

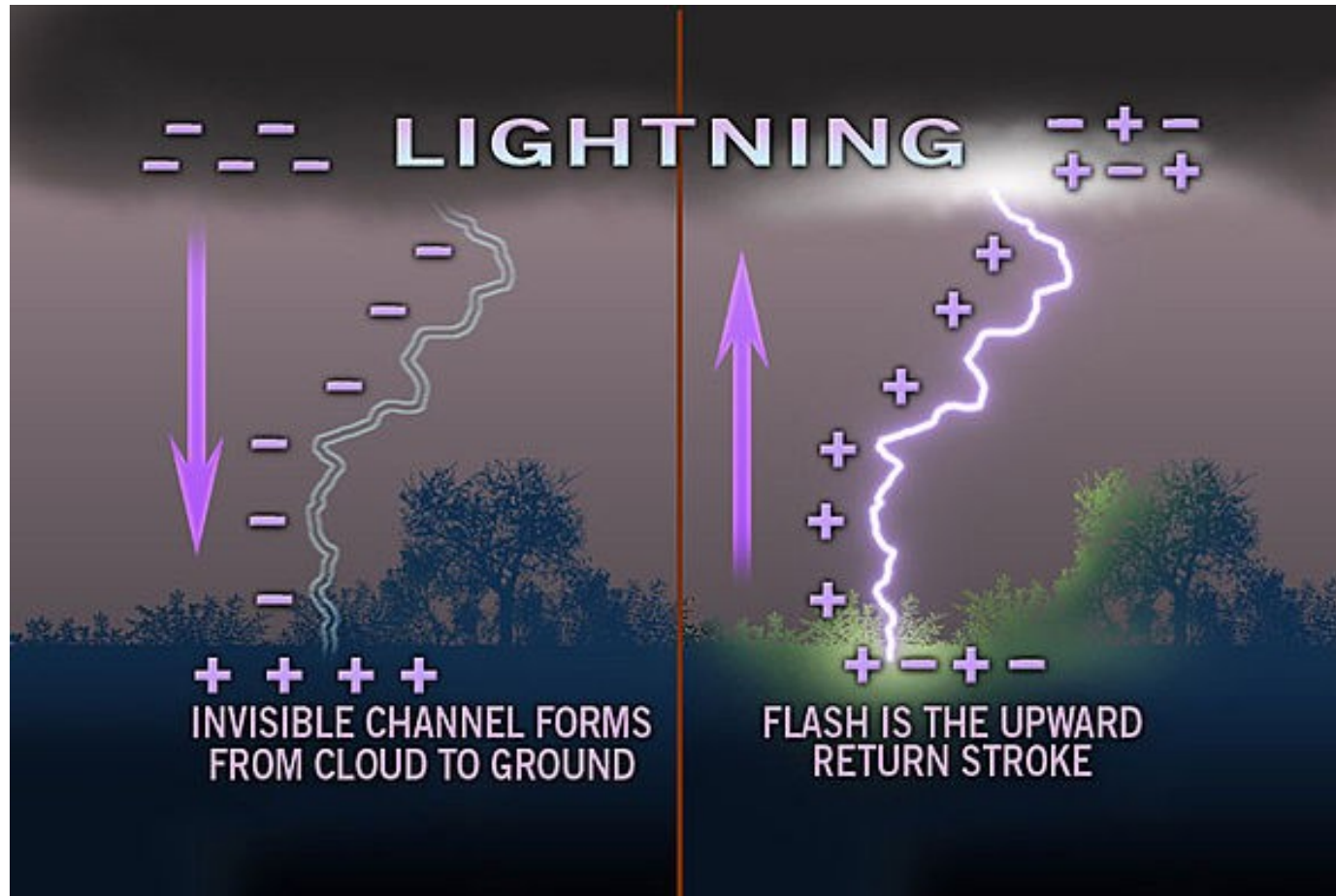
Lightning

A Lightning Talk
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What is it?

- Electrical discharge: IC, CC or GC
- Collision of light and heavy ice particles combined with updraughts
- 100,000 amps (typical)
- 0.2 seconds (typical)
- Top of cloud +ve, bottom of cloud -ve
- GC is what concerns us.

How does it work



What does it look like?



Threat to Life

- Not very high (24,000 deaths annually worldwide)
- Mortality rate about 10% - 20%
- Direct hits mostly fatal but rare
- Trees and damp masonry explode
- Ground currents can choose foot – foot discharge path

Odd burn marks



Protection

- Lightning rod
 - *Increases* chance of hit
 - Conducts current to ground
 - Must have low resistance and low impedance
 - Conductor should be as straight as possible
 - IEC 62305 for assessing risk

Electronics Effects

- Induced currents normally cause damage
- Typical 1KV exponential pulse, 1 ms duration, 10 μ s rise time
- Increased porosity in underground cables causing failure later
- Reciprocal law (1KV once a year, 500V twice a year etc)

Electronics Protection

- Surge arrestor
 - Gas discharge + avalanche diode
 - Limited life
 - Slow to act
 - Fail to open circuit
 - Metal Oxide Varistor (MOV)
 - Limited life
 - Fail to short circuit (catch fire)
 - Combine with slow-blow fuse

Economics

- If device is cheap then don't bother with protection (phones)
- If device is expensive then lightning protection may be worth it (data centre)
- Insurance may depend on lightning protection (churches)
- Plant trees

Advice

- Stay inside
- Use “flash-boom” test (5 seconds per mile)
- If storm is less than 5 miles away then take precautions
- Stay indoors until 30 mins after last thunder heard

Questions?

