

WEATHER RISKS

AND HOW TO ACT UNDER EXTREME WEATHER CONDITIONS



Compiled by: Tiina Tammets

Editors: Tiina Dišlis, Silve Grabbi-Kaiv

Language editor: Anu Rooseniit

Designer: Taavi Kuha

Photographs: Sven-Erik Enno, Eliise Jääger, Jüri Kamenik, Signe Karulaas, Kairo Kiitsak, Taavi Kuha, Ann Kõiva, Villu Lükk, Lea Marmor, Kristjan Nurmela, Piret Pärnpuu, Tiina Tammets, Leili Valdmets, Estonian Rescue Board

The Estonian Environment Agency thanks the Estonian Rescue Board for their recommendations and ilm.ee for great cooperation.

© Estonian Environment Agency, 2019

TABLE OF CONTENTS

■ Glaze	2
■ Cold wave, very cold weather	4
■ Snowstorm (blizzard)	6
■ Heavy snowfall and accumulated snow	8
■ Icicles	10
■ Frost	12
■ Flooding	14
■ Drought	17
■ Ultraviolet radiance	18
■ Heat wave, hot weather	20
■ Thunder	22
■ Heavy rainfall	24
■ Tornado	26
■ Hail	28
■ Fog	30
■ Storm	32

GLAZE



Glaze is a **layer of ice** that forms on tree branches, wires and other objects when **supercooled** rain, drizzle, or fog droplets fall on objects and **freeze**. Large droplets of water that are formed at temperatures around zero degrees freeze slowly. Coming into contact with an object, they spread out and form a layer of water that freezes slowly and forms glazed ice. When glaze appears on the ground, it is called **glazed ice**, which normally appears when the air temperature is below -5°C . The formation of glaze is facilitated by the wind, so there is more glaze on the windward sides of branches and wires.

In **road transport**, the most dangerous weather condition is **glazed ice** forming on the roads, which decreases friction characteristics of the road cover in comparison with dry road and hence **increases braking distance**. The most insidious kind of glaze is a thin layer of ice, through which you can see the black road cover. This kind of glaze is also called **black ice** and it often appears during the night or early morning – when the air and ground temperatures are the lowest and there is minimal traffic. As black ice is very thin, it is quickly melted by the first rays of light, but it may persist on more shaded sections of the road.

Glaze is also dangerous to **planes**. When a plane enters an icing zone, supercooled water droplets from clouds accumulate and freeze on the aircraft. These droplets are much larger than drops of mist and the moving speed of an aircraft is much faster than wind speed. Therefore, the formation of ice on planes is much more **intense** than on ground objects. Ice changes the aerodynamics and speed of an aircraft, increases weight, causes dangerous vibrations, interferes with radio signals, etc. In the case of **ships**, strong icing may unbalance the ships and with strong waves there is a danger of the vessel **lying over** and capsizing.

In case of strong wind a thick layer of ice can **break the branches of trees**, break the **power lines** and make pillars of power lines fall. The crust of ice formed in the field impairs or suspends the supply of oxygen of plants, which may cause some or all of the **planting to perish**. Slippery roads are dangerous for pedestrians. Ice is considered a dangerous weather phenomenon since its formation. If the ice layer is **20 mm thick** or more, then it is considered a **very dangerous phenomenon**.

WHAT TO DO IN CASE OF GLAZE

- Choose footwear that minimizes the risk of slipping and falling on a slippery road.
- Under icy conditions, use winter tyres for driving.
- Choose a driving speed appropriate for the weather conditions.
- Keep aloof of trees, as branches may break under the load of ice.

COLD WAVE, VERY COLD WEATHER



During cold weather or a **cold wave**, the air temperature is considerably lower than normal for winter. Cold air may arrive from the neighbouring areas, but the air may also cool down on the same territory. Cold weather in Estonia is mostly associated with continental or maritime air masses arriving from the **north**, but also with continental polar air arriving from the **east**.

A continental Arctic air mass forms above the ice-covered Arctic seas. When travelling across Kara Sea to North-Russia, this air is quickly transformed into **continental polar air**. The second air mass bringing cold weather to Estonia is **maritime Arctic air** that forms above the western part of the Arctic Ocean and travels across the Norwegian Sea and Scandinavia towards the Baltic Sea. Arriving from the open sea to the continental areas, it also transforms into maritime polar air.

