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taiga

The open northern part of the boreal forest. It consists of open woodland of coniferous trees growing in a rich floor of lichen, and is generally cold and swampy.

tectonic

Corresponding with the broad architecture of the outer part of the Earth

telemetry

A space-to-ground data stream of measured values (including instrument science data, instrument engineering data, and spacecraft engineering data) that does not include command, tracking, computer memory transfer, audio, or video signals.

Television and Infrared Observation Satellite (TIROS)

Television and Infrared Observation Satellite (TIROS) A series of NASA and NOAA satellites launched to monitor Earth's weather from outer space. The era of the meteorological satellites began with the launch of TIROS-1 on April 1, 1960. For the first time, it was possible to monitor weather conditions over most of the world regularly from space. A series of these satellites were launched throughout the 1960s, those funded by NASA for research and development were called TIROS, and those funded by the Environmental Science Services Administration (ESSA, the predecessor of NOAA) for the operational system were called ESSA.

A second generation of ITOS/NOAA* environmental satellites was initiated by the launch of ITOS-1 in 1970, followed by a number of NOAA satellites. The third generation of TIROS-N/NOAA environmental satellites was initiated by the launch of TIROS-N in 1978.

* Pairs of acronyms such as ITOS/NOAA arise because NASA funds and names its prototype satellites and then the operating agency funds and names the rest of the series.

temperate

Region in which the climate undergoes seasonal change in temperature and moisture. Temperate regions of the earth lie primarily between 30 and 60 degrees latitude in both hemispheres.

temperature

A measure of the energy in a substance. The more heat energy in the substance, the higher the temperature. The Earth receives only one two-billionth of the energy the sun produces. Much of the energy that hits the Earth is reflected back into space. Most of the energy that isn't reflected is absorbed by the Earth's surface. As the surface warms, it also warms the air above it.

temporal

A characteristic that refers to the time at which a given data set was acquired.

terminus (of a glacier)

The end, or foot, of a glacier.

Terra

The flagship of the Earth Observing System, a series of spacecraft that represent the next landmark steps in NASA's leadership role to observe the Earth from the unique vantage point of space. Focused on key measurements identified by a consensus of U.S. and international scientists, Terra will enable new research into the ways that Earth's lands, oceans, air, ice, and life function as a total environmental system. See [Terra website](#).

terrestrial radiation

The total infrared radiation emitted by the Earth and its atmosphere in the temperature range of approximately 200-300K. Because the Earth is nearly a perfect radiator, the radiation from its surface varies as the fourth power of the surface's absolute temperature. Terrestrial radiation provides a major part of the potential energy changes necessary to drive the atmospheric wind system and is responsible for maintaining the surface air temperature within limits for livability.

thematic mapper (TM)

A Landsat multispectral scanner designed to acquire data to categorize the Earth's surface. Particular emphasis was placed on agricultural applications and identification of land use. The scanner continuously scans the surface of the Earth, simultaneously acquiring data in seven spectral channels. Overlaying two or more bands produces a false color image. The ground resolution of the six visible and shortwave bands of the Thematic Mapper is 30 meters, and the resolution of the thermal infrared band is 120 meters. Thematic mappers have been flown on Landsats-4 and -5.

theorem

The last statement of a formal proof; a mathematical assertion that can be proven.

theory

An explanation for some phenomenon that is based on observation, experimentation, and reasoning.

thermal

Of, making use of, producing, or caused by heat.

thermal infrared

Electromagnetic radiation with wavelengths between about 3 and 25 micrometers.

