

Satellite Data Sets for the Atmospheric Radiation Measurement (ARM) Program

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Satellite measurement is an important component in the Atmospheric Radiation Measurement (ARM) Program data stream. Currently the real-time, polar-orbit and geostationary satellite data received at the ARM data processing facilities are provided by the SeaSpace Corporation. These data sets include the Advanced Very High Resolution Radiometer (AVHRR) and the TIROS Operational Vertical Sounder (TOVS) measurements from the National Oceanic and Atmospheric Administration (NOAA) satellites and measurements from Geostationary Operational Environmental Satellites (GOES)-7/GOES-8. The AVHRR acquires visible, near-infrared, and thermal infrared data through five channels at the horizontal resolution of approximately 1 km at nadir. The TOVS data produce vertical profiles of temperature, moisture, and wind. With the finishing of data-set transition from GOES-7 to GOES-8, all the five channel measurements of GOES-8 at the horizontal resolution of 4 km are provided to the ARM data processing facilities for the coverage of the continental United States. In addition, full resolution GOES-8 measurements are made available for the 1000 x 1000-km area centered at the ARM Southern Great Plains site. These satellite data sets have been widely used by ARM science team members to derive cloud-top altitude, cloud cover, snow and ice cover, surface temperature, and vertical profiles of temperature, water vapor, and wind, as well as to obtain continuous observation of weather features needed to predict, detect, and track severe weather. In addition to producing satellite data products directly for the ARM data processing facilities, we also examine the application of satellite data from a variety of satellite platforms. The emphasis is on the integration of different data sources, including data from satellite and non-satellite sources, for meteorological studies.

Besides data from the NOAA and GOES satellites, measurements from the Defense Meteorological Satellite Program (DMSP) are gaining recognition in the meteorological research and operational communities. The sensors carried aboard the DMSP satellites include the Operation Line Scanner (OLS), the Special Sensor Microwave Imager (SSM/I), the Special Sensor Microwave Temperature Sounder (SSM/T1), and the Special Sensor Microwave Water Vapor Sounder (SSM/T2). The OLS sensor is a visible/infrared radiometer, and the SSM/I, SSM/T1, and SSM/T2 sensors are microwave radiometers. The SSM/I is primarily used to estimate various geophysical and meteorological properties of the earth and atmosphere. These include total columnar atmospheric water vapor and liquid water, ocean surface wind speed, sea ice concentration, etc. The SSM/T1 has seven channels with the spot size approximately 175 km at nadir. The measurements of these channels can be converted to temperature, geostrophic wind, and thermal wind data at 15 standard pressure levels (1000 mb through 10 mb). The SSM/T2 sensor has five microwave channels. The spot size is approximately 45 km at nadir. The channel measurements can be converted to specific humidity, relative humidity, or dew-point temperature at 6 standard pressure levels (1000 mb through 300 mb). We are examining the temperature and water vapor retrievals with comparison to conventional radiosonde measurements. Considering the advantages of being capable of observing large areas cost-effectively and regularly through satellite remote sensing, it can be anticipated that satellite observation will play a more important role in the future in meteorological researches.