Although the climate is warming, the **frequency of extreme weather** has increased, including the occurrence of unusually cold winters. In Estonia, the persistence of a minimal daily temperature $-30\text{ }^{\circ}\text{C}$ or below during five or more days is considered **extremely dangerous** to human health.

HOW TO PROTECT YOURSELF AND OTHERS FROM COLD WEATHER

- During cold weather, stay indoors, if possible. When going outside, dress warmly, preferably in layers, and take care protecting sensitive body parts.
- A person lying down should be quickly taken to a warm place and warmed up slowly. If the heart stops, start resuscitation immediately and call the emergency number 112.
- In case of hypothermia, start warming up from the inside to the outside. Breathing in warm fumes or drinking warm liquid will help the body warm up.
- The first sign of a frostbite on peripheral body parts (limbs) during local hypothermia is pain. This can be relieved with active movements and massage. Do not dip frostbitten hands or feet in hot water, as a sudden change in temperature may damage tissues.
- Do not go to the sauna after a frostbite, as a sudden rise in temperature may be life-threatening to the body.
- During a cold wave, keep in contact with disabled or elderly neighbours, also with relatives and acquaintances living in rural areas. Pets also need more care than usual.
- Use heating in moderation.
- Wood-fired furnaces should be heated twice or three times per day with one furnace-full of wood at a time; make sure you do not close the damper too early.
- When using electric heaters, make sure you do not overload the electrical system.
- In order to avoid the risk of frozen pipes, wrap additional insulation around pipes.
- Use heating cables or a blower to warm up frozen pipes. Do not use open fire to warm up frozen pipes.
- In order to avoid fires which may start from strangers making a fire in your basement or shed, be sure to lock doors and close off any other passes to the building.
- When driving, make sure you have enough fuel, a charged mobile phone, warm clothes, and a warm drink with you.

SNOWSTORM



Blizzards occur in Estonia during the cold season with moderate wind when there is enough **loose snow**: it is either snowing or wind lifting up the snow from the ground. The air temperature is generally below 0 °C and you cannot see the sun. **Strong wind** often **rotates** at high speed, taking along falling snow as well as loose snow from the ground. Blizzards normally start with a wind speed around 4–6 m/s, but it depends just as much on the **wind speed** as on the **properties of snow**. When the air temperature is low and the snow is fluffy, then a weak wind may also carry the snow along. However, when a strong crust has formed on the snow with positive degrees, then even a strong wind would not cause a **snowstorm**.

Snowstorms carry **vast amounts of snow** from one place to another. They gain an especially strong momentum on plains. **Wind** together with **low air temperature** increases the effects of cold weather and the risk of **freeze burns**. Blizzards are dangerous because of **decreased visibility** and the **accumulation of large masses of snow**. Snow blocks railways and highways; the clearing of such blocks may sometimes be very difficult. **Road as well as air and railway traffic** may be disrupted, not to mention the difficult situation of **pedestrians**. In Estonia, blizzards mainly occur in December, January and February. **Snowstorms** are especially dangerous from wind speed 15 m/s with a duration of 12 hours or longer.

HOW TO PROTECT YOURSELF AND OTHERS FROM A BLIZZARD

- Be prepared for possible power cuts.
- Charge your mobile phone.
- Make sure you have supplies of drinking water.
- If possible, stay indoors.
- When going out, dress according to the weather conditions and remember that wind has a cooling effect; take a charged mobile phone with you.
- If possible, also avoid driving, especially on side roads. When driving, fill up the tank and take a charged mobile phone, a snow shovel, warm clothes, and a warm drink with you.
- Information about road blocks caused by blizzards is available at the road information service number 1510.
- In case of human injuries and direct danger, call the emergency number 112.

WHEN YOU HAVE TO GO OUTSIDE IN A BLIZZARD

- Protect your head, neck, hands, especially your wrists and ankles from cold.
- Make sure your clothes are not too tight, as this may disrupt blood flow. Disrupted blood flow facilitates the occurrence of a freeze burn.
- Wear water-proof clothes and shoes.

HEAVY SNOWFALL AND ACCUMULATED SNOW



The nature has adjusted to having a **snow cover** during a certain period of time by going into **hibernation**. Deep snow hinders the mobility and access to appropriate feeding areas of most wild animals. Accumulation of snow on trees may cause **snow breakage**. Extreme snow damages can be found in dense spruce forests where most of the fallen snow may remain in the tree crowns during mild and quiet days. Thousands of cubic metres of trees have broken under the load of accumulated snow.

