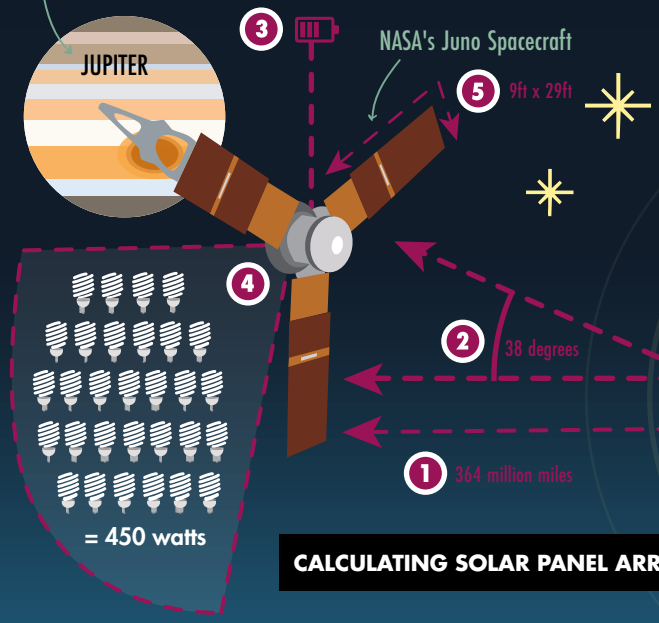
NEEF National Environmental Education Foundation

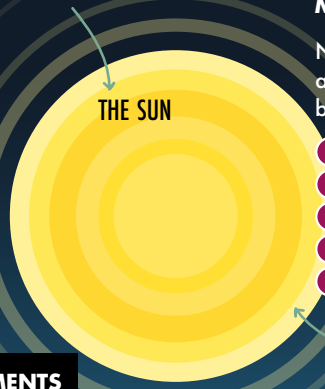
ROOTED IN MATH

TAKE A CLOSER LOOK AT THE WAY WE STUDY THE **ENVIRONMENT** AND HOW WE INTERACT WITH IT. YOU MIGHT BE SURPRISED TO FIND OUT HOW MUCH OF WHAT WE KNOW IS **ROOTED IN MATH**.

Jupiter is 5x as far from the sun as Earth and more than 1,000x the size of Earth.



If the sun were the size of a beach ball, then Jupiter would be the size of a golf ball and Earth would be as small as a pea.



The sun's energy output is 386 billion billion (or 3.86 x 1020) megawatts.

CALCULATING SOLAR PANEL ARRANGEMENTS

MATH + ENVIRONMENTAL ENGINEERING

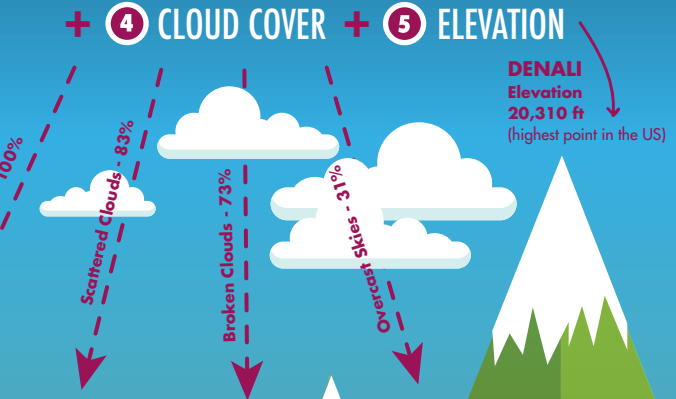
NASA engineers calculate solar panel arrangements on satellites and spacecraft based on:

1. distance from the sun
2. orientation toward the sun
3. the power needed for operation
4. the energy output of each solar cell
5. the surface area available