thermocline

A transition layer of water in the ocean, with a steeper vertical temperature gradient than that found in the layers of ocean above and below. The permanent thermocline separates the warm mixed surface layer of the ocean from the cold deep ocean water, and is found between 100- and 1000-m depths. The thermocline first appears at the 55° (±60° N and S latitudes, where it forms a horizontal separation between temperate and polar waters. The thermocline reaches its maximum depth at mid-latitudes and is shallowest at the equator and at its northern and southern limits. The thermocline is stably stratified, and

	transfer of water and carbon dioxide across this zone occurs very slowly. Thus, the thermocline acts as a barrier to the downward mixing of carbon dioxide.
thermodynamic	The science of heat and temperature and of the laws governing the conversion of heat into mechanical, electrical, or chemical energy.
thermohaline	Refers to the combined effects of temperature and salinity that contribute to density variations in the oceans.
thermosphere	The outermost shell of the atmosphere, between the mesosphere and outer space; where temperatures increase steadily with altitude.
thunder	The sound that results from lightning. Lightning bolts (static electricity) produce intense heat. This burst of heat makes the air around the bolt expand explosively, producing the sound we hear as thunder. Since light travels faster than sound, we see the lightning before we hear the thunder.
thunderstorm	Local storm resulting from warm humid air rising in an unstable environment. Air may start moving upward because of unequal surface heating, the lifting of warm air along a frontal zone, or diverging upper-level winds (these diverging winds draw air up beneath them). The scattered thunderstorms that develop in the summer are called air-mass thunderstorms because they form in warm, maritime tropical air masses away from other weather fronts. More violent severe thunderstorms form in areas with a strong vertical wind shear that forces the updraft into the mature stage, the most intense stage of the thunderstorm. Severe thunderstorms can produce large hail, forceful winds, flash floods, and tornadoes.
TIROS-N/NOAA satellites	NOAA satellites that continuously orbit the Earth from North to South Pole (hence, polar orbiting) at an altitude of approximately 470 nautical miles (870.44 km or 540.86 statute miles). These environmental satellites collect visible and infrared imagery and provide atmospheric-sounding data and meteorological data relay and collection. A primary mission of TIROS-N/NOAA is to monitor the 70 percent of the globe covered by water where weather data is sparse and provide continuous data to the National Weather Service for use in numerical forecast modeling. Each TIROS-N/NOAA carries six primary systems: <ol style="list-style-type: none"> 1. The Advanced Very High Resolution Scanning Radiometer (AVHRR) senses clouds over both ocean and land, using the visible and infrared parts of the spectrum. It stores measurements on tape, and later plays them back to NOAA's command and data acquisition stations. The satellites also broadcast in real time, and the broadcasts can be received around the world by anyone equipped with a direct readout receiving station. 2. The TIROS Operational Vertical Sounder (TOVS) is a 3-part TIROS system to measure: <ul style="list-style-type: none"> * Temperature profile of the Earth's atmosphere from the surface to 10 millibars; * Water content of the Earth's atmosphere; * Total ozone content of the Earth's atmosphere; 3. The ARGOS Data Collection and Platform Location System (DCS) collects data from sensors placed on fixed and moving platforms, including ships, buoys, and weather balloons, and transmits data to a ground station antenna. Because ARGOS also determines the precise location of these moving sensors, it can serve wildlife managers by monitoring and tracking the transmitters placed on birds and animals. 4. The Space Environment Monitor (SEM) measures energetic particles emitted by the sun over essentially the full range of energies and magnetic field variations in the Earth's near-space environment. Readings made by these instruments are invaluable in measuring the sun's radiation activity. 5. Search and Rescue Tracking (COSPAS/SARSAT) equipment receives emergency signals from persons in distress. The satellites transmit the signals to ground receiving stations. The signals then are forwarded to rescue coordination centers. The rescue centers compute the location of the signals and provide the coordinates of the emergency site (usually within a few miles). 6. Earth Radiation Budget Experiment (ERBE) is a radiometer, flown on NOAA 9 and 10, designed to measure all radiation striking and leaving the Earth. This enables scientists to measure the loss or gain of terrestrial energy to space. Shifts in this energy 'budget' affect the Earth's average temperatures. Even slight changes can affect climatic patterns.
TOPEX/POSEIDON	Ocean Topography Experiment, United States (NASA)/France (CNES). Launched in 1992, the mission carries a radar sensor—called an altimeter—to measure the ocean's surface topography with unprecedented precision. TOPEX/POSEIDON is a core element of the international World Ocean Circulation Experiment (WOCE) and the Tropical Ocean Global Atmosphere (TOGA) seagoing measurements

program. Mission objectives are to:

- Study ocean circulation and its interaction with the atmosphere to understand climate change better;
- Improve our knowledge of heat transport in the ocean;
- Model global ocean tides;
- Study the marine gravity field;
- Calculate sea-level variations on both global and local scales.