The accessibility of streets and roads must be ensured under the conditions of snow cover. **Snow load** also has to be considered during the exploitation and construction of buildings, roads, communication lines and many other objects. Heavy snowfall may cause **obstructions in traffic** or **traffic jams** and traffic accidents due to limited visibility.

Estonia's **snow risks** are also conditioned by the **instability of the snow cover**, its unexpected appearance and disappearance. Sudden changes in weather in relation with the sudden appearance or disappearance of the snow cover at late spring or early autumn endanger the lives of many plants and animals. Water reserves that accumulate in snow cover also determine the extent of **springtime high waters**.

HOW TO PROTECT YOURSELF AND OTHERS FROM HEAVY SNOWFALL

- Keep aloof of trees, as their branches may break under snow load.
- Do not walk under eaves, as the snow accumulated on roofs may fall down.
- Clear snow from the roofs to avoid the risk of collapse.
- When driving, take a charged mobile phone and a snow shovel with you.
- In case of a heavy snowfall, accompany children and elderly people who cannot find their way in a snowfall and may therefore lose their way easily.



ICICLES



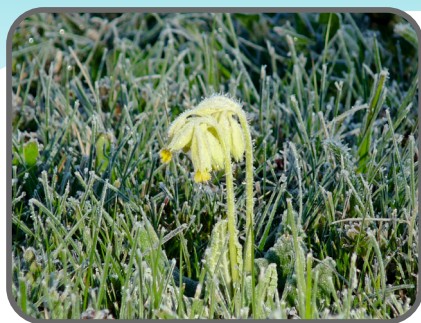
Icicles form when **the roof surface temperature** rises above **0 °C** or when **snow** melts on a roof due to **sunshine**. The melted water drops down and when reaching a **colder** area at the eaves, **freezes** and forms gradually growing icicles. Icicles may **cause trauma** to pedestrians or **damage to vehicles** when they fall down; their weight may **break power lines** and sometimes even the constructions of buildings and facilities.

HOW TO PROTECT YOURSELF AND OTHERS FROM ICICLES

- Do not stand or park your car under icicles.
- The roof must be constructed in a way that prevents leaking of heat.
- House owners are obligated to clear the icicles on their houses and if necessary, they should be reminded of this duty.



FROST



In spring and in early and late summer, plants may be damaged by **air temperatures ranging around zero degrees** – a common phenomenon in Estonian climate. At the same time, the daily average air temperature may extend above 10 °C. Frost is the drop of the temperature of surrounding air, ground, or plantation below 0 °C **during the vegetation period of arable crops**. The air temperature measured on the ground and the vegetation height of plants is often 2–4 °C lower than the air temperature measured at two metres by a meteorology station. Every now and then, frost also causes damage to or death of natural as well as field and garden cultures.

Frost is divided into advection and radiation frost. **Advection frost** appears when air with a temperature below 0 °C enters the area from elsewhere. Such frost is characteristic of early spring and late autumn. The weather is mostly windy then and frost spreads across a wider territory. Often, such frost is accompanied by a temporary snow cover; daily changes in temperature are quite small and frost appears during several consecutive nights. **Radiation frost** appears during calm and clear nights as a result of the **thermal radiation** of the ground and plant leaves, which causes a **strong cooling of the air** near the ground and vegetation. This is facilitated by **clear and calm weather**. In this case, the air temperature starts to drop quickly just before sunrise and if the clear weather persists, achieves its **minimum by the time of sunrise**.

Radiation frost may last for 8–12 hours in early spring, but is much shorter during late spring and mainly covers small areas. Advection and radiation frost often occur simultaneously, with the first one being dominant at the beginning of the frost period and the second one later during the period.

In addition to the geographical latitude, ground height and distance from the sea, the occurrence of frost is also influenced by the local landscape, landforms, soil, forests, proximity of water bodies, and the conditions of incoming and outgoing airflow. **Cold air is heavier** and in case of an uneven relief, air masses that have cooled down near the ground start to **flow to lower places** from the surrounding areas. As a result, there is a constant influx of cold air into the so-called frost holes, while in higher areas, the outflow air masses are replaced with new and warmer air.

HOW TO PROTECT PLANTS FROM FROSTS

- Pre-grow plants that are sensitive to frost in spring and cover them up to protect them from cold.
- Remember that plants that have so far grown in warmth (have been covered up) are especially sensitive to frost.
- Plants that have only just been planted and have not properly rooted yet are sensitive to cold.
- Water your plants with warm water in the evening to protect them from cold. If plants have withered due to cold by the morning, then water (sprinkle) them with cold water to reduce the contrast in temperatures caused by intense morning sunshine.

