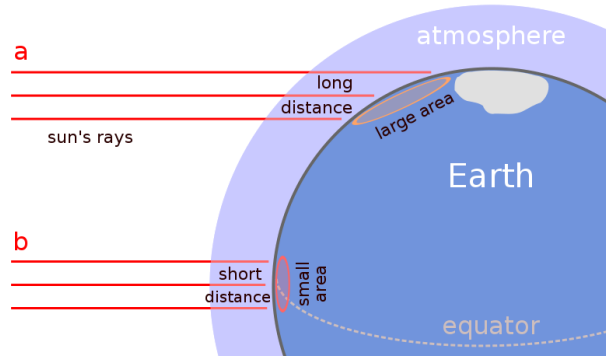
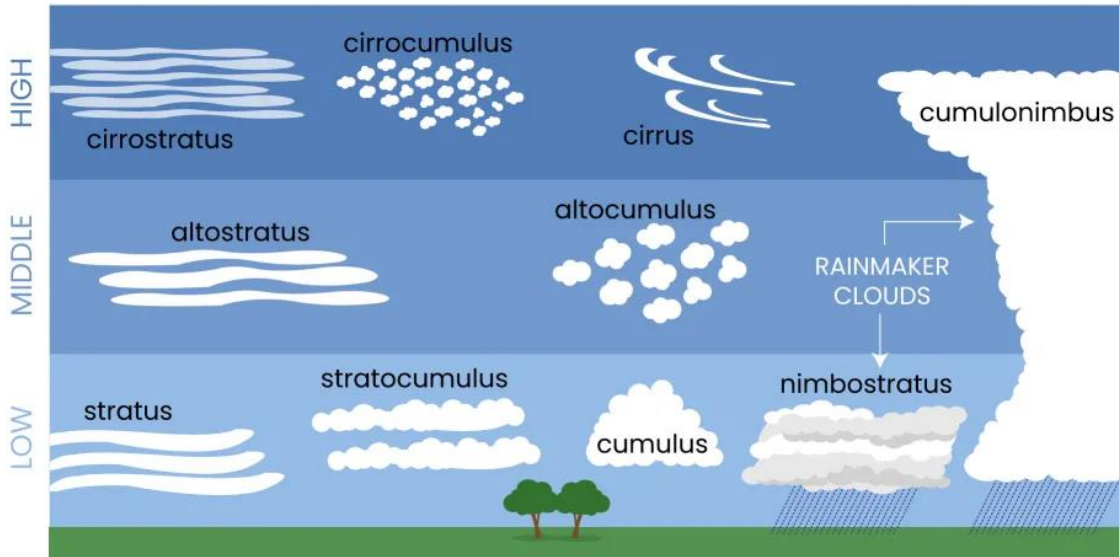


