



# Earth Day

WATER TOUCHES EVERYTHING



# Water Touches Everything

## 2024 EARTH DAY POSTER

The ocean holds about 97 percent of Earth's water and covers 70 percent of our planet's surface. According to the United Nations, the ocean may be home to 50 to 80 percent of all life on Earth. Even if you live hundreds of miles from a coast, what happens in the ocean is fundamental to your life.

The major ocean basins – Atlantic, Pacific, Arctic, Indian, and Southern – shape our planet's climate and weather by absorbing, storing, and moving heat, water, and carbon dioxide. For nearly five decades, NASA missions have enabled researchers to observe from above and measure changes in the ocean across days, months, seasons, and years. Scientists use our satellite and sub-orbital data and climate models to study ocean dynamics, sea level rise, hydrological cycles, marine life, and the intersections of land and sea.

Over the past three years, NASA and its partners have launched three major satellite missions to study the ocean: SWOT, PACE, and Sentinel-6 Michael Freilich. These missions build on and complement existing missions and research campaigns to understand how and where the sea rises and falls, how currents move around the planet, and how the ocean and atmosphere exchange carbon dioxide, pollution, and nutrients.

In the ocean, some of the tiniest creatures have a huge impact. Phytoplankton are floating, microscopic organisms (algae are one example) that, like plants, turn sunlight, oxygen, and nutrients into food (through photosynthesis). They are the center of the aquatic food web, feeding everything from microscopic zooplankton to fish and shellfish – and therefore whales, birds, and other mammals who eat them. Scientists estimate that much of the oxygen in our atmosphere has been produced by phytoplankton, which are also responsible for drawing down carbon dioxide from the air.

### A WHALE OF AN IMPACT

In the circle of life, whales eat creatures that eat phytoplankton, and the nutrient-rich feces (poop) from whales can then fuel phytoplankton growth. Whales also store carbon in their massive bodies, which eventually sinks to the seafloor when they die. According to researchers, a single whale can lock up as much carbon as dozens or hundreds of trees. It is one of the many ways nature removes some of the carbon dioxide that human activities produce. But all of our excess CO<sub>2</sub> may be changing the oceans in ways that can upset the balanced ecosystems that support fish and whales.

### WhaleWatch

The WhaleWatch tool, funded by NASA and the National Oceanic and Atmospheric Administration (NOAA), uses data from NASA's Aqua satellite to identify areas where whales are gathered so that ship captains can avoid the area or reduce speed to avoid collisions.



The ocean is both a source and sink of greenhouse gases. Much of the heat that escapes the ocean comes in the form of evaporated water, one of the most potent greenhouse gases. That water vapor contributes to the formation of clouds, which shade the surface and supply water through precipitation – though they can also trap heat. Clouds are the key regulator of the planet's temperature.

### WHAT'S THAT SWIRLY CLOUD EFFECT?

The spiraling cloud patterns (see image 5) are known as Von Kármán vortices. They form when fluid flow is disturbed by an object, such as when winds are diverted around a volcanic island poking above the ocean surface. The alternating direction of rotation in the air forms swirls in the clouds. These beautiful swirls can occur in both liquids and gases, making them a perfect way to illustrate motion and direction.

Water is common to all living things as we know them, and evidence of water has been found beyond Earth on Mars, comets, and meteorites. Because water seems like it could be universal, astrobiologists are looking for it in the atmosphere of exoplanets as an indicator that a planet could support life.

Closer to home, Jupiter's moon Europa may be hiding a saltwater ocean beneath its icy surface. It may be the most promising place in our solar system to find environments still suitable for some form of life beyond Earth. For this reason, NASA will soon send Europa Clipper to investigate.

### Imagery Key



The 2024 NASA Earth Day poster is composited with real satellite imagery from NASA's Terra, Aqua, and Landsat missions. Scan the QR code to learn more about each image.

1. Cloud Streets over the Black Sea (Aqua)
2. Phytoplankton Factory in the Argentine Sea (Landsat-8, Terra)
3. Groswater Bay, Canada (Landsat-8)
4. Mackenzie River Outflow, Canada (Landsat-8)
5. Von Kármán Vortex off Cheju Do, South Korea (Terra)
6. Phytoplankton in the Chukchi Sea, off the Alaskan coast (Landsat-8)
7. Sea of Okhotsk, Russia (Terra)

### THE SUN TOUCHES EVERYTHING TOO!

This year NASA is also celebrating the Heliophysics Big Year – a global celebration of solar science and the Sun's influence on Earth and the entire solar system. Learn more at <https://go.nasa.gov/45ruX56>.

