HW

REPORT OF THE SEVENTEENTH MEETING OF COORDINATION OF GEOSTATIONARY METEOROLOGICAL SATELLITES

CGMS XVII

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EUMETSAT, DARMSTADT

FEDERAL REPUBLIC OF GERMANY

3-7 OCTOBER 1988

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CGMS XVII

Held in the Headquarters of EUMETSAT, Darmstadt, Federal Republic of Germany from the 3rd to the 7th October 1988.

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A.1 INTRODUCTION

CGMS XVII was convened at 09h00 on 3rd October by Mr. J Morgan, Director of EUMETSAT, who welcomed the CGMS members to the meeting, the first to be hosted by EUMETSAT.

Mr Morgan noted with pleasure that at this meeting of CGMS all members and the Peoples Republic of China (PRC) were able to participate. Since the last meeting of CGMS there had been several successful polar orbiting and geostationary meteorological satellite launches and therefore these meetings served as an excellent forum to exchange the latest information on these systems.

Furthermore, the role of CGMS as a coordinator of satellite systems had already been well demonstrated. The operation of the Meteosat DCP system had only been possible over the last three years because of the generous support provided by the USA in the form of the loan of its GOES-4 satellite as a DCP message transponder.

The reader should note that a full list of acronyms and abbreviations can be found in Annex I.

A.2 ELECTION OF THE CHAIRMAN

Mr. John Morgan, Director of EUMETSAT, nominated by Mr L Heacock, was unanimously elected chairman.

A.3 DRAFTING COMMITTEE

A Drafting Committee, co-chaired by Messrs C Staton and G Bridge, was appointed. CGMS members were requested to nominate a representative to provide inputs to the drafting committee.

A.4 ADOPTION OF THE AGENDA

The meeting agreed to a proposal by the Secretariat for an additional item dealing with future polar orbiting meteorological satellites. There would, furthermore, be a presentation on the activities of CEOS, in particular relating to its recommendations on future data formats and standards, given by Mr M Fea from ESRIN, Frascati, Italy. In a separate Agenda item the USA requested preliminary discussion of possible future interference between transmissions from GOMS and GMS.

With these additions the agenda was adopted. The reader should note that the numbering of sections of this report correspond to those used in the Agenda. A list of Working papers submitted to CGMS XVII can be found in Annex II.

A.5 REVIEW OF ACTIONS FROM PREVIOUS MEETINGS

1. Review of continuing actions from earlier CGMS meetings.

Action - Circulation of satellite operations quarterly reports.

Status - Operations reports from USA (WEFAX bulletins) have been regularly distributed. Japan informed the meeting that quarterly reports on GMS operations have been regularly distributed to CGMS members.

ACTION 17.1 Japan to add EUMETSAT to the distribution list for GMS quarterly reports.

ACTION 17.2 EUMETSAT to distribute METEOSAT Quarterly Reports to CGMS members.

Action - Quarterly exchange of photography.

Status - Photographs have been regularly exchanged.

Action - Intercomparison of extracted winds.

Status - No recent comparisons of satellite wind information have been received. See Agenda item H.

Action - Satellite anomalies: all satellite operators to provide NOAA/NESDIS with information on unexplained anomalies for further study and NOAA to provide solar event information to the satellite operators on request and a status report on the correlation study at each meeting.

Status - The Secretariat was not aware of any anomaly reports being sent to NOAA. ESA informed the meeting that a report on Meteosat anomalies had been sent to NGDC.

The USA informed the meeting that statistics of anomalies compiled by the NGDC could be made available to CGMS members.

Action - USA to issue quarterly to all other admitting authorities the consolidated DCP assignments.

Status - continuing

2. Action items from CGMS XVI

ACTION: 16.1 The Secretariat to update and distribute the eighth edition of the CGMS Consolidated Report to all members.

Status - Continuing. A preliminary draft had been distributed to CGMS members. Members were requested to comment on the draft within two months. The Secretariat would then issue the finalised eighth edition (to include comments and recommendations from CGMSXVII).

ACTION: 16.2 USA is to inform all CGMS members of the type of vehicle to be used to launch GOES-I.

Status - completed (see C.1.5).

ACTION: 16.3 USA to mail information package on GIMTACS to all CGMS members within 30 days.

Status - completed

ACTION: 16.4 (Commonality of satellites). CGMS Secretariat to incorporate this proposal when preparing the agenda for the next CGMS session.

Status - completed

ACTION: 16.5 USA to provide CGMS members with the revised launch schedule (GOES I - M) as soon as it becomes available.

Status - completed.(see C.1.5).

ACTION: 16.6 (Interference on the IDCS). CGMS members to discuss this topic and express concern over the resulting problems with appropriate organizations or agencies of their country and to report on this matter at the next meeting of CGMS.

Status - continuing (see section E).

ACTION: 16.7 JMA to distribute the technical information about GMS ship radar DCP and data transmission scheme to the CGMS members.

Status - completed

ACTION: 16.8 EUMETSAT, Japan and USA to inform the WMO not later than 1 November 1987 if they are not able to provide the 06 UTC and 18 UTC time slot allocations for ASAP ships during the BUAN evaluation period beginning 1 January 1988. No reply will be interpreted as an agreement to provide the time slots.

Status - completed.

ACTION: 16.9 EUMETSAT to inform the CGMS on the level of interference on IDCS channels once Meteosat-3 becomes the primary transponder for the DCS.

Status - completed.

ACTION: 16.10 WMO to inform USA on the preferred ASDAR support by GOES-E.

Status - Completed (see section E.3).

ACTION: 16.11 The Secretariat to complete and distribute Issue 6 of IDCS Users Guide to all CGMS members.

Status - completed.

ACTION: 16.12 The USA to distribute to all CGMS members a detailed schedule of imaging/sounding used in the normal, hurricane support and tornado support modes of dissemination.

Status - completed.

ACTION: 16.13 The USA to investigate and present a proposal to CGMS members outlining the implementation of a digitally encoded header and an enhancement wedge for WEFAX imagery.

Status - closed (see section F 1.2).

ACTION: 16.14 CGMS members to continue to develop proposals for digital WEFAX and a change-over scenario for consideration at CGMS XVII.

Status - continuing

ACTION: 16.15 WMO to prepare a draft proposal for a study of the analysis and processing of data from a three-axis stabilized spacecraft and to circulate this proposal to CGMS members by the end of December 1987.

Status - completed.

India reported that it had received the request for image data from the WMO and would supply data covering a period of seven consecutive days in the first part of September 1988. The data tapes (1600 bpi) would be sent to the WMO.

ACTION: 16.16 CGMS members are requested to include graphical presentations on the history of the quality and quantity of satellite winds for working papers prepared for CGMS-XVII. CGMS members are also requested to highlight any improvements made since the last CGMS session in their satellite winds products.

Status - completed.

ACTION: 16.17 USA to provide time series of satellite to satellite wind comparisons for CGMS XVII.

Status - action continuing.

ACTION: 16.18 USA to provide CGMS members with information on the products derived from the VAS Data Utilisation Centre.

Status - completed (see action 17.21, section H.3)

ACTION: 16.19 JMA to provide CGMS members with the specification of the digital cassette tape storage system.

Status - completed (see Section I).

ACTION: 16.20 CGMS members to send all reports of spacecraft anomalies (retroactively where possible) to the NGDC.

Status - continuing.

ACTION: 16.21 EUMETSAT to coordinate with all CGMS members the date of CGMS XVII and confirm.

Status - completed.

A.6 REVIEW OF CONSOLIDATED REPORT

Working papers identifying modifications and corrections to the draft eighth edition of the CGMS Consolidated Report were presented by Japan, USA and additional comments were provided by the WMO. The meeting approved the new format of the report, developed jointly by the Secretariat and the WMO, and agreed to make any further comments on the draft within two months. The Secretariat informed the meeting that any modifications and recommendations arising from the discussions at CGMS XVII would be included in the eighth edition.

ACTION: 17.3 **CGMS members to provide comments on the draft of the eighth edition of the Consolidated Report within two months.**

ACTION: 17.4 **The Secretariat to update and distribute the finalised eighth edition of the CGMS Consolidated Report to all members in due course.**

B. REPORT ON THE STATUS OF SATELLITE SYSTEMS

B.1 EUMETSAT

ESA presented WP 1 which described the launch and commissioning of Meteosat-3 (formerly P2). The commissioning of the satellite was nominal with the DCP, Dissemination and Imaging missions all performing satisfactorily. The DCP mission was transferred to Meteosat-3 on 20 July, after having been supported for almost three years on the NOAA GOES-4 satellite. The imaging and dissemination missions were transferred on 11 August and since that date Meteosat-3 has been the operational spacecraft.

Meteosat-2 started its move to a westerly location on 11 August but was stopped at 2.8 degrees West on 29 August due to an anomaly which had occurred with the Electronically Despun Antenna (EDA) on Meteosat-3. At the present time the anomaly situation has had no impact on the mission but a further degradation cannot be excluded. In this case it would be necessary to split the mission between Meteosat-2 and Meteosat-3.

ESA WP 2 described the performance of Meteosat-2 since July 1987. No major problems had occurred although the lack of fuel to perform manoeuvres resulted in further increase in the satellite inclination to about 1.5 degree. This caused problems with some dissemination user stations, a problem which was slightly alleviated by a small reduction of 0.15 degrees in the inclination in early May 1988.

B.2 INDIA

In its WP 1 India presented the status of INSAT IB and INSAT IC.

1) INSAT IB

INSAT IB, located at 74.0 degrees East, has continued to be the operational satellite. The VHRR and DCP missions are working satisfactorily. The data processing and product derivation activities have continued over the past year.

2) INSAT IC

INSAT IC, launched on 22 July 1988, has been located at 93.5 degrees East and will be the on-orbit spare for INSAT IB. The satellite suffered a short circuit in one of the two power buses resulting in non availability of some transponders and redundant subsystems. As far as the meteorological mission is concerned, the radiometer is available with one of its two transmitters along with one data relay transponder to meet all requirements.

B.3 JAPAN

The status of GMS-3 VISSR observation was reported in Japan WP 3-1.

The GMS-3 has continued to operate normally since CGMS-XVI. From March 1988, stretched VISSR operations commenced.

The slightly reduced number of observations in January and February of 1988 were caused by the replacement of ground facilities.

Because of the degradation of some sub-systems, GMS-2 was de-orbited from the geostationary orbit. Operation of this satellite ceased on November 20, 1987.

The S-band (TX1) output power of GMS decreased during the eclipse, and was switched to the redundant unit (TX2) on 8 September 1988. Apart from this anomaly the status of GMS is the same as described in the status report of CGMS-XVI.

B.4 USA

GOES-6 (West 135 degrees WEST)

GOES-6 continues to operate as the west satellite despite a degradation of the last encoder lamp. A failure of the last encoder lamp is expected before the end of 1988. After this failure GOES-6 will remain at 135 degrees West for dissemination of stretched VAS, WEFAX and DCP data. The last North/South station keeping manoeuvre was executed in March 1988. The inclination of GOES-6 will continue to grow at a rate of approximately 1 degree per year.

A "one-GOES" operational plan has been formulated and is ready for implementation immediately after GOES-6 fails. The plan calls for moving GOES-7 to a central location (either 98 degrees West or 108 degrees West) and leaving GOES-5 at its current location of 65 degrees West for dissemination of VAS, WEFAX and DCS data. GOES-5 may be moved to 75 degrees West if DCS support is degraded at this location.

GOES-7 (East 75 degrees WEST)

Goes-7 is operating normally. The only malfunction has been in one of the two electronic systems for the "de-spun" antenna.

GOES-4 (43 degrees WEST)

GOES-4 will be placed out of orbit in October 1988 utilising all remaining fuel. It is uncertain how much fuel remains because of fuel sensor calibration uncertainties. The results of this de-orbiting exercise will be used to "gauge" the fuel remaining on GOES-5, 6 and 7.

C. REPORT ON FUTURE SATELLITE SYSTEMS

C.1 Geostationary Meteorological Satellite Systems

C1.1 EUMETSAT

A) The Meteosat Operational Programme

Under the ESA Pre-Operational Meteorological Programme, three satellites Meteosat-1, Meteosat-2 and Meteosat-3 have been built and launched. All missions formerly carried out by Meteosat-2 and GOES-4 have now been transferred to Meteosat-3.

The METEOSAT Operational Programme will provide three more satellites with provisional launch dates as follows:

MOP-1	January/February 1989
MOP-2	1990
MOP-3	1991*

* The launch date of MOP-3 will depend upon the performance of MOP-1 and MOP-2 and the requirement to overlap the first year(s) of operations of Meteosat Second Generation.

If there should be a failure during launch or early in the life of one of the MOP satellites, the programme foresees the manufacture of a set of spare sub systems which would be integrated into an additional satellite (MOP-4) and launched when possible. The basic philosophy remains however that where possible one satellite will be maintained in orbit as a spare.

The Meteosat Operational Programme is currently foreseen to extend until at least 1995.

B) Meteosat Second Generation

EUMETSAT has started to define its requirements for the Meteosat Second Generation (MSG) Satellites (EUMETSAT WP-3 refers). The final version of this document will serve as the basis for the mission requirements specification to be submitted to ESA industry for phase-A studies planned for 1989.

The planned operational missions remain:

- an imaging mission
- a sounding mission
- a data circulation mission

These operational missions would be supplemented by a package of ESA scientific experimental payloads.

C.1.2 INDIA

In WP2 (see Annex III), India presented the Status of its future INSAT I and INSAT II satellite systems.

A) INSAT-I System

The next satellite i.e. INSAT-ID of the INSAT-I series of satellites, is at an advanced stage of fabrication. It is expected to be ready by the end of 1988. Its launch is currently scheduled for the period March - April 1989 with a Delta 4925 launch vehicle. INSAT-ID will initially be placed at 83 deg. East and eventually it will replace the currently operational INSAT-IB satellite located at 74 deg. E.

B) INSAT-II System

During the 1990s INSAT-II series satellites will replace the currently operational INSAT-I satellite in a phased manner. The first two satellites of the INSAT-II series are already in the 42nd month of their construction programme. The first INSAT-II satellite, currently under fabrication, is expected to be launched during late 1990 and a second in late 1991 using the Ariane launch vehicle.

C.1.3 JAPAN

GMS-4 is now in preparation with a planned launch in the Summer of 1989.

Japan has started the development of GMS-5, to be launched in 1994. The wave-lengths of the VISSR are 0.55-0.90 μm in the Visible channel, 10.5-11.5μm and 11.5-12.5 μm in infrared window channel, and 6.5-7.0 μm in water vapor channel.

C.1.4 PEOPLES REPUBLIC OF CHINA (PRC)

The first Experimental Geostationary Meteorological Satellite System (FY-2) Programme.

China is now seriously considering the development of a geostationary meteorological satellite system. At present, the programme is in the stage of system design. It is planned to have the experimental geostationary meteorological satellite launched in the mid-1990's. This work will be performed with higher priority than the polar orbiter programme.

The first experimental geostationary meteorological satellite system consists of five parts, that is a geostationary meteorological satellite called FY-2, a launch vehicle, a launch facility, a tracking control center, a command data acquisition station and data process center.

Because facilities for a launch vehicle, launch facility, and tracking control center have technologically matured, special attention is now being paid to the FY-2 satellite, the command data acquisition station and the data processing center.
The data acquisition and processing system is a multi-function, real time operational one, including a Command Data Acquisition Station (CDAS), a Data Process Center and System Operational Control Center (DPC-SOCC), Ranging stations (one primary station, two secondary station), widely dispersed data collection platforms (DCP), Mid-range Data Utilization Stations (MDUS) and Small-range Data Utilization Stations (SDUS), WEFAX or cloud image obtaining stations, a ground communication system.

The FY-2 Satellite

The satellite consists of following subsystem: remote sensing, data transmission and cloud picture broadcasting, data collection, telemetry and command, antenna, attitude and orbit control, structure, power, thermal control and apogee motor, etc.

1. Satellite functions are planned to include:

   (1) Obtaining visible, infrared cloud image from scan radiometer on FY-2. Through data processing, PRC will provide sea surface temperatures, cloud analysis chars, cloud top temperatures and wind vectors;
   (2) Collecting and transmitting observation data from widely dispersed data collection platforms in meteorology, oceanography, hydrology;
   (3) Broadcasting either WEFAX from Beijing Meteorology Center, or processed cloud images;
   (4) Accepting Space Environmental Monitor data from satellite.

2. FY-2 Satellite location is planned between 105 deg. E - 110 deg. E.

3. Sensors on board the satellite:

   (1) Visible and infrared (water vapour) spin scan radiometer. It will obtain day and night visible and infrared cloud pictures and water vapour distribution charts. Full earth disk coverage will be possible every 30 minutes.

(2) The on-board space environment monitor (SEM) can monitor the space environment in real time, providing corresponding monitored data.

(3) Data collection system (DCS) in accordance with WMO standard format and transmission characteristics to relay data from data collection platforms (DCP).

