Ground System at the Meteorological Satellite Center

This paper describes ground systems at the Meteorological Satellite Center (MSC). These systems consist of the MTSAT-1R ground system, the satellite data processing system, and the polar-orbiting meteorological satellite data receiving system.

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1. Introduction

MSC consists of two facilities, i.e. the Command and Data Acquisition Station (CDAS) at Hatoyama, Saitama Prefecture, and the Data Processing Center (DPC) at Kiyose, Tokyo. Figure 1 shows the schematic diagram of the operating ground systems at MSC.
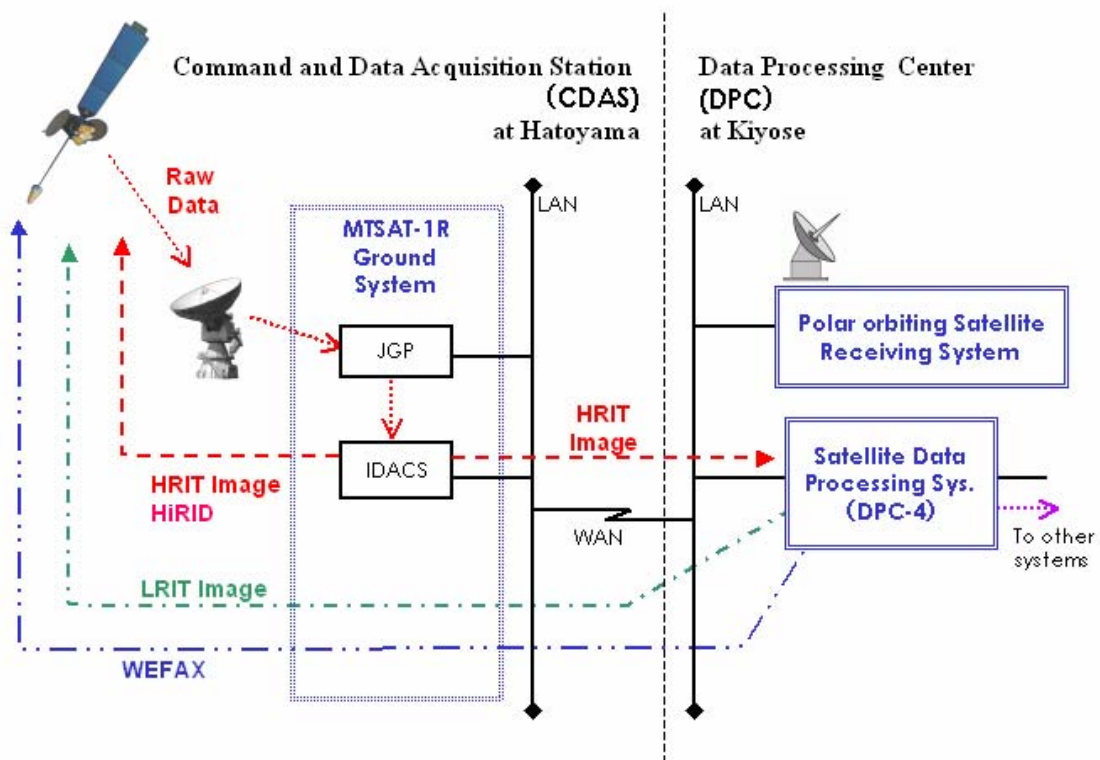

Figure 1   Schematic diagram of the operating ground systems at MSC

The MTSAT-1R ground system is installed at CDAS. The main functions of the system are to control MTSAT-1R and preprocess MTSAT-1R imager data such as image navigation and calibration. Details are described in Section 2.

The satellite data processing system is installed at DPC. The main function of the system is to derive satellite products from MTSAT-1R imager data and polar orbiting satellite data. Details are described in Section 3.

The polar-orbiting meteorological satellite data receiving system is installed at DPC. Details are described in Section 4.

2.   MTSAT-1R ground system

MTSAT-1R ground system has two major functions, i.e. satellite control and preprocessing of imager data.

The satellite control function of the system controls components onboard the satellite by sending commands and monitoring the conditions of the satellite in telemetries from the satellite.

The preprocessing function of the system processes MTSAT-1R imager data observed by the Japanese Advanced Meteorological Imager (JAMI) aboard on MTSAT-1R. The function is conducted by the JAMI Ground Processor (JGP) and the Imager Data Acquisition and Control System (IDACS). JGP converts the raw data of imager observations into radiance, and then IDACS produces High Resolution Imager Data (HiRID) and the High Rate Information Transmission (HRIT) data from the calibrated data. HRIT and HiRID data are disseminated to Medium scale Data Utilization Station (MDUS) via MTSAT-1R. HRIT data are also transmitted to the satellite data processing system at DPC through landline.