FLOODING



Flooding occurs when **excess water** is where it should not be: on fields, in the city, on the streets, in the basement, or elsewhere. The most common cause of flooding is that it rains more than the ground can deposit. **The soil cannot deposit rainwater** that has come down with a **greater intensity** than **25 mm per hour**. This is why water spreads out, causing **erosion**, breaking buildings, damaging sown crop, drowning people and animals: this occurs during **flash floods**. Flash floods are usually sudden events which do not allow advance warning. According to the available statistics, most lives are lost in floods out of all natural disasters.

Extensive **frontal systems** cause rainfalls on large areas and often over a long period of time. Rivers and streams cannot hold the water between their banks, so that water enters cities and households. In addition to the amount and intensity of precipitation, the likelihood of flooding is also largely dependent on **hydrological factors** – the existence of water bodies, soil characteristics, the ground relief, and the status of ground water. Other **meteorological factors**, such as air temperature, wind speed, duration of sunshine and air humidity, also have a role. Flooding or high waters may also be caused by **the fast melting of snow** and **ice blockage on rivers**. Land may also be drowned under water due to **sea level rises**. **Storm surges** are a danger on the coast, as they push large masses of water on a land which may already be saturated with water.

Floods also often occur due to **technical reasons**, such as when hydrological facilities break or are technically unfit to extreme situations. In cities, floods are dangerous because the **asphalt cover** does not absorb water. **Land rendered hard by drought** does also not absorb water well. **Agriculture, deforestation**, and urbanisation increase the water flow from precipitation; storms that would not have caused flooding during earlier periods now cause flooding on massive areas of land. It has been presumed that the sprinkling of dry areas may also increase the amount of precipitation, as it increases air humidity and evaporation of water. **Flowing water is especially dangerous**: a flowing mass of water with the height of 15 cm may pull down an adult person and cause serious damage to buildings and property.

HOW TO PROTECT YOURSELF AND OTHERS FROM FLOODING

- Make sure your weather forecast is as accurate as possible and be well-informed of any changes in water levels and of the water level that might put your household at risk.
- If possible, build water barriers.
- Inform your neighbours.
- Be ready for possible power cuts; turn off the power supply in case of immediate danger and when leaving home.
- Charge your mobile phone.
- Have supplies of drinking water.
- Close the openings of waste water drains and outlet tubes with wooden closures. Disconnect rainwater drains that lead to the sewage system.
- Check that your domestic animals or pets are not trapped.

- In the flooded area, take your personal property, including chemicals that may cause contamination, to a place that is higher up from the ground.
- Be ready for evacuation.
- Once the water enters the building, recede to the first floor, the attic or the roof. Take along the things you need in case of an emergency.
- Make yourself or your household visible/audible for the rescue team and follow the instructions given during the evacuation.
- When being outside, consider the risks that large masses of water may cause to people, animals, vehicles and floating vessels, loose items, etc.
- Avoid walking or driving through a flooded area.
- Stay clear of flooded power stations and electrical devices and cables.
- When returning to a flooded area, watch out for the risk of electric shock and other dangers caused by damaged devices and contamination.
- Please report any human injuries and immediate danger to the emergency line 112.
- After flooding, notify the insurance company and the local authorities of the damages as soon as possible. It is difficult to establish the extent of actual damages later on.



DROUGHT



Drought is caused by **lack of precipitation**. In Estonia, this may happen during the warm season. The **impact** of drought **to people and the environment** depends on the **time** of water shortage and its **duration** in comparison with the **water need**. Water need can be evaluated on the basis of water use intensity and existing water reserves. Droughts occur practically everywhere around the world, but their characteristic indicators may vary to a great extent. While most weather risks appear suddenly, drought **develops over a longer period of time** – weeks, months, and some-times even years. Drought often causes **deterioration in water quality**, as the concentration of several additives in ground-water may increase. Drought is also mostly characterised by **higher air temperatures** than normal, as the water loss from evaporation is more intense at higher temperatures. Evaporation is also facilitated by **strong winds** and **low air humidity**, which may cause the drought to intensify.

RECOMMENDATIONS FOR ADAPTING TO DROUGHT

- Use water sparingly.
- Take care of garden and field plants suffering from drought.
- Drought is related to a high risk of forest and landscape fires – take measures to avoid fire risk:
 - ◆ do not smoke or make fire in a forest
 - ◆ do not leave glass bottles lying around as they concentrate sunrays
 - ◆ when noticing smoke or fire, call the emergency line 112, warn other people, and start to put out the fire or limit its spreading as much as you can.

