

What do you know about...

Clouds



- Can you name some cloud types?
- Do they all look the same?
- Do they all block the light of the sun?
- How do they form?

Let's investigate the process that causes clouds to form.



Make a model cloud in a bottle.

You will need:

- Plastic soda or water bottle with a screw cap
- Wooden matches (*Ask an adult to help you with this!*)
- A flashlight
- Small cup of warm water

Step 1:

- Add 1 inch of warm water to the bottle
- Screw the cap on top
- Squeeze and release the bottle and observe what happens.
- Shine the flashlight on the bottle. Do you see any changes?

Squeezing increases the pressure and temperature in the bottle. The release lowers the pressure and temperature. Similar to what occurs in the atmosphere.



Clouds are more than just water

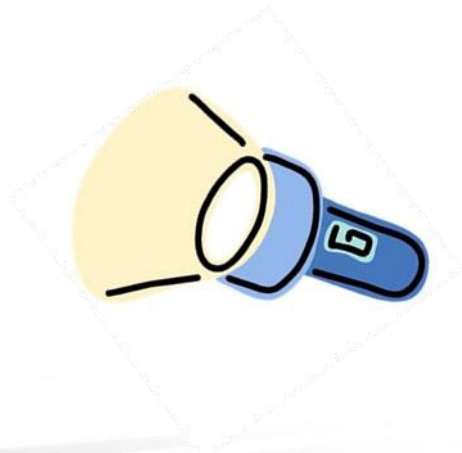


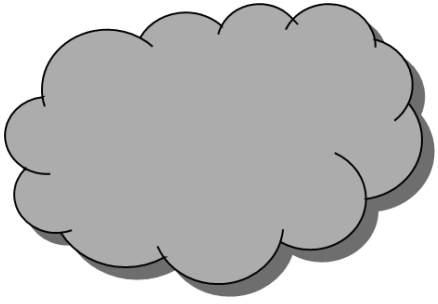
Step 2:

- Remove the cap from the bottle.
- Ask an adult to carefully light a match and hold it near the opening of the bottle.
- Drop the match into the bottle and quickly replace the cap, trapping the smoke inside. The match will extinguish when it lands in the water.
- Once again, slowly squeeze the bottle and release. What do you observe?
- Shine your flashlight through the bottle at various angles? What do you notice?

Challenge: Design your own experiment

- Use water at different temperatures to make clouds.
- What happens if you use 2 matches?
- Does the cloud change when you squeeze more or less?
- Other ideas?





How do clouds form?

- Water
- Drop in pressure/temperature
- Aerosols

Aerosols are the particulate, or nuclei, for cloud droplets.

When you look up at the sky, you are looking at more than just air. There are also billions of tiny bits of solid and liquid floating in the atmosphere. Those tiny floating particles are called **aerosols** or **particulates**.

What aerosol acted as a nuclei for your cloud in a bottle?