3.   Satellite Data Processing System

The satellite data processing system is designed to derive various kinds of satellite products including the Weather Facsimile (WEFAX) and the Low Rate Information Transmission (LRIT) data for the Small scale Data Utilization Station (SDUS).

JMA replaced the system and started the operation of fourth-generation computer system (hereinafter referred to as DCP-4) on 1 March 2005.

DPC-4 is specialized for derivation of satellite products, while its predecessors were designed to deal with satellite control function, preprocessing function and derivation of satellite products. DPC-4 has capability to process image data of MTSAT series satellite which deploy an imager of high spatial resolution and a new IR channel as well as polar-orbiting satellites and earth observation satellites (EOS).

A rough estimate of DPC-4 processing capability is more than 100 times of that of the previous system. It enabled reduction of elapsed time of each process, introduction of new algorithm for improvement of products, and new products such as hourly AMVs (see WP7-J4). The following is the major specifications of DPC-4:

UNIX Servers
Satellite Product Producing Server   x 4
85 SPECint_rate2000, Main MEM 16GB   (per machine)
Satellite Data Collecting Server   x 2
42 SPECint_rate2000, Main MEM 8GB   (per machine)
The other servers are for: data management, scheduler control, and integrated system monitor.
Shared Magnetic Disks
Storage Area Network : 4 TB
Network Attached Storage : 7 TB
Cartridge Tape Library : 2000 TB   (sharing with NWP Supercomputer system)
TCP/IP network based on Giga-bit network switch

Table 1   Major specifications of DPC-4

4.   Polar-orbiting meteorological satellite data receiving system

JMA has been directly receiving data from NOAA's polar-orbiting meteorological satellites (POES) since 1968, and currently it receives the High Resolution Picture Transmission (HRPT) data from NOAA-17 and NOAA-18.

The received HRPT data are used for derivation of various kinds of satellite products such as vertical profile of temperature, total ozone amount, and sea surface temperature. Extracted ATOVS (Advanced TIROS Operational Vertical Sounder) data are used for Numerical Weather Prediction (NWP).

JMA has been preparing to replace the system in order to receive satellite data from both POES and METOP (Meteorological Operational Polar satellites of EUMETSAT). The system is designed to receive signal at X-band from NPOESS (National Polar-orbiting Operational Environmental Satellite System) as well.

4.1   Outline

The receiving system consists of a parabolic antenna of three meters across, an HRPT receiver, an AHRPT receiver, data processing monitor units and other units. The data processing units are networked to DPC-4.
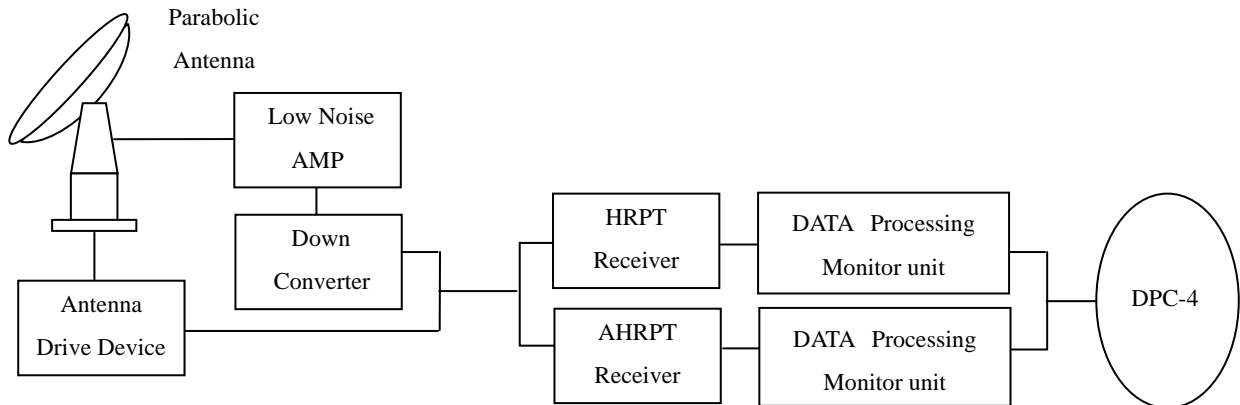
Figure 2 shows the system configuration.

Figure 2   Configuration of receiving system of polar-orbiting meteorological satellite

4.2   Functions

The new receiving system will have the following functions:

- Direct reception of HRPT data from NOAA satellites
- Direct reception of Advanced HRPT (AHRPT) data from METOP satellites
- Antenna capability to receive signal at X-band for High Rate Data (HRD) of NPOESS and NPOESS Preparatory Project (NPP)