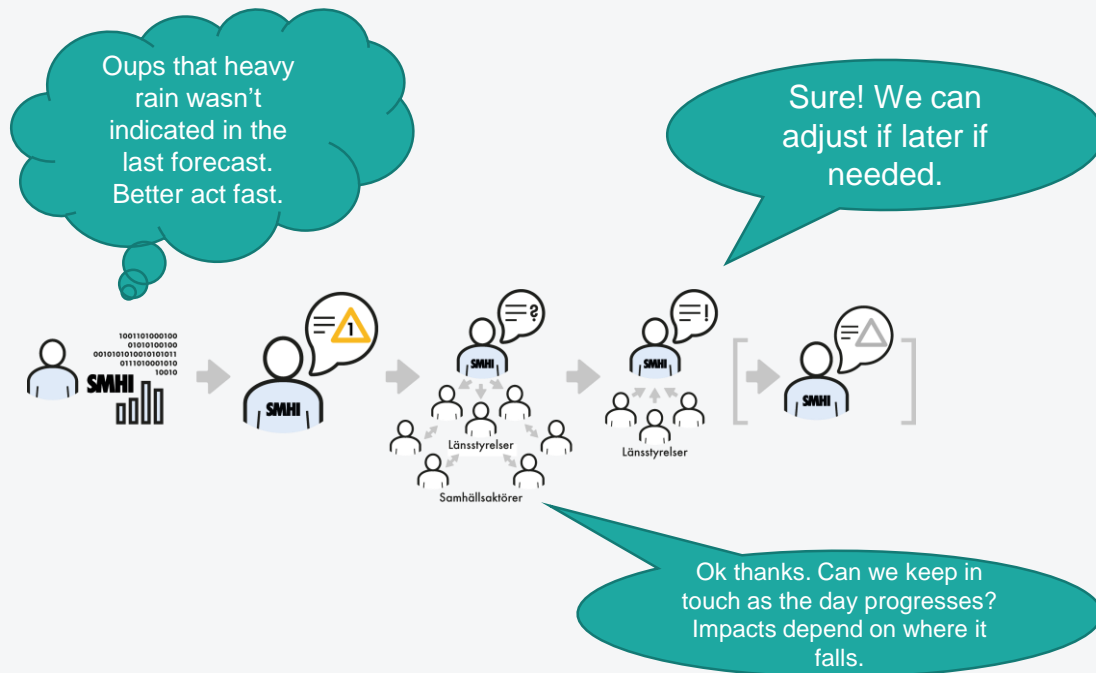
# The process (es)

Main process, with collaborative assessment before publication

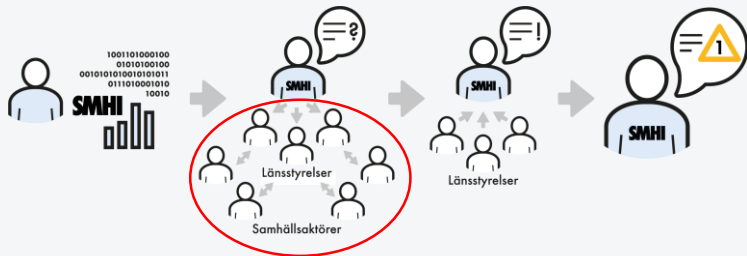


# The process (es)

The fast track...collaboration after publication.



*The information is fast tracked so that the public can prepare.*



## WIS – Web based portal for civic response collaboration

The screenshot shows the WIS portal interface with several sections:

- SMHI SMHI's bedömning av varningsnivå**: Information about the assessment of warning levels, including orange, yellow, and red warnings.
- Osäkerhet**: A section discussing uncertainty in weather forecasts.
- Prognosunderlag**: Multiple weather forecast maps showing wind and precipitation patterns.

The screenshot shows the SMHI Vädervarningar portal interface. It includes a navigation menu on the left, a list of active warnings on the right, and a map of Sweden showing warning areas.

