

## Lesson 02

# Weather and Weather Instruments

# Learning Intentions

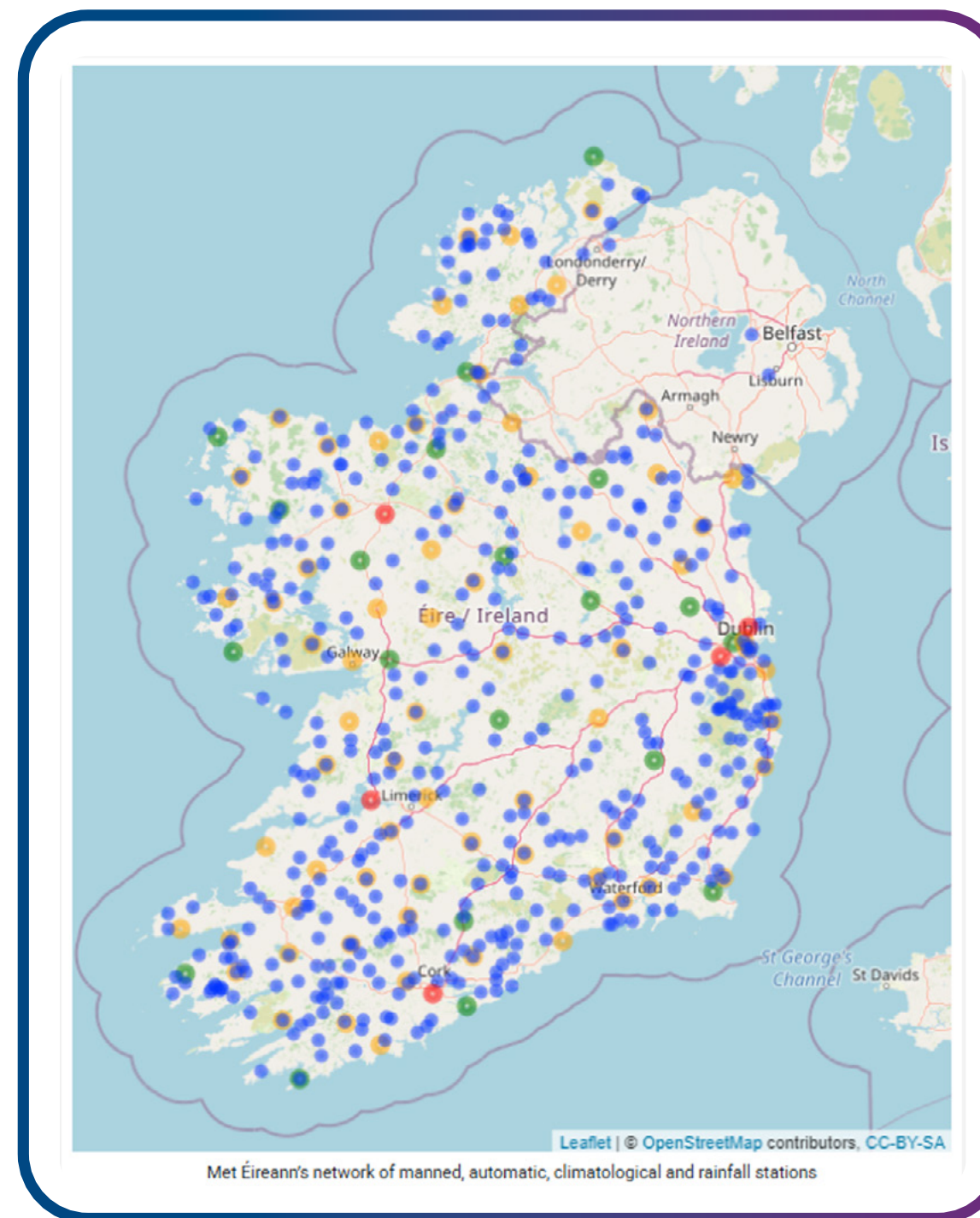
**At the end of this lesson students should be able to**

- Explain why weather forecasts are important.
- Identify weather conditions on a weather map – synoptic charts.
- Describe different weather instruments and how they work.



Weather stations use equipment and instruments to measure and observe the weather. These gather data on:

- Temperature
- Humidity
- Atmospheric (air) pressure
- Precipitation
- Wind direction and speed
- Sunshine hours and intensity



Met Éireann has an observation network that gathers data across the country for use in weather forecasting.

See the locations of these stations on this map.

The blue dots represent rainfall stations. The yellow dots represent climatological stations. The green dots represent automatic weather stations. The red dots represent manned weather stations.

**Met Éireann, 2025.**



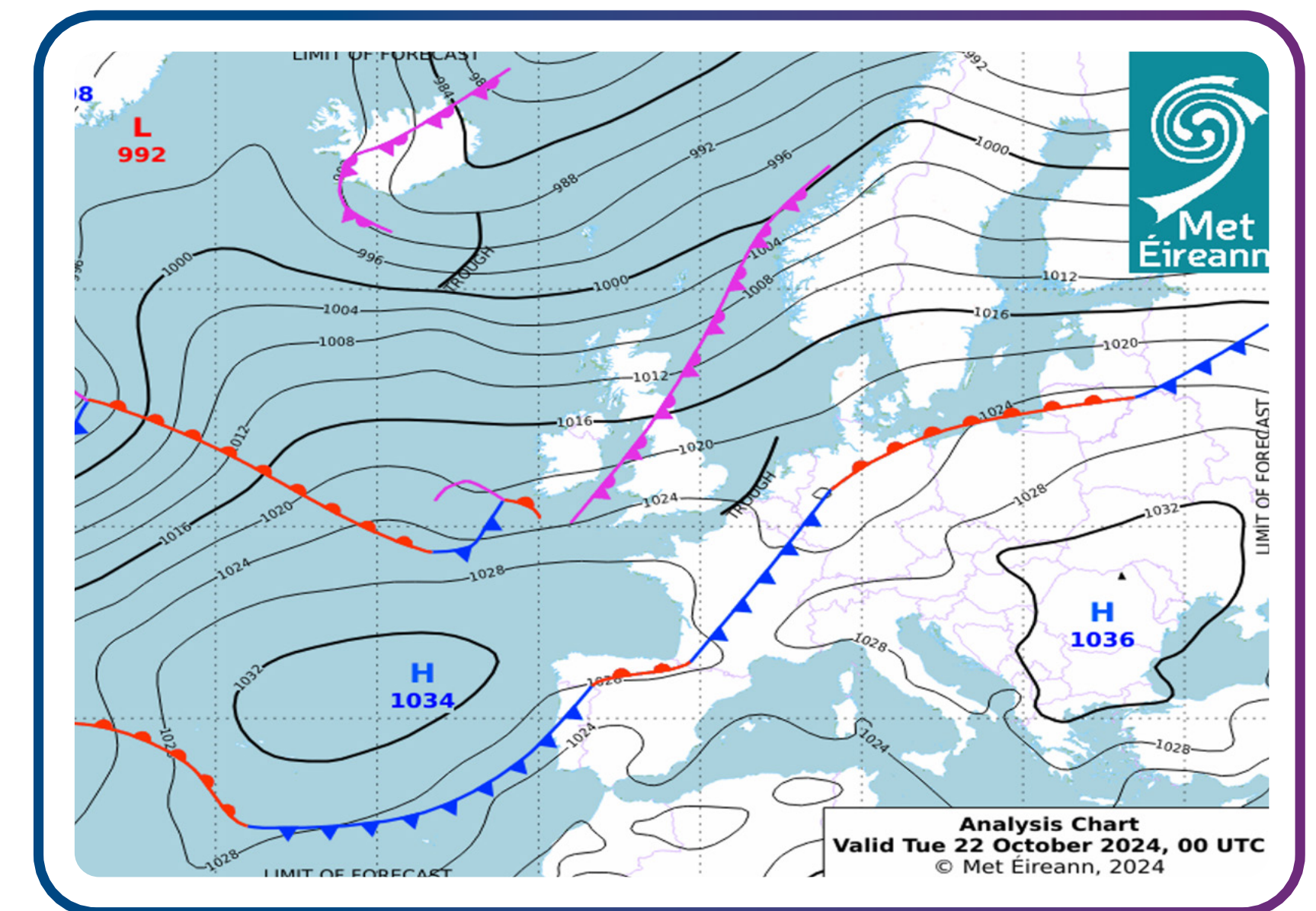
# Weather & weather forecasting

## Weather

- Weather is the short-term condition of the atmosphere, i.e., what is happening in the atmosphere at a particular time and place.
- Climate is the long-term pattern of weather in a particular area.

