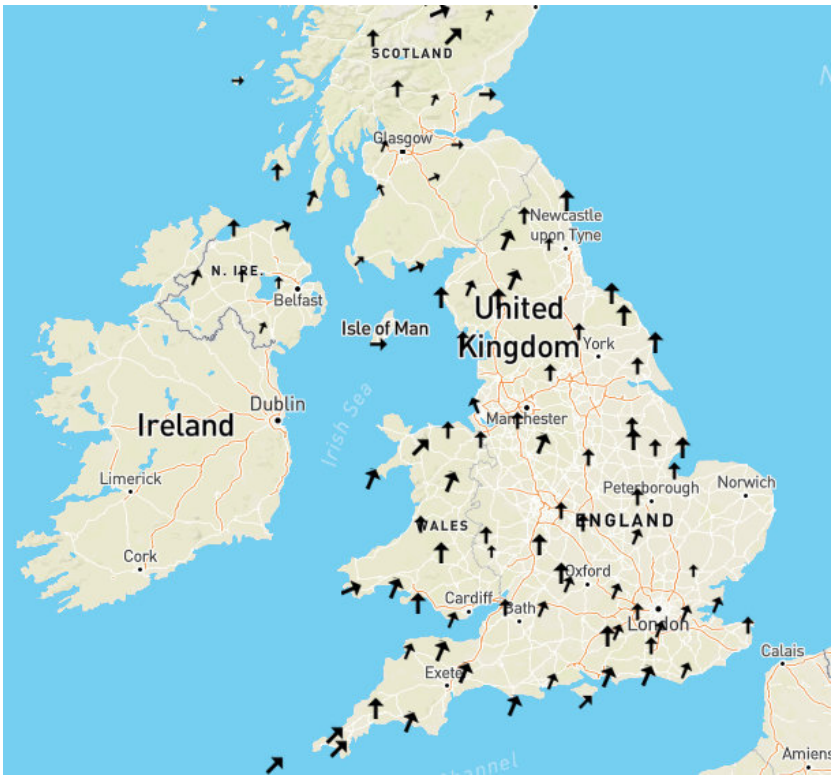
A Case Study of a Weather System using WOW data

Notes for Teachers
This exercise asks students to use real weather data to investigate the weather conditions associated with a cold front passing over the UK.
The WOW website is run by the Met Office. Some Met Office weather data is available through it, but there is much more data that has been submitted by the general public. Anyone can submit data – whether they have a weather station in their back garden or are just looking out of the window.

Preparation
Each student or pair of students will need a PC or laptop with internet access. They should go to the WOW website http://wow.metoffice.gov.uk .



Use the pop up calendar to select 24th December 2015 and the drop down box to choose 0600 to 0659 in the morning.
Use the Layers menu on the right to select wind speed/ direction.
Use the Filters menu to select official observations.

Where is the wind coming from?
Answer: The wind is from the South over most of the UK and from the South West in the South West

Is the wind weak or strong?
The wind arrows are variable, but it's pretty windy in places.

Change the time to 0800-0859. How does the wind look now?
More of the western edge of the country is experiencing southwesterlies – the wind direction is still southerly elsewhere.

Change the time to 1200-1259. How does the wind look now?
It's still very windy, and the wind is now from the west/ southwest over most of the country. The westerlies (over the west of the country) are weaker than the southwesterlies over the east of the country.
Capture the image, stick it into a work book

Now use the layers menu to look at temperature.

At 0600-0659, what are the temperatures across the UK? (you may need to click on some dots to work out exactly what the temperature is)
The temperature is around 10C in all of England and Wales. It is cooler in Northern Ireland, and the temperature varies considerably in Scotland with temperature falling below zero in the Cairngorms. You'd expect this temperature pattern in winter, particularly before dawn, but there might be something else going on.