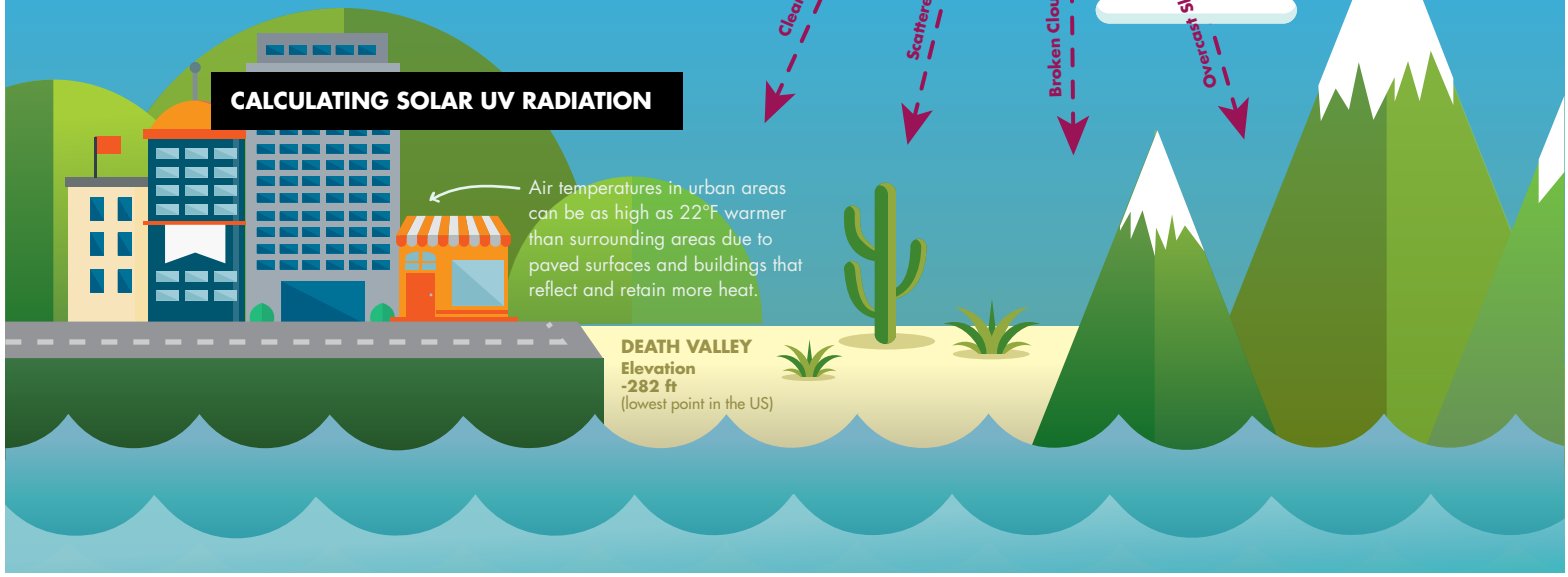
MATH + ENVIRONMENTAL SCIENCE

Scientists from the National Weather Service use formulas to calculate the strength of solar ultraviolet radiation (UV), taking into account multiple factors:

1. **LATITUDE:** Latitudes closer to the equator have more UV exposure
2. **TIME OF YEAR:** UV levels are highest in summer months when the sun is at its highest arc in the sky
3. **TIME OF DAY:** UV levels are highest around noon when the sun is highest
4. **CLOUD COVER:** UV levels are highest when cloud cover is lowest
5. **ELEVATION:** UV levels increase at higher elevations due to less atmospheric absorption