## Weather forecasting

- A prediction or estimate of what weather conditions will be like in area over the coming days.
- In Ireland, the national weather forecaster is Met Éireann.



**Met Éireann, 2025.**



# Why are weather forecasts important?



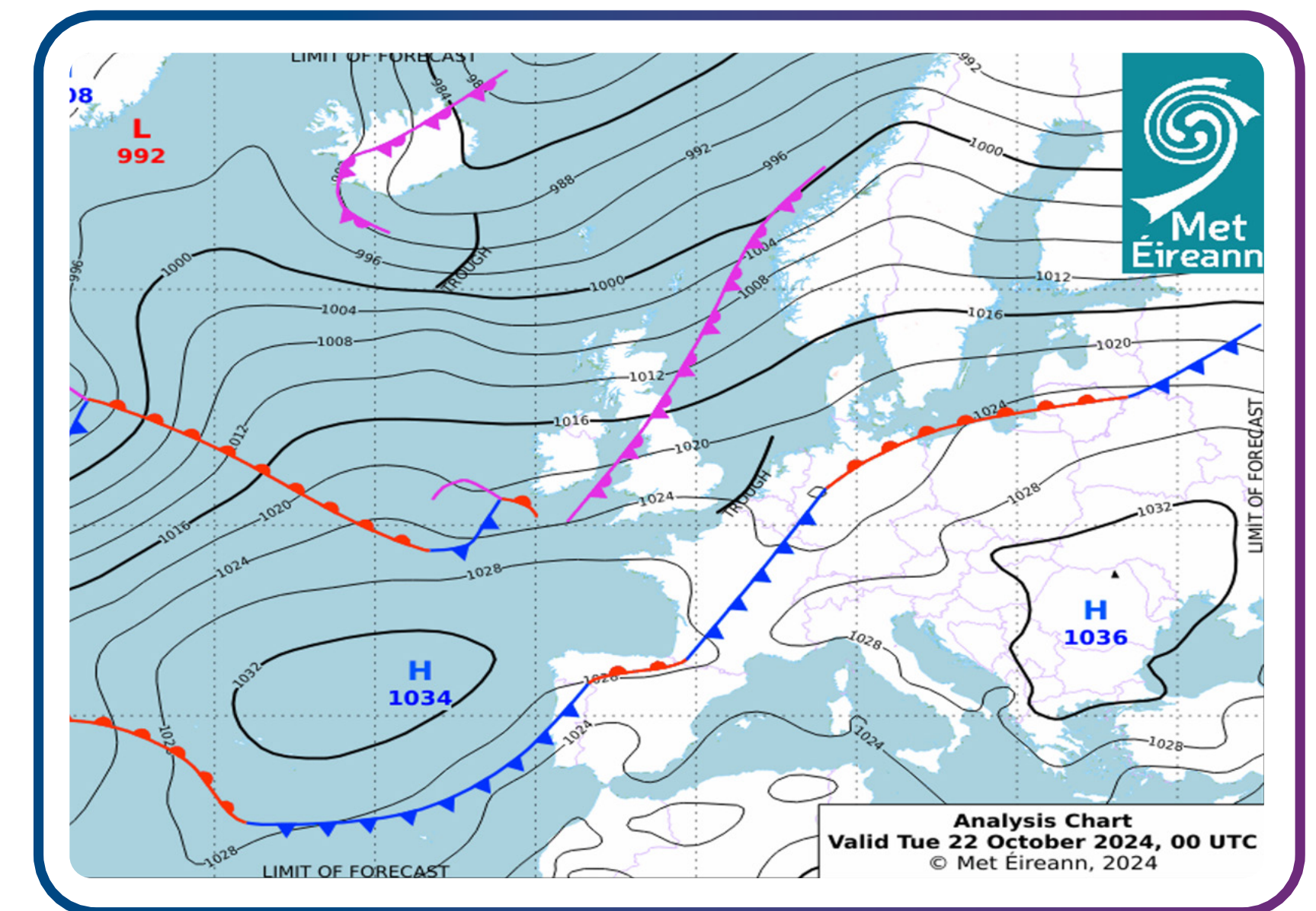


# Mapping weather data – synoptic charts

Meteorologists working at Met Éireann in Glasnevin, Dublin produce our weather maps, these are called synoptic charts. They show how the weather is changing and can be drawn on a weather map using lines. They use data collected in weather stations.

Lines on a weather map connecting places of equal:

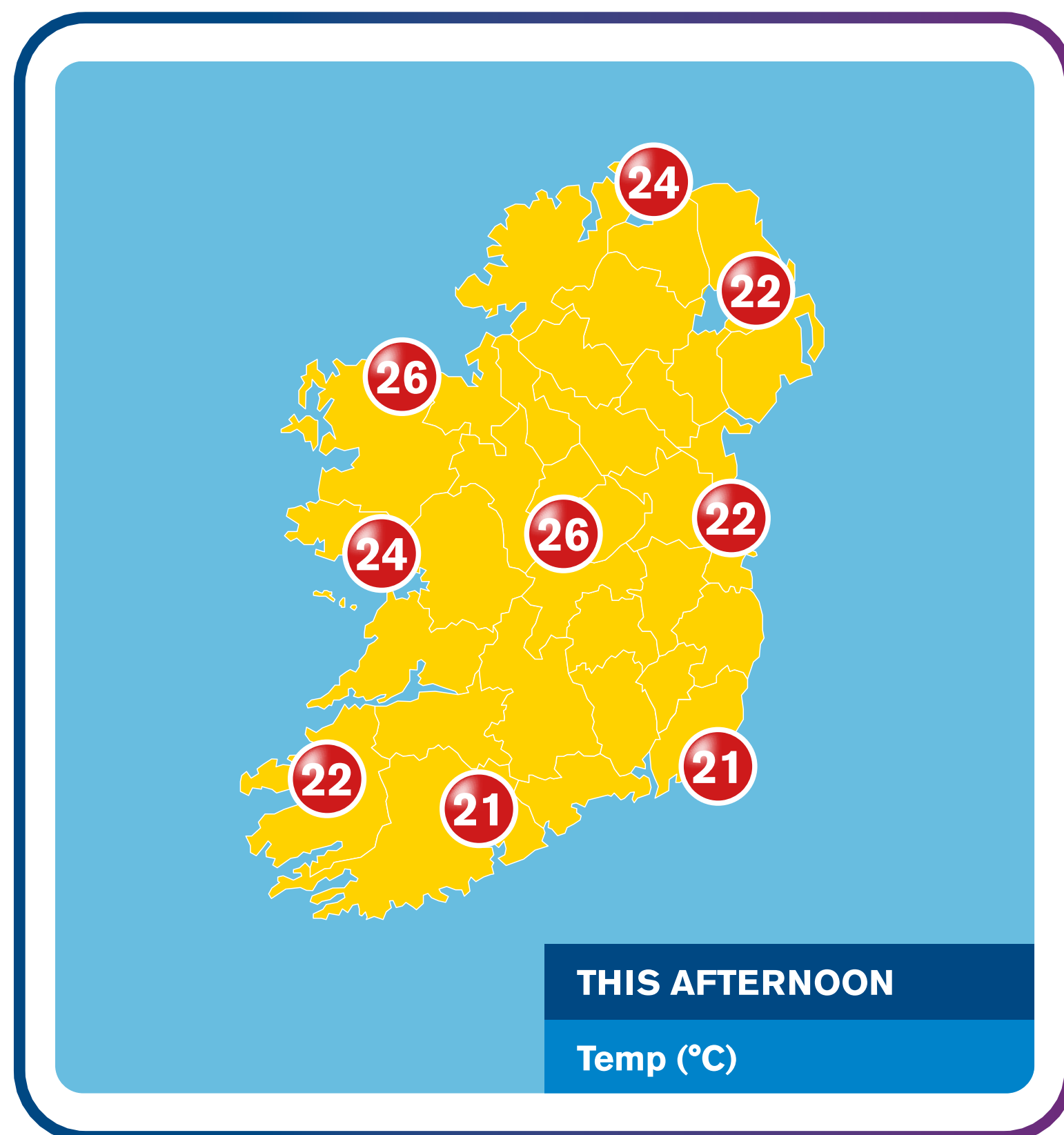
- **Temperature** are called **isotherms**
- **Air pressure** are called **isobars**
- **Sunshine hours** are called **isohels**
- **Rainfall** are called **isohyets**
- **Wind speed** are called **isotachs**