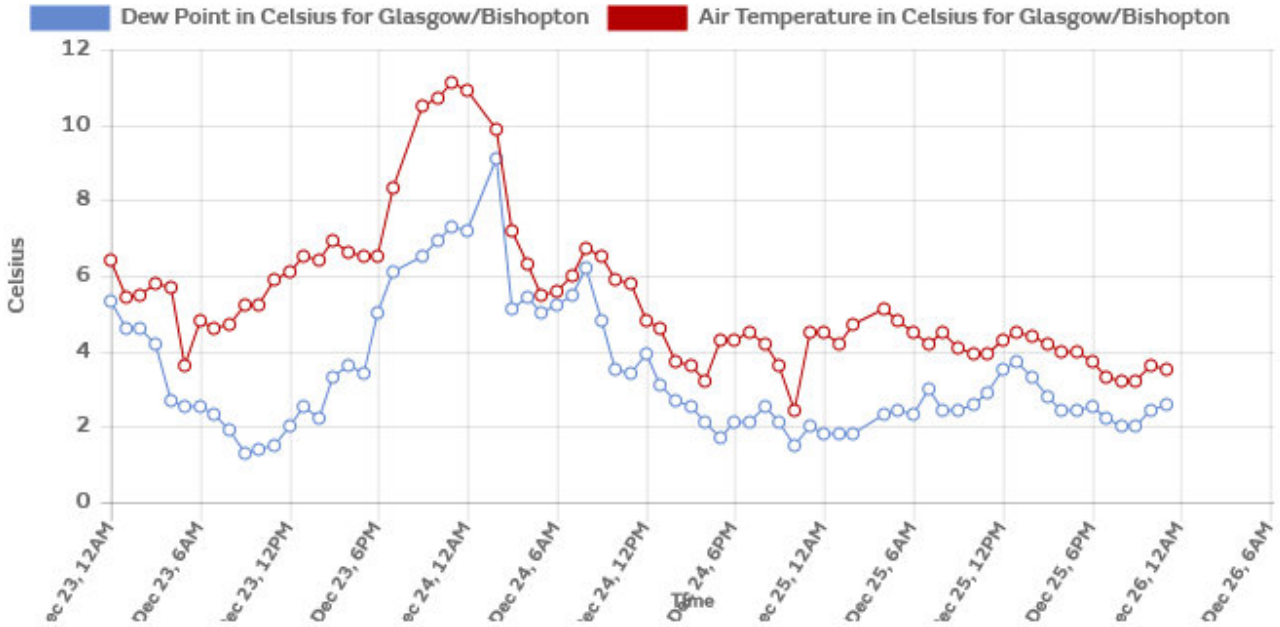
Capture the image, stick it into a work book at draw a line roughly dividing colder and warmer temperatures. What is a line dividing cold and warm temperatures called?
Such a line is called a front. This is a cold front, because the colder temperatures are behind the front.

Now look at the temperature between 0800-0859. What is the pattern of temperatures?
The range of temperatures are roughly the same, but it has actually got colder in Scotland and Wales. This is surprising, as you would expect temperatures to start rising at sunrise.

Now look at the temperature between 1200-1259. What is the pattern of temperatures?
The colder air has spread further across the country. .
Capture the image, stick it into a work book at draw a line dividing colder and warmer temperatures.

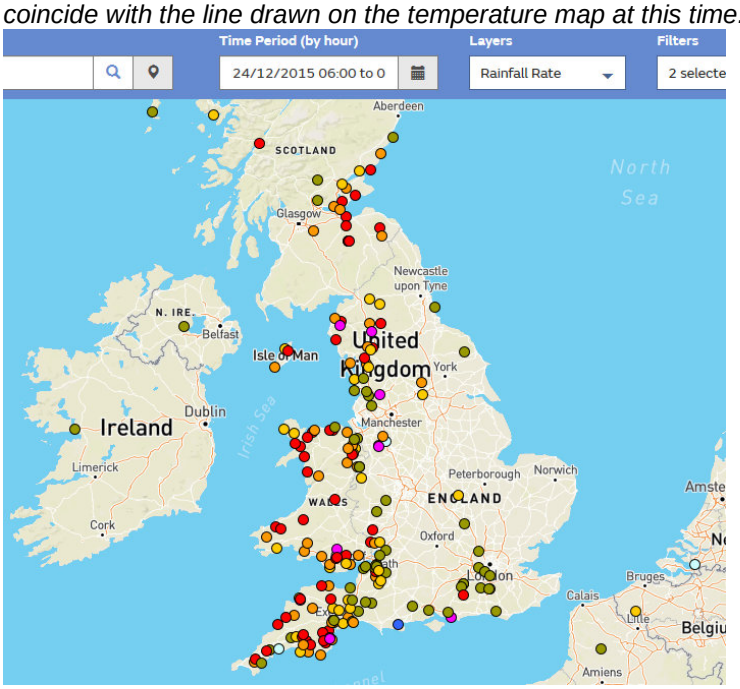
Now compare this image and the line you have drawn on it with the wind image you captured earlier. What do you notice?
The wind direction as well as the temperature changes at the front. The winds ahead of the front (in the cold sector) are stronger than the winds behind the front. The air is moving around the depression in an anticlockwise direction.