4. Radio frequency allocation (MHZ):

Downlink:
CDAS: Command and Data Acquisition. Station:
1671.6-1691.6; 1701.5-1703.5
1708.9-1709.4.
data collection platform (DCP) calls, dissemination of data from DCP, transmission of meteorological information and trilateral ranging data, telemetry.
TT&C: Tracking, Telemetry and Command station: 4182.0-4200.0.
DCP: Meteorological data transmission: 468.4-468.9.
DUS: Data Utilization Station 1686-1688; 1690.5-1691.5; 1699.4-1699.6.

Uplink:
CDAS: Command and Data Acquisition Station: 2040-2070.
data collection platform (DCP) calls, dissemination of data from DCP, transmission of meteorological information and trilateral ranging data.
TT&C: Tracking, Telemetry and Command station: 5925-5943.
DCP: Meteorological data transmission: 401.0-401.5; 402.0-402.1.

The meeting expressed its pleasure over the amount of information provided on the FY2 satellite. The Chairman requested that members should study in particular the information provided on transmission frequencies to ensure that there were no areas of possible interference.

ACTION 17.5 All CGMS members to study the information provided on the proposed Chinese FY2 transmission frequencies to ensure that there are no areas of possible interference, and to report to the Secretariat and to the PRC delegation. If no conflict then ITU should be informed accordingly.

C.1.5 USA

Future Geostationary Meteorological Satellites

The USA reported that the first launch in the GOES-Next series will be the launch of GOES-I on an ATLAS-I (ATLAS-CENTAUR) commercial launch vehicle, currently scheduled for July 1990. This being a commercial launch, whereas all previous launches were US Government (NASA) launches. There are contractual penalties for launch delays, thus providing an incentive for maintaining this launch schedule. The contractual launch dates for the entire GOES-Next series are shown below:

GOES I-M PLANNING LAUNCH DATES

GOES-I	Jul 1990
GOES-J	Nov 1991
GOES-K	May 1992
GOES-L	1996
GOES-M	1997

The design of the GOES-Next series is now largely completed. The spacecraft Critical Design Review was held August 8-10, 1988 and go-ahead was given for manufacture of all systems. GOES-Next will provide the missions described in Annex IV. The reader should note that this Annex also provides, for comparison purposes, the same parameters for GOES-4, 5 and 6.

C.1.6 USSR

General Information

The current Soviet geostationary meteorological satellite programme will be augmented at the end of the 1980's with the planned launched of GOMS and the subsequent follow on spacecraft of these series after the design and test of the first one. The first GOMS is provisionally planned for launch in 1989-1990 and will be located at 76 deg. East. Two other Experimental GOMS, possibly at times located at 14 deg. West and 166 deg. East, are under consideration.

The GOMS system incorporates as the space segment, a three axis stabilized satellite with high-resolution scan imager instruments, which provide full disk images in visible (0.4-0.7. μm) and infrared (10.5-12.5 μm) with spacial resolution of 1.25 and 5 km in sub-satellite point respectively. The useful coverage of these images extends to over 60 degrees around the sub-satellite point. The full images can be generated in less then 20 minutes

and repeated up to 24 times daily. The minimal time slot between successive images is 30 minutes. It is possible to produce 3 series of 4-5 such images daily.

The other instruments include a measurement system (magnetometer, energetic particle sensor, solar X-ray sensor) for the registration of solar and outer-space particle flows, solar electromagnetic radiance and variances of the magnetic field.

The GOMS is designed to perform the following functions:

- image taking of the Earth's surface and cloud coverage (in visible and infrared) and the extraction of meteorological information;
- dissemination of images and other meteorological information to user stations;
- collection and relay of measurement data from fixed or mobile Data Collection Platforms located on the Earth's surface.

General Receiving and Processing Center

The ground processing centers are based in Moscow (main computing center), Tashkent and Khaborovsk.

These centers include receiving stations providing reception, operational quality control of the received signals and the creating and relay of data streams to the respective computing centers.

Collection and Dissemination of Data

Automatic hydrometeorological stations, drifting or fixed buoys and ship stations, either Soviet or International, can be used as Data Collection Platforms (DCP).

The collection and relay of DCP will take place 8 times daily at the synoptic hours: 00, 03, 06, 09, 12, 15, 18, 21 UTC.

The transmission of DCP data is possible through 100 Soviet and 33 international channels at a rate of 100 bit/s. The length of a message relaying data from all of the DCPs should not be greater than 30 minutes in the time slots +/- 15 minutes from the synoptic hour.

Dissemination of Meteorological Data

The dissemination of various kinds of meteorological data (by re-transmission via GOMS) is accomplished by 2 channels of alpha-numeric data and 2 channels for WEFAX.

Noting the possibility of interference to METEOSAT and GMS if the GOMS satellites were to be operated at 14 degrees West and 166 degrees East the meeting requested the USSR to provide more information on these experiments to the next meeting of CGMS.

ACTION 17.6 The USSR to provide more information on the operation of experimental GOMS satellites at 14 degrees West and 166 degrees East and if possible to provide full details of transmission frequencies to be used during the experiments.

C.2 Polar Satellite Systems of interest

C.2.1 EUMETSAT

A) European Polar Platform - Planning Status

The planned launch date of the ESA polar platform is 1997. Present plans call for a non-serviceable platform with a lifetime in the order of 4 years. The payload capacity will be in the order of either 2300 Kg or 1500 Kg, depending on the platform type adopted.

A decision to proceed with this concept is expected early 1989.

B) EUMETSAT Polar System (EPS)

An initial study activity for a EUMETSAT POLAR SYSTEM (EPS) has been approved by the EUMETSAT Council in June 1988. Its main purpose is to prepare a programme proposal for funding some elements of the operational polar platform system.

It is currently planned to have a draft of the EPS programme proposal ready by the end of 1989, and to have the final version ready for consideration by the EUMETSAT Council during 1990.

C) Operational Payload

The following operational meteorological core payload list for the first platforms is supported by EUMETSAT after discussion within the relevant EUMETSAT bodies and within IPOMS:

- AMRIR
- AMSU-A (two redundant instruments on each platform)
- AMSU-B
- ARGOS
- MCP (Meteorological Communications Package)

In addition, EUMETSAT recognises the need for instruments primarily for oceanography (such as a wind scatterometer) and for climatology (such as an earth radiation budget instrument).

C.2.2 INDIA

India informed the meeting that the Indian Remote Sensing Satellite (IRS) is now operational and it may consider the use of a microwave sounding instrument for remote sensing on experimental satellites to be launched during the development programme of Indian satellite launch vehicles.

C.2.3 JAPAN

Japan informed the meeting that MOS-1 and MOS-1b had different characteristics from other polar orbiting meteorological satellites, however, the images from MOS-1, 1b are useful for meteorological research (see Annex V for details).

C.2.4 PEOPLE'S REPUBLIC OF CHINA

Polar Orbiting Meteorological satellite FY-1

Introduction

China successfully launched its polar orbiting satellite, named FY-1, from a satellite launching Center in Taiyuan, Shanxi province, at 5:30 Beijing Summer time on 7th September, 1988. The satellite is three-axis stabilized polar orbiting platform in a sun-synchronous orbit. It is the first Chinese experimental and trial satellite.

The principal payload of the satellite is a multi-spectral scanning radiometer. This provides the basic data of the FY-1 system as three visible channels, one near-infrared channel and one infrared channel producing images. Various image products, land and ocean digital remote sensing products are derived through ground data receiving and processing system. The communication equipment aboard the satellite in real-time broadcasts High Resolution Picture Transmission (HRPT) and Automatic Picture Transmission (APT) data over the world. The data format of HRPT and APT are compatible with NOAA satellite.

As far as now, FY-1 satellite already has obtained large amounts of operational and experimental data. After certain predetermined time, the operational experiment will transition to the trial step.

Two weeks after launch when the IR channel (10.5 - 12.5 μm) was open a degrading in the response of the sensor was noted. This problem is under investigation. All other channels are functional.

The Satellite

FY-1 consists of 7 main subsystems, structure, meteorological remote sensing, cloud pictures transmission, attitude control, telemetry and command, power supply and thermal control.

Weight: about 750 Kg

Structure: the major structure takes the shape of a hexahedron of 1.4x1.4x1.2M. Two folded solar panels are mounted on each side.

(1) Orbit

FY-1 satellite is in a sun-synchronous orbit with an afternoon Equator Crossing Time of approximately 14h10 Local standard time. The orbit parameters are:

Altitude: 900 Km
Inclination: 99 degrees
Period: 102 minutes
Eccentricity: $e<0.005$
Equator Crossing Time: 14h10 Local standard time

(2) Detector

The detector is a visible, near infrared and infrared scanning radiometer. This instrument operates in five spectral bands:

0.58 - 0.68 μm
0.725- 1.1 μm
0.48 - 0.53 μm
0.53 - 0.58 μm
10.5 - 12.5 μm

Scanning rate: 360/minute

Resolution: HRPT 1.1 Km (at SSP)
APT 4 Km (uniform)

(3) Image Dissemination

The characteristics of image dissemination are as follows:

HRPT/APT Transmission Channel Characteristics

	Carrier Frequency	Code Rate	Modulation Code	Power
HRPT	1695.5 MHz 1704.5	0.6654 Mbps	PCM/PSK	5W
APT	137.795 MHz 137.035	2.4 KHz	AM/FM	8W

Noting the possibility of interference to MDD transmissions from future EUMETSAT MOP satellites the meeting requested PRC to provide more information on the bandwidth of the downlink frequencies used for the HRPT image broadcasts.

ACTION 17.7 PRC to provide to all CGMS members information on the bandwidth and frequency spectrum of FY-1 HRPT image transmissions.

Future Activities

Two satellites have been built (FY-1 being the first) and the second will be launched when some problems on FY-1 have been investigated and corrected. In the meantime, the development of a geostationary meteorological satellite is progressing with a higher priority. It is expected that further polar satellites will be launched, and will carry some new instrument (e.g. sounder).

C.2.5 USA

NOAA-11 was successfully launched Sept. 24, 1988. All systems are normal at this point in the checkout. The satellite is identical to NOAA-10 except that the radiation budget experimental payload is not on-board.

C.2.6 USSR

The USSR provided information on the improved operational meteorological satellite system "Meteor-3", which is planned to replace the current "Meteor-2" system. It is intended that two or three satellites will be in orbit simultaneously; to date one, "Meteor-3" has been launched and the plan is for one satellite to be launched each year. The current plans are for the system to operate until 1995. For further details of these satellite systems the reader should refer to Annex VI.

C.3 Operational Continuity and Reliability

C.3.1 Inter-Regional Planning

EUMETSAT presented in its WP 5 a proposal for the relay of INSAT imagery and in its WP 6 the relay of GOES imagery via Meteosat.

India informed the meeting that the Indian authorities are considering the request made by ESA to ISRO for the relay of INSAT image data.

Vice President of CBS reminded the meeting that the world meteorological community urgently required satellite imagery on a global scale.

The USA informed the meeting that GMS data and GOES West data could be relayed through GOES East.

ACTION 17.8 EUMETSAT to request that NOAA investigate ways to transmit GMS and GOES West image data through the GOES East satellite.

D. GEOSTATIONARY SATELLITES AS PART OF WMO PROGRAMMES

WMO

Satellite-related items discussed during the Tenth WMO Congress (4th to 29th May 1987) were summarized in WMO WP-1. CGMS was informed about budget matters and the scientific and technical programmes for the tenth financial period 1988-1991 in relation to the WMO Second Long-term Plan. The Congress requested the Executive Council to continue its role in the overall Coordination of WMO satellite activities and to continue its efforts to ensure satellite continuity. The Executive Council re-established its Panel of Experts on Satellites.

The CGMS was also informed about the possible future participation of China, Brazil, and Australia in the global satellite network of the WWW.

D.1 WORLD WEATHER WATCH

The Operational WWW System Evaluation - Africa (OWSE-AF)

The OWSE-AF is the second evaluation to be organised by the WMO and was requested by Resolution 3 (EC XXXVI). The initial objective is to evaluate the use of DCP and the DCP Retransmission System (DRS) for the improvement of telecommunications in Africa. At present, some 15 African countries are involved with the OWSE-AF as are four donor members of the WMO, the UNDP and EUMETSAT. Additional countries and donors are considering the possibility of joining. The organising meeting will be held 14-18 November 1988 in Nairobi, Kenya.

The emphasis during the initial phases will be on the collection of observational data from a number of sites in each country and the insertion of these data onto the GTS. DCP's and/or DRS equipment will be located at some 30 observing sites, NMC's and RTHs. All of the data will be transmitted through the METEOSAT at 0 degrees longitude (nominal position) over the regional channels.

The NMCs will receive the data from the stations in their respective country via the DRS and generate bulletins. If a suitable connection exists with the GTS from the NMC, the data will be inserted directly. Otherwise, the data will be relayed back through the satellite to the appropriate RTH where it will be inserted onto the GTS.

A detailed evaluation programme is being organised to determine the value of using this equipment, its total cost and the impact on the National Weather Service activities.

Formal reports will be prepared by the WMO and EUMETSAT on the overall programme. An interim report will de prepared for the tenth session of the Regional Association I (Africa) to be held in 1990. The initial phase of the OWSE-AF is expected to continue through the end of 1991. The OWSE-AF will be expended in 1989/90 to accommodate the MDD to be available on the MOP-1 satellite.

WEATHERWATCH INTERNATIONAL

The USA in its working paper 6 presented details of the NOAA proposal for an international Weatherwatch.

EUMETSAT informed the meeting that it was currently investigating the setting up of an Electronic Bulletin Board (EBB) for Europe, similar in concept to that developed by NOAA.

Several member expressed interest in the setting up of EBBs in other parts of the world.

ACTION 17.9 CGMS Members to report on the progress with the setting up of EBBs at the next meeting of CGMS.

D.2 OTHER PROGRAMMES

D2.1 EUMETSAT

ESA presented WP 3 which provided details of the Meteosat contribution to the ISCCP and GPCP. ESOC acts as the Meteosat processing centre for both projects on behalf of EUMETSAT.

D2.2 WMO

The WMO working paper 4 presented the status of the project after five years of operations.

The ISCCP was established in July 1983 by the World Climate Research Programme as a project to develop a global climatology of clouds from satellite data over a 5-year period. The ISCCP observational period has since been extended for at least an additional two years to allow for an adequate overlap with the Earth Radiation Budget Experiment as well as the various planned ISCCP regional experiments, and to allow for a feedback from the modelling community whose utilization of the data was only just beginning.

It was noted that the compact data format developed for ISCCP had facilitated a spectacular growth in research use of image data and the data management plan was therefore very effective and useful.

The meeting noted that so far no INSAT data had been made available to the ISCCP project and as a consequence a large gap in the global data base existed in the Indian Ocean region.

India informed the meeting that up to the present time no decision had been taken to supply data to the ISCCP project.

CGMS requested India to bring to the attention of its authorities the importance of this data set to the world scientific community in order that a positive decision to release data to the ISCCP project might be possible.

D.3 The role of CEOS

The representative of the Committee on Earth Observation Satellites (CEOS), introduced CEOS activities and work objectives. As main goal, the two CEOS Working Groups on Data Management (WGD) and on Sensor Calibration and Data Validation (WG CAL/VAL), address the international coordination of various user-oriented fields, like standardisation of lexicon, user products formats, catalogues inter-operability, data exchange, and CAL/VAL, data management, test sites inventory, optical media storage, etc. To make the CEOS effort most effective, technically focused subgroups

have been established on specific topics. A copy of the already agreed CEOS SHARP format, adopted by all agencies for AVHRR archived data, was presented to the CGMS Secretariat for consideration; a copy of the CEOS CAL/VAL WG-3 meeting minutes and of CEOS WGD 4th meeting minutes were also distributed to the session.

CGMS welcomed the presentation on CEOS and its working groups, and took note of the work performed by the various CEOS subgroups. The meeting considered that the presence at CGMS of USSR and People's Republic of China could be the vehicle to involve additional partners in CEOS activities.

CGMS expressed the wish to receive CEOS proposals as they are developed in order to analyse, and where appropriate, to examine possible cooperation activities. CGMS noted that there were already examples of CGMS and CEOS representatives both working within the same Agency.

The meeting concurred with the CEOS approach of first analysing existing solutions (e.g. coming from the TOVS working groups or other WMO activities) before proposing any new format.

WMO stressed, however, the importance of standards already achieved by its organisation, e.g. in relation to the World Climate Data Programme and the development of the BUFR code for the rapid exchange of data between National Meteorological Centre computers.

E. COORDINATION OF DATA COLLECTION

E.1 Status and Problems of IDCS

E.1.1. EUMETSAT

WP 4 from ESA reported on the current status and problems of the IDCS. The Meteosat DCS was now operating via METEOSAT-3 with effect from July 20 1988 after being supported by GOES-4 for almost three years. The METEOSAT DCS was currently in a state of refurbishment and 36 new receiver channels had already been installed at the ground station. A further 30 would be installed in October 1988.