## 9. How and why do we measure weather?



Weather and climate varies due to the angle of incidence

### Cloud types



### How do we measure weather?



Stevenson screen



Thermometer - temperature



Barometer - air pressure



Campbell Stokes  
Sunshine recorder - hours of sunshine



Anemometer - wind speed

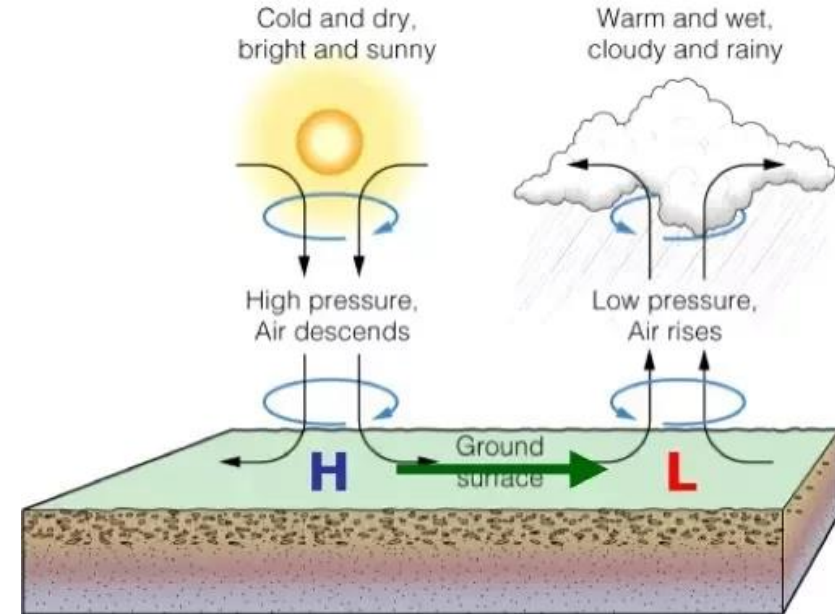


Wind vane - wind direction



Rain gauge - amount of rainfall

### Air pressure





## Extreme weather case studies

### 9. How and why do we measure weather?

**Hurricane Katrina** www.internetgeography.net

Hurricane Katrina initially formed about 200 miles (322 km) southeast of the Bahamas on Aug. 23, 2005. The storm was a Category 3 storm when it made landfall near New Orleans on the morning of Aug. 29.

193 kph  
120 mph  
380mm

6m

3m without  
1800 deaths  
\$300 billion damage  
slow evacuations

10k+ homeless  
1m homeless  
400k displaced

300k homes destroyed  
levées broke  
\$1.1 billion crops destroyed

25k sheltered in the New Orleans Superdome  
1.5m evacuated  
national guard deployed  
\$800m rebuilding flood defences  
\$35 billion rebuilding homes schools  
\$105 billion government aid

**EXTREME WEATHER** www.internetgeography.net

**Beast from the east**

On 25th February 2018 The Beast from the East arrived in the UK. It was caused by a change to the northern polar jet stream, which twisted its direction unexpectedly, drawing in cold air to the UK from the east.

lows of **-12°**  
A sudden stratospheric warming reverses the jet stream, and means that the UK's weather starts coming from the east - meaning the freezing mass of Siberia.

50cm snow  
10 deaths  
200k without water  
8,260 collisions  
high ground  
61mph

Cost economy £1 billion per day  
+450 schools closed  
100s flights cancelled

power cuts  
businesses closed

supermarkets lost  
£22 million

red weather warning  
flood warning SW England  
four water companies write action plans to improve response  
OFWAT

10 RAF vehicles transported patients & doctors  
M62 army  
rescued vehicles

£100 million compensation paid by water companies  
NHS winter plans for future extreme weather

**EXTREME WEATHER** www.internetgeography.net

**Big Freeze 2010**

The Big Freeze hit in Nov/Dec 2010, caused by high pressure over the polar region. This pushed cold air towards northern Europe. Winds from the north and north east, rather than the south and south east brought freezing temperatures to the UK.

lows of **-19°**  
A sudden stratospheric warming reverses the jet stream, and means that the UK's weather starts coming from the east - meaning the freezing mass of Siberia.

50cm snow  
7 deaths  
100k without water  
1/3 increase insurance claims  
high ground  
40k A&E

Cost economy £1.6 billion  
7000 schools closed  
14000 cancelled  
roads closed  
businesses closed  
100s flights cancelled

power cuts  
businesses closed

shops lost xmas sales  
panic food buying

doubled  
Met Office warning

M62 army  
rescued vehicles  
grit supplies almost run out  
300k+ more potholes £20m to fix

stockpiling salt and grit  
councils set up emergency plans





Extreme weather case studies

# How a Twister Forms

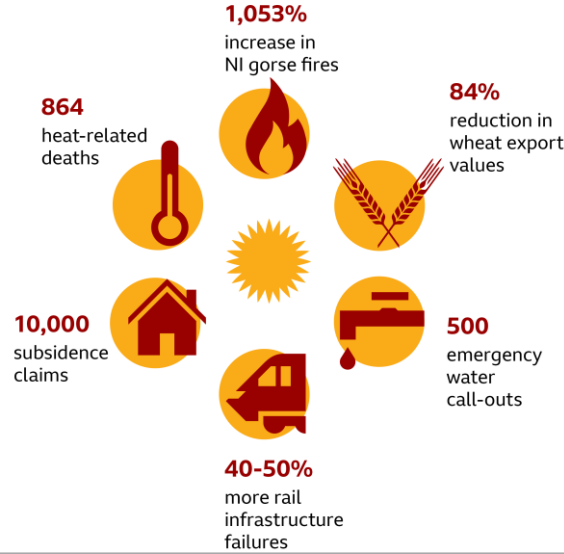
Tornadoes are an unusual and deadly weather phenomenon that can destroy trees, houses, and most anything in its path. The engine that fuels them is a large thunderstorm known as a supercell.