For Stronger Students:
Find the Met Office Weather Station in Glasgow/ Bishopton, and click on it. Click on 'View Full Observation' and use the Graph view and the calendars to select from 23/12/15 to 25/12/15. How does the air temperature change?
The air temperature rises sharply from 6pm, then falls from about midnight on the 24th – exactly the opposite of how you would expect temperatures to behave at night! These two changes in temperature mark the passage of the warm and cold fronts.



Now use the Layers Menu to select rainfall rate at 0600-0659. You'll also need to add 'WOW observations' from the Filter menu because the official observations don't include rainfall. Where is it raining?

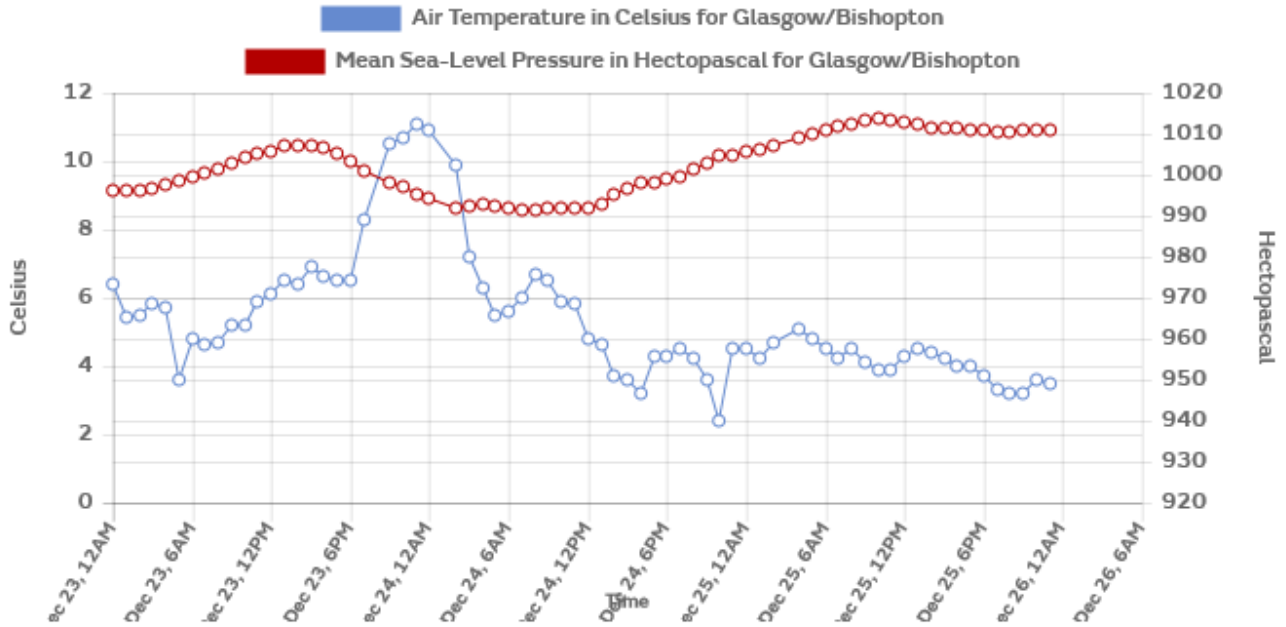
The rain is mainly in a band going down from Scotland through Wales and southwestern England. It should roughly coincide with the line drawn on the temperature map at this time.