The refurbishment has been carried out because of the expected large increase in the number of DCP in the immediate future. Additionally ESA reported that it was studying ways of improving the monitoring and administration of the DCP mission.

E.1.2 JAPAN

In its WP 6 Japan informed CGMS that it was intending to extend the westerly limit of its IDCS area of responsibility from 94 degrees East (92 degrees East north of latitude 14 degrees North) to 70 degrees East with effect from January 1989, until this mission is supported by a satellite covering 70 degrees East.

CGMS were please to note this increase in the area of DCP responsibility exercised by Japan.

E.1.3 USA

The status of its support to the IDCS was outlined by the USA. The GOES DCS is currently supporting four international data collection channels. These channels are: I12, I14, I15, and I17. Channel I14 supports the ASDAR program and I12, I15, and I17 support the SEAS, ASAP, and other ship-borne DCP's. This is the maximum number of international channels the current GOES DCS ground system can support. However, when the new DAPS ground system becomes operational (scheduled for July 1989) additional international channels will be added.

Since the last CGMS meeting, arrangements for the relay of data, received through the GOES East spacecraft, back to ESA users was completed. Data received at NESDIS is sent to the National Meteorological Center (NMC) where it is rerouted, with appropriate headers over the GTS.

The meeting were pleased to note that the USA would be able to expand its support to the IDCS when the GOES DCS Ground System is replaced.

The meeting noted that the USA also agreed to make information available, as required, on the management of its DCS processing system to CGMS members.

ACTION 17.10 USA to provide information on the management of its DCS processing system, as requested CGMS members.

E.2 Ships

E.2.1 JAPAN

Japan reported on the successful deployment of shipboard weather radar data relay system. The program continues to function well and is detailed in Japan WP-7.

Some interference to regional DCP channels had at times been detected in Japan.

The meeting recalled that there was a potential for interference of DCS frequencies by vertical profilers, which were gradually coming into use in various parts of the world. The USA informed the meeting that it was intending to deploy around 50 profilers and some tests had been carried out on the extent of interference to the DCS. CGMS requested further information from the USA on the potential interference from vertical profilers.

ACTION 17.11 USA to provide CGMS members with further information on the potential interference from vertical profilers.

E.2.2 WMO

Status of the ASAP programme

Currently, the following countries are operating, and/or planning, ASAP units on commercial ships:

Country	Current	Additional
North Atlantic		
Denmark	2	-
Finland	1	-
France	4	-
Federal Republic of Germany	1	3
United Kingdom	2	possibly 2
Spain	-	1
North Pacific		
Canada	3	possibly 2

In addition, Japan and the FRG each operate an ASAP periodically on research or fisheries protection vessels.

The major action item from CGMS XVI was the assignment of back-up time slots for participation in the Baseline Upper Air Network evaluations. Due to a number of factors, the ASAP ships did not participate fully in the BUAN evaluations and the evaluation is now ended which eliminates the need at present for additional back-up time slots.

Prior to the launch of Meteosat-3, data losses over the N. Atlantic reached 60%. This had a major impact on the scientific evaluations for the OWSE-North Atlantic and a number of studies were cancelled due a lack of data. The situation was not immediately improved with the launch of Meteosat-3.

However, over recent weeks EUMETSAT and ESA had carried out a DCS end to end system check with RTH Offenbach and several anomalies in the operational data relay software had been detected and corrected. The performance of the DCS was now much improved and a dramatic increase in the number of ASAP messages relayed had been reported by the users.

E.3 ASDAR

E.3.1 EUMETSAT

The meeting was provided with a summary report of the CAD/OCAP ASDAR coordination meeting held in Shinfield Park, Reading, UK, from the 19th to the 23rd September 1988.

E.3.2 WMO

Status and Planning for the Operational ASDAR Programme

The Consortium for ASDAR Development (CAD) was set up in 1982 to initiate the ASDAR programme and to fund and procure the first 13 operational units. The Operating consortium of ASDAR Participants (OCAP) was established in 1985 to take on the responsibility of operating the ASDAR as part of the World Weather Watch. The participants in the ASDAR programme are Australia, Canada, New Zealand, the Netherlands, Saudi Arabia, Spain , Sweden, Germany, Federal Republic of, UK, USA, and Switzerland. The Secretary-General of the WMO acts as the Buyer for the two consortia as part of the WMO assistance to the programme.

The prototype programme established as part of the FGGE consisted of ASDAR systems on 16 B-747 aircraft of commercial airlines and one USAF C-141. Five of these are still flying and reporting valuable data. Japan reported receiving some 750 reports each month (each report normally consists of 7 observations) and EUMETSAT receives about 450-500 reports per month. More than half of the reports are from the southern hemisphere and are of special importance to the WWW due to the large data sparse areas.

The Operational ASDAR programme has entered the initial stages of implementation. IDCS certification was completed successfully in July/August 1988. An installation kit has been installed on a BA DC-10. The first production unit has been assembled and has entered the company testing programme required as a basis for CAA certification. The CAA certification is expected to be completed in December 1988. The unit will then enter a three month flight trial to demonstrate the operation of the software and the generation of meteorological messages.

The UK will operate the initial ASDAR centre to monitor and evaluate the performance of the ASDAR systems and to provide an interface with the satellite operators.

The operators of the satellites agreed to make special efforts to monitor the performance of the first operational ASDAR during the three month trial period.

The WMO agreed to notify directly the satellite operators in advance of the start of the three month trial period. The WMO also agreed to provide full information to CGMS, as soon as possible, on the contacts through the ASDAR centre in the UK.

The certification programme required by the ASDAR participants includes obtaining both CAA and FAA certificates. The FAA certification is particularly critical as several of the participants accept this certificate directly as part of their national certification process. The CAD has stated that an operational programme cannot be implemented without FAA certification. A major problem, however, has been the unwillingness of US air carriers to do the certifications because of the amount of other work with higher company priority.

One alternative under investigation is the possibility that the FAA in New York City would be able to carry out the FAA certification for both DC-10 and B-747 aircraft, based upon the CAA certifications. Avionics equipment of the class of ASDAR, however, is normally certified through an airline rather than by the FAA directly. If it were possible for the FAA to directly carry out the certification, it could only do so after the CAA certification had been completed. Consequently, the schedule for completing the FAA certification has not yet been fixed. At present, the FAA certification likely could not be completed before may or June 1988 and would depend on the availability of suitable aircraft as well as the schedule of work on the part of the FAA in New York City.

In view of the possibility for extended delays in the procedure with the FAA, other alternatives are being sought. One is the possibility of conducting a six month test and evaluation of ASDAR and satellite communications with Continental Airlines which would include the certification of ASDAR. Continental is an appropriate airline because they purchased a DC-10 from British Air which had already been fitted with an ASDAR antenna, wiring and racks (not the same DC-10 currently owned by BA and on which the CAA certi-

fication will be completed). They also have their B-747 fleet coming in for major service over the next three months and an ASDAR could be fitted to any of these aircraft. Thus, both types of aircraft could be certified by Continental.

Continental is interested in evaluating the ASDAR in the context of their operational programmes for fuel management and maintenance. As part of this evaluation conducted over a six month period, they would wish to receive some four to six pieces of housekeeping information on each flight in addition to the routine meteorological data. If such an evaluation were to be possible, the ASDAR would likely be installed late in 1988 and early 1989 on the two aircraft. The evaluation would likely begin in March or April 1989 and could be preceded by a short period of normal ASDAR operation until the housekeeping data could be added to the message. After the evaluation period the ASDAR unit would be modified back to its normal operational state.

The WMO proposed to the CGMS that consideration be given to supporting the six month test and evaluation by Continental as part of the overall programme for certification and implementation of the ASDAR. The support would consist of two parts. First, being able to separate the meteorological from the housekeeping data so the meteorological data could be sent on the GTS as usual. Second, would be to make the data (both meteorological and housekeeping) available to Continental. The details of how either part would be carried out need to be defined. WMO noted that the details were being assembled and would be available in from three to four weeks. At the time of the CGMS meeting it was only necessary to reach agreement in principle, pending the further definition of what was required.

The CGMS agreed that, in principle, it would be able to support a limited test as part of the ASDAR certification programme. In view of the short time available to make arrangements, the CGMS asked the WMO to provide the details for consideration by the operators as soon as possible. EUMETSAT agreed to assist directly in formulating procedures for the consideration of the operators.

The WMO noted that, assuming the FAA certification could be carried out in the next three to four months as outlined above, up to six units could be in service by the end of 1989 with the remaining seven being put into service shortly after. If, however, the FAA certification could not be completed in the next few months, there could be further delays of up to one year in the implementation since installation had to match the maintenance schedules of the airlines.

The WMO noted that, for the coming year it would not be necessary to activate channel I18 for ASDAR as there was sufficient capacity on Channel I17 for both the five prototype and the 6 operational systems expected to be implemented. Note was made that after 1989, all satellite operators expected to have the capability of handling both channel I17 and I18 for ASDAR so that future expansion of the programme could be supported.

The CGMS noted that Annex 15 of the IDCS users guide contained the coding formats for the operational ASDARs and that steps were being taken by all operating parties to implement them in time for the expected start of the three month trial of the first operational ASDAR in December 1988.

The satellite operators are asked to ensure that the processing systems will handle both the prototype and operational ASDARs by December 1988.

E.3.3 JAPAN

Japan informed the meeting that it was now ready to handle the new ASDAR code.

E.3.4 USA

The USA reminded the meeting that the new GTS ASDAR code had been developed specifically to incorporate ASDAR observations taken on ascent and descent phases of flight. It would be necessary to validate the ASDAR measurements using radio-sonde ascents made in close proximity to some of the major world airports.

EUMETSAT and the USA informed the meeting that the implementation of software to handle the new ASDAR code was in progress.

ACTION 17.12 EUMETSAT and USA to inform other members of CGMS when the new ASDAR code handling software has been implemented.

The meeting noted that in 1989 the ASDAR system would operate via IDCS channel I17 then with the expected growth in the use of this system in 1990 there may be a requirement to open up IDCS channel I18.

CGMS further noted that the ASDAR Centre would request additional DCS monitoring by satellite operators during the forthcoming ASDAR flight trials.

ACTION 17.13 WMO to negotiate with operators concerning test implementation details and inform all CGMS members when ASDAR flight trials are expected to commence.

E.4 Review of IDCS User's Guide

USA

The USA, in WP 9, reported that it had reviewed the IDCS User's Guide and requested the Secretariat to make some corrections to the document.

F. COORDINATION OF DATA DISSEMINATION

F.1 Dissemination via Satellite

F.1.1 High Resolution

JAPAN

The dissemination of stretched VISSR digital data has been carried out since March 1988. Several users of the HR-FAX have already received the stretched VISSR data and other users are now making preparations.

From January 1989, full disk VISSR observation will be carried out for all observations and HR-FAX dissemination via GMS will be discontinued.

The reader should refer to Annex VII for details of the dissemination schedule.

USA

In WPs 10 and 11 the USA informed the meeting that it wished to provide the best information to the user community concerning the utilization of the GOES variable data format to be transmitted by the new GOES I-M spacecraft. This data, its GVAR format, and the instruments from which the data are derived were described in NOAA Technical Report NESDIS 33. A copy of this report was provided to all members. The report contains information on ordering additional copies.

CGMS members were invited to note the availability of this report and to make ordering information available to their respective user communities.

The USA reminded the meeting that in 1990 the first of a new series of five GOES spacecraft would be launched. The GOES-I spacecraft, promised to be an evolutionary follow-on to the current series of GOES. Separate imager and sounder instruments necessitated the adoption of a new processed data format. The GVAR (GOES Variable) format, while similar in basic structure to Mode AAA, would allow the full capabilities of the new instruments to be utilized.

In technical memoranda NESDIS 21 - "GVAR Users Compendium, Volume 1", and NESDIS 33 "An Introduction to the GOES-I Imager and Sounder Instrument and the GVAR Retransmission Format", a spectrum of issues important to the GOES Direct Readout User are addressed. Included are planned "Day 1" operational scenarios for GOES-I, a section on downlink parameters, and a section on dealing with Mode AAA to GVAR conversion issues.

The CGMS took note of the documentation provided by the USA. Additional copies of these documents are available from NOAA and EUMETSAT.

EUMETSAT

The current status of the METEOSAT dissemination system was presented in ESA WP 7. The METEOSAT dissemination mission was transferred to METEOSAT-3 on 11 August 1988. Despite a 3-4 dB drop in the signal due to a fault with the EDA the current signal strength of the downlink is above the specification for PDUS and SDUS users.

Since 30 November 1987 the time for retransmission of DCP between consecutive WEFAX formats has been extended to 27 seconds by eliminating the 10 second black signal at the end of each WEFAX format.

ESA WP 8 presented information on proposals for the compression and encryption of METEOSAT data. The higher volume of data to be received from the MOP satellites will require compression if all available data in full resolution is to be distributed within a half hour time period.

EUMETSAT reminded CGMS that there was no intention to encrypt WWW data. The EUMETSAT Council had requested studies to be carried out on the technical aspects of encryption, key management etc which could be applied to certain products which might have commercial value since the national meteorological services in Europe were becoming increasingly aware of the potential for competition.

F.1.2 Low Resolution (WEFAX)

JAPAN

In WP 11 Japan informed the meeting that analogue facsimile formats transmitted via GMS were currently classified as either HR-FAX (High Resolution Facsimile) or LR-FAX (Low Resolution Facsimile). HR-FAX dissemination would, however, be discontinued at the end of 1988 and replaced by stretched VISSR. Therefore, from January 1989, analogue facsimile formats transmitted via GMS would be LR-FAX only.

The meeting noted that because the specification of LR-FAX is almost identical to that used for WEFAX formats transmitted by GOES and METEOSAT, the GMS LR-FAX will be renamed WEFAX.

USA

The US, in WP 12, highlighted the current consideration by the USA regarding computer readable header of WEFAX products and the new USA WEFAX ground system.

Japan reported that this was already implemented on GMS.

ACTION 17.14 EUMETSAT to investigate if there are any problems with the adoption of a digitally encoded header for WEFAX transmissions and report at CGMS XVIII.

F.1.3 DCP Data

JAPAN

Japan reported in WP 12 on the status of regional DCPs in the GMS field of view. Outside Japan regional DCP's are installed in Australia, China and France (New Caledonia). New Zealand is planning to install some DCP's.

Japan is preparing to install a DCP using a METEOSAT regional channel at its Syowa Station in the Antarctic. Japan noted the effective cooperation of EUMETSAT and ESA in this respect.

USA

Representatives of NOAA attended the seventh SFCG meeting held in Paris in November 1987. A topic of discussion was the interference on the international channels on GOES-4, being used by EUMETSAT for DCS. The problem was discussed with IFRB with no resolution. The USA outlined the discussions in its WP 13.

ACTION 17.15 CGMS members to supply any information on interference to the DCS either to their SFCG representatives or to the CGMS Secretariat, in time for the next SFCG meeting (to be held in November 1988).

F.1.4 Digital WEFAX

EUMETSAT

EUMETSAT in its WP 8 presented some further ideas on a new standard for digital WEFAX. It was foreseen that any new concept would have to make use of existing international standards in telecommunications and data processing methods wherever possible. Furthermore the antenna size of the user station should be similar to that of an SDUS, i.e. around 2 meters. New transmission techniques (e.g. packetised) would be studied to allow flexibility in handling data from different sources. Further details on this preliminary proposal can be found in Annex VIII.

JAPAN

Japan informed the meeting that it did not yet have any plans to change the present analogue WEFAX (LR-FAX) to a digital form.

Any decisions on changes to digital WEFAX in the future would have to take into account the effects on a large population of users. An adequate change-over period would have to be considered.

The representative of the CBS stated that WMO would strongly support the idea for a common standard for digital WEFAX and agreed with a suggestion made by the Chairman that a working group be set up to study the matter further. It was agreed that the USA would make the invitation for participants to this working group.

ACTION 17.16 USA to invite CGMS members, by the 15 November 1988, to a digital WEFAX working group meeting to discuss the development of a common specification and the subsequent implementation plan for digital WEFAX

F.2 Dissemination via GTS

EUMETSAT

ESA reported that problems with the reception and processing of ASDAR and other DCP messages had been identified and corrected.

JAPAN

Japan, in WP 13, reported on the operation of SAREP.

Japan regularly disseminates operational satellite reports on tropical cyclones (SAREP, WMO international code FM 85 VI) when these phenomena are located in the region between 100 degrees E and 140 degrees E in the northern hemisphere, corresponding to the present area of responsibility.

F.3 Other Dissemination

EUMETSAT

In WP 10 EUMETSAT provided details of the MDD mission, to be supported by MOP satellites. Further details can be found in Annex IX.

USA

Quality of Stretched VAS (mode AAA) Data Relayed Through a Spacecraft Transmitting WEFAX (WP 14)

Concern had been expressed in the past over the possible degradation of quality when a single satellite was used to relay both stretched VAS (mode AAA) data and WEFAX data simultaneously. A test had been performed of this configuration to insure that neither service would suffer undo degradation.