- 1** cool dry air / warm moist air
- 2** An added force pushes warm air upward into the cool dry layer.
- 3** Once the barrier is breached, a bulge of warm moist air expands into the upper layer.
- 4** The runaway expansion typically loses momentum at the stratosphere.
- 5** Moisture condenses into rain and begins to fall pushing cool air downward.
- 6** Falling cool moist air is cycled back up into the cloud.
- 7** The tornado extends down from the wall cloud.

**Fujita Scale of Tornado Intensity**

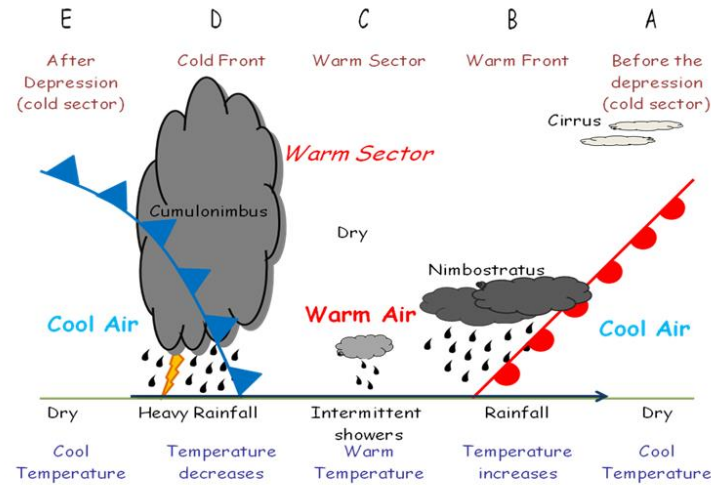
SCALE	WIND SPEED	POSSIBLE DAMAGE
F0	40-72 mph	Light damage: Branches broken off trees; minor roof damage
F1	73-112 mph	Moderate damage: Trees snapped; mobile home pushed off foundations; roofs damaged
F2	113-157 mph	Considerable damage: Mobile homes demolished; trees uprooted; strong built homes unroofed
F3	158-206 mph	Severe damage: Trains overturned; cars lifted off the ground; strong built homes have outside walls blown away
F4	207-260 mph	Devastating damage: Houses levelled leaving piles of debris; cars thrown 300 yards or more in the air
F5	261-318 mph	Incredible damage: Strongly built homes completely blown away; automobile-sized missiles generated

2018 heatwave in numbers



Source: CCRA

BBC



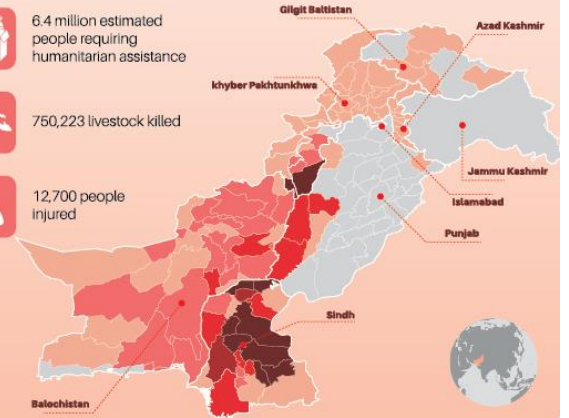
Mid-latitude depressions

Pakistan Monsoon Floods 2022

What have the Floods done?

Nearly a third of Pakistan still remains submerged after catastrophic flooding from record monsoon rains and glacial melt in the mountainous north have left:

- 33 million estimated flood affected people in Pakistan
- 6.4 million estimated people requiring humanitarian assistance
- 1.8 million estimated houses damaged or destroyed
- 750,223 livestock killed
- 1,481 estimated flood related deaths
- 12,700 people injured
- 6,575 kilometres (4,086 mi) of roads and 269 bridges destroyed
- More than 17,560 schools completely or partially damaged



Pakistan's Floods Affect More than 30 Million People

Map of the estimated number of homes destroyed in the August 2022 monsoon floods



Source: UN Office for the Coordination of Humanitarian Affairs Pakistan