Weather satellite

The weather satellite is a type of satellite that is primarily used to monitor the weather and climate of the Earth. Satellites can be polar orbiting, covering the entire Earth asynchronously, or geostationary, hovering over the same spot on the equator.

Meteorological satellites see more than clouds and cloud systems: city lights, fires, effects of pollution, auroras, sand and dust storms, snow cover, ice mapping, boundaries of ocean currents, energy flows, etc. Other types of environmental information are collected using weather satellites. Weather satellite images helped in monitoring the volcanic ash cloud from Mount St. Helens and activity from other volcanoes such as Mount Etna. Smoke from fires in the western United States such as Colorado and Utah have also been monitored.

Other environmental satellites can detect changes in the Earth's vegetation, sea state, ocean color, and ice fields. For example, the 2002 Prestige oil spill off the northwest coast of Spain was watched carefully by the European ENVISAT, which, though not a weather satellite, flies an instrument (ASAR) which can see changes in the sea surface.

El Niño and its effects on weather are monitored daily from satellite images. The Antarctic ozone hole is mapped from weather satellite data. Collectively, weather satellites flown by the U.S., Europe, India, China, Russia, and Japan provide nearly continuous observations for a global weather watch.

Observation of Weather satellite

Observation is typically made via different 'channels' of the electromagnetic spectrum, in particular, the visible and infrared portions.

Some of these channels include:

1.Visible and Near Infrared: 0.6–1.6 μm – for recording cloud cover during the day

2.Infrared: 3.9–7.3 μm (water vapor), 8.7–13.4 μm (thermal imaging)

1. Visible spectrum

Visible-light images from weather satellites during local daylight hours are easy to interpret even by the average person; clouds, cloud systems such as fronts and tropical storms, lakes, forests, mountains, snow ice, fires, and pollution such as smoke, smog, dust and haze are readily apparent. Even wind can be determined by cloud patterns, alignments and movement from successive photos.

2. Infrared spectrum

The thermal or infrared images recorded by sensors called scanning radiometers enable a trained analyst to determine cloud heights and types, to calculate land and surface water temperatures, and to locate ocean surface features. Infrared satellite imagery can be used effectively for tropical cyclones with a visible eye pattern, using the Dvorak technique, where the difference between the temperature of the warm eye and the surrounding cold cloud tops can be used to determine its intensity (colder cloud tops generally indicate a more intense storm). Infrared pictures depict ocean eddies or vortices and map currents such as the Gulf Stream which are valuable to the shipping industry. Fishermen and farmers are interested in knowing land and water temperatures to protect their crops against frost or increase their catch from the sea. Even El Niño phenomena can be spotted. Using color-digitized techniques, the gray shaded thermal images can be converted to color for easier identification of desired information.

Geostationary meteorological satellite

"Geostationary meteorological satellite" redirects here. For the Japanese satellites called "Geostationary Meteorological Satellite". Geostationary weather satellites orbit the Earth above the equator at altitudes of 35,880 km (22,300 miles). Because of this orbit, they remain stationary with respect to the rotating Earth and thus can record or transmit images of the entire hemisphere below continuously with their visible-light and infrared sensors. The news media use the geostationary photos in their daily weather presentation as single images or made into movie loops. These are also available on the city forecast pages of www.noaa.gov (example Dallas, TX).

Several geostationary meteorological spacecraft are in operation. The United States has five in operation; GOES-12, GOES-13, GOES-15, GOES-16 and GOES-17. GOES-12, previously designated GOES-East and now used for South America, is located at 60 degrees west. GOES-13 took over the role of GOES-East on April 14, 2010 and is located at 75 degrees west. GOES-11 was GOES-West over the eastern Pacific Ocean until it was decommissioned December 2011 and replaced by GOES-

15. GOES-16 and-17 remain stationary over the Atlantic and Pacific Oceans, respectively.

Weather satellite Uses

Snowfield monitoring, especially in the Sierra Nevada, can be helpful to the hydrologist keeping track of available snowpack for runoff vital to the watersheds of the western United States. This information is gleaned from existing satellites of all agencies of the U.S. government (in addition to local, on-the-ground measurements). Ice floes, packs and bergs can also be located and tracked from weather space craft.

Even pollution whether it is nature-made or man-made can be pinpointed. The visual and infrared photos show effects of pollution from their respective areas over the entire earth. Aircraft and rocket pollution, as well as condensation trails, can also be spotted.

The ocean current and low level wind information gleaned from the space photos can help predict oceanic oil spill coverage and movement. Almost every summer, sand and dust from the Sahara Desert in Africa drifts across the equatorial regions of the Atlantic Ocean. GOES-EAST photos enable meteorologists to observe, track and forecast this sand cloud.

In addition to reducing visibilities and causing respiratory problems, sand clouds suppress hurricane formation by modifying the solar radiation balance of the tropics. Other dust storms in Asia and mainland China are common and easy to spot and monitor, with recent examples of dust moving across the Pacific Ocean and reaching North America.

In remote areas of the world with few local observers, fires could rage out of control for days or even weeks and consume millions of acres before authorities are alerted. Weather satellites can be a tremendous asset in such situations. Nighttime photos also show the burn-off in gas and oil fields. Atmospheric temperature and moisture profiles have been taken by weather satellites since 1969.