ULTRAVIOLET RADIATION



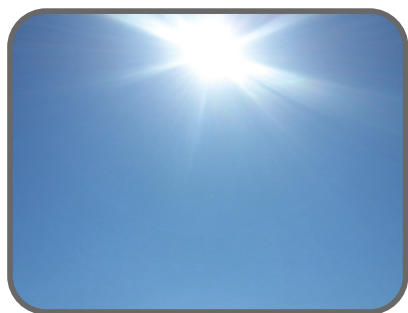
Out of all the electromagnetic radiation that comes from the Sun towards the Earth, **thermal radiation**, **visible light radiation**, and some of **ultraviolet (UV) radiation** reach the Earth's surface. The shortest-wave part of UV-radiation, **UVC-radiation**, is the most **harmful** to people and nature. Fortunately, this is absorbed at the height of 15–35 km at the stratosphere, in the ozone layer. How much of medium-wave ultraviolet radiation, **UVB-radiation**, reaches the Earth, is largely dependent on the thickness of the ozone layer. The longest-wave part of ultraviolet radiation, **UVA-radiation**, is absorbed in the ozone layer only to a small extent.

The **absolute intensity** of UV-radiation is measured with sensors the spectral sensitivity of which corresponds to the erythema sensitivity of people's skin. **Erythema** is the reddening of skin caused by the dilation of superficial capillaries. **UV-index** 1 designates radiation density 0.025 W/m^2 , which may cause an erythema. In Estonia, **the highest** measured value of the **UV-index** has been **8.6 units**.

UV-radiation in moderation is beneficial to people, as it facilitates the synthesis of **vitamin D3**. This vitamin promotes the strengthening of bones and protects from osteoporosis. The period between November to March is the so-called ‘vitamin D winter’ – a time when sunlight does not enable producing the necessary vitamin naturally in the skin.

HOW TO PROTECT YOURSELF AND OTHERS FROM ULTRAVIOLET RADIATION

- People with delicate (sensitive) skin, children, and elderly people, as well as people with irregular birth marks, should be careful when sun-tanning.
- Tanning time is dependent on the UV-index, the values of which are available at the website of the Estonian Weather Service www.ilmateenistus.ee.



HEAT WAVE, HOT WEATHER



Heat is mainly associated with the arrival of an **anticyclone**, i.e. a **high-pressure area**, into Estonia. Such an anticyclone spreads out across a vast area and a **very warm Mediterranean Sea air** or dry continental air from **South-Russia** and **Central Asia** moves northwards along its western or southwestern edge. If the anticyclones have formed in the dry air mass of continental temperate climate, then the weather will be dry, with little cloudiness and the air will warm to 25–30 °C. The warming is very **rarely** associated with the arrival of **tropical** air to our latitudes. In this case, air temperature reaches 30–35 °C in summer and 26–30 °C in spring.

High air temperatures have also occurred **under the conditions of a depression**, mainly in relation with a **southern cyclone**, along the eastern edge of which hot tropical air may travel far into the north. Estonia's **absolute heat record** was registered on 11 August 1992 in Võru, with a measured maximum air temperature of **+35.6 °C**. In Estonia, a daily maximum air temperature of +30 °C that persists over a period of five or more days is considered to be **extremely dangerous** to human health.

It is important to evaluate heat both on the basis of the air temperature as well as air humidity data, as **heat is more difficult to tolerate** under the conditions of **high air humidity**. The respective combined characteristics are referred to as the **heat index**, sometimes also the **perceived air temperature** or effective temperature. During Estonia's heat record, air humidity was relatively high and therefore the perceived air temperature was nearly +40 °C. **Wind speed** is also important when evaluating heat – **heat is easier to tolerate** when **the air is moving**.

HOW TO PROTECT YOURSELF AND OTHERS FROM A HEAT WAVE

- Dress in light colours, as light colours reflect more sunlight.
- Dress lightly, but make sure to cover your head.
- Drink plenty of fluids, preferably water, and have water at hand to refresh yourself.
- If possible, periodically cool yourself in water.
- All windows should be open in a vehicle.
- People tend to lose their appetite in heat, but make sure you eat something.
- If possible, eat ice cream (in moderation).
- Older and sick people, especially those who suffer from high blood pressure or heart disease, should avoid straining themselves and stay out of sunshine.
- Consider that the risk of forest, landscape and general fire is higher during a heat wave.

