



A Day in the Life of Earth: What NASA Sees from Space

Each day, our planet undergoes a dynamic cycle of light, temperature shifts, and environmental activity that shapes life across the globe. From the ground, we experience these transitions in the form of sunrises, changing weather, and the seasonal rhythm of nature. Yet, from space, NASA satellites capture a comprehensive, 24-hour portrait of Earth, uncovering patterns and changes that are often hidden from our daily experience. Thanks to these continuous orbits, data is collected across all times, providing a global view of our planet's health.

On this Earth Day, let's orbit through one full day on our planet and explore why these insights are crucial for protecting our home.

Morning: A Clearer View

As the Sun rises across the globe, people everywhere wake to the familiar signs of a new day. Light streams through the windows and morning frost evaporates. While we sip coffee or head out the door for a walk, **NASA's sun-synchronous satellites** begin their daytime observations. These satellites follow a consistent orbit that passes over the same part of the planet at the same time each day, providing comparable data that can show changes over time.

The longest-running Earth observation satellite program, **Landsat**, crosses the equator around 10:00 a.m. local solar time with its eighth and ninth models. At this hour, sunlight is strong, and cloud cover is still minimal, especially over equatorial regions like the Amazon rainforest where afternoon storms are common. These conditions allow **Landsat** to capture clearer information on vegetation health, land use changes, and wildfire impacts with reduced shadow interference.

Only fifteen minutes later, NASA's **Terra satellite**, equipped with the **MODIS** (Moderate Resolution Imaging Spectroradiometer) instrument, makes its morning pass. Also taking advantage of the lack of morning cloud development, **MODIS** imagery tracks the progression of land surface changes throughout the day.

By capturing the world as it awakens, these satellites set the tone for understanding how Earth responds to a new day. As we adjust to a new day each morning, satellite imagery captures the environment in a wider view to illustrate the Earth's adjustments over time.

Midday: Day-Light Dependent

While you're experiencing that traffic firsthand, NASA's **TEMPO** (Tropospheric Emissions: Monitoring of Pollution) satellite, 22,000 miles above the Earth's surface, can capture pollution data on a much broader scale. From that high vantage point, it maps air quality changes across the entire North American continent as you daydream about finally walking through your front door.

With the Sun directly overhead, the midday hours surrounding solar noon become a prime window for collecting data that depends on sunlight. **TEMPO** is the first space-based sensor



designed to capture hourly air quality data over North America, offering an unprecedented look at how pollutants evolve throughout the day.

Positioned in a geostationary orbit, **TEMPO** stays in a fixed region as Earth rotates, allowing it to track fluctuations in pollutants from a fixed vantage point. Because it relies entirely on sunlight, **TEMPO** collects its data from sunrise to twilight. Unlike other Earth-observing satellites equipped with thermal sensors, **TEMPO** doesn't collect meaningful data after dark.

The pollutants it tracks include nitrogen dioxide, ozone, formaldehyde, and aerosols. By visualizing these emissions in motion, **TEMPO** helps scientists identify pollution sources, understand how weather and traffic patterns affect air quality, and inform both public health advisories and environmental regulations.

So, the next time you're stuck in traffic with the windows up, remember that while you inch along, NASA's satellites and scientists are analyzing the broader environmental impacts of everyday activity—turning those moments into data that can help improve the air we all share

Afternoon: Tracking Earth's Response to Daytime Heat

In the afternoon, when atmospheric conditions are often in flux, **NASA's GPM (Global Precipitation Measurement)** and **SMAP (Soil Moisture Active Passive)** satellites capture the Earth's changing environment. They provide data on precipitation and soil moisture, respectively, essential to analyzing changes in both climate and weather.

Ever find yourself in the middle of a random downpour without an umbrella? Tracking precipitation patterns across the world, **GPM** offers high-resolution data on the intensity and distribution of thunderstorms that often develop in the afternoon hours. Its ability to track across both land and oceans allows us to track long track weather systems, predict flooding, and improve our weather forecasting.

SMAP, on the other hand, focuses on measuring soil moisture levels. As temperatures rise in the afternoon, moisture levels in the soil can fluctuate. This impacts agriculture, fire risk, and drought predictions. You've probably noticed that your garden needs more attention in periods of drought, and **SMAP's** radar notices, too, by measuring moisture levels in the top layer of the soil. With its large-scale capabilities to inform regional practices in irrigation and water use, **SMAP** helps communities respond more effectively to drought patterns.

Together, these two satellites provide imagery of how Earth responds to the heat and energy of the afternoon hours. By capturing the planet during this dynamic time of day, they turn everyday weather and climate challenges into measurable data to support decisions for the people in a changing environment.



Night: Seeing Through Darkness

When the Sun sets and cities glow with artificial light, a perspective invisible to our eyes during the day comes forward. While most of us are settling in for the night, NASA satellites are still hard at work, revealing essential data captured best in the dark.

NASA's VIIRS (Visible Infrared Imaging Radiometer Suite) instrument, aboard the **Suomi NPP** and **NOAA-20** satellites, can detect extremely faint light at night. It tracks the glow of city lights, identifying power outages caused by natural disasters and light pollution patterns. New and active wildfires can be detected as well, assisting response teams and evacuation notices to keep you safe in the overnight hours. **VIIRS** can even detect bioluminescence from plankton blooms in water and auroras in polar regions.

Now further North and South, during the extended darkness of polar night, **Landsat 8 and 9's LEAP (Landsat Extended Acquisition Plan)** is collecting crucial Arctic data. The slow but significant changes occurring in the Arctic Ocean's glaciers and sea ice, in areas where sunlight won't return for months at a time, are still unfolding. **LEAP** allows scientists to continually monitor these remote and vulnerable regions during winter months, providing year-round insights into how polar landscapes respond to a changing climate.

Another NASA satellite, **ICESat-2 (Ice, Cloud, and land Elevation)**, uses its **ATLAS (Advanced Topographic Laser Altimeter System)** laser system to track ice sheet loss in these polar regions as well. By sending pulses of green light toward Earth's surface and measuring the time it takes for them to bounce back, **ICESat-2** provides high-resolution elevation data even in the overnight hours. This data is crucial because Arctic Sea ice plays a powerful role in regulating Earth's climate by cooling the planet. As sea ice continues to diminish, more solar energy is absorbed by the ocean, warming the Earth. Continued monitoring of Arctic waters is essential to understanding this dynamic and protecting the delicate balance of the planet.

Full Circle: Why This Orbit Matters on Earth Day

On Earth Day, we're reminded that protecting our planet starts with understanding it. NASA's Earth observation satellite fleet offers a round-the-clock view of Earth's changing systems: helping us see patterns, respond to crises, and recognize that our planet's health is deeply tied to our own.

The Earth observation fleet, over five decades in the making, gives us the data we need to prepare for storms, track air quality, monitor wildfires, and more. And while these satellites provide a view from space, their purpose is rooted in life on the ground—designed to serve people, communities, and ecosystems. So, the next time you glance at the sky or check the weather, remember that our planet is always in motion—and we have tools to help us understand and protect it.