

Oceanic Atmospheric Measurements

Weather and Climate

“Climate is what you expect: weather is what you get.”

• Mark Twain

Weather is the state of the atmosphere, with respect to its effects upon life and human activities. Weather consists of instantaneous to month-long variations of the atmosphere whereas **climate** consists of weather variations over a period of months to years.

Mapping of the Atmosphere using Satellites

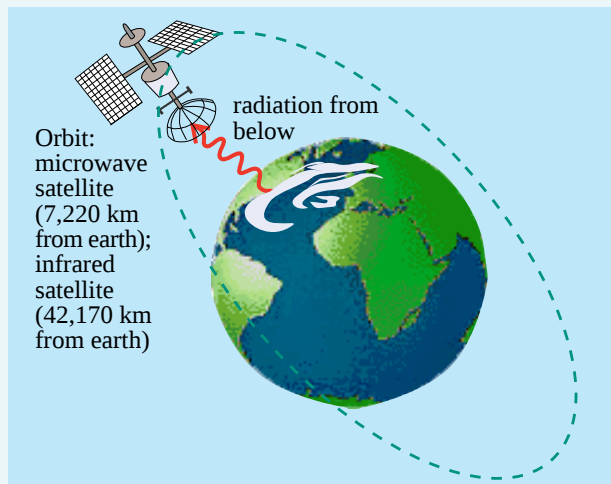
Weather satellites are important tools for mapping the characteristics of the atmosphere, especially in ocean regions where surface observations are sparse.

Advantages of satellites:

- Wide area of coverage over a period of years with the same instrument builds data sets necessary for climate research.
- Often more cost effective than deploying numerous surface instruments to cover the same area.

Disadvantages of satellites:

- View is from the top of the atmosphere, so some types of information are obscured by clouds and gases.
- Measurements are “remote.” The satellite is trying to measure weather by looking at it from afar with radiometers (instruments similar to infrared cameras).



A weather satellite orbiting earth. Day-to-day weather occurs within the lowest 18 km of the atmosphere.

Atmospheric Measurements Taken at Sea are Needed to Calibrate Satellite Measurements

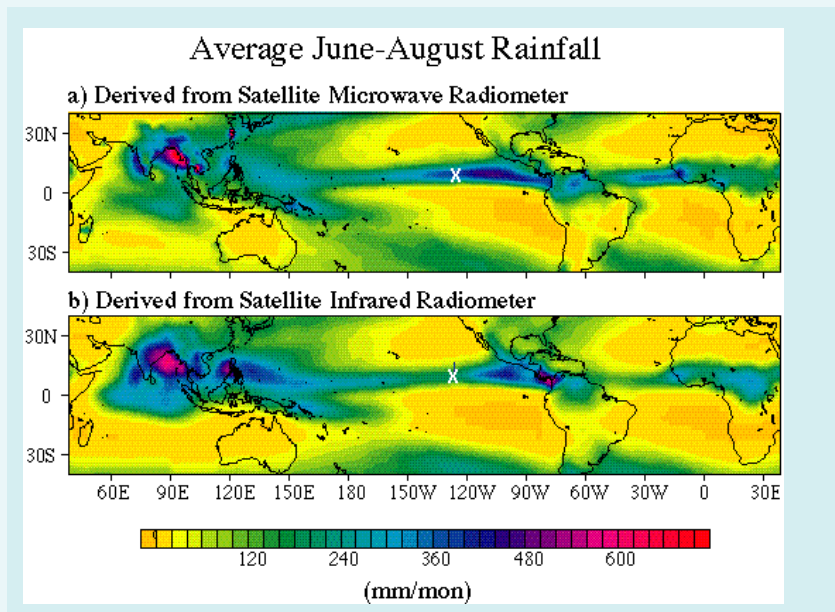
Accurate global mapping by satellite requires that satellite-derived estimates of atmospheric parameters are validated and calibrated over a wide range of conditions.

Land and ocean weather conditions are different. Therefore, to make full use of satellite measurements for accurate global mapping, calibration and validation has to occur over diverse regions of both continents and oceans.