**Met Éireann, 2025.**



## Temperature on a weather map

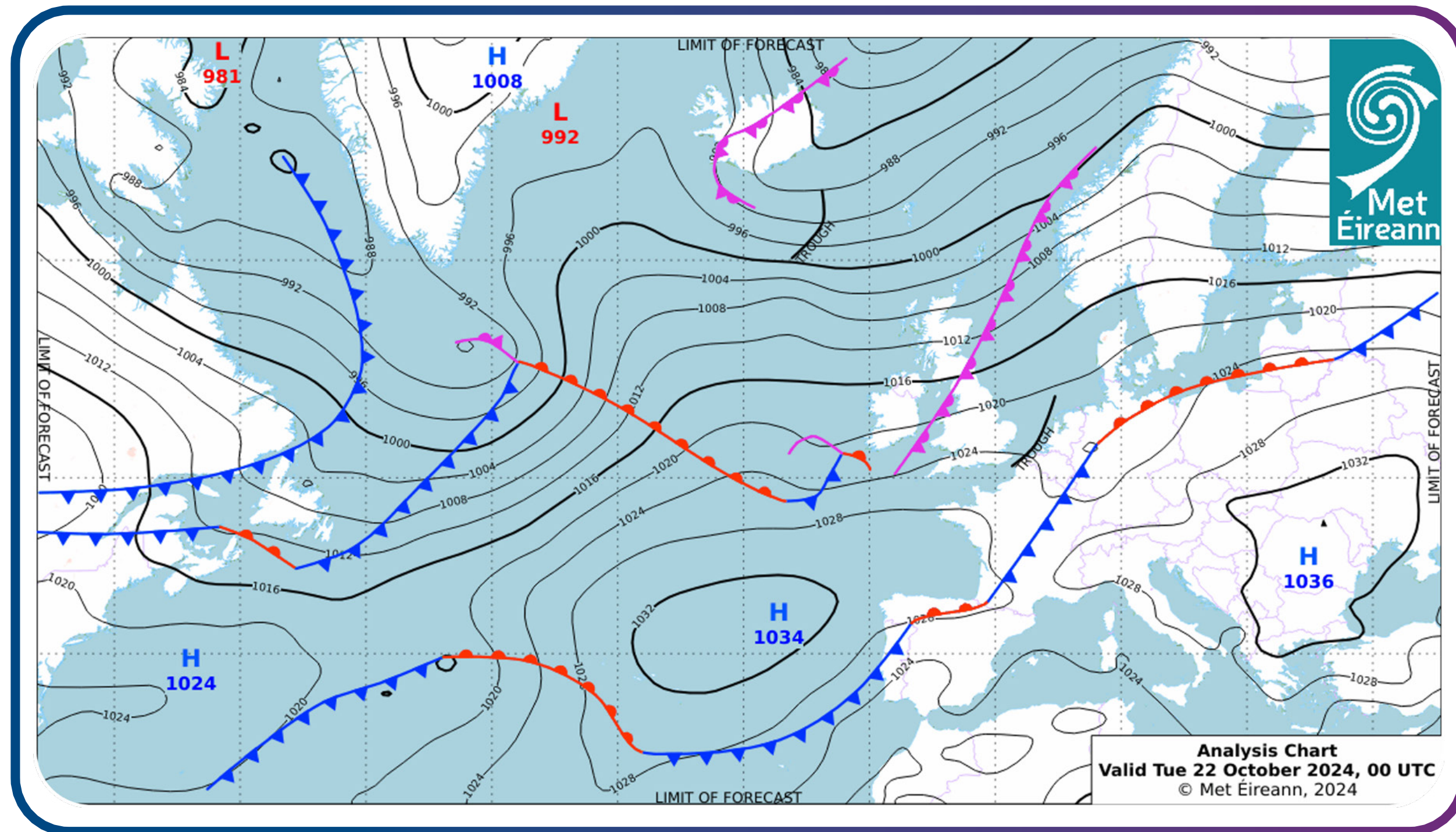


Lines on a weather map connecting places of **equal temperature** are called **isotherms**.

On a weather map, average (mean) temperature for an area is displayed in the form of a number.



## Air pressure on a weather map



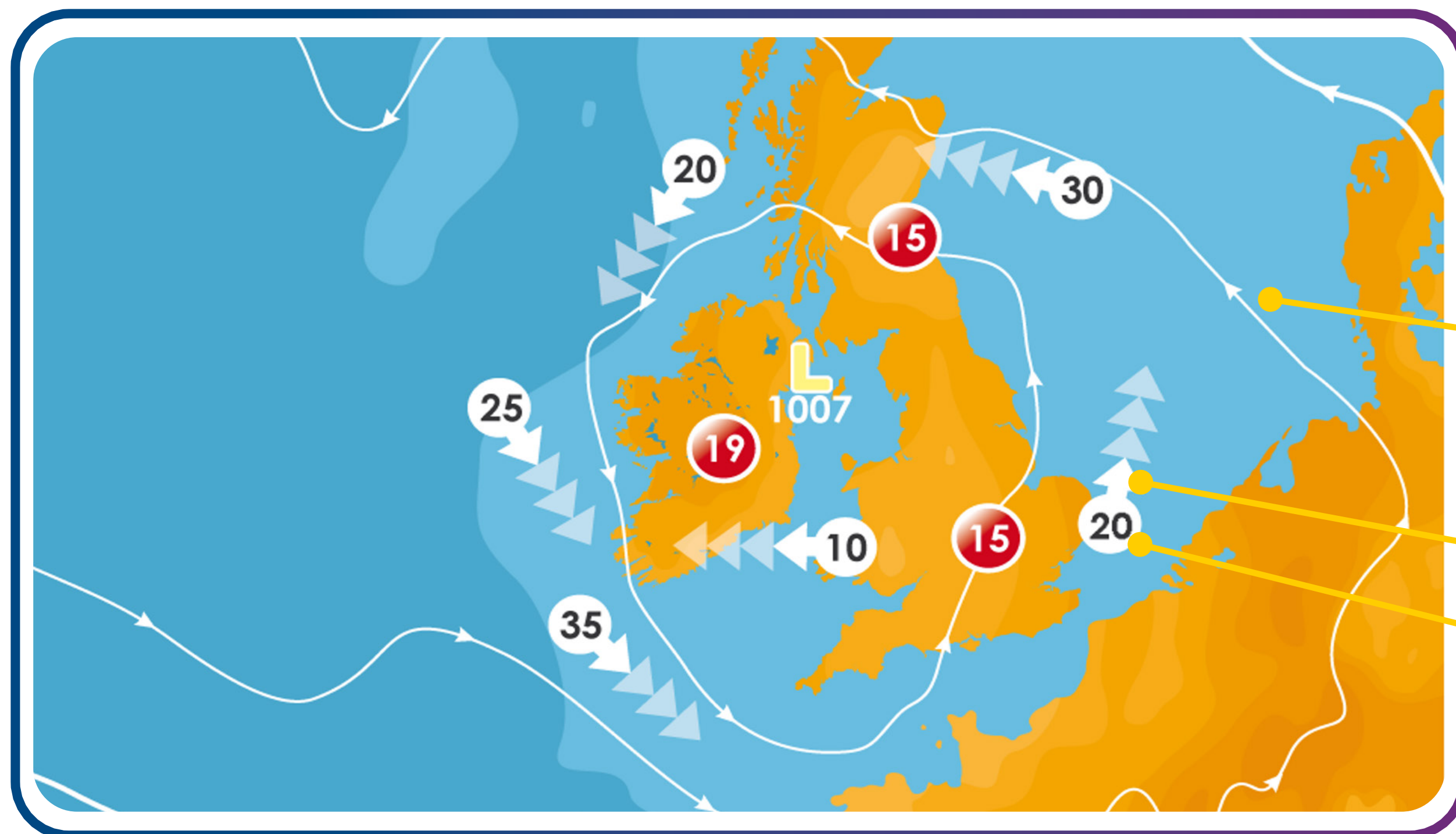
Lines on a map connecting places of equal **air pressure** are called **isobars**.

Met Éireann, 2025.