THUNDER-STORM



Thunderstorm is a powerful **electrostatic discharge** between clouds or between a cloud and the ground, accompanied by lightning and the sound of thunder; it mainly occurs in **cumulonimbus clouds**. Thunderstorm mostly comes with **storm winds, heavy rainfall**, sometimes also **hail**, more rarely with a **tornado** or a **waterspout**.

Cumulonimbus clouds turn into **thunder clouds** under favourable conditions due to updraft. When the updraft is very strong, then the tips of cumulonimbus clouds rise very high, form a veil around them and develop into thunder clouds. Thunder clouds may reach as high up as 18 kilometres. They have rising as well as descending air flows in them with the speed of up to 30 m/s, in some cases even 60 m/s. They also have air vortices.

The lower part of the cloud consists of **water droplets** with a negative charge and the upper part of **ice crystals** with a **positive charge**. Lightning is caused by the electrostatic discharge between two cloud sections with different charges. This may happen within a cloud, but also between a cloud and the ground or between two clouds. **Cloud-to-ground lightning** is the **dangerous** kind – it normally happens between a negatively charged bottom of a cloud and positively charged ground. Lightning is one of the greatest dangers in nature.

HOW TO PROTECT YOURSELF AND OTHERS FROM THUNDERSTORM

- Collect all items from outside that may be picked up by wind.
- Park your vehicle at a clear area or in the garage.
- Be prepared for possible power cuts.
- Charge your mobile phone.
- Have supplies of drinking water.
- If possible, stay indoors, close the doors and windows of buildings.
- Help older and sick people get to a safe place.
- Remove household appliances from the power supply and stay clear of wall sockets.
- Do not make fire in a stove during lightning, as smoke is a good electric conductor and attracts lightning.
- Do not hide under trees.
- If you are in or on a water body during thunder, come to the shore immediately, as water is a good electrical conductor and attracts lightning.
- Stay clear of power lines that have fallen down and notify Elektrilevi of them by calling the number 1343.
- Information about road blocks is available at the road information number 1510.
- Information about power cuts should be forwarded to Elektrilevi by calling the breakdown line 1343.
- In case of human injuries or damages that pose immediate danger, call the emergency service number 112.
- Explain to children that the sound of thunder is not dangerous, but lightning is.
- Do not use a landline, as it may cause an electric and acoustic shock.
- A correctly installed lightning protection system will protect buildings from thunder.

HEAVY RAINFALL

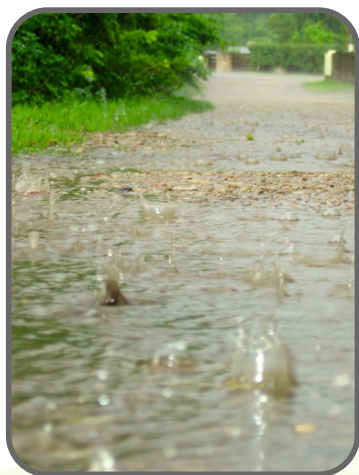


In case of heavy rainfall, **precipitation** accumulates **too fast for the soil to absorb it**. A rainfall is considered intense when **at least 1 mm** of precipitation falls down **in one minute**. A rainfall that produces **at least 30 mm of precipitation in one hour** or less is **also** considered **dangerous**. In Estonia, very intense rainfalls occur during the summer and normally **they do not last long**. Strong **showers** usually occur for less than an hour, whereas the **intensity** of the rainfall in time as well as space **varies** to a great extent. Therefore, it is difficult to register the intensity of heavy rain, the time and place of rain, and the amount of precipitation at any given moment.

Many cases of intense precipitation are not registered in the meteorological database due to their **local nature**. As a rule, heavy precipitation comes from **cumulonimbus clouds**. These clouds grow in an upward direction due to fast-rising warm and humid air and can sometimes even reach the upper edge of the **troposphere**, which is at the height of 12–14 kilometres at our latitude. Favourable conditions for the development of such clouds are created by **cyclones**.

HOW TO PROTECT YOURSELF AND OTHERS FROM HEAVY RAINFALL

- Make sure your weather forecast is as accurate as possible and be well-informed of any changes in water levels and of the water level that might put your household at risk.
- Be prepared for possible power cuts; turn off the electricity when you leave house.
- Stay clear of flooded power stations, electrical devices and cables.