CGMS members were pleased to note the successful outcome of the tests.

New DCS Ground System (WP 15)

The USA informed the meeting that it was installing a new DCS Automated Processing System (DAPS). The DAPS would allow expansion of the USA support to both the international and domestic GOES DCS. More channels could be added to the DCS and a DOMSAT broadcast of DCP messages would be the prime method of dissemination. Higher DCP baud rates were also being considered.

The US announced that it was considering the development of a charging policy for users of its DCS. However, this policy was not expected to apply to the IDCS.

G. COORDINATION OF SATELLITE DATA CALIBRATION

EUMETSAT

Some changes to the calibration of METEOSAT data were reported in ESA WP 9. The IR-channel calibration is now derived by comparing the METEOSAT SST data with the global SST analysis from NMC Washington instead of conventional SST data received over the GTS.

A new scheme for WV-channel calibration makes use of the ESOC radiation scheme to calculate pseudo-radiances from radiosonde data and relate them to WV counts with which they are collocated. This new scheme allows a physically consistent calibration and takes account of the contribution function of the WV channel. The meeting was reminded of the calibration related data which will become available from the ISCCP. The ISCCP Satellite Calibration Center at CMS Lannion calculates normalised coefficients for the geostationary satellites as compared to the NOAA polar orbiter.

USA

Data from the eight channels of the GOES visible sensors need to be normalised to prevent the images form being degraded by artificial stripes. Normalisation is done with look-up tables in the ground processing. The USA reviewed two competing methods for generating normalisation look-up tables: the current operational method and a new method proposed for use with data from GOES I-M.

The CGMS considered the idea of a workshop on comparison of visible image quality obtained with various normalisation techniques and decided that, for the time being, this was probably not necessary. However an interchange of ideas by correspondence should be encouraged.

ACTION 17.17 ESA to provide CGMS members with copies of papers produced by the ISCCP calibration centre.

H. COORDINATION OF METEOROLOGICAL PARAMETER EXTRACTION

H.1 Satellite Winds

EUMETSAT

ESA WP 10 reported a recent improvement in the calculation of cloud motion winds. A significant improvement of the bias of upper level winds occurred after the introduction of a new WV channel calibration technique in September 1987. The result of the new calibration scheme was to reduce the heights assigned to high level wind vectors based on semi-transparent clouds.

Studies are taking place to determine the feasibility of using forecast data to determine the initial direction for automatic correlation tracking. Work is also being undertaken on manual wind extraction, water vapour wind automatic processing and preprocessing of image data prior to correlation matching.

In response to a request made at CGMS XVI, ESA WP 12 presented the history of the comparison of METEOSAT Cloud Motion Winds with collocated radiosonde winds.

From January 1989 satellite winds will also be generated at 18 UTC in addition to the current products at 00, 06, 12 UTC.

JAPAN

Japan reported the status of GMS wind derivation. (see Annex X).

From January 1989, the coverage zone for wind derivation at 06 UT and 18 UT would be expanded to the full earth disk instead of the northern earth disk.

The total number of the derived cloud motion winds had been steadily increasing.

Approximately 30,000 low level winds and 26,000 high level winds had been routinely derived per month since March 1987.
CGMS expressed great interest in a report on the estimation of ocean surface winds in a typhoon using GMS cloud motion winds.

Focal point: C. Staton

USA

Quantity only

The US in its WPs 17 and 18 summarised NESDIS satellite wind procedures, and CGMS members were asked to note the focal point for USA involvement in satellite winds.

In addition the USA presented a review of the progress in improving the quality and quantity of the NESDIS satellite winds in response to the request made by the WMO at CGMS XVI.

In WP 19 the USA informed CGMS that the National Meteorological Centre of the USA routinely compared satellite winds with six hour numerical weather prediction. Initial results showed biases in high level winds which were independent of producer but which appeared to vary with season and location. This bias cannot be compensated for in numerical weather analysis until its cause is better understood.

The USA also presented a table of image times used to derive satellite winds. It was noted that the images used to derive the winds were several hours prior to the synoptic time for which the winds were valid.

India indicated that they would consider shifting their wind image times to allow more time for the wind vectors to arrive at the centres. This would also permit the extraction of additional winds.

geographical distribution of CMW speed bias, zonal/meridional

CGMS expressed considerable interest in the findings presented in USA WP 19 and considered that since the problem of winds bias affected all satellite operators a workshop should be convened to discuss the matter further with research and operational meteorologists. A suitable forum for this workshop might be the ECMWF workshop on use of satellite data being planned in 1989. ECMWF could be asked to extend their workshop to address CMV problems in general. EUMETSAT agreed to follow up this action.

ACTION 17.18 EUMETSAT to provide information to CGMS on the date and format of the ECMWF workshop on the use of satellite data, with particular emphasis being placed on the problems associated with the derivation of satellite winds.

The status report on the semi-annual CGMS international comparison of winds was reported in WP 20. CGMS took note of the new address of the focal point for wind comparison data.

In WP 21 information was provided on the current NESDIS procedures for producing operational satellite winds.

CGMS noted satellite winds were not always based on the nominal synoptic observation time. Participants were requested to supply similar schedule information. The results are shown below:

Images used by CGMS Satellite Operators for Wind Extraction

ESA

Synoptic Time (UTC)	Image Triplet
06:00	04:30, 05:00, 05:30 *
12:00	10:30, 11:00, 11:30 *
18:00	16:30, 17:00, 17:30 *
00:00 **	22:30, 23:00, 23:30 *

* Back-up triplets one and two hours later will be used when the nominal triplet is not available.

** During the eclipse period the triplet is usually based on images for 21:30, 22:00, 22:30 with no back-up triplet available.

INDIA

Synoptic Time (UTC)	Image used
06:00	05:30/06:00 or 06:00/06:30

The wind extraction is based on VIS for the displacement measurement and IR for the height assignment.

JAPAN

Synoptic Time (UTC)	Image Triplet
06:00	04:30, 05:00, 05:30
12:00	10:30, 11:00, 11:30
18:00	16:30, 17:00, 17:30
00:00	22:30, 23:00, 23:30

Only the northern area is being processed for 06:00 and 18:00 UTC. As from January 1989 the full disc will be processed at all four times.

USA

Satellite	Synoptic Time (GMT)	Picture Pair Low Level (GMT)	Manually Derived High Level (GMT)
GOES East	12:00	9:00, 9:30,10:00	9:00, 9:30,10:00
GOES West	12:00	9:15, 9:45,10:15	9:45,10:15,10:45
GOES East	18:00	14:30,15:00,15:30	16:00,16:30,17:00
GOES West	18:00	14:15:14:45,15:15	15:45,16:15,16:45
GOES East	00:00	20:30,21:00,21:30	21:00,21:30,22:00
GOES West	00:00	20:45,21:15,21:45	20:45,21:15,21:45
GOES East	06:00	03:00,03:30,04:00	03:00,03:30,04:00
GOES West	06:00	03:15,03:45,04:15	03:15,03:45,04:15

The WMO reminded the meeting that the SATOB code and its bulletin header could accommodate the anomaly created when the synoptic observation time might be different from the observation time. Both times were recorded in the message and were thus available to the user community.

Furthermore CGMS recommended that the time of observation should be the time of the middle image of a triplet.

Noting the growing flexibility in the use of non synoptic satellite wind data in data assimilation schemes the Chairman requested that satellite operators time their wind extraction runs so that the data could be used in the various forecast model data assimilation runs.

The CGMS were please to note in the report made by the USA that the quality of INSAT winds had increased significantly over recent months.

H.2 Sea Surface Temperatures

No working papers were submitted for this section of the agenda.

H.3 Other Parameters

EUMETSAT

ESA WP-11 noted that from January 1989 two further products would be produced, namely the cloud top height product for 0900 UTC and a cloud analysis for 1800 UTC.

USA

USA informed the meeting that greater interest was now being shown in the parameterisation of regions of deep convection since it appeared that this was a valuable input to numerical model data assimilation schemes. Global coverage of this parameter was not yet available however the satellite operating community should study the possibility of extracting information on deep convection from image data.

The Chairman agreed on the need for a uniform product and requested that CGMS members discuss this matter with their local data analysis groups in order to determine what product should be derived and report back to CGMS within 6 months so that the subject could be discussed further possibly at the ECMWF workshop on the use of satellite data and the next CGMS meeting.

ACTION 17.19 All CGMS to determine what type of information relating to areas of deep convection is required by the data assimilation community and to report to the Secretariat within 6 months.

INDIA

India informed the meeting that it was investigating the possibility of increasing the area of extraction of satellite winds. It would also study the use of an image triplet timed near 0930 or 1000 UTC for the 1200 UTC wind extraction instead of the 1200 UTC triplet used at present in order that INSAT wind data could be used by operational model assimilation schemes.

JAPAN

Japan presented the status of GMS meteorological products. For more details see Annex XI.

Japan also presented information on two new products derived from GMS image data. One of them is called Satellite-derived Index of precipitation intensity (SI) and will be started in hourly operational basis from March 1989. The other is named Cloud Amount Anomaly Chart and aiming at monitoring the climate system. This product has been disseminated in quasi-real-time via land line domestically since July 1988 for serving in the long-range forecasting.

This subject was described WPs-17 and 18. (Annex XI also refers).

THE CGMS expressed great interest in these new products and requested that Japan provide more information on each product, and in particular how they were being used to assist extended range forecasting.

ACTION 17.20 Japan to inform CGMS members on progress made with the development of new products and, where possible, to demonstrate their use in extended range forecasting methods.

USA

In WP 22 the USA introduced the initial operational use of VAS products. The production of meteorological products from VAS radiances and multi-spectral images had been demonstrated using the NESDIS VAS Data Utilisation Centre (VDUC). VAS derived winds have proven to be a useful data source for tropical regions and VAS derived images of precipitable water and stability has proven useful for the recognition of mesoscale meteorological signatures contributing to improved severe weather forecasts.

CGMS Members requested the USA to submit reports at CGMS XVIII to show the application and results of these VAS products.

ACTION 17.21 USA to brief CGMS on the use of VAS products at the next meeting of CGMS

ACTION 17.22 The Secretariat to include a new item in the agenda of the next CGMS meeting dealing with sounding products.

In its WP-23 the USA reported on the current status of the GPCP.

CGMS agreed that this was a very useful data set which had great value in particular in parts of the globe where other observations of rainfall were sparse.

I. COORDINATION OF ARCHIVING AND RETRIEVALS

EUMETSAT

The current status of the METEOSAT archive was presented in ESA WP 13. At present the archiving system uses 6250 bpi CCT. A move to an optical disk system had been envisaged and a tender action with industry was undertaken. However, the current costs involved in operating such a system are considered prohibitive at the present time, despite the obvious advantages in terms of data security and storage accommodation. Instead, a system based on tape cartridges will be installed, the running costs of such a system being approximately one third of that of an optical disk system.

CEOS matters

Further to the discussion on coordination of archiving and retrievals, the representative of CEOS asked the Chairman permission for reporting to the fifth meeting of CEOS Working Group on Data (11-14 October 1988) the findings described in ESA WP 13 on METEOSAT data storage on optical disks.

The meeting were happy to agree to this request since this was a typical example of useful coordination between CGMS and CEOS.

Additionally, M. Fea agreed to distribute to CGMS members the report of the work and tests performed by ESA/Earthnet on 12" optical disc data storage systems from various manufacturers. The exercise was meant to provide technical information for choosing a OD brand, relevant software driver and the related hardware to allow long-term (12 years) storage of ERS-1 Low Bit Rate data, i.e. raw data and Fast-delivery data products generated at the ESA ground stations (LBR data include sea surface winds extracted from ERS-1 wind scatterometer raw data). The proposal was accepted and CGMS Secretariat will provide M. Fea with the CGMS members distribution list.

ACTION 17.23 **The representative of CEOS to distribute to CGMS members the report of the work and tests performed by ESA/Earthnet on 12" optical disc data storage systems produced by various manufacturers.**

PEOPLES REPUBLIC OF CHINA

The PRC announced that it was using the IBM 3480 cartridge system for the storage of its image data.

JAPAN

In WP 20 Japan presented the status of data archives concerning GMS products and reported the specification of the cartridge tape system which is used in MSC from March 1987. For the users outside of MSC, contents in cartridge tape would be converted to 6250 bpi magnetic tape in a CCT format by the JMA. To date the new cartridge system had been working satisfactorily.

INDIA

India informed the meeting that it was considering updating its data archive in the 1990 time-frame as part of its ground segment preparations for the second generation INSAT II programme.

USA

WP 24 presented the proposed GOES-Next Archive Plan, and reviewed the plans for archiving of data and products of the GOES-Next (GOES I-M) imager and sounder. The first satellite in this series is scheduled to be launched in July, 1990. CGMS members were informed that this document would serve as an input to a formal data management plan for GOES-Next data.

The meeting took note of the fact that the USA were now seriously considering the use of the IBM 3480 cartridge magnetic tape system for the archive of image data in the future.

Furthermore the meeting remarked that the advances being made with the development of the technology of efficient data archive were not keeping pace with the expected production of data from the next generation of earth observation satellites. The main problem was still the space needed to store the large volume of image data (e.g. ESOC - 18000 tapes of Meteosat image data to date).

J. TELECOMMUNICATIONS

JAPAN

Japan, in its WP 21, presented the plan and early test results of a method for the dissemination of WWW data using the GMS WEFAX transmission system with the purpose of adding to present SDUS receiving station. JMA were considering the implementation of this transmission scheme in the 1990/1991 time-frame.

More details of the proposed transmission scheme can be found in Annex XII.

The meeting noted that the test of this transmission technique had so far been carried out using the large JMA satellite ground-station antennas.

WMO expressed interest in the distribution of WWW data via this new transmission scheme as it would improve the overall performance of the GTS in South-east Asia. WMO requested that information of this scheme be presented at the relevant WMO Regional Association meeting in future.

INDIA

India informed the meeting that the planning for the dissemination of meteorological information from New Delhi to outstations using an INSAT TV transponder was progressing and the necessary equipment had been ordered. About 25 reception stations would be installed within the continent of India.

K. MISCELLANEOUS

CEOS

M. Fea expressed, on behalf of the CEOS WGD Chairman, his gratitude for having been permitted to attend the meeting as an observer. The meeting had been very useful would initiate a promising future cooperation.

FORMAT OF CGMS WORKING PAPERS

The USA informed the meeting that with effect from CGMS XVII it had begun to present a summary of the contents of its WPs on the first (cover page) of each document, similar to a format adopted by the WMO.

The meeting agreed that the summary could save considerable time in the analysis of working papers and would greatly assist the drafting committee since the summary could be presented in a form very close to the text to be used in the final report of the meeting.

ACTION 17.24 All CGMS members to consider the format used by WMO for working papers and if possible to implement the change in time for the next meeting of CGMS.

DISTRIBUTION

The meeting noted that at times the distribution list for documents and working papers had been omitted when information had been exchanged between members.

ACTION 17.25 All CGMS members to include a distribution list with any exchange of documentation.

L. DATE AND PLACE OF NEXT MEETING

The meeting provisionally agreed that the next meeting of CGMS (CGMS XVIII) would be held in November 1989, in the Headquarters of the WMO, Geneva, Switzerland.

ACTION 17.26 WMO to confirm its willingness to host CGMS XVIII

ACTION 17.27 The Secretariat to inform all members on the date and place of CGMSXVIII

M. LIST OF ACTIONS FROM CGMS XVII

ACTION 17.1 Japan to add EUMETSAT to the distribution list for GMS quarterly reports.

ACTION 17.2 EUMETSAT to distribute Meteosat Quarterly Reports to CGMS members.

ACTION 17.3 CGMS members to provide comments on the draft of the eighth edition of the Consolidated Report within two months.

ACTION 17.4 The Secretariat to update and distribute the finalised eighth edition of the CGMS Consolidated Report to all members in due course.

ACTION 17.5 All CGMS members to study the information provided on the proposed Chinese FY2 transmission frequencies to ensure that there are no areas of possible interference, and to report to the Secretariat and to the PTT authorities.

ACTION 17.6 The USSR to provide more information on the operation of experimental GOMS satellites at 14 degrees West and 166 degrees East and if possible to provide full details of transmission frequencies to be used during the experiments.

ACTION 17.7 PRC to provide more information on the bandwidth of frequencies used for HRPT image transmissions.

ACTION 17.8 EUMETSAT to request that NOAA investigate ways to transmit GMS and GOES West image data through the GOES East satellite.

ACTION 17.9 CGMS Members to report on the progress with the setting up of EBBs at the next meeting of CGMS.

ACTION 17.10 USA to provide information on the management of its DCS processing system to CGMS members.

ACTION 17.11 USA to provide CGMS members with further

information on the potential interference from vertical profilers.

ACTION 17.12 EUMETSAT and USA to inform other members of CGMS when the new ASDAR code handling software has been implemented.

ACTION 17.13 WMO to inform all CGMS members when ASDAR flight trials are expected to commence.