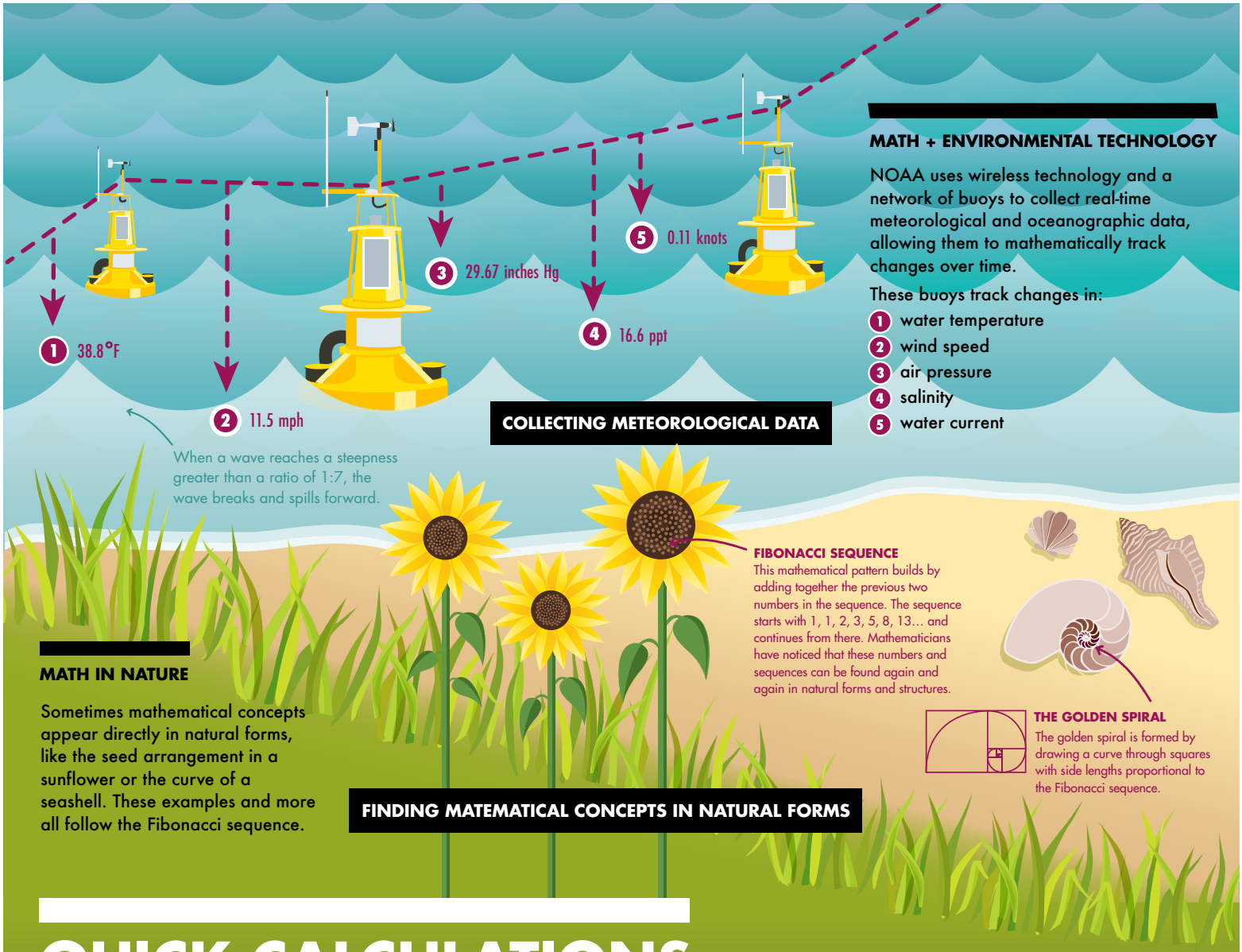


CALCULATING SOLAR UV RADIATION



Air temperatures in urban areas can be as high as 22°F warmer than surrounding areas due to paved surfaces and buildings that reflect and retain more heat.

DEATH VALLEY
Elevation
-282 ft
(lowest point in the US)



MATH + ENVIRONMENTAL TECHNOLOGY

NOAA uses wireless technology and a network of buoys to collect real-time meteorological and oceanographic data, allowing them to mathematically track changes over time.

These buoys track changes in:

1. water temperature
2. wind speed
3. air pressure
4. salinity
5. water current

COLLECTING METEOROLOGICAL DATA

When a wave reaches a steepness greater than a ratio of 1:7, the wave breaks and spills forward.

MATH IN NATURE

Sometimes mathematical concepts appear directly in natural forms, like the seed arrangement in a sunflower or the curve of a seashell. These examples and more all follow the Fibonacci sequence.

FIBONACCI SEQUENCE
This mathematical pattern builds by adding together the previous two numbers in the sequence. The sequence starts with 1, 1, 2, 3, 5, 8, 13... and continues from there. Mathematicians have noticed that these numbers and sequences can be found again and again in natural forms and structures.

THE GOLDEN SPIRAL
The golden spiral is formed by drawing a curve through squares with side lengths proportional to the Fibonacci sequence.

FINDING MATEMATICAL CONCEPTS IN NATURAL FORMS

QUICK CALCULATIONS

Did you know that a standard showerhead uses 2.5 gallons of water per minute? Next time you take a shower, time the number of minutes you let the water run.

2.5 gallons x **# of minutes** x **365 days** = **Gallons of water your showers use in a year**

COMPARE: Repeat these calculations, shortening the usage time of each resource, to see how much you could save!

You can calculate pounds of CO_2 emissions by common household electronics. For a lightbulb, use this equation:

(**wattage of a lightbulb** / **1,000** to calculate kilowatts) x **# of hours light is on a day** x **1.33lbs CO_2/kWh** the national average for utility CO_2 conversion = **Pounds of CO_2 emissions per lightbulb each day**

Learn more at NEEFusa.org

National Aeronautics and Space Administration; US Environmental Protection Agency; National Park Service; National Oceanic and Atmospheric Administration; Discovery Education

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