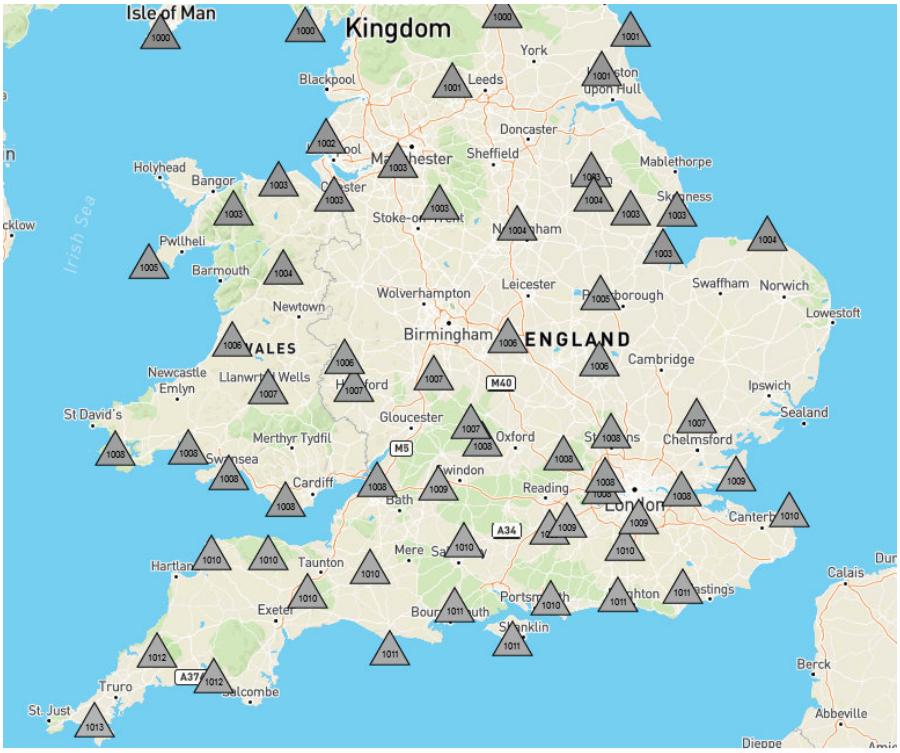
Go back in time, hour by hour, what happens to where the rain is?
The belt of rain moves slowly across the country.

Now use the layers menu to select 'pressure' and investigate how that changes through the day.
Throughout the day, the lowest pressures are in the North of Scotland, with pressure getting gradually higher as you go further south. This pattern stays the same, but pressures everywhere rise through the day.

For Stronger Students:
Find the Met Office Weather Station in Glasgow/ Bishopton again, and click on it. Click on 'View Full Observation' and use the Graph view and the calendars to select from 23/12/15 to 25/12/15. How does the mean sea level pressure change?
The air temperature falls in the afternoon of the 23rd and then rises again steadily through the 24th and 25th. The pressure changes are much slower than the temperature changes.



For Stronger Students:
Capture the pressure image from 1200-1259 on 24th December 2015. Can you sketch pressure contours for 992, 996, 1000, 1004, 1008 and 1012hPa?



Summarise what you think is going on with the weather on the 24th December 2015.

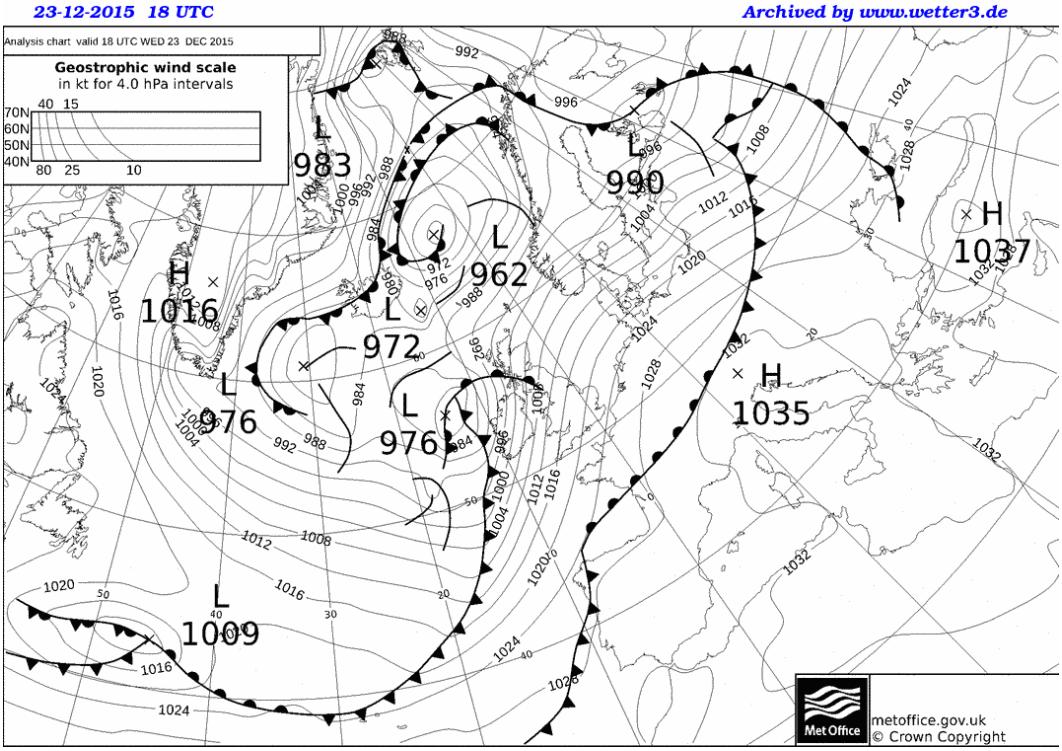
Through the 23/ 24th, a depression or mid-latitude low pressure weather system passed over the UK. In the morning of the 24th, a cold front passed across England and Wales. There was a clear band of heavy rain on the front. Temperatures fell as the front passed. The wind direction also changed and the winds were lighter behind the front. Because the pressure fell very rapidly across the country (if you could see pressure contours, they would be close together) the wind speeds were very fast.