Met Éireann. (n.d.). Met Éireann – The Irish Meteorological Service.  
Retrieved January 29, 2025, from <https://www.met.ie/>



# Wind direction and speed on a weather map



Lines on a weather map connecting places of equal **wind speed** are called **isotachs**.

- The direction of the arrow shows the direction from which the wind is blowing.
- Wind is displayed as a white arrow.
- The number indicates the speed of the wind in kilometres per hour.

## The Wild Report, 2022

The Wild Report. (2022, September 23). How do weather stations work? [Video]. YouTube. [https://www.youtube.com/watch?v=X817S1J\\_hKo](https://www.youtube.com/watch?v=X817S1J_hKo)



## Rainfall on a weather map

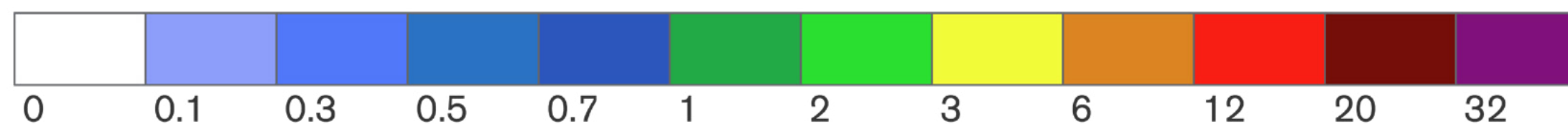
Lines on a weather map connecting places of equal **rainfall** are called **isohyets**.

Forecast precipitation on a weather map is displayed in colour.

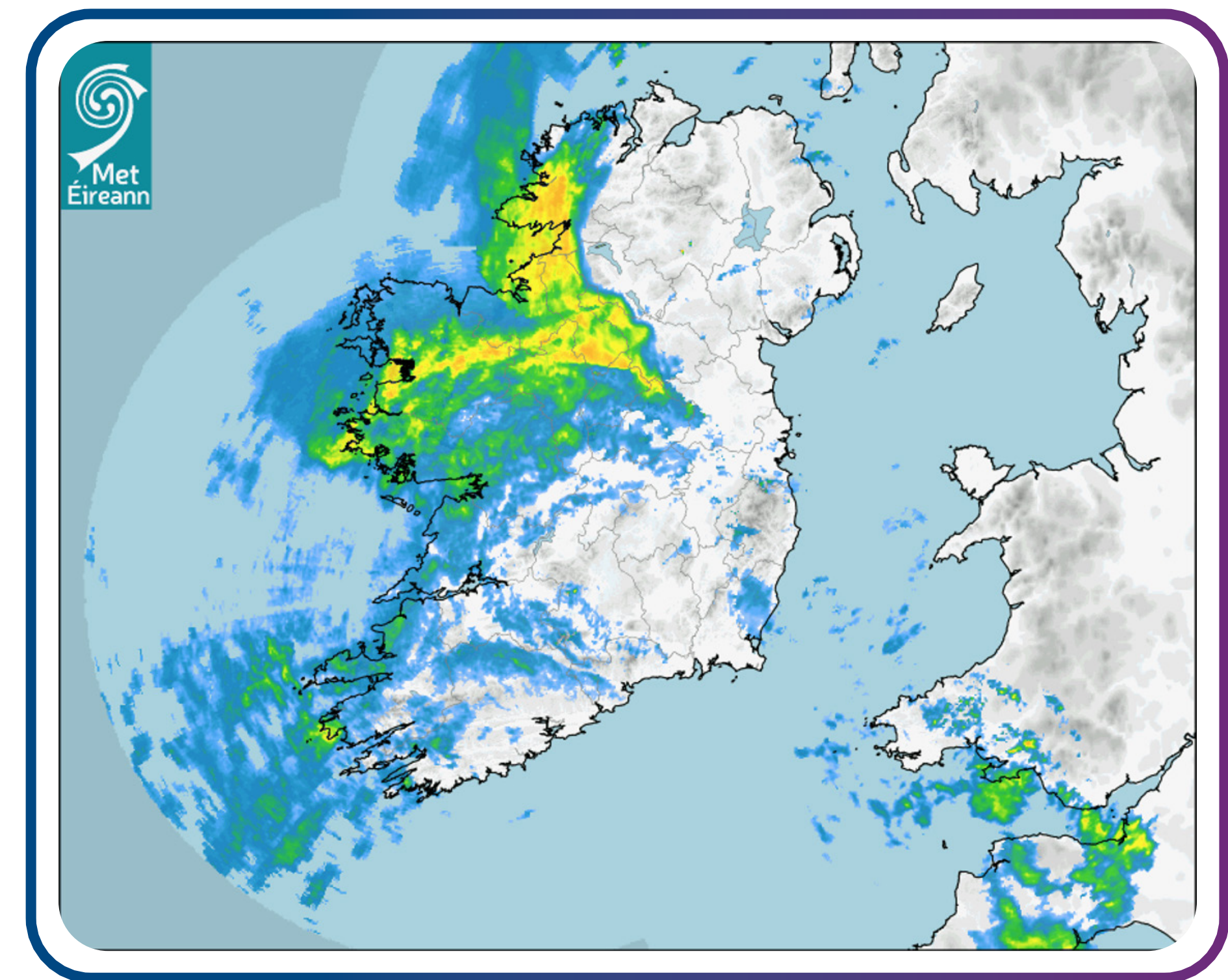
**Blue shades** show **light rain**

**Yellow and red** show **heavy rain**

mm/hr



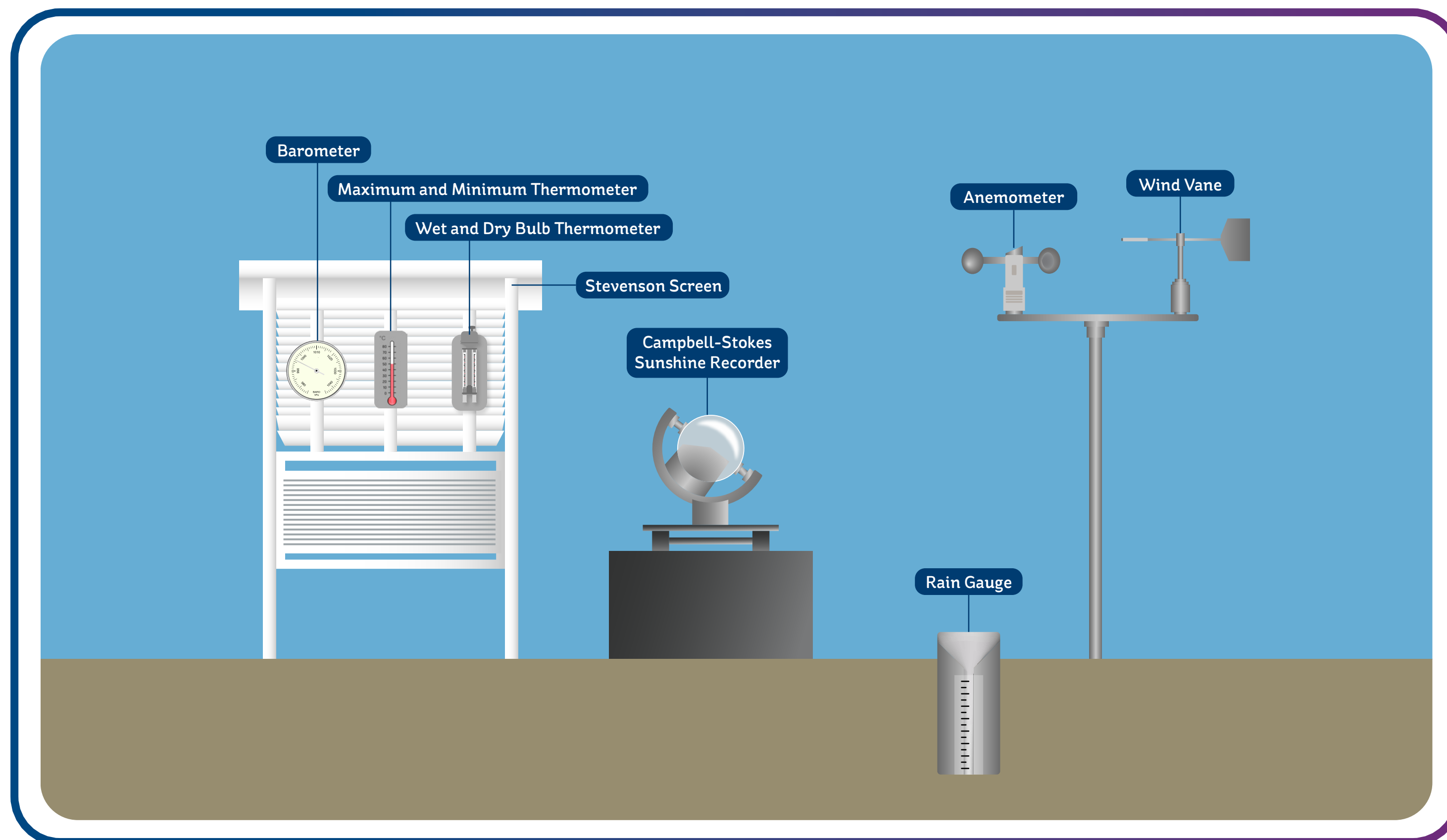
Met Éireann. (n.d.). Met Éireann – The Irish Meteorological Service.  
Retrieved January 29, 2025, from <https://www.met.ie/>



**Met Éireann, 2025.**



# Weather instruments



A weather station is a place where **weather instruments** used to measure weather are kept.