Natural sources of aerosols



Desert dust storms



VOCs from vegetation



Smoke from forest fires



Ash from erupting volcanoes

Manmade sources of aerosols



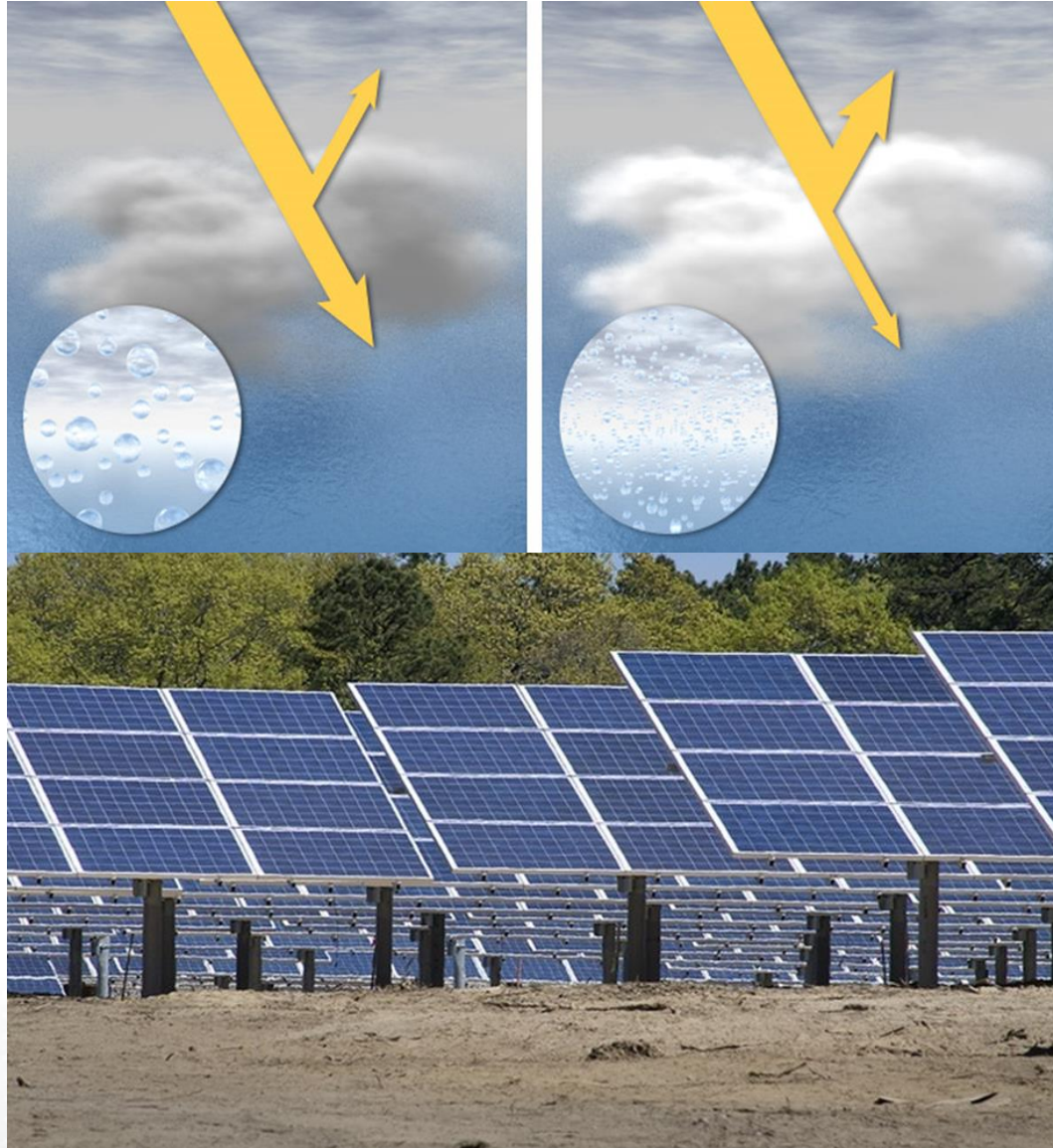
Automobile and plane exhaust



Deforestation

Aerosol size affects the amount of incoming solar energy that reaches the earth

The larger the aerosol, the larger the droplet, allowing more solar energy to reach the earth.