**SMHI Vädervarningar**

Föreslagna / Publicerade

Antal träffar(0) Sortera Uppdateringstid

Regn 1 2022-09-27 15:00  
Starttid: 2022-09-27 15:00 Till: 2022-09-28 03:00  
Påverkansbedömning pågår

Vind 1 2022-09-27 02:00  
Starttid: 2022-09-27 02:00 Till: 2022-09-27 19:00  
Påverkansbedömning svara senast: 2022-09-28 16:00

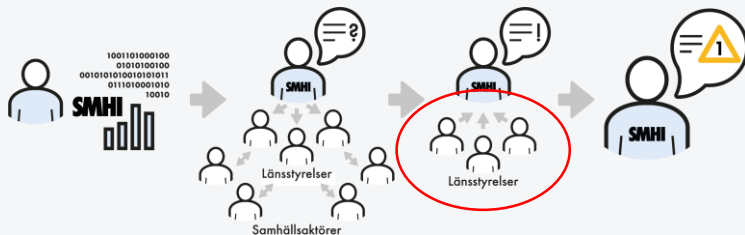
Medelvind till havs 3 2022-09-27 00:00  
Starttid: 2022-09-27 00:00 Till: 2022-09-29 14:00

Vind på kalfjället 1 2022-09-26 21:00  
Starttid: 2022-09-26 21:00 Till: 2022-09-28 14:00

Medelvind till havs 6 2022-09-26 15:00  
Starttid: 2022-09-26 15:00 Till: 2022-09-28 15:00

The map shows Sweden with several areas highlighted in orange and yellow, indicating active weather warnings.





Swedish Civil  
Contingencies  
Agency

SMHI

## WIS – Web based portal for civic response collaboration

DU ÄR HÄR: > SMHI VÄDERVARNINGAR

Minimera menyn

SMHI vädervarningar

Föreslagna / Publicerade Filtera

Antal träffar(6) Sortera Uppdateringstid iF

Regn 1 1 2022-09-27 02:00  
Starttid: 2022-09-27 15:00 Till: 2022-09-28 03:00  
Påverkansbedömning pågår

Vind 1 1 2022-09-27 02:00  
Starttid: 2022-09-27 02:00 Till: 2022-09-27 19:00  
Påverkansbedömning svara senast: 2022-09-28 18:00

Medelvind till havs 3 1 2022-09-27 00:00  
Starttid: 2022-09-27 00:00 Till: 2022-09-29 14:00

Vind på kalfjället 1 1 2022-09-26 21:00  
Starttid: 2022-09-26 21:00 Till: 2022-09-28 14:00

Medelvind till havs 6 1 2022-09-26 15:00  
Starttid: 2022-09-26 15:00 Till: 2022-09-28 15:00

### Påverkansbedömning

Ta ställning till den föreslagna varningen.

Skriven av: SMHI,

2022-09-26 14:23

#### Fråga 1 Obligatorisk

Instämmer ni med föreslagen varning (nivå och område)?

Eventuella önskemål om justeringar beskrivs och motiveras i kommentarsrutan.

- Ja  
 Nej

#### Kommentar

Kommentar

#### Fråga 2 Obligatorisk

Instämmer ni med föreslagen varningstext till allmänheten utifrån föreslagna exempel på påverkan?

Eventuella önskemål skrivs i kommentarsrutan. Tänk på att texterna måste hållas korta.

- Ja  
 Nej

#### Kommentar

Kommentar





# Warning types

Impact based warnings
Wind
Wind and snow
Snow
Rain
High temperatures
High sea level
Flooding

Not impact based warnings
Downpour
Thunderstorm
Black ice and freezing rain
Strong cooling effect
Wind at sea
Low sea level
Ice accretion (on ships)
High water discharge (in rivers)


# What does a warning consist of?

- Initial information overview – what, where and what day.
- Expand for deeper knowledge
  - Free hand geometry → more accurate extent
  - How can this affect me?
  - More precise when and where
  - More details on what is happening

Thursday 18 January  Friday 19 January  Saturday 20 January  Sunday 21 January 

[← Back](#)

Press the back button to see the rest of the warnings.

 **Orange - Wind and snow**  
The coastal land of Västernorrland county and the coastal land of southern Västerbotten

Occasionally fresh easterly or north-easterly wind in combination with persistent snowfall. Among other things, this can lead to very limited accessibility on the roads. On the coast mainly in Kramfors municipality, east of the E4, storm surges may also occur during Wednesday evening.

**How can this affect me?**

- Very limited accessibility on roads, especially in open landscapes, that, for example, has not been cleared of snow or due to traffic accidents.
- Delays in bus-, train- and air traffic as well as canceled departures.
- Likely power outage in areas with overground power lines, which also affects mobile networks for telecommunications.