# Stevenson Screen

- A Stevenson Screen is a wooden box that contains a maximum and minimum thermometer, a hydrometer (a wet and dry bulb thermometer) and a barometer/barograph.
- A Stevenson screen is white to reflect the sun.
- It has a pitched roof, and slatted sides allow rain to run off.
- The sides have gaps to allow air flow but not direct sunlight.
- The Stevenson screen allows for more accurate measurements to be recorded.





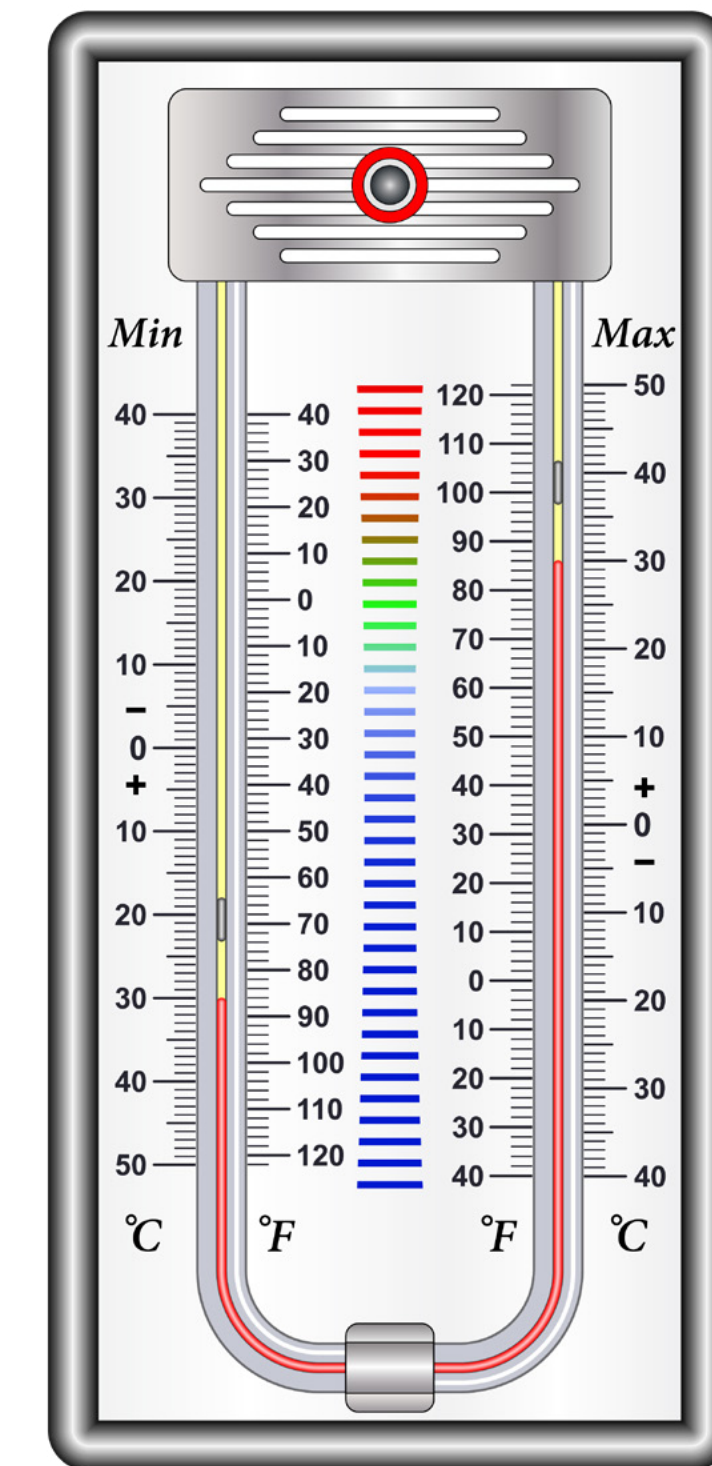
# Weather elements and instruments

Weather Element	Instrument
Temperature	Maximum and minimum thermometer
Precipitation (rain, hail, sleet, snow)	Rain gauge
Humidity	Hygrometer/ Wet and dry bulb thermometer
Air/Atmospheric pressure	Barometer
Wind direction	Wind vane
Wind speed	Anemometer
Sunshine hours and intensity	Campbell- Stokes sunshine recorder
Cloud cover	Observation



## Max and min thermometer

- Used to measure **temperature**. The unit of measurement is **degrees Celsius (°C)**.
- It records the highest and lowest temperatures over a period. The average of the two measurements is the average daily temperature.
- It has two tubes: one with **mercury** and another with **alcohol**.
- As the **temperature rises, mercury expands** and pushes a marker to record the maximum temperature.
- When the **temperature falls, the alcohol contracts**, moving the mercury to push another marker, recording the minimum temperature.

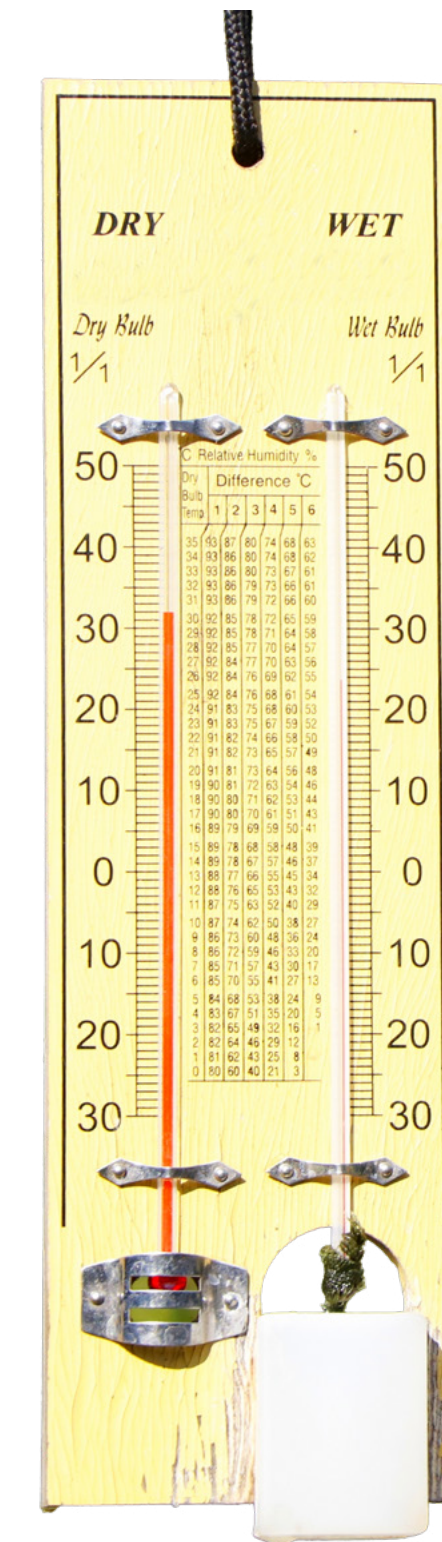




# Wet and dry thermometer

- Used to measure **humidity**. Humidity is the **amount of water vapor in the air**.
- The unit of measurement is **relative humidity** and is given as a percentage (% RH).
- The **dry bulb** thermometer measures the **current air temperature**.
- The **wet bulb** thermometer **has a cloth wick soaked in water**.

To find the relative humidity, subtract the wet bulb temperature from the dry bulb temperature and use a chart (**RH scale**).