[TOPEX/POSEIDON Website](#)

topography	The technique of graphically representing the exact physical features of a place or region on a map. The physical features of a place or region.
tornado	A twisting, spinning funnel of low pressure air. The most unpredictable weather event, tornadoes are created during powerful thunderstorms. As a column of warm air rises, air rushes in at ground level and begins to spin. If the storm gathers energy, a twisting, spinning funnel develops. Because of the funnel's cloud and rain composition and the dust, soil, and debris it draws up, the funnel appears blackish in color. The most energetic storms result in the funnel touching the ground. In these tornadoes, the roaring winds in the funnel can reach 300 mph, the strongest winds on Earth. Funnels usually travel at 20 to 40 mph, moving toward the northeast. When tornadoes form over lakes or oceans they suck water into the funnel cloud and are called waterspouts.
Total Ozone Mapping Spectrometer (TOMS)	Flown on NASA's Nimbus-7 satellite, its primary goal is to continue the high-resolution global mapping of total ozone on a daily basis. The Nimbus-7 launch in 1978 enabled TOMS to begin delivering data in 1979 and continue providing information until 1993. TOMS has mapped the total amount of ozone between the ground and the top of the atmosphere, provided the first maps of the ozone hole, and continues to monitor this phenomenon. Because of its longevity, TOMS also has obtained information on the more subtle trends in ozone outside the ozone hole region. This results from development of a powerful new calibration technique that removes the instrument measurement drift that developed over the years. With this technique applied to the TOMS 14.5-year data record, a global ozone decrease of 2.69 percent per decade was detected. To ensure that ozone data will be available through the next decade, NASA will continue the TOMS program using U.S. and foreign launches. In 1991, the former Soviet Union launched a Meteor-3 satellite carrying a TOMS instrument provided by NASA. A third TOMS will be launched onboard a NASA Earth probe satellite in 1994, and the Japanese Advanced Earth Observations Satellite (ADEOS) will carry a fourth TOMS when it launches in 1996.
total solar irradiance	The amount of solar energy hitting the top of the Earth's atmosphere, currently accepted to be about 1,368 watts per square meter.
TOVS	TIROS Operational Vertical Sounder. See Television Infrared Operational Satellite (TIROS).
trace gas	Any one of the less common gases found in the Earth's atmosphere. Nitrogen, oxygen, and argon make up more than 99 percent of the Earth's atmosphere. Other gases, such as carbon dioxide, water vapor, methane, oxides of nitrogen, ozone, and ammonia, are considered trace gases. Although relatively unimportant in terms of their absolute volume, they have significant effects on the Earth's weather and climate.
Tracking and Data Relay Satellite System (TDRSS)	Tracking and Data Relay Satellite System (TDRSS) An orbiting communications satellite, developed by NASA, used to relay data from satellite sensors to ground stations and to track the satellites in orbit.
trade winds	Surface air from the horse latitudes that moves back toward the equator and is deflected by the Coriolis Force, causing the winds to blow from the Northeast in the Northern Hemisphere and from the Southeast in the Southern Hemisphere. These steady winds are called trade winds because they provided trade ships with an ocean route to the New World.
transpiration	The process in plants by which water is taken up by the roots and released as water vapor by the leaves. The term can also be applied to the quantity of water thus dissipated.
tropical	The area between 23.5 degrees north and south of the equator. This region has small daily and seasonal changes in temperature, but great seasonal changes in precipitation.
Tropical Ocean-Global Atmosphere (TOGA)	TOGA is a program jointly sponsored by the United Nations World Meteorological Organization (WMO); the International Council of Scientific Unions (ICSU); the United Nations Educational, Scientific, and Cultural Organization (UNESCO) Intergovernmental Oceanographic Commission (IOC); and the ICSU Scientific Committee on Oceanic Research (SCOR).