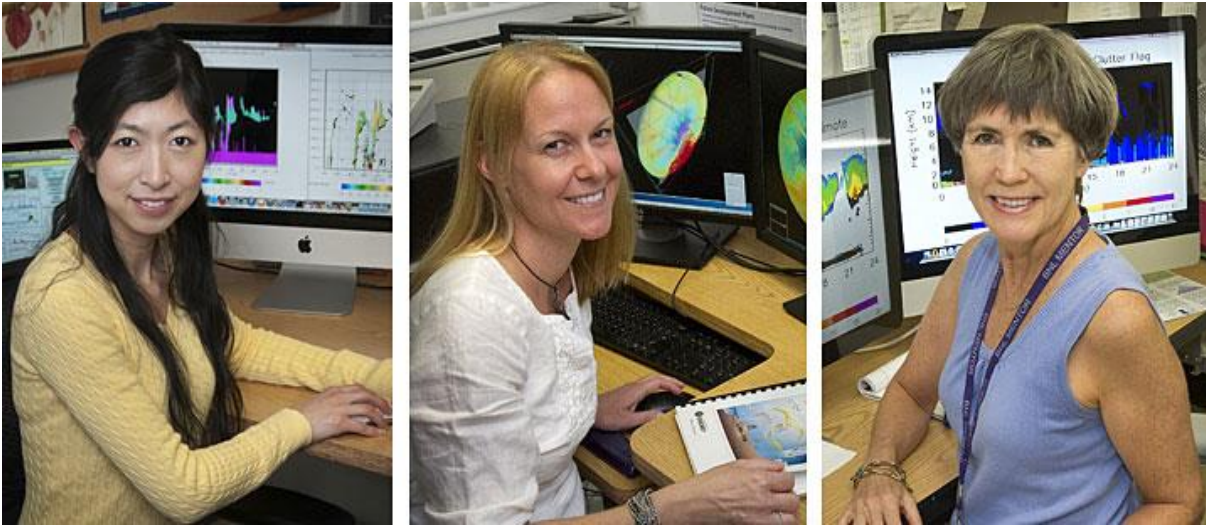


Which cloud will allow more insolation to reach the solar panels?

Hint: look at the droplet sizes, and the space between them.

Scientists at Brookhaven National Lab are studying aerosols to better understand clouds, precipitation and climate

Meet the Engineers Whose Programming Helps Enhance Climate Research



Meng Wang, Tami Fairless, and Karen Lee Johnson use teamwork to bring atmospheric data into focus.

<https://www.bnl.gov/newsroom/news.php?a=217051>

Meet Brookhaven's Arthur Sedlacek, Aerosol Hunter



<https://www.arm.gov/news/features/post/57701>

Cloud Identification Guide

A Dichotomous Key
Created by Dr. Tina Carhenge, Marshall University
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Look carefully at your cloud. Answer the questions below, and follow the instructions. When you reach a cloud name in **bold**, that is the type of cloud you are observing.

1. Is it raining?

No- go to number 2.

Yes- with thunder, lightning, & heavy rain - your cloud is a **cumulonimbus**.



Yes- but only drizzly, with small raindrops - your cloud is a **nimbostratus**.



2. Is it a high wispy cloud, like a horse's tail?

No- go to number 3.

Yes- your cloud is a **cirrus**.



3. Is it flat & layered, puffy & bumpy, or some of both?

Flat & layered-go to number 4

Puffy & bumpy-go to number 5

Both- If your cloud is a nearly solid layer of large puffs (the size of your fist or larger), your cloud is a **stratocumulus**.



4. Determine how high and how thick your flat layered cloud is.

If your cloud is high, thin, and the sun is shining casting distinct shadows, it is a **cirrostratus**.



If it is thicker, the sun is dimmer, and there are hardly any shadows, it is an **altostratus**.



If it is a low cloud, so low it's hard to see the bottom and it covers most of the sky, it is a **stratus**.



5. Hold your hand up toward your cloud. Look at the size of the puffs.

Compare them to your hand. If the puffs are the size of your fingernail (very small), your cloud is a **cirrocumulus**.



If the puffs are the size of your thumb (medium-sized), your cloud is an **altocumulus**.



If the puffs are the size of your fist (large), your cloud is a **cumulus**.



- You can learn to recognize clouds with a little practice. Use this Cloud Identification Guide to get started.
- See the next slide to find out where to use your cloud observing skills for real citizen science!

[file:///C:/Users/slc/Desktop/Mars hall%20cloud%20identification%20guide.pdf](file:///C:/Users/slc/Desktop/Mars%20hall%20cloud%20identification%20guide.pdf)

Become an official cloud observer by visiting the NASA GLOBE site and contributing data to their citizen science program!

Your observations will be an important contribution to the world's understanding of clouds.

- <https://scool.larc.nasa.gov/>
- Learn [how to participate in the NASA GLOBE Cloud Observation Project](#).
- Citizen Science Observations can be submitted through the [GLOBE Observer app](#).
- **Download the GLOBE Observer app:**
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Tiny Airborne Particles from Wildfires have Climate Change Implications

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NYPA Extends Solar Forecasting Network to Albany as Part of Study to Improve Grid Reliability

<https://www.bnl.gov/newsroom/news.php?a=116629>

New Campaign Will Track Deep Convective Clouds Over Houston

<https://www.bnl.gov/newsroom/news.php?a=214346>

Citizen Science

Become an Official Cloud Observer through the GLOBE Program

<https://www.globe.gov/web/s-cool/home/participate>

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