Possible Extension Activities:

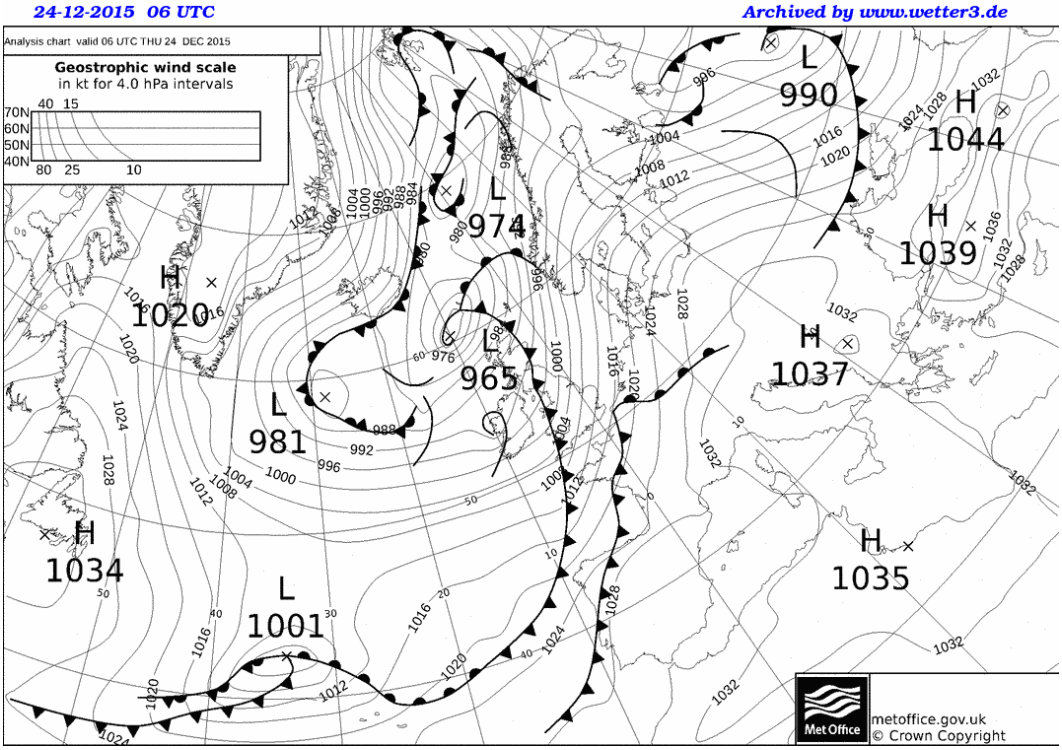
- Draw station plots for some of the weather stations on the weather charts showing pressure, temperature, weather etc. You can find information about this at http://www.metlink.org/ by selecting secondary – key stage 4 – weather maps – student charts from the left hand menu.
- The WOW website has 2 types of data – WOW observations (which can be submitted by anybody) and official observations. Do you need to take the quality of the data into account? Does the quantity of data on the map matter?
- Look up news reports of this weather event, which was called storm Eva.