TOGA has four major objectives:

* To collect and catalog observations of the tropical atmosphere and ocean;

* To assess the evolution of the tropical atmosphere/ocean system in real time; To promote the development of short-term climate-prediction computer models for the tropics;

* To study the influence of the tropical atmosphere/ocean system on the climate at higher latitudes.

Tropical Rainfall Measuring Mission (TRMM)

A joint NASA/NASDA mission launched in November 1997. The goal of TRMM is to obtain a minimum of 3 years of climatologically significant observations of rainfall in the tropics. Because rainfall is such a variable phenomenon, adequate sampling is a difficult problem. By averaging the instantaneous rainfall rates for 30 days over a 5 degrees by 5 degrees grid, TRMM will obtain observations that meet climatological requirements. TRMM measurements, used together with cloud models, also will provide accurate estimates of vertical distributions of latent heating in the atmosphere.

The present uncertainty about the quantity and distribution of precipitation, especially in the tropics, prohibits definition of the mass and energy exchange between the tropical ocean and atmosphere. Since the tropical atmosphere and oceans are closely coupled, cloud radiation and rainfall are likely to have significant effects on ocean circulation and marine biomass.

TRMM data will play a significant role in global change studies, especially in developing an interdisciplinary understanding of atmospheric circulation, ocean-atmospheric coupling, and tropical biology. TRMM data on tropical clouds, evaporation, and heat transfer will be used to understand the larger scale coupling of the atmosphere to oceans.

tropical storm

Tropical storms generally form in the eastern portion of tropical oceans and track westward. Hurricanes, typhoons, and willy-willies all start out as weak low pressure areas that form over warm tropical waters (e.g., surface water temperature of at least 80 degrees F). Initially, winds and cloud formations over the warm tropical waters are minimal. Both intensify with time. Formation of tropical storms also requires a significant Coriolis effect to induce proper spin in the wind formation. As the storm begins to organize itself into a coherent pattern, it will experience increased activity and intensity.

When a storm develops a clearly recognizable pattern, it is referred to as a tropical depression. When wind speeds reach 35 knots (40.3 mph), it is called a tropical storm and is given a name. When wind speed equals or exceeds 74 mph, the storm is called a hurricane. In the western Pacific, a hurricane is referred to as a typhoon. In waters around Australia it is called a cyclone or willy-willy.

Hurricanes intensify when moving over areas of increased water temperatures, and weaken over colder water surfaces. Upper atmosphere wind shear (different wind direction and speeds at different elevations) will frequently prevent or slow intensification of tropical storms by 'spreading out' the storm horizontally and preventing the formation of strong updrafts of warm, humid air. Movement over a land-mass will weaken hurricane winds but will result in large-scale rain that can result in large-scale flooding. When encountering a strong frontal system (such as a polar front) the hurricane will curve and track along the leading edge of the front or become implanted in it.

Satellite infrared imagery can identify surface water temperatures that will foster tropical storm development.

tropopause

The boundary between the troposphere and the stratosphere (about 8 km in polar regions and about 15 km in tropical regions), usually characterized by an abrupt change of lapse rate. The regions above the troposphere have increased atmospheric stability than those below. The tropopause marks the vertical limit of most clouds and storms.

troposphere

The lower atmosphere, to a height of 8-15 km above Earth, where temperature generally decreases with altitude, clouds form, precipitation occurs, and convection currents are active. See atmosphere.

Tropospheric Emission Spectrometer

A high-resolution infrared spectrometer for monitoring the minor components of the lower atmosphere.

tropospheric ozone (O3)

Ozone that is located in the troposphere and plays a significant role in the greenhouse gas effect and urban smog. See Ozone for more details.

trough

Elongated area of low atmospheric pressure, either at the surface or in the upper atmosphere.

tundra

A type of ecosystem dominated by lichens, mosses, grasses, and woody plants. It is found at high latitudes (arctic tundra) and high altitudes (alpine tundra). Arctic tundra is underlain by permafrost and usually very wet.

typhoon

Hurricanes in the Western Pacific Ocean.

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