TORNADO



A twister or a tornado is a rapidly **rotating column of air** that extends **from a thunder cloud to the ground** and in which winds may achieve the speed of up to 145 m/s. This phenomenon is mainly known as a **tornado** in the world. The **air pressure** is extremely **low** in the middle of the twister and this sucks up dust and litter from the ground. The column of a tornado is made visible by the **condensation of water vapour** inside it. The movement of a tornado on ground may almost come to a halt at times, but it can also achieve the speed of a passenger car (110 km/h). Most tornados rotate cyclonically, that is **counter-clockwise** on the Northern Hemisphere and **clockwise** on the Southern Hemisphere.

In Estonia, a tornado is referred to as **whirlwind**, and a whirlwind that has formed over a water body as a **waterspout**. A sudden high-speed gust of wind that may occur during a thunderstorm is called a **squall**. Whirlwind and squall may be difficult to tell apart, which is why they are commonly referred to as small-range **summer storms**. Such summer storms may be related to cyclones, but are normally connected to **small-range depression areas** that have developed in the neighbourhood. As the common name (*suvetorm* in Estonian) hints, whirlwinds only appear in Estonia in the summer. Their wind speed surpasses the **danger criterion, 25 m/s**.

In the U.S., a tornado encompasses a vast area of land, an average of 50–300 m in width and up to 8 kilometres in length; the area is smaller in Estonia. As they last only **a few minutes** and encompass a small area of land, whirlwinds and waterspouts have rarely been observed at meteorology stations.

HOW TO PROTECT YOURSELF AND OTHERS FROM A TORNADO

- Seek shelter from the basement or indoors; if this is not possible, from a ditch or low treeless area.
- In buildings, it is safer to remain at the lower floors, away from windows and exterior walls, preferably in small rooms.
- Try to exit large spaces as their ceilings may fall in. This includes shopping centres, lecture halls, service centres, etc. If you have no time to exit, descend on the lower floors, avoiding the escalators.
- Get out of a caravan, as the tornado may pick it up. Seek shelter from a place where the caravan would not hit you or bury you under it.
- When hit by a tornado, get out of the car.
- When on water, come to the shore immediately.
- Avoid the forest and if you happen to be there, do not make a fire.
- If there is nowhere to find shelter at, escape the tornado crossways with the path of the tornado.
- Stay clear of fallen power lines and notify about them by calling Elektrilevi at 1343.
- Stay clear of loose items or trees that may break.
- Information about road blocks is available at the road information number 1510.
- Elektrilevi should be notified of power cuts by calling the breakdown line 1343.
- In case of human injuries or damages that pose immediate danger, call the emergency service number 112.
- If you are at a public event during a tornado, follow the instructions of the event organiser.

HAIL



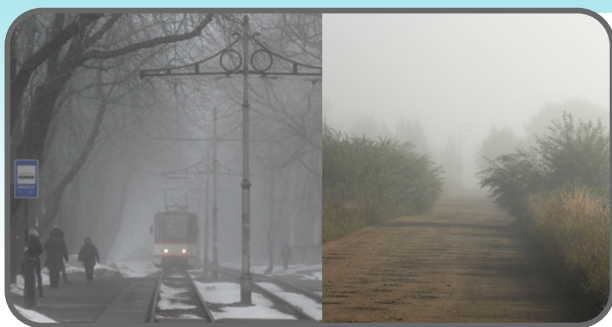
During the warm season, thunder and showers is sometimes accompanied by hail, which mostly comes unexpected. Hail comes down from massive and high **cumulonimbus clouds**. It normally occurs on scorching hot summer days when warm and humid Mediterranean air has reached Estonia. When mixing with cooler air, it produces a massive amount of water droplets as a result of condensation. When there are simultaneously relatively little nuclei necessary for condensation, then most of the water droplets will remain in a **supercooled** liquid phase. This means that abnormal amount of water droplets will freeze on a small amount of ice crystals. At the same time, air warms up due to the condensation of water vapour and produces an updraft of up to 100 km/h. The light crystals with a frozen layer of water are taken upward with the rising air and their **speckles of snow** attach on the layer of ice. This forms the **non-transparent layer of a hailstone**. In a cumulonimbus cloud, hailstones repeatedly move up and down with the **rising** and **descending** airflows and **attach new layers of frozen water and non-transparent snow**. There may be as much as 25 layers. When a hailstone becomes so heavy the airflow can no longer carry it around, it drops down so fast that it has no time to melt in the lower layers of warmer air. The **circumference of a hailstone** can range from 4–5 mm to 10 cm, their weight may vary from a few grams to a kilogram. **Hailstones fall** never for long – only **1–8 minutes**. Hail mostly comes with thunder.