# Hygrometer

- Used to measure **temperature** and **humidity**.
- Inside it, a thin **piece of paper** is **attached to a coil**. When the paper **absorbs moisture from the air**, it **expands**, **causing the coil to rotate**.
- This movement **shifts the humidity needle**, showing current relative humidity.

What is the %RH shown in the image?





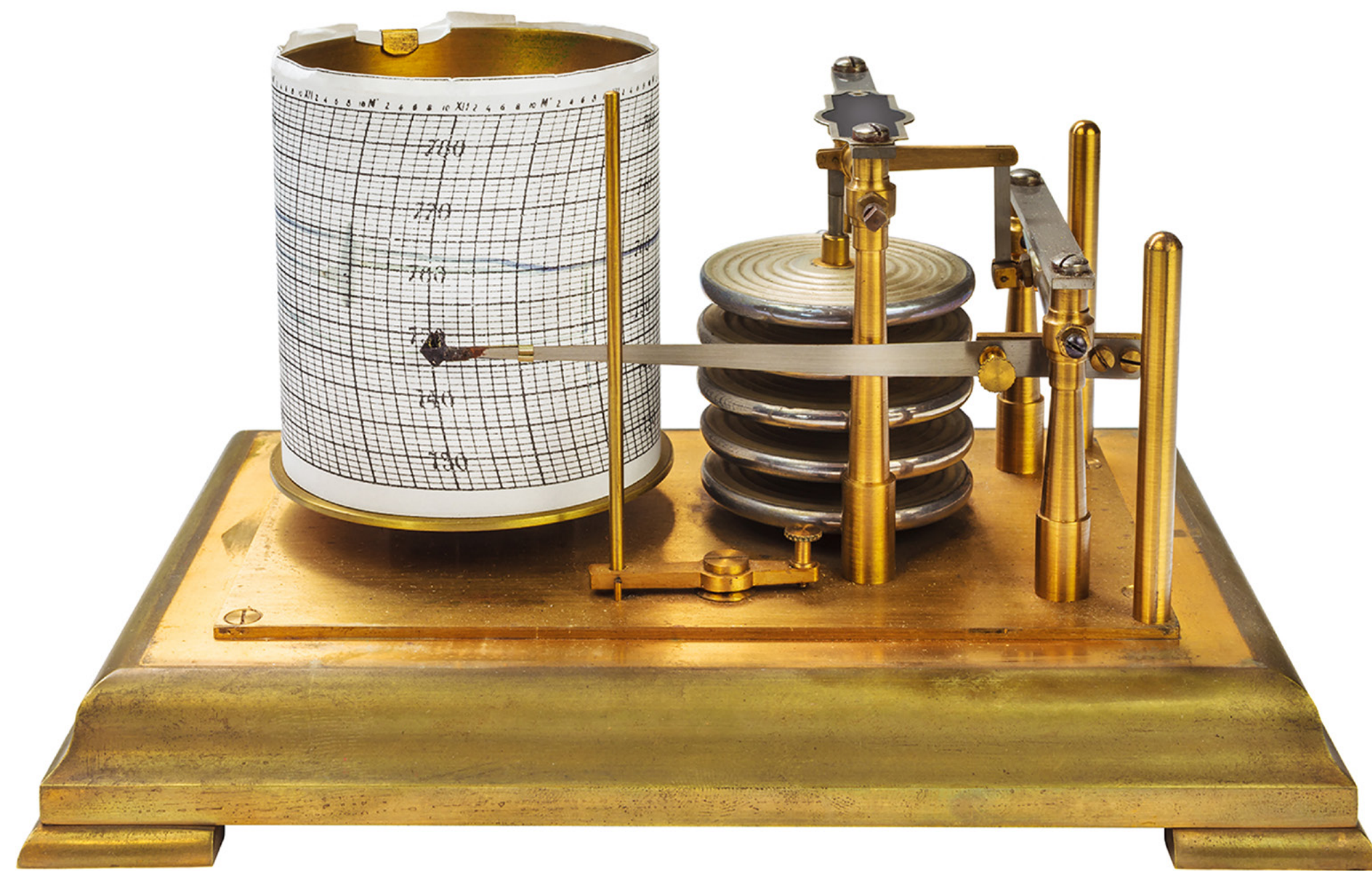
# Barometer

- Used to measure **atmospheric (air) pressure**.
- The unit of measurement is **millibars (mb)** or **hectopascals**.
- A barometer is a **sealed metal tin containing a vacuum**. Small **changes in atmospheric pressure cause slight movements** of the lid of the tin, which move the black pointer.
- Tapping the cover glass resets the barometer and turns the **red marker needle** until it lines up with the black pointer.
- When you visit a barometer, tap the glass. **If the pressure has changed, the black pointer will move.** The direction of movement tells you immediately if air pressure has fallen or risen.





# Barograph

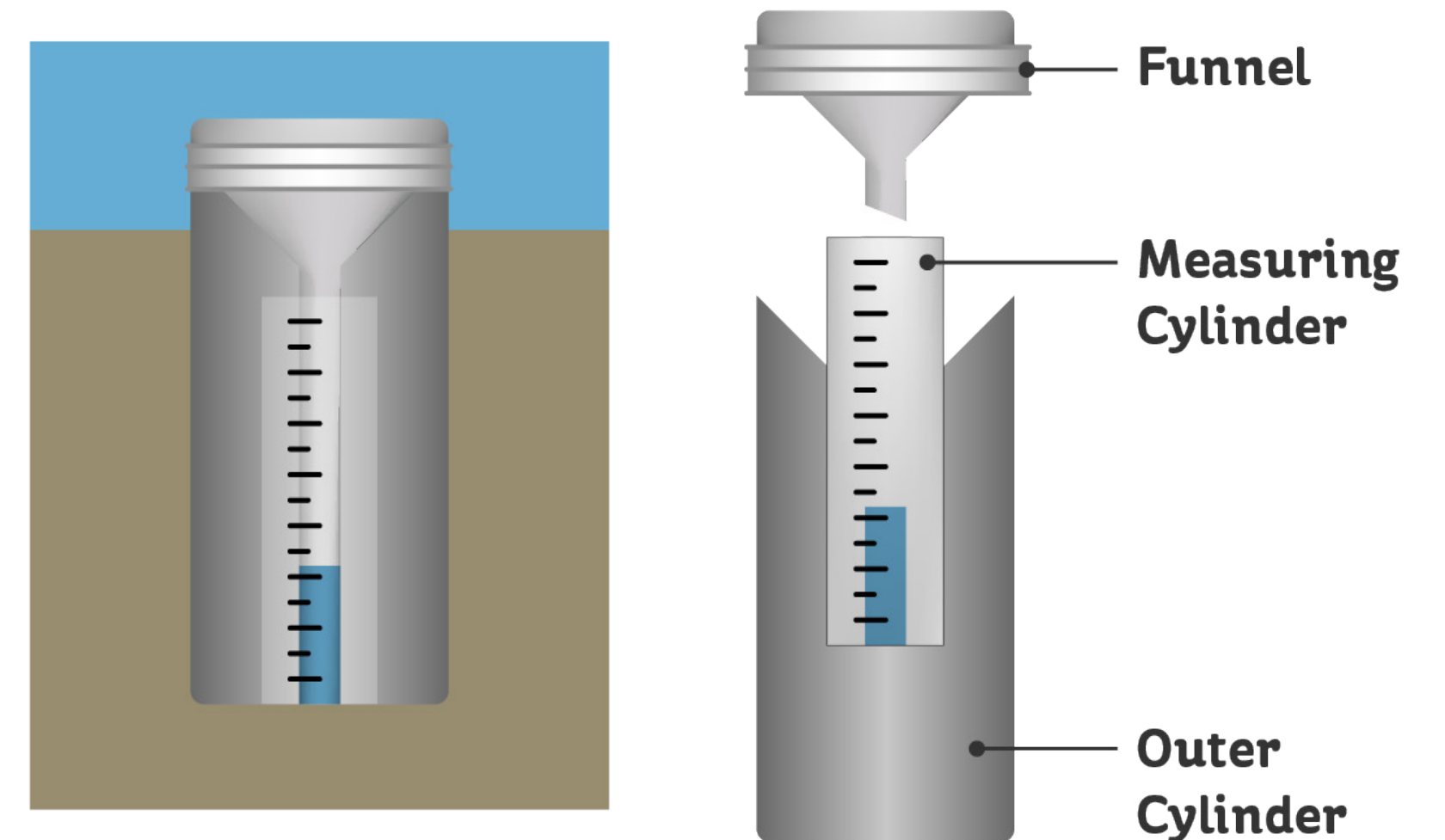


- A barometer that records its readings on a moving graph is called a **barograph**.
- A barograph measures and records **atmospheric pressure** in a weather station.