ACTION 17.14 EUMETSAT to investigate if there are any problems with the adoption of a digitally encoded header for WEFAX transmissions and report to CGMS in due course.

ACTION 17.15 CGMS members to supply any information on interference to the DCS either to their SFCG representatives or to the CGMS Secretariat, in time for the next SFCG meeting (to be held in November 1988).

ACTION 17.16 USA to invite CGMS members, by the 15 November 1988, to a digital WEFAX working group meeting to discuss the development of a common specification and the subsequent implementation plan for digital WEFAX

ACTION 17.17 ESA to provide CGMS members with copies of papers produced by the ISCCP calibration centre.

ACTION 17.18 EUMETSAT to provide information to CGMS on the date and format of the ECMWF workshop on data assimilation, with particular emphasis being placed on the problems associated with the derivation of satellite winds.

ACTION 17.19 All CGMS to determine what type of information relating to areas of deep convection is required by the data assimilation community and to report to the Secretariat within 6 months.

ACTION 17.20 Japan to inform CGMS members on progress made with the development of new products and, where possible, to demonstrate their use in extended range forecasting methods.

ACTION 17.21 USA to brief CGMS on the use of VAS products at the next meeting of CGMS

ACTION 17.22 The Secretariat to include a new item in the agenda of the next CGMS meeting dealing with new products.

ACTION 17.23 The representative of CEOS to distribute to CGMS members the report of the work and tests performed by ESA/Earthnet on 12" optical disc data storage systems produced by various manufacturers.

ACTION 17.24 All CGMS members to consider the new format for working papers and if possible to implement the change in time for the next meeting of CGMS.

ACTION 17.25 All CGMS members to include a distribution list with any exchange of documentation.

ACTION 17.26 WMO to confirm its willingness to host CGMS XVIII.

ACTION 17.27 The Secretariat to inform all members on the date and place of CGMSXVIII in due course.

ANNEXES

ANNEXES TO CGMS XVII REPORT

I. List of Abbreviations and Acronyms

II. Working Papers Submitted to CGMS XVII.

III. Report on Future Satellite Systems - India WP 2.

IV. Report on Future Satellite Systems - USA WP 5.

V. Marine Observation Satellite - NASDA brochure.

VI. Low-orbit Meteorological Satellite Systems of the USSR

VII. Changes in High Resolution Image Dissemination - Japan WP 9.

VIII. Further Ideas on Digital WEFAX- EUMETSAT WP 8.

IX. The Meteosat Meteorological Data Distribution (MDD) Mission - EUMETSAT WP 10.

X. Estimation of Ocean Surface Wind for a Typhoon from GMS Cloud Motion Winds - Japan WP 15.

XI. GMS Meteorological Products - Japan WPs 16, 17 and 18.

XII. Plans for the Dissemination of WWW Data via GMS - Japan WP 21

XIII. Addresses for the Procurement of Archived Data.

XIV. Contact List for Operational Engineering Matters.

XV. Distribution List for Documents.

XVI. Agenda for CGMS XVII.

LIST OF ABBREVIATIONS AND ACRONYMS

LIST OF ABBREVIATIONS AND ACRONYMS

ACC	ASAP Coordinating Committee
AFOS	Automation of Field Operations and Services (USA)
AM/FM	Amplitude/Frequency Modulation
AMRIR	Advanced Medium Resolution Imaging Radiometer
AMSU	Advanced Microwave Sounding Unit
APT	Automatic Picture Transmission
ARGOS	Data Collection and Location System
ASAP	Automated Shipboard Aerological Programme
ASDAR	Aircraft to Satellite Data Relay
ASPP	Advanced Satellite Products Project (USA)
AVHRR	Advanced Very High Resolution Radiometer
BA	British Airways
BUAN	Baseline Upper Air Network
BUFR	BUFR Code (WMO)
CAA	Civil Aviation Authority (UK)
CAC	Climate Analysis Centre (USA)
CAD	Committee on ASDAR Design
CDA	Command and Data Acquisition Station
CEOS	Committee on Earth Observations Satellites
CGMS	Committee for coordination of Geostationary Meteorological Satellites
CMS	Centre de Meteorologie Spatiale (Lannion)
DAPS	DCS Automated Processing System (USA)
DCP	Data Collection Platform
DCPR	Data Collection Platform report
DCS	Data Collection System
EBB	Electronic Bulletin Board
EC	Executive Council (WMO)
ESA	European Space Agency
ECMWF	European Centre for Medium range Weather forecasts
ELV	Expendable Launch Vehicle
ERS-1	European Remote Sensing Satellite (first)
ESOC	European Space Operations Centre
FAA	Federal Aviation Authority of the USA
FAX	Facsimile
FIRE	First ISCCP Regional Experiment
FRG	Federal Republic of Germany
GARS	GOES Archive and Retrieval System (USA)
GMS	Geostationary Meteorological Satellite (Japan)
GOES	Geostationary Operational Environmental Satellite (USA)
GOMS	Geostationary Operational Met. Satellite (USSR)
GPCP	Global Precipitation Climatology Project
GTS	Global Telecommunications System
GVAR	GOES Variable (data format) (USA)
HRPT	High Resolution Picture Transmission
INSAT	Indian geostationary satellite
IR	Infrared
IRS	Indian Remote Sensing Satellite
ISCCP	International Satellite Cloud Climatology project

ITU	International Telecommunications Union
JMA	Japanese Meteorological Agency
LBR	Low Bit Rate data (ERS-1)
LR	Low Resolution
MCP	Meteorological Communications Package
METEOSAT	European geostationary meteorological satellite
MOP	Meteosat Operational Programme
MOS	Marine Observation Satellite of Japan
MSC	Meteorological Satellite Centre (Japan)
MSG	Meteosat Second Generation
NASDA	Japanese National Space Agency
NESDIS	National Environmental Satellite Data and Information Service (USA)
NGDC	National Geophysical Data Centre (USA)
NHC	National Hurricane Centre (USA)
NMC	National Meteorological Centre
NOAA	National Oceanographic and Atmospheric Administration
NSSFC	National Severe Storms Forecasting Centre (USA)
NWS	National weather service (USA)
OCAP	Operational Committee of ASDAR Participants
OD	Optical Disc storage
OWSE	Operational WWW Systems Evaluation
PRC	Peoples Republic of China
PCM/PSK	Pulse Code Modulation/Phase Shift Keying
SAREP	Synoptic interpretation of cloud data obtained by a met satellite, WMO code form FM 85-VI
SARSAT	Search And Rescue, Satellite supported facility
SCIC	Satellite Cloud Information Chart (Japan)
SDSD	Satellite Data Services Division (USA)
SDUS	Secondary Data User Station (Meteosat)
SEAS	Shipboard Environmental (data) Acquisition System
SFCG	Space Frequency Coordination Group
SI	Satellite-derived Index of precipitation intensity
S-VISSR	Stretched VISSR (see below)
SST	Sea Surface Temperature
TTC	Telecommand and Telemetry Centre (Japan)
TT&C	Tracking, Telemetry and Command station
USAF	United States Air Force
UTC	Universal Time Code
VAS	VISSR Atmospheric Sounder
VDUC	VAS Data Utilisation Centre
VHRR	Very high resolution radiometer
VISSR	Visible and Infra-red Spin Scan Radiometer
WCRP	World Climate Research Programme
WEFAX	Weather facsimile
WGD	Working Group on Data (CEOS)
WMO	World Meteorological Organization
WP	Working Paper
WV	Water Vapour
WWW	World Weather Watch
XBT	On board transmitter

WORKING PAPERS SUBMITTED TO CGMS XVII

WORKING PAPERS SUBMITTED TO CGMS XVII

WORKING PAPER	TITLE
ESA	
ESA-WP-1	Meteosat-P2 Launch and commissioning
ESA-WP-2	Report on the Status of Satellite Systems
ESA-WP-3	Geostationary Satellite as Part of WMO Programmes - Status Report on the Contribution of Meteosat Data to the ISCCP and GPCP
ESA-WP-4	Status and Problems of the IDCS
ESA-WP-5	DCP Data
ESA-WP-6	Dissemination via GTS
ESA-WP-7	Meteosat High and Low Resolution (WEFAX) Status Report
ESA-WP-8	Dissemination of High Resolution Data Via Meteosat - Compression and Encryption of Digital Image Data
ESA-WP-9	Coordination of Satellite Calibration - The Current Status of Calibrating the Meteosat Radiometric Channels
ESA-WP-10	Coordination of Meteorological Parameter Extraction - Meteosat Cloud Motion Winds
ESA-WP-11	Coordination of Meteorological Parameter Extraction - Status of Meteosat Meteorological Products
ESA-WP-12	Coordination of Meteorological Parameter Extraction - The Comparison of Meteosat Cloud Motion Winds with Collocated Radiosonde Winds
ESA-WP-13	Coordination of Archiving and Retrieval

EUMETSAT

EUMETSAT-WP-1	Review of Action Items
EUMETSAT-WP-2	Review of Consolidated Report
EUMETSAT-WP-3	Meteosat Second Generation
EUMETSAT-WP-4	EUMETSAT Polar System
EUMETSAT-WP-5	INSAT relay
EUMETSAT-WP-6	GOES relay
EUMETSAT-WP-7	Report on ASDAR Coordination meeting
EUMETSAT-WP-8	Some further considerations on digital WEFAX
EUMETSAT-WP-9	Report on Future Satellite Systems
EUMETSAT-WP-10	The Meteosat MDD mission

INDIA

India-WP-1	Report on the Status of the INSAT-I System
India-WP-2	Report on Future Satellite Systems

JAPAN

Japan-WP-1	Review of Action Items from CGMS XVI
Japan-WP-2	Review of Consolidated Report
Japan-WP-3-1	Status of GMS-3 VISSR Observations
Japan-WP-3-2	Status of Geostationary Meteorological Satellites
Japan-WP-4	Future Satellite System
Japan-WP-5	Status and problems of IDCS
Japan-WP-7	Shipboard weather data via DCS
Japan-WP-8	ASDAR
Japan-WP-9	HR dissemination

Japan-WP-10	Consideration of digital WEFAX
Japan-WP-11	Renaming of GMS LR-FAX
Japan-WP-12	DCP Data
Japan-WP-13	Dissemination via GTS (SAREP)
Japan-WP-14	Satellite-Winds
Japan-WP-15	Ocean surface wind for a Typhoon
Japan-WP-16	Other Parameters
Japan-WP-17	Index of precipitation intensity
Japan-WP-18	Cloud amount anomaly chart
Japan-WP-19	Coordination of Archiving and Retrievals
Japan-WP-20	Cartridge tape system
Japan-WP-21	Plans for the dissemination of WWW data via GMS

Peoples Republic of China (PRC)

PRC-WP-1	Status of PRC Satellite Systems
PRC-WP-2	Report on Future PRC Satellite Systems

USA

USA-WP-1	Comments on the Agenda
USA-WP-2	Review of Action Items from CGMS XVI
USA-WP-3	Review of Consolidated Report
USA-WP-4	Report on US Satellite Systems
USA-WP-5	GOES I-M
USA-WP-6	Weatherwatch International
USA-WP-7	Status of IDCS
USA-WP-8	ASDAR update
USA-WP-9	Reviews of IDCS Users' Guide

USA-WP-10	HR data - GVAR
USA-WP-11	GVAR and direct readout user
USA-WP-12	LR-WEFAX
USA-WP-13	Report on DCS interference
USA-WP-14	Quality of VAS data
USA-WP-15	New DCS ground system
USA-WP-16	Normalisation of GOES VIS image data
USA-WP-17	CGMS satellite winds
USA-WP-18	Improving the quality and quantity of NESDIS satellite winds
USA-WP-19	Monitoring of CMVs at the NMC
USA-WP-20	Report on semi-annual comparison of satellite winds
USA-WP-21	Current NESDIS procedures for producing operational satellite winds
USA-WP-22	VAS Products
USA-WP-23	Precipitation and cloud cover
USA-WP-24	GOES next data archive plan
USA-WP-25	Global Geosynchronous Search and Rescue System

WMO

WMO-WP-1	Status and planning for the OWSE-Africa
WMO-WP-2	Automated Ship-board Aerological Programme
WMO-WP-3	Implementation of the operational ASDAR Programme
WMO-WP-4	Status of the International Satellite Cloud Climatology Project (ISCCP)

REPORT ON FUTURE SATELLITE SYSTEMS - INDIA WP 2

CGMS XVII - WP 2
Agenda Item C2
Prepared by India

REPORT ON THE FUTURE SATELLITE SYSTEMS

1. INSAT SYSTEM

INSAT-ID, the next satellite in the INSAT-I series, is at an advanced stage of fabrication. It is expected to be ready by the end of 1988. Its launch is currently scheduled for March - April 1989 with a Delta 4925 launch vehicle. INSAT-ID will at first be located at 83 degrees East and eventually it will replace the currently operational INSAT-IB satellite located at 74 degrees East.

2. INSAT-II SYSTEM

During the 1990s INSAT-II series satellites will replace the currently operational INSAT-I satellite in a phased manner. The first two satellites of the INSAT-II series are already in 42nd month of their construction programme. The first INSAT-II satellite currently under fabrication is expected to be launched during late 1990 and the second in late 1991 using the Ariane launch vehicle. The INSAT-II satellites will also be 3-axis stabilised multi-purpose satellites. The meteorological payloads on INSAT-II will consist of:

i) A Very High Resolution Radiometer (VHRR) for imaging the earth's cloud cover in visible and IR channels. The resolution at sub-satellite point will be 2.0 Km (visible) and 8 Kms (IR). The VHRR will be for imaging the earth's cloud cover over India and adjoining land and sea areas. There will be a capability for full earth scan with 20 degrees (N-S) X 20 degrees (E-W) scan angle and sector scan (20 degrees E-W X 4.5 degrees N N-S). Normally VHRR will scan 14 degrees (N-S) X 20 degrees (E-W) field of view for most of the day-to-day operations.

ii) A 400 MHz Data Relay Transponder (DRT), for collection of meteorological data from remote and inaccessible areas.

In addition, a 406 MHz (uplink) distress alert detection transponder is also being planned on the first two INSAT-II satellites, to aid the international satellite aided Search and Rescue programme.

Table 1 and figure 1 give a comparison of INSAT-I and INSAT-II satellites and their respective capabilities.

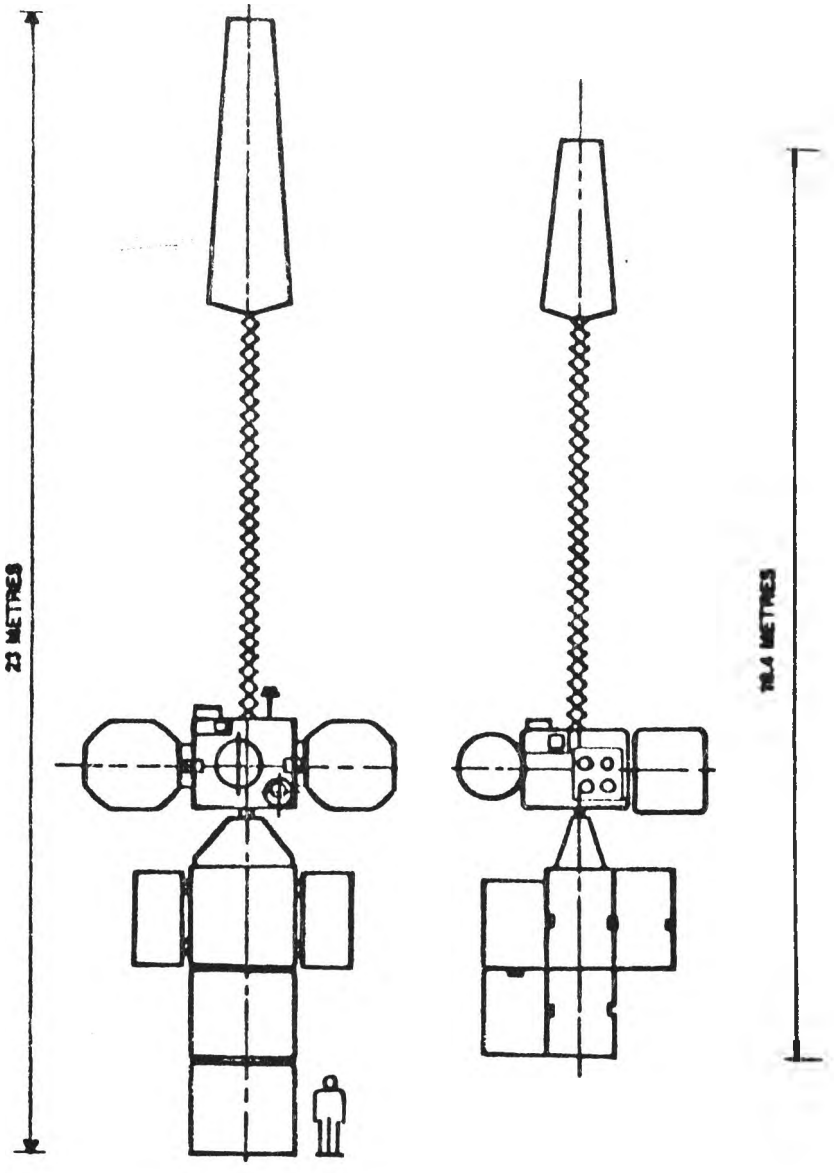
Table-1

COMPARISON BETWEEN INSAT-I & INSAT-II SPACECRAFT

	INSAT-I	INSAT-II
Length (m; fully deployed	- 19m	- 23m
Dry Mass (Kg)	- 550 Kg	- 860 Kg
EOL minimum power (W)	- 930 Watts	- 1180 Watts
Payload Complement (in each spacecraft)		
- C-band FSS transponder channels	12 (32 dBW EOC); Functional channel redundancy (10/12)	18 total--16 (32 dBW EOC) & 2 (34 dBW EOC). Functional redundancy in conventional C-band 10/12), and 3:2 in output stages for 6 extended C-band transponder channels.
- S-band high power BSS channels	2 (42 dBW EOC); 3:2 TWTA redundancy	2 (42 dBW EOC); 3:2 TWTA redundancy.
- VHRR and DRT	2.75 Kms visible and 11 Kms IR resolution. 2:1 redundancy in VHRR electronics, x'mtr and DRT.	VHRR (Improved resolution) -- 2 Kms visible and 8 Kms IR resolution. S/c level VHRR & DRT redundancy as in INSAT-I. 6 dB improvement in VHRR x'mtr e.i.r.p.
- 406 MHz S&R Transponder	--	Included.
- Eclipse operating capability for Payloads (in each s/c; equivalent at EOL)	150 W (Approx.)	340 W (approx.)
Omni-TT&C	Yes. Uses FSS transponder channel Nos.4 & 5 TWTAs.	An additional antenna added for improved coverage. Independent output stages; FSS channels not tied down.