HOW TO PROTECT YOURSELF AND OTHERS FROM HAIL

- Seek shelter.
- Park your vehicle on a clear space or in the garage.
- If possible, stay indoors, close the doors and windows of buildings.
- Help old and sick people to a safe place.
- Find shelter for domestic animals, let your pets in.
- Indoors, stay clear of windows as hailstones may break them.
- In case of human injuries or damages that pose immediate danger, call the emergency service number 112.



FOG



Fog is nothing else than **a cloud touching the ground**. Like a cloud, fog appears once a layer of air cools down below dew point. The water vapour in the air then achieves saturation, which means that it turns from gas to liquid or even solid form. Fog usually consists of water droplets with a circumference of up to 0.05 mm and with minus degrees can also consist of ice crystals. The whitish colour of mist is caused by **dispersal of radiation** from the particles. The more floating particles in the air, the worse is visibility. This poses a danger **to road, water, railway**, and especially **air traffic**.

Fog can persist with **calm weather**. Due to fog risk, one must be attentive near **low damp areas** – wetlands and water bodies, as fog often appears in a driver's field of vision unexpectedly. This type of fog is called ground fog. If visibility drops below 500 m and fog persists for over 3 hours, then such fog is considered as **dangerous** weather. When visibility drops below 50 m and fog persists for 12 hours, then it is classified as **extremely dangerous** weather. The visibility limit for dangerous fog at sea is 1000 m and extremely dangerous fog 200 m.

Modern technology has made traffic in fog much easier. Many floating vessels have **radars** that help them navigate in fog. Cars driving on roads use **fog lamps**. Airports have tested different methods of dispersing fog. One of them is to sprinkle the air with salt particles to create condensation nuclei; the other method is to heat the air, thus creating favourable conditions for convection. These methods are most efficient at negative degrees. The best recommendation, however, is the following: **be careful!**

HOW TO DRIVE IN FOG

- If possible, avoid driving.
- If you do have to drive, drive slowly with low beam lights. With fog, high beam lights create a so-called white wall effect. Watch your speed on the speedometer, as in fog, one perceives their moving speed as slower than it actually is.
- Use your fog lamps, but do not forget to switch them off once visibility improves.
- Be careful when droplets of fog precipitate on the cold road and on the car and form a glaze. The road then quickly turns very slippery.



STORM



According to an international agreement, storm is a wind with an average speed of at least **21 m/s**. This kind of wind causes trees to break or tears them up with their roots and may cause extensive damage to buildings. In Estonia, such winds occur an average of twice per year, mainly on the West-Estonian islands.

In addition to the average wind speed, the speed of **squalls** or gusts of wind is also important and this is characterised by **maximum wind speed**. Sudden strong gusts of wind are the main reasons for damages. Squalls ravage forests and cause damage to power lines, roads and buildings. At sea, squalls may be fatal to ships because they create high waves.

The danger level of **squalls** rises significantly starting from **25 m/s**. The cruise ferry Estonia went down in cool north-western squalls with the speed of 25–27 m/s. The average wind speed in Estonia has never reached the level of a hurricane, which starts from **34 m/s**; however, squalls may reach that wind speed.

HOW TO PROTECT YOURSELF AND OTHERS FROM A STORM

- Collect loose items that may be picked up by wind from outdoors.
- Park your vehicle at a clear area or in the garage.
- Be prepared for possible power cuts.
- Charge your mobile phone.
- Store drinking water and if necessary, also pharmaceuticals.
- Keep your identity documents and bank cards at an easily reached place.
- Help old and sick people to a safe place.
- Stay indoors, close doors and windows of buildings. When exiting a building, use a door that opens downwind.
- If possible, avoid driving. When driving, fill up the tank and take a charged mobile phone with you.
- Stay clear of power lines that have fallen down and notify Elektrilevi by calling at the number 1343.
- Stay clear of loose items and trees that may break.
- Elektrilevi should be notified of power cuts by calling the breakdown line 1343.
- In case of human injuries or damages that pose immediate danger, call the emergency service number 112.
- Consider that wind has a cooling effect that intensifies rapidly as the wind speed increases.
- Before starting to repair damages, wait until the storm subsides.