# Rain Gauge

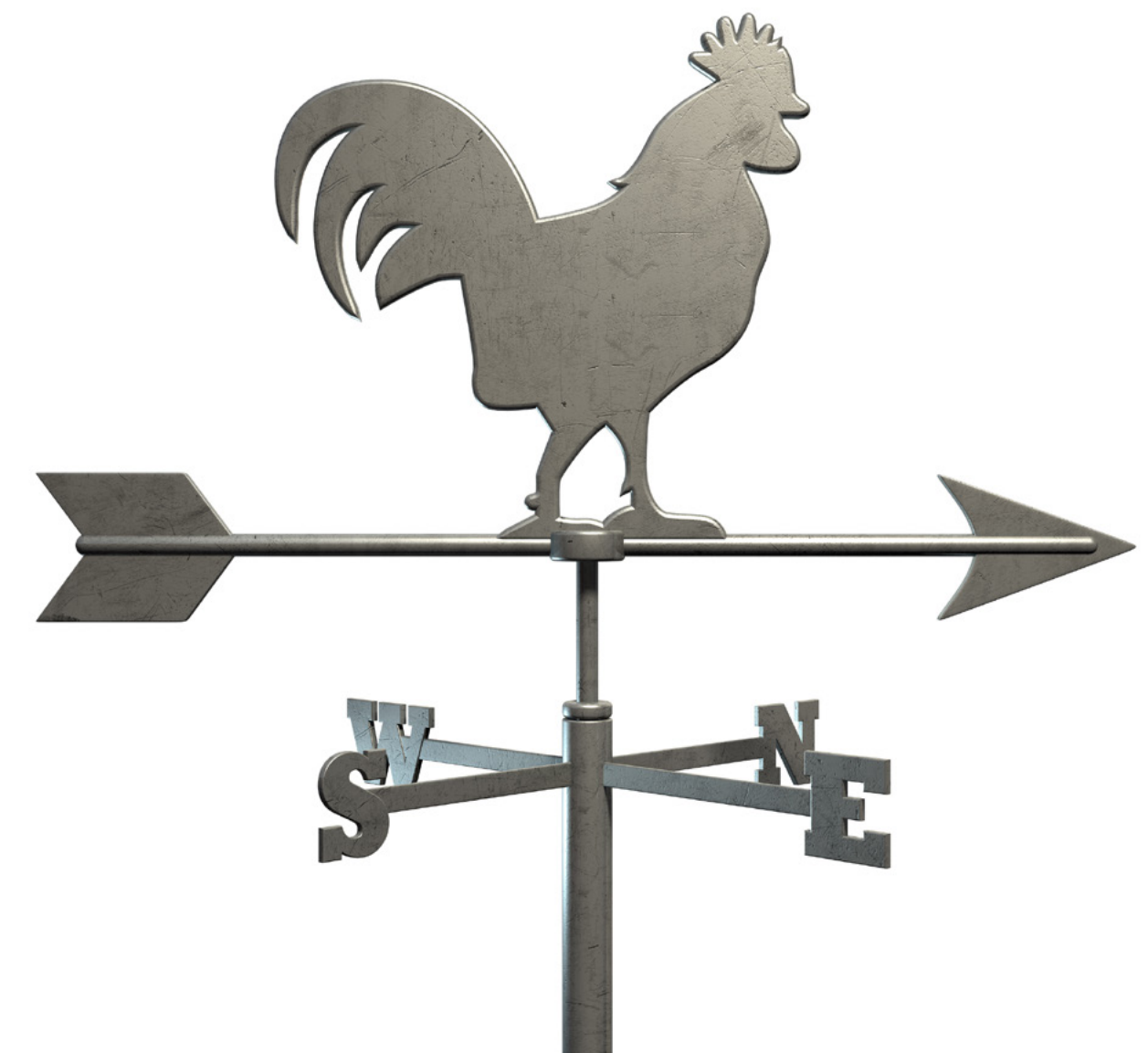
- Used to measure **rainfall**. The unit of measurement is **millimetres (mm)**.
- The rain gauge has a cylinder container with a funnel at the top. The **rainwater is collected in the measuring cylinder**.
- They are located in open areas, away from buildings and trees, to **avoid obstruction**, and are partially buried so they don't fall over.
- Read the **amount of rain in the measuring cylinder** in mm.
- **Record the measurement**, for example if 10mm of rain is collected, it means 10mm of water fell over the area.





## Wind vane

- Used to record the **direction of wind**. The unit of measurement is compass direction (**North, South, East, West**).
- The wind vane is a **free-moving arrow** on a high mast.
- The **tail of the arrow is wide** and blown forward by the wind.
- This allows the **head of the arrow** to point in the direction from which the wind is blowing.





# Anemometer

- Used to measure **wind speed**. The unit of measurement is kilometers (**km per hour**) or knots.
- An anemometer has **three cups**. These rotate when the wind blows.
- The **stronger** the wind, the **faster** they move.
- The **number of times the cups rotate** is used to calculate wind speed. It is recorded and displayed on the meter.
- A **handheld anemometer** works on the same principle, except there is a fan instead of cups.





# Beaufort Scale

- Used to describe the **strength (force) of wind** by observing the effect wind has on the landscape, e.g., trees, water, steam.
- Wind strength is divided into 12 forces. Modern shipping weather forecasts still refer to wind ‘force’ as used in the Beaufort scale.

0	1	2	3	4	5
Calm	Light Air	Light Breeze	Gentle Breeze	Moderate Breeze	Fresh Breeze
Light Winds					
<1 mph	1–3 mph	4–7 mph	8–12 mph	13–18 mph	18–24 mph
<1 knot	1–3 knots	4–6 knots	7–10 knots	11–16 knots	17–21 knots
<0.3 m/s	0.3–1.5 m/s	1.6–3.3 m/s	3.4–5.5 m/s	5.5–7.9 m/s	8.0–10.7 m/s

The Beaufort Scale's lighter winds  
 Photo: Wikipedia

6	7	8	9	10	11	12
Strong Breeze	Near Gale	Gale	Strong Gale	Storm	Violent Storm	Hurricane Force
High Winds		Gale-force		Storm-force		Hurricane-force
25–31 mph	31–38 mph	39–46 mph	47–54 mph	55–63 mph	64–72 mph	≥73 mph
22–27 knots	28–33 knots	34–40 knots	41–47 knots	48–55 knots	56–63 knots	≥63 knots
10.8–13.8 m/s	13.9–17.1 m/s	17.2–20.7 m/s	20.8–24.4 m/s	24.5–28.4 m/s	28.5–32.6 m/s	≥32.7 m/s

The Beaufort Scale's heavy winds  
 Photo: Wikipedia

Wikipedia, 2025.



## Campbell-Stokes recorder

- Used to measure **sunshine hours** and **intensity**.
- The unit of measurement is **hours of sunshine per day**.
- A **solid glass** ball focuses the sun's rays onto a removable strip of heat sensitive card, which is placed behind the ball.
- The **sun's rays mark the card throughout the day**. If the sun is not shining, there is no mark on the card.
- The **card is divided into hours** - the marks on it show when the sun was shining and for how long.