Deployments:

- Solar Array	Asymmetrical; involves multi-axial deployments. Partial deployment in transfer orbit.	Asymmetrical Accordion type; simpler deployment. No partial deployment in transfer orbit.
- Antenna	Two deployables on East & West faces. All 6GHz receive functions on East face deployable antenna.	Two deployables on East & West faces. But a third fixed antenna added for all 6 GHz receive & VHRR and DRT transmit functions. Greater mission functions saving in case of deployment anomalies.



ON ORBIT CONFIGURATIONS

Figure 1

REPORT ON FUTURE SATELLITE SYSTEMS - USA WP 5

Future Satellite Systems

Summary and Purpose of Document

The new GOES system will put atmospheric soundings to operational use, simultaneously with and totally independent of the imaging mission. Increased use of numerical data will be supported by the new capabilities of the system. These important weather missions are joined by the important space environment monitoring (SEM) mission needs.

The other mission requirements include three additional services which are also provided simultaneously and independently of the other services:

a. an interrogation and relay service for the rapidly expanding data collection platform operation.

b. a relay service of weather and GOES data satisfied by the concurrent WEFAX operation and the retransmitted processed data.

c. an operational search and rescue relay service, complementing the polar satellite operation.

Finally, the operational weather satellite program has a history of adding or retrofitting new instruments into existing spacecrafts. The GOES I-M, designed with a spacecraft bus to operate into the 21st century, is planned to accommodate such new instruments important to the overall mission.

Action Proposed

Future Satellite Systems
GOES I-M

The GOES I-M system opens a new generation of operational environmental satellites in orbit. These satellites will benefit from newer spacecraft technology and, combined with an advanced ground system, will provide the operational and research community with the tools needed for them to move into the 21st century.

The current National Oceanic and Atmospheric Administration's (NOAA's) geostationary satellite program (GOES NOW) will be augmented in the 1990's with the planned launch of GOES-I and the subsequent follow on spacecrafts of this series. The new spacecraft system will provide greater capability and operational flexibility. Attached is a table which compares the requirements of the new GOES I-M series and the current "GOES NOW" series in orbit. The new spacecraft system also includes some unique ground equipment which, when combined with the modernization of the NOAA command, control, and telemetry ground system, will provide a new ground capability to satisfy the GOES mission. Only a brief discussion on the "unique ground equipment" is included; the overall ground modernization is not part of this paper.

The new system incorporates, as the space segment, a three axis stabilized satellite with separate imager and sounder instruments. The other instruments, part of the space environment monitor (SEM) subsystem, are similar to the GOES NOW. The system involves ground processing of the raw imager and sounder instrument for radiometric calibration and earth location information. The processed data is then retransmitted through the satellite to data users. The SEM data and the other operational products are transmitted to the user community as they currently are for the GOES NOW.

The satellite's configuration consists of a six-sided main body that carries the command, control, and payload subsystems, a continuous drive solar array attached to the south panel through a yoke assembly, a solar sail mounted off of the north panel (to offset solar pressure torque), and a SEM magnetometer (redundant) on a boom attached to the antiearth panel. The telemetry and command antenna is also boom mounted, on the east panel (all other antennas are hard mounted to the earth facing panel).

Future Satellite Systems
GOES I-M

The imager is a five channel (four infrared (IR) and one visible) radiometer containing a two axis gimballed scanning mirror which sweeps along an east-west path providing coregistered data of the viewed scene from all channels simultaneously. Position and size of the area scan are controlled by command.

The sounder, a separate instrument (GOES NOW uses a common instrument to time share the imaging and sounding functions), is a 19-channel (18 IR and one visible) discrete filter wheel radiometer. A two-axis gimballed scanning mirror steps an east-west swath of the viewed scene. As with the imager, position and size of the sounding area are controlled by command.

In order for the imager and sounder to operate independently and maintain their registration requirements, a combination of on board and ground processed compensation is necessary. Spacecraft attitude disturbances caused by instrument mirror motion are removed by the mirror motion compensation (MMC) system. The MMC system is a closed loop on board system.

The periodic apparent motion is removed by the image motion compensation (IMC) system. This combination of spacecraft and ground processing identifies the long term (i.e., orbital motion, thermal distortions, and spacecraft attitude deviations) effects on the registration. The IMC generates a number of coefficients which are transmitted to the spacecraft and, along with the MMC, maintain the navigation and registration performance requirements of the system.

The WEFAX and data collection system has been enhanced to provide the same capabilities as on the present series and add some new capabilities. The WEFAX can be operated independently and simultaneously of the other services. The spacecraft receive frequency bands for the data collection reports has been extended to add the European/Japanese band (though the spacecraft to ground frequency is centered at 1694.8 MHz).

The search and rescue subsystem, experimental on the GOES NOW, has been added to the GOES I-M to allow for an operational mode.

Future Satellite Systems
GOES I-M

The SEM performance requirements are similar to the GOES NOW SEM requirements, except for the energetic particle sensor (EPS). Two additional Electron channels were added to the EPS. In addition, the spacecraft was designed to accommodate a solar x-ray imager.

In addition to the solar x-ray imager, there have been other studies of instruments (e.g., lightning mapper) which may be considered for the future experimental or operational use of the program. With a reliable system designed to accommodate growth in future payloads, the GOES I-M is ready for the 21st century.

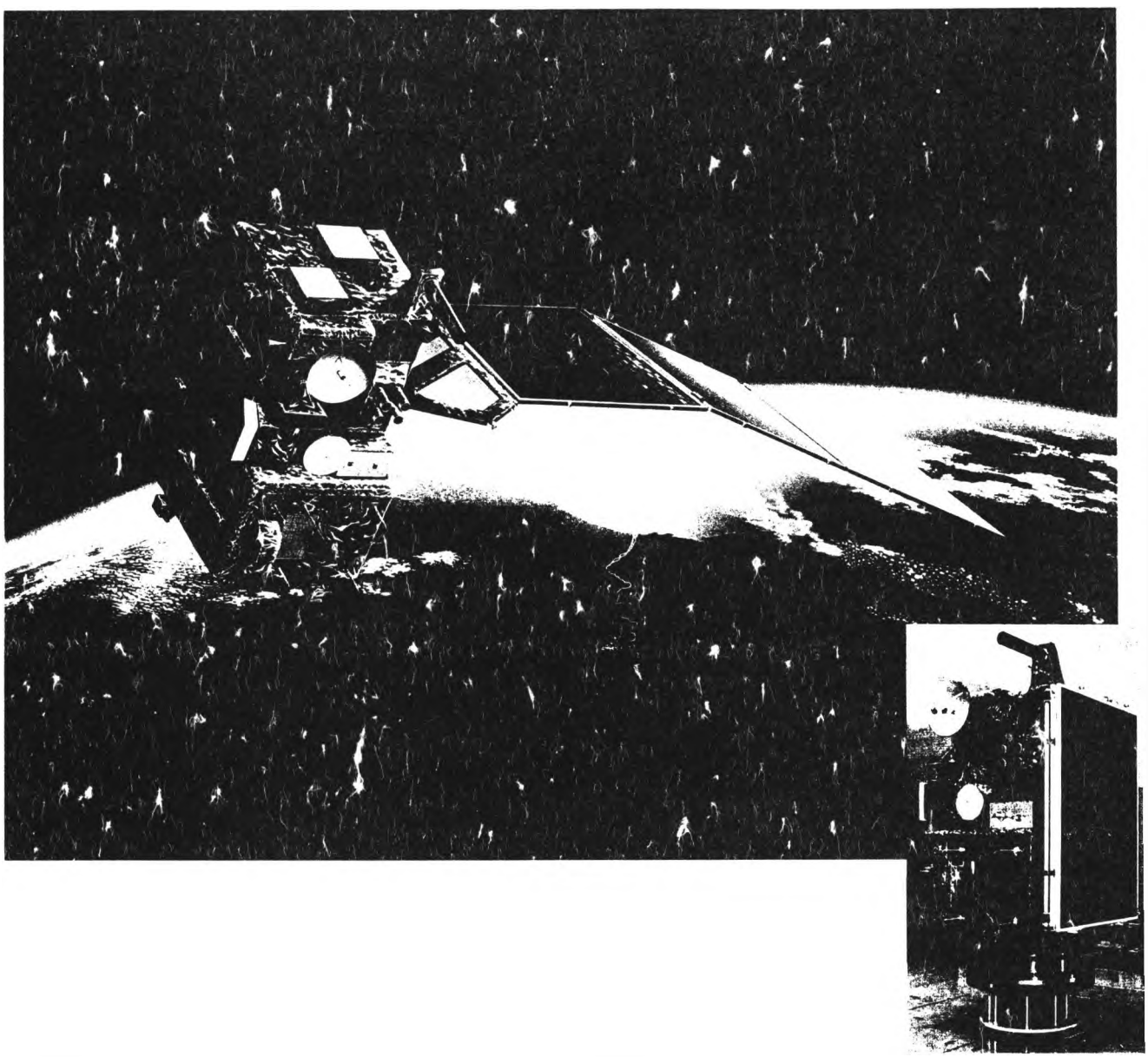
Comparison of the Performance Requirements of
GOES I-M and GOES NOW

	Performance Requirement	GOES I-M	GOES NOW
1.	Spacecraft Operational Lifetime	5 years	5 years
2.	Launch Vehicle Compatibility	Atlas Centaur	Delta
3.	Spacecraft Separation Weight	2061 kilograms	840 kilograms
4.	Launch Network Compatibility	DSN/GSTDN	DSN/GSTDN
5.	Station Keeping, N-S, E-W	$\pm.1^{o}, \pm.5^{o}$	$\pm1.0^{o}, \pm.5^{o}$
6	Station Change @1°/day rate	3 times	2 times
7.	Boost Out of Geo Orbit	Yes	No
8.	Magnetometer	"	Yes
9.	Solar X-Ray Sensor	"	"
10.	Energetic Particles Sensor	"(improved)	"
11.	High-Energy Proton and Alpha Part.	"	"
12.	Telemetry Analog Word Length	8 Bits	9 Bits
13.	" Operating Modes	Normal/Dwell	Nor./Dwe./Inhibi
14.	" Bit Rate	1000 Bps	188 Bps
15.	Command Message	48 Bits	8 Bits
16.	" Execute Modes	Grd/Real Time	Grd Verify only
17.	" Bit Rate	250 Bps	128 Bps
18.	Communications Subsystem Summary	UHF/S/L-Band	UHF/S-Band
19.	DCPR Repeater	Three Bands	Two Bands
20.	DCPI Repeater	Yes	Yes
21.	WEFAX	Continuous	Time-shared
22.	Imager/Sounder Data	Independent	" "
23.	Search & Rescue Subsystem	Operational	Experimental
Imager Requirements			
24.	Imager Channel Requirements	5 Channel	2 to 5 Time-shar
25.	Earth Location Accuracy of image	4 Km	no requirement
26.	Visible Channel Data Quantization	10 Bit	6 Bit
27.	Infrared " " "	10 "	8 or 10 Bit
28.	Data Registration Requirements	Yes	No
Sounder Requirements			
29.	Sounder Channels	19	12
30.	Earth Location Accuracy of Sounder	10 Km	no requirement
31.	Visible Channel Data Quantization	10 Bit	" "
32.	Infrared Channel Data Quantization	13 Bit	10 Bit
33.	Data Registration Requirements	Yes	No
34.	Operations Ground Equipment	"	"
35.	Growth Instrument Potential	"	"

MARINE OBSERVATION SATELLITE - NASDA BROCHURE

海洋観測衛星
Marine Observation Satellite

NASDA



MOSの概要

海洋観測衛星（MOS）は、地球資源の有効利用、環境の保全等に資する人工衛星による地球観測システムの開発の一環として開発された我が国初の地球観測衛星です。海洋観測衛星1号（MOS-1）は、昭和62年2月19日に、種子島宇宙センターから、N-IIロケットにより打ち上げられました。MOS-1の後継機として、現在MOS-1bが開発されており、この衛星は昭和64年度に打上げ予定です。これらの衛星の3つの放射計とデータ収集システムにより取得されるデータは、海洋資源の確保や有効利用だけでなく、農林業や環境状況のモニタ等にも利用できるものと期待されています。

Outline of Marine Observation Satellite

Marine Observation Satellite (MOS) is Japan's first earth observation satellite developed domestically. It will be part of a system for earth observation by satellite that will contribute to the effective use of the earth's resources and the conservation of its environment. Marine Observation Satellite-1 (MOS-1) was launched on February 19, 1987 from the Tanegashima Space Center by a N-II rocket. The MOS-1b as a succeeding satellite to the MOS-1 is being developed and will be launched in 1990.

It is expected that the data collected by three radiometers and a data collection platform of each satellite will be used not only to efficiently use marine resources but also to monitor agricultural, forestry and environmental conditions as well.

開発の目的と経緯

MOSにはMOS-1及びMOS-1bがあり３種類の観測機器で地表面の画像を撮像します。

MOS-1は、次のような目的で開発されました。

- 地球観測衛星の基本技術の確立
- 搭載放射計の開発及び機能・性能の確認並びにこれらによる海洋を中心とした地球全般の実験観測
- データ収集システム(DCS)の基礎実験

MOS-1bはMOS-1の後継機としてそのプロトタイプモデルをリハービッシュするもので、開発目的は次のとおりです。

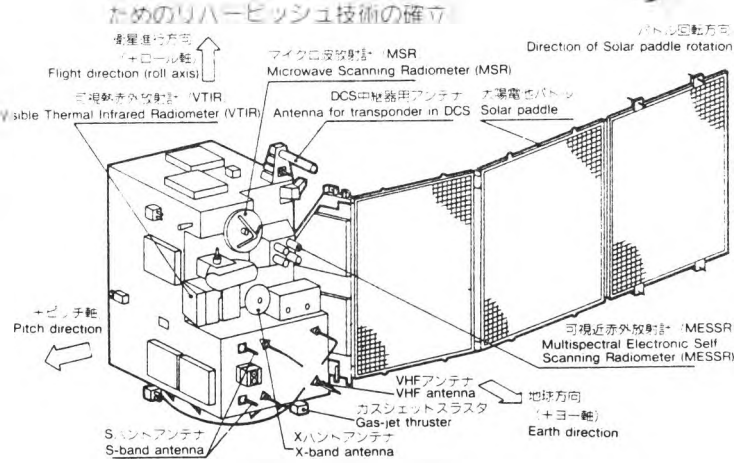
- ３種類の観測機器及びデータ収集システムによる海洋を中心とした地域全般の観測の継続
- MOS-1とMOS-1bの2衛星運用を含む地球観測衛星システムの運用技術の確立
- 衛星のプロトタイプモデルをフライトモデルにするためのリハービッシュ技術の確立

Development Purpose and History

The MOS consists of two satellite: MOS-1 and MOS-1b. The satellites will use three types of observation sensors to take pictures of the earth's surface.

The mission objectives of the MOS-1 are as follows:

- Establishment of fundamental technology for earth observation satellites
- Experimental observation of the earth, in particular the oceans; development of observation sensors; verification of their functions and performance



- Basic experiments on the data collection system (DCS)

MOS-1b is made by refurbishing the MOS-1 proto-type model and its mission objectives are as follows.