Some remote sensing techniques utilize ocean characteristics to detect atmospheric characteristics. Since these techniques do not work over land, they can only be

Precipitation

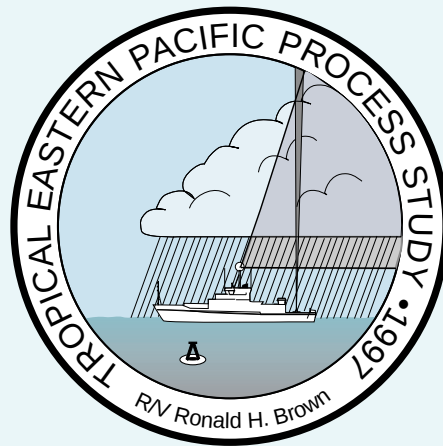
The amount and distribution of precipitation are important factors in global energy balance and climate. Over the last two decades two primary methods have been developed to derive surface precipitation from satellite measurements. One uses measurements in the infrared and the other uses measurements from the microwave part of the electromagnetic spectrum. The two methods do not always agree.



Maps of average June-July-August rainfall derived from satellites. (a) Oceanic precipitation derived from microwave measurements from polar satellites. Since the microwave method does not work over land, the microwave-derived rainfall over the oceans is combined with rain gauge measurements over the continents to create the global map. (b) Global precipitation derived from infrared measurements from geosynchronous satellites. The white X marks the

The Intertropical Convergence Zone (ITCZ) in the tropical eastern Pacific is a persistent band of clouds and storms which have a strong influence on global circulations and climate. Satellite-borne microwave sensors indicate that the eastern Pacific ITCZ is one of the rainiest on earth, while the satellite-borne infrared sensors indicate much less precipitation.

It is important to resolve this discrepancy between the satellite precipitation estimates since the amount and distribution of precipitation are critical inputs to global climate models used for climate and weather prediction. The difference between the satellite-borne microwave versus the infrared precipitation estimates has a large effect on the resulting forecasts.



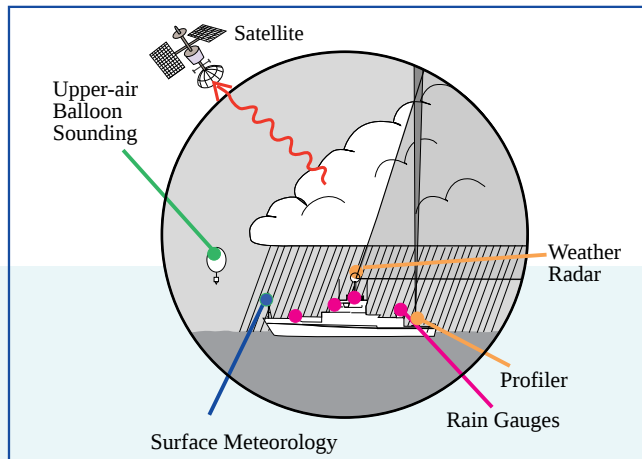
PACS 1997 Tropical Eastern Pacific Process Study

The purpose of the PACS 1997 Tropical Eastern Pacific Process Study cruise is to document the clouds and precipitation of the tropical eastern Pacific from the surface. The timing and location of the cruise are designed to permit the ship's instruments to sample storm structure when and where there is the greatest difference between the different satellite precipitation estimates.

The scientific objectives of the PACS 1997 Tropical Eastern Pacific Process Study are:

- to estimate precipitation with radar and compare it with the two satellite estimates.
- to understand the physical reasons behind the difference in precipitation estimates based on infrared and microwave satellite data.

The R/V RONALD H. BROWN will be equipped with the atmospheric sensors necessary to determine the amount of precipitation and to explain it physically.



Atmospheric instrumentation on the R/V RONALD H. BROWN.

Instrument	Measurements
Rain Gauges and Distrometers Weather Radar	Precipitation rates and amounts Patterns of precipitation: horizontal and vertical
Profiler	Vertical profile of cloud structure and winds
Upper-Air Balloon Sounding	Temperature, moisture, and wind profile of atmosphere from surface to 18 km altitude -- to determine the atmospheric conditions in which the precipitation occurs
Surface Meteorology	Temperature, pressure, wind, moisture, short-wave radiation -- surface weather and how it changes with occurrence of precipitation

Since the R/V RONALD H. BROWN is a dedicated research vessel, quality control procedures can be instituted to insure that the measurements are consistently of high quality. Simultaneous measurements from the several types of atmospheric sensors provide context for one another and are important for building a complete and accurate picture of the atmosphere. In contrast, with ships of opportunity, the quality of measurements is unknown and simultaneous measurements of different types are few, providing limited context at best.

Support for the ship time on the R/V RONALD H. BROWN for the PACS 1997 Tropical Eastern Pacific Process Study is provided by NOAA's Office of Global Programs.