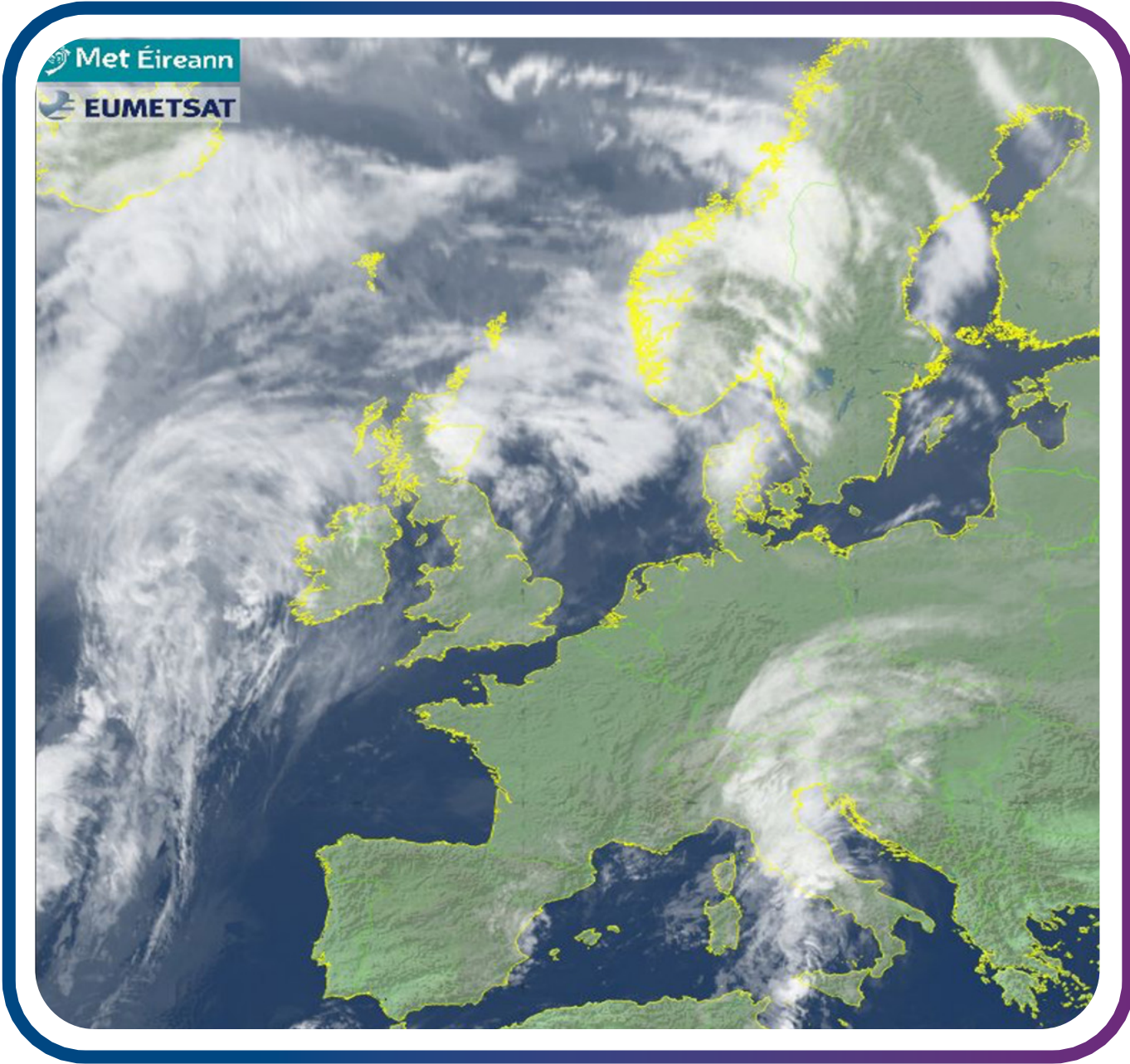




Cloud cover – observation

Okta cloud cover

Sky Cover (oktas)	Sym-bol	Name	Abbr.
0	☉	Sky Clear	SKC
1	☉	Few* Clouds	FEW*
2	☉		
3	☉	Scattered	SCT
4	☉		
5	☉	Broken	BKN
6	☉		
7	☉		
8	●	Overcast	OVC
(9)	⊗	Sky Obscured	
(/)	☉	Not Measured	



Wikipedia, 2025.

Met Éireann, 2025.

Wikipedia contributors. (n.d.). Okta. Wikipedia, The Free Encyclopedia. Retrieved February 11, 2025, from <https://en.wikipedia.org/wiki/Okta>  
Met Éireann. (n.d.). Met Éireann – The Irish Meteorological Service. Retrieved January 29, 2025, from <https://www.met.ie/>



# What's the weather like now?

## Is it a good time to use electrical appliances?

- Check your Weather Station data – is it windy out now?
- If it's windy, it's a good time to use appliances as wind generates renewable energy and Ireland will be relying on that more and more.



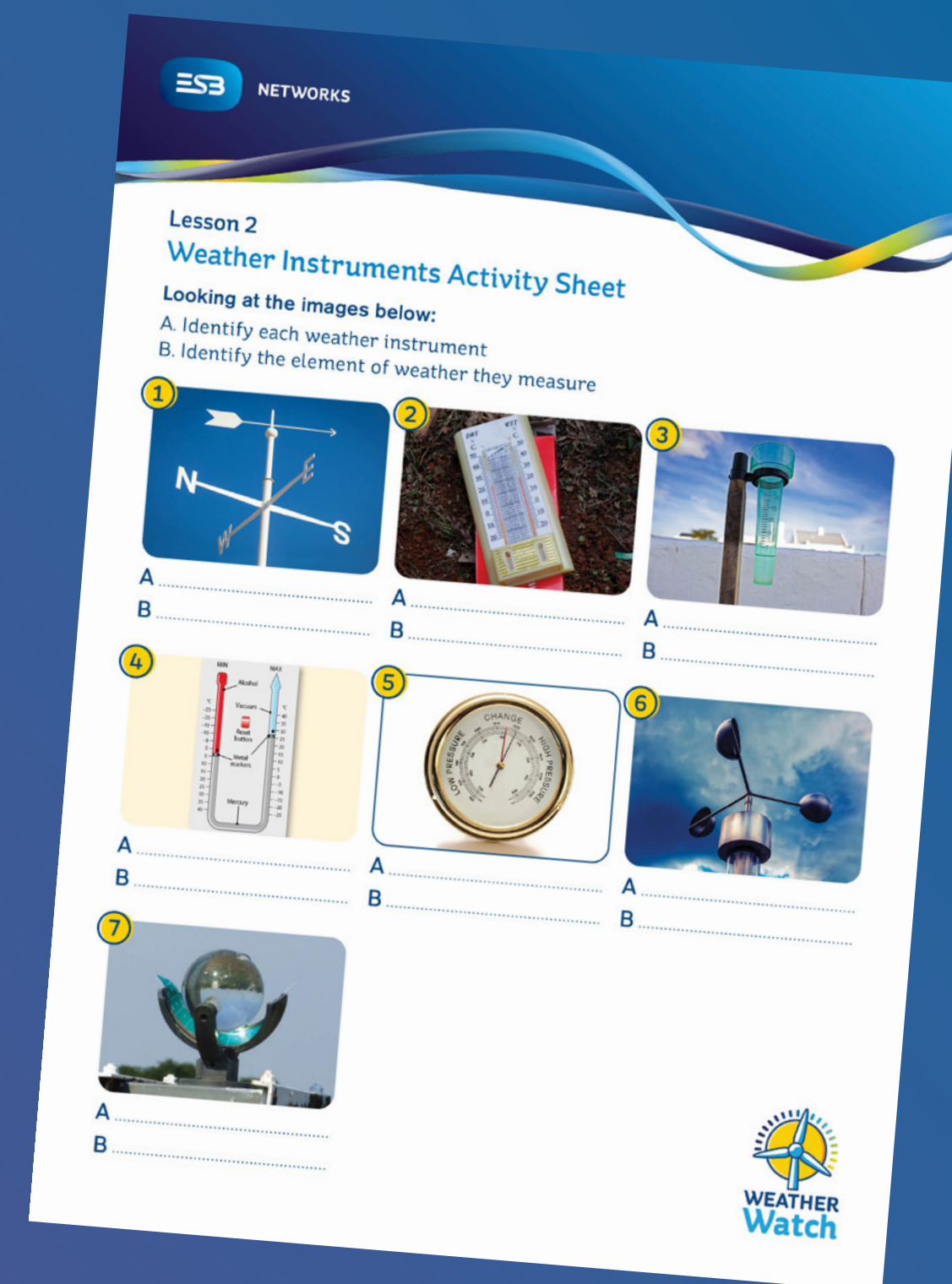
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# Class Activity

## Weather instrument worksheet

- Complete this worksheet by identifying the weather instrument and the element of weather they measure.





# 1 Take Home Activity - DIY weather forecast

a

## Access

- Access weather data online (use your school's Weather Station link via Weather Cloud or met.ie).

b

## Record

- With your guardian, record the weather conditions for a day and create a mini weather report.

c

## Observe

- Use the prompts in the table to guide your observations.

Weather Condition	Observation
Temperature	
Wind Speed/Direction	
Rainfall/Forecast	



# Well Done!

You have completed Lesson 2.