- Succession of earth observation by MOS-1
- Establishment of earth observation system operation technology including synchronous two satellite operation
- Establishment of refurbising technology

主要諸元

形状	一翼式太陽電池パドルを有する箱型 本体1.26×1.48×2.4(m) 太陽電池パドル2.0×5.28(m)	
重量	打上げ時　約740kg	
姿勢安定方式	三軸姿勢安定方式（コントロールドバイアスモーメンタム方式）	
ミッション期間	2年	
信頼度	2年後の残存確率　0.5以上	
打上げロケット	MOS-1：N-II ロケット、MOS-1b：H-I ロケット	
打上げ場所	種子島宇宙センター	
打上げ日時	MOS-1：昭和62年2月19日、MOS-1b：昭和64年度冬期	
軌道	種　類	太陽同期準回帰軌道
	高　度	約909km
	傾斜角	約99度
	周　期	約103分
	回帰周期	17日（西方移動）
	降交点通過 地方平均太陽時　午前10時～午前11時	

Major Characteristics

Shape	Box type with expanding type solar paddle (one wing) Body 1.26×1.48×2.4(m)　Solar paddle 2.0×5.28(m)	
Weight	Approx. 740kg (at liftoff)	
Attitude Control	Three-axis stabilized (controled bias momentum)	
Mission life	2 years	
Reliability	0.5 (after 2 year in orbit)	
Launch vehicle	MOS-1: N-II rocket, MOS-1b: H-I rocket	
Launch site	Tanegashima Space Center, Kagoshima	
Launch date	MOS-1: 10:23 a.m. February 19, 1987, MOS-1b: early 1990	
Orbit	Type	Sun Synchronous Subrecurrent
	Altitude	Approx. 909km
	Inclination	Approx. 99deg
	Period	Approx. 103min.
	Recurrent period	17 days (west-ward shift)
	Descending Node Time 10:00～11:00 a.m.	

ミッション機器主要諸元

観測機器

観測機器	可視近赤外放射計（MESSR）	可視熱赤外放射計（VTIR）	マイクロ波放射計（MSR）
観測対象	陸域、海域	雲及び海面温度	海面、大気中の水蒸気、海氷、積雪
走査方式	電子走査（CCD利用）	機械走査	機械走査
観測波長周波数	可視域2バンド 近赤外域2バンド	可視域1バンド 熱赤外域3バンド	23GHz帯、 31GHz帯
分解能	約50m	可視域約900m 熱赤外域約2700m	23GHz帯:約32km 31GHz帯：約23km
観測幅	約100km （両系運用時約200km）	約1500km	約320km

Major Specifications of Mission Equipments

Measurement Equipment

Measurement Equipment	Multispectral Electronic Self Scanning Radiometer (MESSR)	Visible and Thermal Infrared Radiometer (VTIR)	Microwave Scanning Radiometer (MSR)
Measurement objectives	Air, Sea	Clouds, Temperature of ocean surface	Sea surface, Water vapor, Snowfall
Scanning method	Electronic (using CCD)	Mechanical	Mechanical
Wavelength, Frequency	Two visible bands, Two near-infrared bands	One visible band, Three thermal infrared bands	23GHz band, 31GHz band
Resolution	Approx. 50m	Visible range 900m, Thermal infrared 2700m	23GHz band: Approx 3[illegible] km, 31GHz band: Approx 23km
Swatch width area	Approx. 100km (Approx. 200km when both systems are operated)	Approx. 1500km	Approx. 320km

データ収集システム中継器

機能	データ中継プラットフォームからのデータの中継
方式	ランダムアクセス型位相再変調方式
使用周波数帯	400MHz帯（アップリンク）及び1.7GHz帯（ダウンリンク）

Transponders for Data Collection System

Function	Relay of data from data collection platform
Method	Random access phased remodulator
Operating frequency band	400MHz band (uplink) and 1.7GHz band (downlink)

可視近赤外放射計(MESSR)

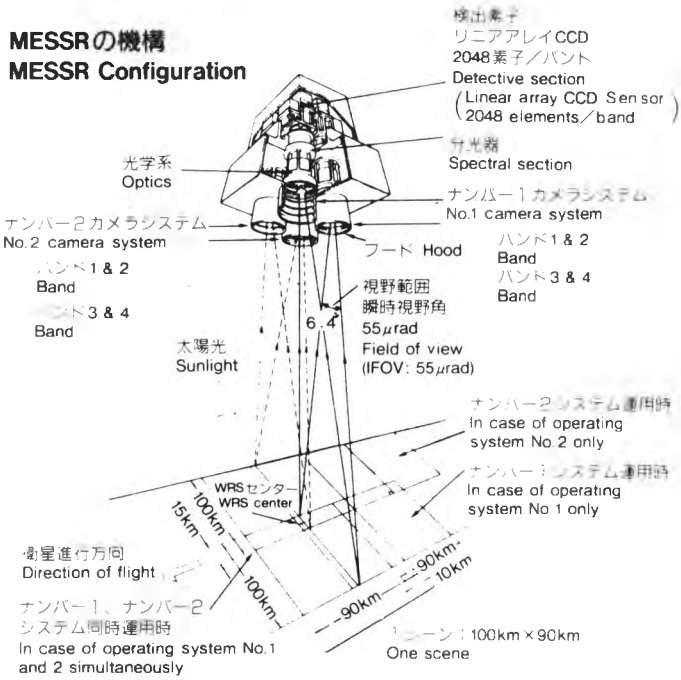
MESSRは、地表面の太陽反射光を捉える電子走査式の放射計で、衛星進行方向に並行して2系統のカメラシステムを装備しています。

Multi-spectrum Electronic Self-scanning Radiometer (MESSR)

MESSR is an electronic meter for scanning radiation that collects solar light reflected off the earth's surface.

It is equipped with two camera systems that are set parallel to the satellite's flight direction.

MESSRの機構
MESSR Configuration



MOS−1によるMESSR画像

（札幌市周辺：昭和62年4月27日　午前10時14分～22分）

The photo of MESSR image by MOS−1

(in and around Sapporo city: April 27, 1987, from 10:14:00 a.m. to 10:22:00 a.m. JST)

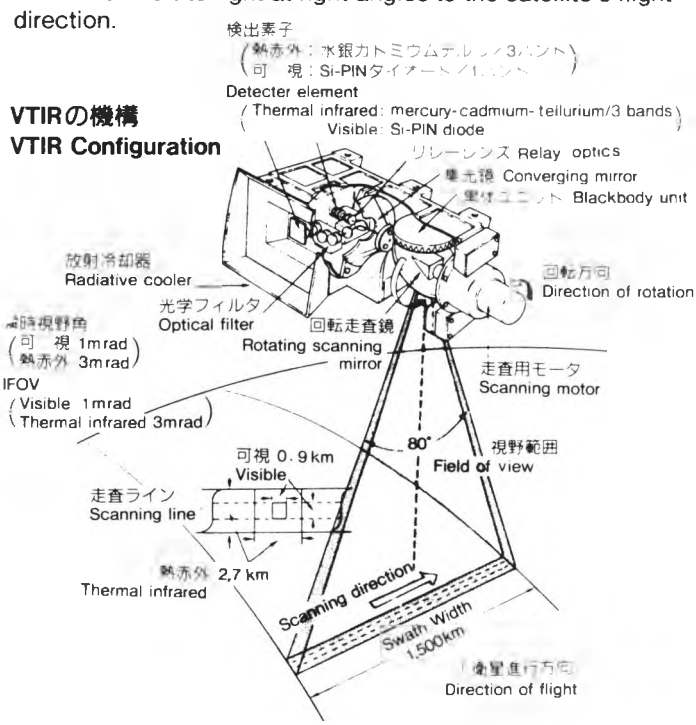
可視熱赤外放射計(VTIR)

VTIRは、回転する走査鏡により、衛星の進行方向に対して直角に、右から左へと機械的に走査します。

Visible and Thermal Infrared Radiometer (VTIR)

Using a rotating scanning mirror, the VTIR mechanically scans from left to right at right angles to the satellite's flight direction.

VTIRの機構
VTIR Configuration



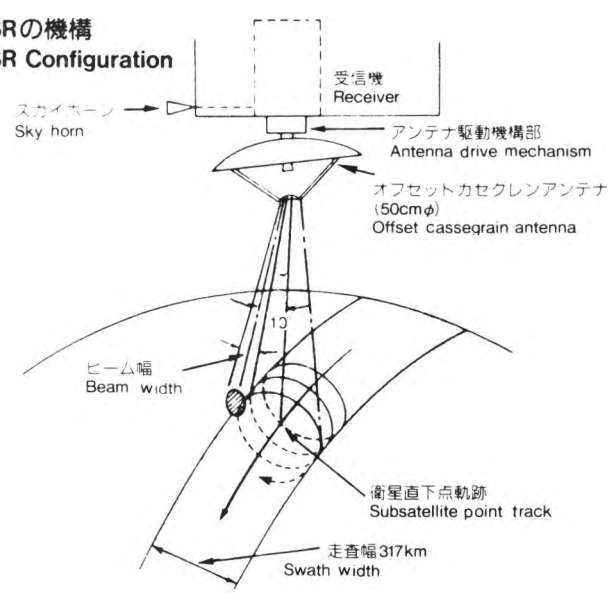
マイクロ波放射計(MSR)

MSRは、衛星に搭載したパラボラアンテナを回転させることにより、衛星の進行に合って連続して地表を走査する電波センサーです。

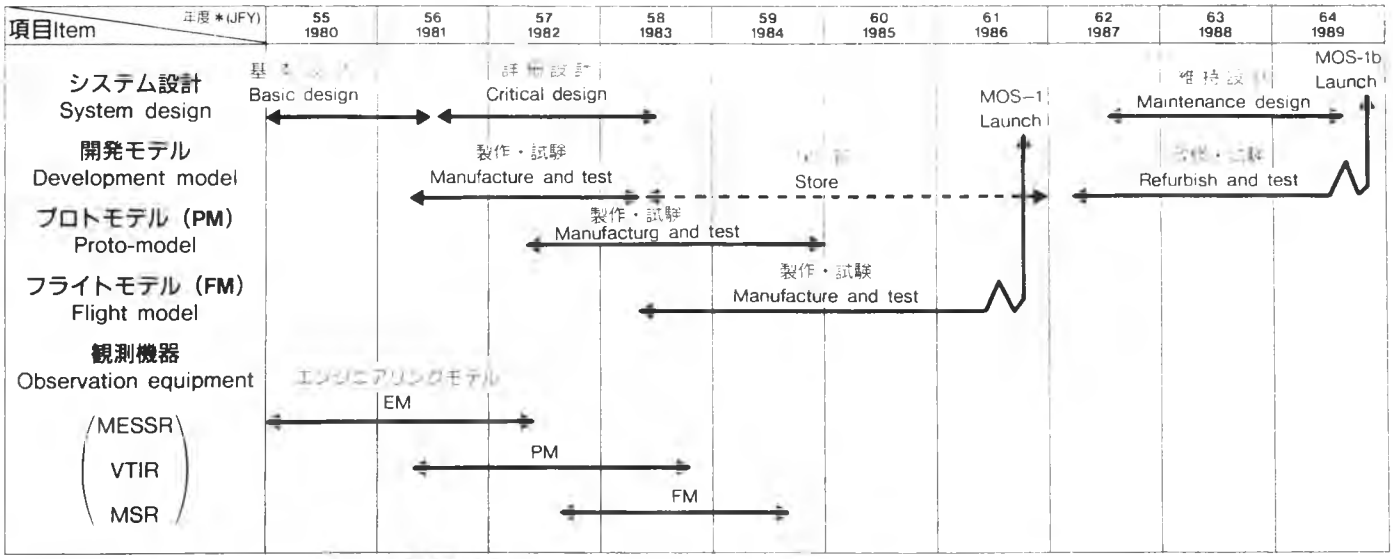
Microwave Scanning Radiometer (MSR)

The MSR is a signal sensor that rotates the dish antenna mounted on the satellite so that as the satellite moves over the earth's surface, the sensor can continuously scan a path on the earth's surface.

MSRの機構
MSR Configuration



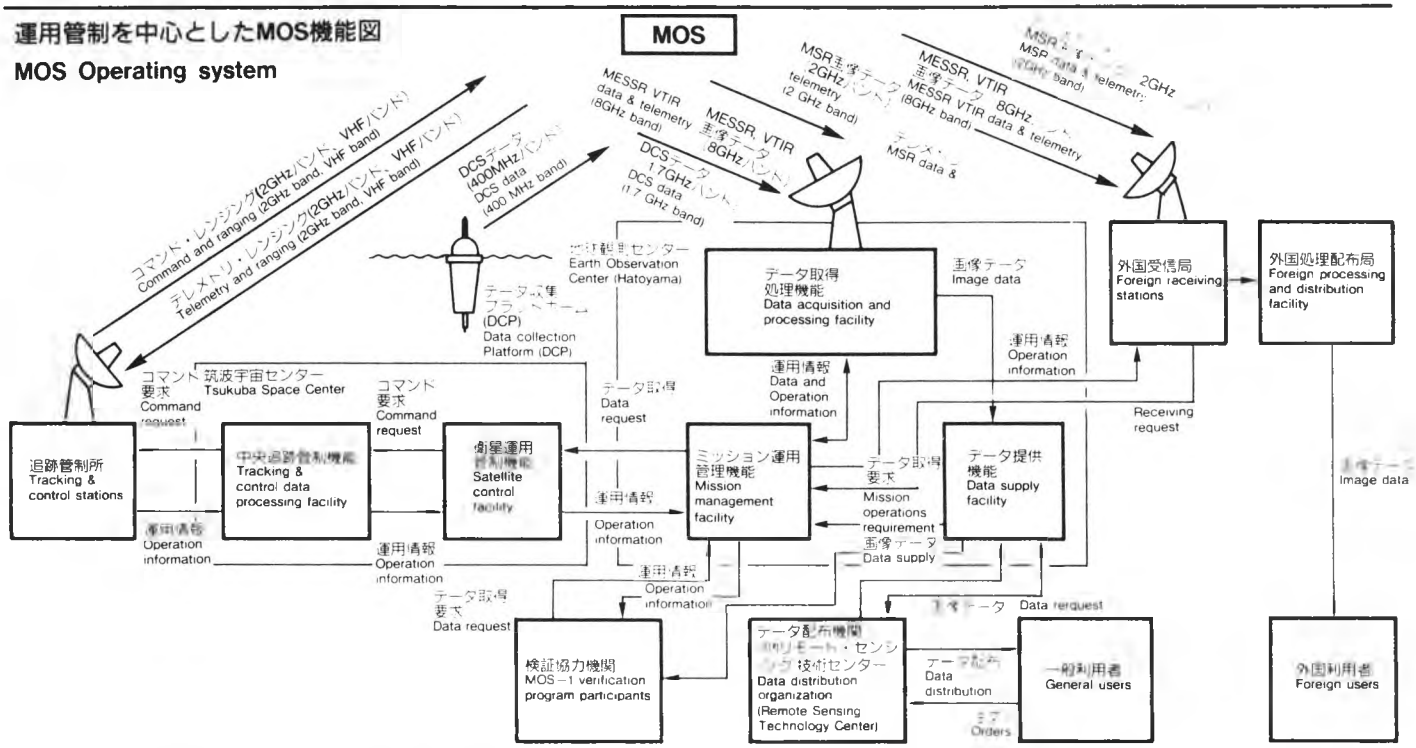
MOSの開発スケジュール　Development Schedule of the MOS



52年(1977)から54年(1979)にかけてMOS-1の概念設計及び予備設計を実施した。
Conceptual design and Prelimanary design for the MOS-1 were carried out from 1977 to 1979.

＊JFY : Japanese Fisical Year

運用管制を中心としたMOS機能図
MOS Operating system



利用

MOSにより得られる画像データは地球観測技術を確立するために行われる様々な利用実験のために、大学、研究所などの利用機関に提供されます。また外国からもこれらのデータの利用の引き合いが来ています。宇宙より地上を撮像して得た可視域、赤外域及びマイクロ波による画像データは、農耕・水産資源、水資源の利用状況や調査、海洋・大気汚染等の監視などに利用できるものと期待されています。

Utilization of data

Picture data obtained from the MOS will be distributed to universities, research institutes and other user institutions so that that they can perform the many different kinds of experiments that will lead to the establishment of an earth observation technology. Many foreign countries have requested the use of these data. Anticipation is high that good use can be made of the visual, infrared and microwave image data from space to monitor water and air pollution and to survey conditions in farm cultivation, marine and water resource use.

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LOW-ORBIT METEOROLOGICAL SATELLITE SYSTEMS OF THE USSR

A. LOW-ORBIT METEOROLOGICAL SYSTEMS

1. METEOR-2 OPERATIONAL METEOROLOGICAL SATELLITE SYSTEM

1.1 System outline, status and plans

1.1.1 METEOR-2 operational meteorological satellite system

Number of satellites in the programme: two or three satellites will be in orbit and operational at any one time; to date, 17 satellites have been launched, and one or two are to be put up every year.