**When?**  
17 January at 16:00 – 18 January at 12:00

**Where?**  
The coastal land of Västernorrland county and the coastal land of southern Västerbotten

**What happens?**  
During Wednesday, a low pressure moves up from the southwest and brings with it snowfall and increasing wind. The snowfall stops over the area and from Wednesday evening to Thursday morning snowfall that can be jämtlandsfjällen to the southern

[Show legend](#)

© OpenStreetMap contributors

# Evaluation/verification

- All land based warnings are evaluated based on:
  - **Forecast quality**  
*"did it rain as much as we said it would"?*
  - **Perceived quality**  
*"was the warning justified in your area"?*
- Each warning is given a "grade" based on the outcome of the who quality categories
  - **Accurate**
  - **Missed**
  - **False**
  - **Non verifiable**

## Forecast quality

- Four aspects
  - Amount  
*Correct amount or rain/snow/wind speed/water level etc.*
  - Geography  
*The event happened where we said it would*
  - Time  
*The event happened when we said it would*
  - Timeliness of warning  
*Published at least 6 hours before event*

## Percived quality

- Regional councils are asked to evaluate the warning based on:
  - Was the warning justified in your area?
  - Information/communication from/with SMHI
- They can also send comments or suggestions for improving the process.



# Maintaining the warningsystem

- SMHI owns the process
- National reference group, meets a few times each year.
- National guidelines are reviewed on a regular basis
  - First edition in 2021
  - Reviewed in 2022
  - Next reviews in 2026, 2030.



**Continuous improvements along the way!**

# Limitations and challenges

## Pre-defined warning types

- Hans (Aug – 23)
  - Rain on already saturated ground
    - *Not enough rain for a "rain warning", yet large consequences.*
  - Urban flooding (hard surfaces)
    - *Our "flood warning" is limited to rivers and lakes*

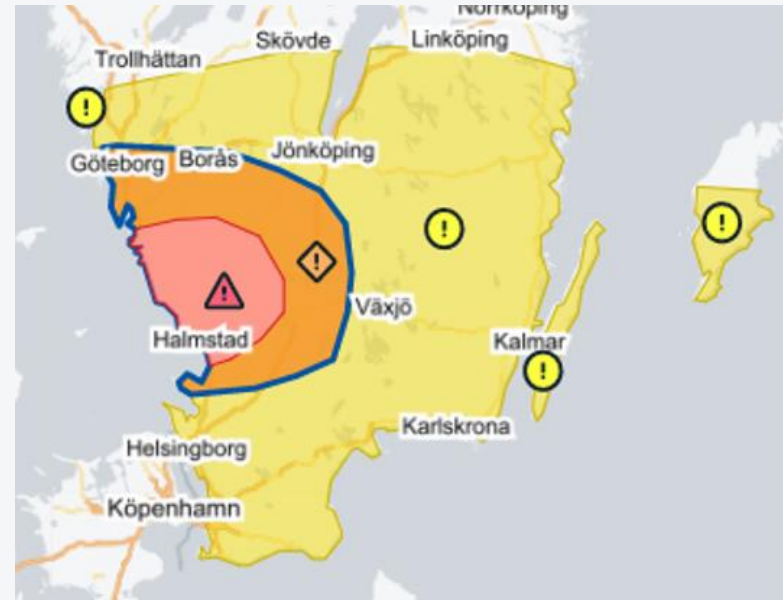
Open warning type for combination effects?



# Limitations and challenges

- How to get the message across?
  - *Yellow and orange can also lead to consequences!*

Need to re-educate!





# Lessons learned – helpful tips

- Include hazard management authorities early on in the process and identify their reasons for introducing impact based warnings.
- Encourage close collaboration when forming the method and prepare common exercises.
- Build on existing responsibilities, collaboration structures and technical solutions within crisis management organizations.
- Acknowledge that it is a learning process, and be prepared for continuous evaluation and adjustments after implementation
- Learn from fellow institutes that already has experience in operational impact based warnings.
- Consider verification routines at an early stage.
- Communication efforts are critical – public, media, authorities.
- Don't start building new technical systems until the process is set, tested and re-set!

**Change takes time!**

**Thank you!**