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DATA DISSEMINATION METHODS OF THE FOLLOW-ON SATELLITES TO MTSAT

In response to CGMS Action Item 34.29

This paper reports on the planned data dissemination methods of the follow-on satellites to MTSAT as JMA's response to CGMS Action Item 34.29.

All observation data from the follow-on satellites is planned for dissemination over the Internet instead of direct broadcasting.

In addition to this Internet dissemination, research into the feasibility of using a communications satellite will be continued in order to find an effective combination of methods or technologies, taking account of 1) convenience to users (particularly those in relatively low-speed Internet environments), 2) cost-effectiveness for both meteorological satellite operators and users, and 3) the possible mutual complementarity of dissemination through communications satellites and the Internet.

DATA DISSEMINATION METHODS OF THE FOLLOW-ON SATELLITES TO MTSAT

1 Introduction

The Japan Meteorological Agency (JMA) has been directly broadcasting High Rate Information Transmission (HRIT) for Medium-scale Data Utilization Stations (MDUSs) and Low Rate Information Transmission (LRIT) for Small-scale Data Utilization Stations (SDUSs) since the commencement of MTSAT-1R's operation in 2005. The HRIT and LRIT direct broadcast is scheduled for continuation until at least around 2015 when MTSAT-2 will terminate operation.

JMA also disseminates MTSAT imagery over the Internet to the National Meteorological and Hydrological Services (NMHSs) in the Asia-Pacific region as an alternative method and as JMA's contribution to the Integrated Global Data Dissemination Service (IGDDS). In addition to the current service, JMA will start disseminating low-resolution JPEG imagery over the Internet by the end of 2007 to enable easier access to MTSAT imagery by users in relatively low-speed Internet environments.

JMA has studied, from both technical and operational viewpoints, possible data dissemination methods -- direct broadcast, the Internet and communications satellites -- in the course of concept studies for the MTSAT-2 follow-on satellites (referred to below as *the follow-on*) to be equipped with an imager that will collect larger amounts of data than the current MTSAT. The results of the study are summarized in the following sections.

2 Dissemination methods

2.1 Direct broadcast

The transmission capacity of the current direct broadcast will be insufficient to disseminate the observation data that will be collected by the follow-on, which may need several tens of Mbps for communication links. For this reason, several technical and operational difficulties in disseminating data need to be overcome in order to keep using the medium of direct broadcasting.

Advanced compression/coding techniques are required to reduce data size and increase transmission capacity in addition to repartitioning of the frequency band to maintain use of the current 1670-1710 MHz range allocated for the Meteorological Satellite Service (MetSat). Meanwhile, the imager data downlink needs a new and broader frequency band such as 18.1-18.3 GHz to handle the increased quantity of data from the follow-on. Securing the best use of the satellite data that will be collected by the follow-on would require new and separate radio communication systems for different frequency bands to establish communication links for the imager data downlink and direct broadcast, even with advanced compression/coding techniques. This would lead to an increase in the manufacturing cost of the follow-on, and current users will be obliged to purchase new receiving equipment suitable for the new frequency as well as a new transmission method to obtain the data from the follow-on.

Acquisition of the 7450-7550 MHz radio frequency band would be challenging, since it is already fully occupied by other services such as communications satellites. Moreover, there is no domestic frequency allocation to the MetSat (space-earth) by the Japanese radiocommunication administration. Dissemination using the 18.1-18.3 GHz radio frequency band would also involve rain attenuation issues, which are unfavorable in operational use by the NMHSs.

2.2 Internet

The Internet is a widespread communications infrastructure covering the whole world, providing an advanced network environment in a cost-effective way. The Internet is expected to further develop as part of the IGDDS for delivering voluminous data such as satellite imagery and meteorological products to users. The initial and running costs of using the Internet are affordable for both meteorological satellite operators and users, but the Internet environment might not be good enough for users in some countries and/or areas even in the next decade.

Dissemination of MTSAT imagery over the Internet has been widely accepted by users in the Asia-Pacific region. As of October 2007, 21 NMHSs are registered for this dissemination service. The NMHSs can selectively download full-resolution and/or low-resolution imagery according to their needs and their Internet environment. Since March 2007, JMA has also been providing satellite imagery and Numerical Weather Prediction (NWP) products for SATAID (Satellite Animation and Interactive Diagnosis, a software program used to superimpose NWP data onto satellite imagery) over the Internet as one of its WIS prototype services.

MTSAT imagery is also available through Sentinel Asia, an Internet-based Web-GIS disaster management support system for the Asia-Pacific region. This is made possible through joint efforts by JMA and the Japan Aerospace Exploration Agency (JAXA). Sentinel Asia has been chiefly promoted by JAXA as its contribution to the GEONETCast initiative, and distributes natural disaster information including other earth observation data to the Asia-Pacific region (http://dmss.tksc/jaxa.jp/sentinel/).

2.3 Communications satellites

Data dissemination using communications satellites has several advantages (including scalability, accessibility, flexibility, transition planning and robustness) as an alternative dissemination method to direct broadcasting (see CGMS-XXXII WMO WP-20). Data dissemination services based on a communications satellite constellation are already in operation or are planned for the future under the IGDDS implementation plan.

Most communications satellites provide a high-speed data transmission service using the Digital Video Broadcasting-Satellite (DVB-S), a coding and modulation standard for satellite television. Receiving equipment for DVB-S is generally marketed and widely used around the world, and users of satellite imagery dissemination services can utilize commercial off-the-shelf devices without large overheads. The initial and running costs for using communications satellites are affordable for users.

3 Conclusions

JMA has studied, from both technical and operational viewpoints, possible dissemination methods for provision to all end users of the follow-on's observation data, which is expected to increase significantly in volume. With the evolution of telecommunications technology, some dissemination methods offer a powerful and cost-optimized alternative to direct broadcasting to transmit the huge amounts of data that will be collected by the satellite.

The results of the study can be briefly summarized as outlined below.

- Data dissemination using direct broadcast poses several technical and operational difficulties, particularly the acquisition of appropriate radio frequencies and the procurement of additional ground equipment.
- The Internet offers a widespread communications infrastructure covering the whole world, providing an advanced network environment without large overheads.
- Data dissemination services based on a communications satellite constellation are already in operation.

Based on the study results, JMA has drafted a general plan for the data dissemination methods of the follow-on. A summary is given below.

All observation data from the follow-on is planned for dissemination over the Internet instead of direct broadcasting. Internet dissemination, which JMA has already introduced as an alternative to direct broadcasting, is slated for further enhancement to assure its reliability and stability.

In addition to dissemination over the Internet, research into the feasibility of using a communications satellite will be continued in order to find an effective combination of methods or technologies, taking account of 1) convenience to users (particularly those in relatively low-speed Internet environments), 2) cost-effectiveness for both meteorological satellite operators and users, and 3) the possible mutual complementarity of dissemination through communications satellites and the Internet.