Background information: https://www.metoffice.gov.uk/barometer/uk-storm-centre/storm-eva

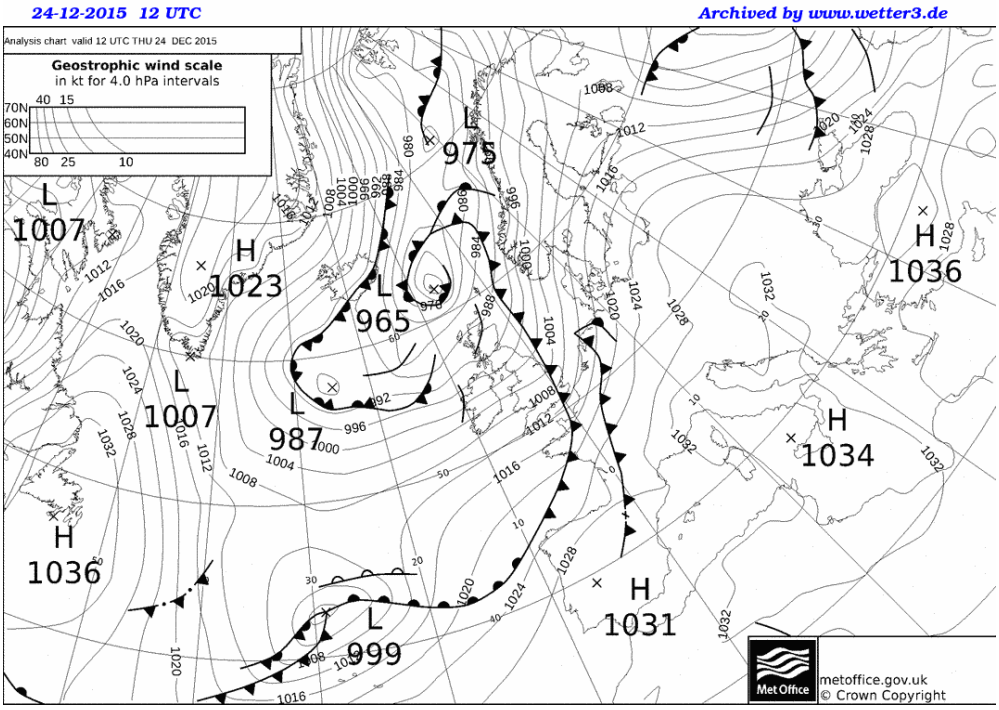
23-12-2015 18 UTC *Archived by www.wetter3.de*

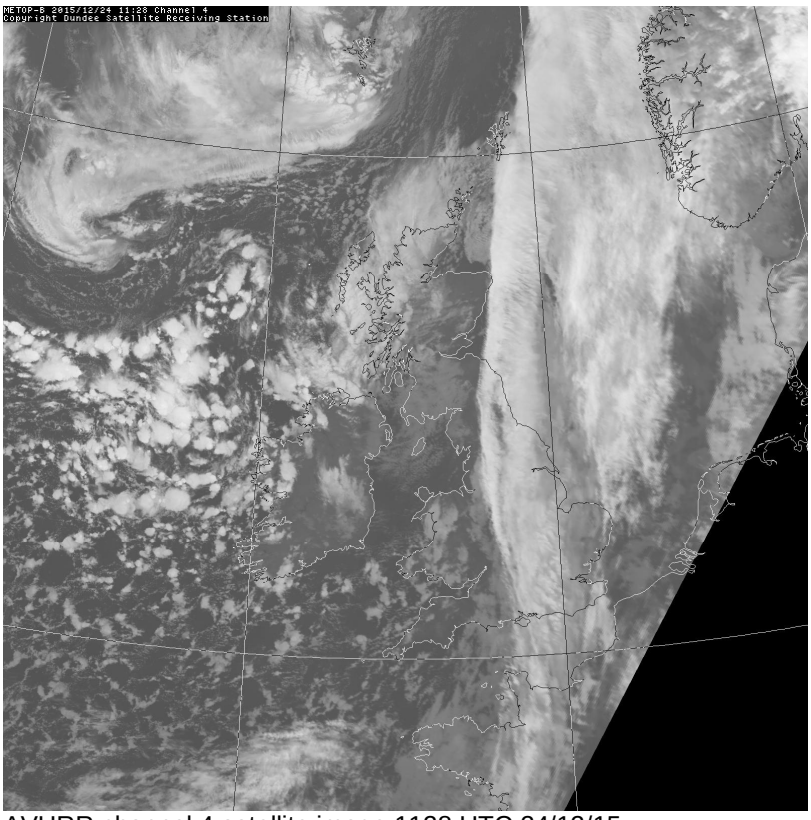


24-12-2015 06 UTC *Archived by www.wetter3.de*



MetLink
Royal Meteorological Society





AVHRR channel 4 satellite image 1128 UTC 24/12/15

The warm sector is filled with cloud, and the cold front is clearly marked by the edge of the cloud.