There are receiving and processing complexes in Moscow (USSR State Committee for Hydrometeorology main computing centre), Novosibirsk and Khabarovsk (regional computing centres).

- The earth complex is planned and controlled by the main computing centre.

- There are independent information receiving stations in the USSR, the Arctic, the Antarctic and on research vessels, a total of about 95 stations in all.

- Information is received and processed at each regional computing centre and is transmitted by telecommunication link to the main computing centre in Moscow. The information is disseminated through telecommunication links.

1.1.2 Name of satellites:

METEOR-2 No. 1, METEOR-2 No. 2, METEOR-2 No. 3 and so on.

1.1.3 Description of future work:

The system will operate till 1990, and will then be replaced by the METEOR-3 system.

1.2 Programme objectives

- To obtain, on a regular basis, global data on the distribution of cloud, snow and ice cover and surface radiation temperatures twice daily at times close to the synoptic (0300 and 1500 Moscow time);

- To obtain, on a regular basis, regional data on the distribution of cloud, snow and ice cover;

- To obtain, on an experimental basis, global data on the vertical temperature and humidity distributions in the atmosphere;

- To observe, on a regular basis, fluxes of penetrating radiation in near-Earth space.

1.3 Authority in charge of the programme:

USSR State Committee for Hydrometeorology

(WWW 3909)

1.4 Authority operating the system:

State Scientific and Research Centre for the Study of Natural Resources

1.5 Orbit

Height:	950 km
Inclination:	82.5°
Period:	140 minutes
Type:	Circular near-polar

2. REMOTE SENSING

2.1 Sensor discription

A scanning telephotometer for direct transmission of images in the visible spectrum (0.5-0.7 μm), giving a swath width of 2100 km at a resolution of 2 km.

A television-type scanner (spectral range 0.5-0.7 μm), giving a swath width of 2600 km at a resolution of 1 km.

A scanning IR radiometer (spectral range 8-12 μm), giving a swath width of 2800 km at a nadir resolution of 8 km.

A scanning IR radiometer (spectral ranges 11.10, 13.33, 13.70, 14.24, 14.43, 14.75, 15.02 and 18.70 μm), giving a swath width of 1000 km at an angular resolution of 2°.

A device for measuring penetrating radiation flux densities.

2.2 Signal characteristics:

Carrier frequency:	466.5 MHz
Modulation type:	FM
Allocated bandwidth:	± 120 kHz
Radio transmitter output power:	10 W

2.3 Operational products

2.3.1 Image products

The measuring systems on the METEOR-2 meteorological satellites are designed to obtain global data with a frequency of once or twice a day; after suitable processing, these data go to meet the requirements for operationally accessible hydrometeorological information (images of cloud, snow and ice cover in the visible and IR regions, sea-surface temperatures, temperature profiles and so on) of the forecasting organizations of the USSR State Committee for Hydrometeorology and a number of economic organizations. The television images are obtained using a scanning photometer operating between 0.5 and 0.8 μm at a scanning angle of 90°, which corresponds, at an orbital distance of about 950 km, to a swath width of 2100 km with a sub-satellite resolution of 2 km.

IR images are obtained using a scanning IR radiometer in the 8-12 μm atmospheric transparency window, which, with a scanning angle of 108°, gives a swath width of 2800 km with a spatial resolution of 8 km at nadir. The data obtained using the IR radiometer, besides being used in the synoptic analysis, undergo special processing in order to obtain a sea-surface temperature chart.

To obtain data on atmospheric temperature and humidity conditions, there is a multichannel scanning IR radiometer on board with spectral channels corresponding to the absorption bands of water vapour (one measurement in the 18 μm band) and carbon dioxide (six measurements in the 15 μm band), and to the window of transparency (two measurements in the 11 μm band) and ozone (one measurement in the 9.6 μm band). The multichannel IR radiometer has a scanning angle of 45° and a nadir resolution of 37 km. There are 25 measurements per scanning line.

Data on fluxes of electron and protons of various intensities are provided in both stored and storm modes by a system of measuring apparatus.

Space survey data in the form of IR and visible images from satellites in the METEOR-2 system arrive in two forms: as stored images (with storage beforehand in on-board memory) and as direct transmissions (with direct transmission to the receiving station). The first mode is designed to produce surveys of any area on Earth, while the second is for making operational surveys within the limits of the areas of radio visibility of the receiving stations. The data transmitted by the satellite in stored mode and in direct mode in the HF range are accepted only by the main and regional data receiving and processing centres in Moscow, Novosibirsk and Khabarovsk. Data transmitted in direct mode in the VHF band are accepted by a large network of independent information receiving stations.

2.3.2 Atmospheric temperature and humidity sensing

Radiometric measurements from the satellite of radiation emanating from the surface-atmosphere system below, i.e., spectrometric information, form the basis for the remote temperature sensing of the atmosphere, i.e., obtaining quantitative data on the vertical distributions of temperature T(p), and humidity (p) from which a relative geopotential Hp(p)can be derived.

Two types of method are used in the thematic processing of satellite radiometry data for remote temperature sensing: solving the inverse problem, and the regression method of estimating T(p) and (p). The first method is based on solving, numerically, the integral IR radiation transport equation which describes the relationship between the radiation recorded at the upper boundary of the atmosphere and the unknown vertical profile parameters T(p) and (p). The regression method of estimating T(p) and (p) is based on statistical estimates of the unknown parameters as functions of the measurements recorded.

The reliability of remote temperature sensing results depends in the main on the measurement composition and conditions. Remote temperature sensing data give the thermal structure of the atmosphere (below 10 Pa) with a mean accuracy of the order of 2.0-2.5°C in cloud-free or nearly cloud-free conditions, and can be used for partial compensation of traditional (radiosonde) data in numerical weather analysis and forecasting systems.

(WWW 3909)

Remote temperature sensing data which have been edited by interactive processing procedures can supplement and refine the standard information on regions with small-scale structure in their meteorological element fields.

Spectrometric information is processed operationally in the receiving and processing centres at Obninsk, Novosibirsk and Khabarovsk. The results of interpretation, in the form of SATEM summaries (relative geopotential and humidity data), are transmitted on a regular basis through the telecommunication channels of the automatic data transmission system to Moscow and are added to the hydrometeorological databases of the State Committee for Hydrometeorology. The volume of information from one orbit is 10^5 bytes, and up to 1.3×10^6 bytes may arrive per day. The information is received at the USSR Hydrometeorology Centre at about 5 and 1700 h for the main synoptic times of 0 and 1200 h (Moscow time).

2.3.3 Sea- and ocean-surface temperature sensing (SST)

Two types of method are used in processing IR information to determine SST: correction of satellite radiation temperature measurements using a transport equation (transfer function method), and the regression estimation method. The transfer function method includes, as separate stages, calculation of the transfer function on the basis of a transport equation, and temperature, humidity, ozone and aerosol data followed by correction of the measured radiation temperatures using transfer functions. Where there is no current data on the meteorological parameters, estimates of their climatic means and the transfer functions, computed once, are used to form a global catalogue, which is then included in the processing technology.

The regression method for estimating SST includes stages for forming representative "satellite radiation temperature-ship temperature" cycle excerpts for individual regions, calculation of regression coefficients for these regions and compilation of an SST regression estimate and numerical SST charts. Preliminary stages in putting these methods into effect are splitting the mass of satellite measurements into the headings "water-land" and "clear-cloudy".

The end product of the thematic processing of IR information is a numerical SST chart (disseminated over the automatic data transmission network by computer); the characteristics of these charts are shown in Table 1.

Table 1

Characteristics of the results from IR information processing

Parameters	Land- and sea-surface temperature charts
Resolution over area, km	From 20 to 250
Size of output to automatic data transmission system	From $1:(2.5 \circ 10^6)$ to $1:(30 \circ 10^6)$
Size of blank chart, mm	300 x 310

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The reliability of satellite SST data depends on the composition of the measurements. For single-channel IR radiometers, the root-mean-square error in SST determination is 1.5-2.0°C, and 1.0-1.5°C for multichannel IR radiometers (in cloud-free and nearly cloud-free conditions). The reliability of SST data is slightly worse in the tropics as a result of the low degree of natural atmospheric temperature variability and the high atmospheric humidity.

2.3.4 Other products

In addition to the information mentioned above, the data receiving and processing stations provide users on a regular basis with the following materials:

- Photomontages of cloud and surface images of the northern and southern hemispheres, Eurasia and the tropics;
- Numerical cloud top height charts;
- Photographic charts of sea ice conditions;
- Snow cover limit charts;
- Nephanalysis charts and development of cloud formations;
- Tabular data on cloud amount at regular grid mesh points;
- Tabular data on fluxes of penetrating radiation of various intensities.

3. DIRECT DATA TRANSMISSION

The METEOR-2 satellite orbital data needed for WMO member countries to receive visible spectrum television images in VHF direct transmission mode are transmitted over the GTS. The orbital data are disseminated in FANAS coded form every first and third Tuesday of the month.

Signals transmitted from the satellite have the following characteristics:

3.1 Signal characteristics:

Carrier frequency:	137.3, 137.4 and 137.85 MHz
Modulation type:	FM
Deviation:	± 15 kHz
Allocated bandwidth:	± 50 kHz
Radio transmitter output power:	At least 5 W

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3.2 Characteristics of the low-frequency television image signal:

Subcarrier frequency:	2400 Hz ± 10%
Subcarrier modulation:	AM with a modulation coefficient of up to 90%, maximum amplitude corresponding to "white" level
Automatic control signals:	A line phasing signal is transmitted by amplitude modulation of the subcarrier at 256 Hz with a relative instability of $5o10^{-6}$ or better and a modulation intensity of close to 100%: length of phasing signal 90-100 ms

3.3 Characteristics of the television image recording device:

Interaction index:	264
Scanning rate:	120 lines/min
Scanning density:	3.8 lines/mm
Image size:	195 x 290 mm
Number of grey levels:	At least 12
Scanning direction:	Right to left

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Subcarrier frequency:	2400 Hz
Subcarrier modulation:	AM with a modulation coefficient of up to 90%, maximum amplitude corresponding to "white" level
Automatic control signals	A line phasing signal is transmitted by amplitude modulation of the subcarrier frequency at 512 Hz with a relative instability of $5o10^{-6}$ or better and a modulation intensity of close to 100%: length of phasing signal 150-200 ms

3.5 Characteristics of the IR image recording device:

Interaction index:	70
Scanning rate:	20 lines/min
Scanning density:	1 line/mm
Scanning direction:	Right to left
Number of grey levels:	At least 8
Size of image:	148 x 290 mm

4. DATA COLLECTION AND DISTRIBUTION

There is no collection and dissemination of DCP data from METEOR-2 satellites.

(WWW 3909)

1. METEOR-3 OPERATIONAL SATELLITE SYSTEM

1.1. System outline, status and plans

METEOR-3 improved operational meteorological satellite system

1.1.1 Number of satellites in the programme

Two or three satellites will be in orbit and operational at any one time; to date, one METEOR-3 satellite has been launched, and the plan is for one to be put up every year.

Earth information receiving, processing and dissemination complex

- There are receiving, processing and disseminating complexes in the main and regional computing centres in Moscow, Novosibirsk and Khabarovsk.

- There are independent information receiving stations in the USSR, the Arctic, the Antarctic and on research vessels, a total of about 95 stations in all.

- The earth complex is planned and controlled from the main USSR State Committee for Hydrometeorology computing centre.

- Information is received and processed at each regional computing centre and is transmitted by telecommunication link to the main computing centre in Moscow.

1.1.2 Name of satellites

METEOR-3 No. 1, METEOR-3 No. 2, METEOR-3 No. 3 and so on.

1.1.3 Description of future work

The system will operate till 1995; after that, no decision has yet been made

1.2. Operational purpose:

- To obtain, on a regular basis, global data on the distribution of cloud, snow and ice cover and surface radiation temperatures once or twice daily at times close to the synoptic;

- To obtain, on a regular basis, regional data on the distribution of cloud, snow and ice cover;

- To obtain, during each communication session, global data on the vertical temperature and humidity distributions in the atmosphere;

- To observe, on a regular basis, information on radiation conditions in near-Earth space: globally once or twice a day, and for each orbit in storm conditions.

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1.3 Authority in charge of the programme

USSR State Committee for Hydrometeorology

1.4 Authority operating the system

State Scientific and Research Centre for the Study of Natural Resources

1.5. Orbit

Height:	1200 - 1250 km
Inclination:	81-83°
Period:	110 minutes
Type:	Circular near-polar

2. REMOTE SENSING

2.1. Sensor description

A scanning telephotometer for direct transmission of images in the visible spectrum (0.5-0.7 μm), giving a swath width of at least 2600 km at a resolution of 1.0 x 2.0 km or better at the sub-satellite point.

A scanning telephotometer for global survey mode in the visible spectrum (0.5-0.7 μm), giving a swath width of at least 3100 km and a resolution at sub-satellite point of 0.7 x 1.4 km or better.

A scanning IR radiometer for direct image transmission and global survey mode (spectral range 10.5-12.5 μm), giving a swath width of at least 3100 km. Nadir point resolution 3 x 3 km.

The on-board processing system corrects geometrical image distortion and forms two data streams:

- Video information for transmission to independent image receiving stations in the 137 MHz band (1000 pixels per line);

- Video information for obtaining global cloud cover images in numerical form (256 pixels per line).

It is proposed that in future the total volume of information received should be transmitted (2400 pixels per line) in the 1.7 GHz band.

A scanning IR radiometer for global survey mode (spectral range 8-12 μm) providing a swath width of at least 3100 km. Resolution at the nadir point 10 x 10 km..

A multispectral scanning IR radiometer (10 channels between 9.6 and 15.2 μm and 18 μm) for atmospheric temperature and humidity sensing. Swath width 1000 km, surface resolution 50 km.

A radiation measuring complex for recording fluxes of protons and electrons with threshold energies from 0.15 MeV to 90 MeV.

There is an experimental complex for measuring total ozone content and vertical ozone distribution in individual regions.

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2.2. Signal characteristics:

Carrier frequency:	466.5 MHz
Modulation type:	FM
Allocated bandwidth:	± 120 kHz
Radio transmitter output power:	10 W

2.3 Operational products

2.3.1 Image products

The measuring systems on the METEOR-3 meteorological satellites are designed to obtain global data with a frequency of once or twice a day; after suitable processing, these data go to meet the requirements for operationally accessible hydrometeorological information (images of cloud, snow and ice cover in the visible and IR regions, sea-surface temperatures, temperature profiles and so on) of the forecasting organizations of the USSR State Committee for Hydrometeorology and a number of economic organizations. The television images are obtained using a scanning photometer operating between 0.5 and 0.8 μm at a scanning angle of 90°, which corresponds, at an orbital distance of about 950 km, to a swath width of 2100 km at a sub-satellite resolution of 2 km.

IR images are o tained using a scanning IR radiometer in the 8-12 μm atmospheric transparency window, which, with a scanning angle of 108°, gives a swath width of 2800 km with a spatial resolution of 8 km at nadir. The data obtained using the IR radiometer, besides being used in the the synoptic analysis, undergo special processing in order to obtain a sea-surface temperature chart.

To obtain data on atmospheric temperature and humidity conditions, there is a multichannel scanning IR radiometer on board with spectral channels corresponding to the absorption bands of water vapour (one measurement in the 18 μm band) and carbon dioxide (six measurements in the 15 μm band), and to the window of transparency (two measurements in the 11 μm band) and ozone (one measurement in the 9.6 μm band). The multichannel IR radiometer has a scanning angle of 45° and a nadir resolution of 37 km. There are 25 measurements per scanning line.

Data on fluxes of electron and protons of various intensities are provided in both stored and storm modes by a system of measuring apparatus.

Space survey data in the form of IR and visible images from satellites in the METEOR-3 system arrive in two forms: as stored images (with storage beforehand in on-board memory) and as direct transmissions (with direct transmission to the receiving station). The first mode is designed to produce surveys of any area on Earth, while the second is for making operational surveys with the limits of the areas of radio visibility of the receiving stations. The data transmitted by the satellite in stored mode and in direct mode in the HF range are accepted only by the main and regional data receiving and processing centres in Moscow, Novosibirsk and Khabarovsk. Data transmitted in direct mode in the VHF band are accepted by a large network of independent information receiving stations.

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2.3.2 Atmospheric temperature and humidity sensing

Radiometric measurements from the satellite of radiation emanating from the surface-atmosphere system below, i.e., spectrometric information, form the basis for the remote temperature sensing of the atmosphere, i.e., obtaining quantitative data on the vertical distributions of temperature T(p), humidity (p) from which a relative geopotential [humidity] Hp(p)can be derived.

Two types of method are used in the thematic processing of satellite radiometry data for remote temperature sensing: solving the inverse problem, and the regression method of estimating T(p) and (p). The first method is based on solving, numerically, the integral IR radiation transport equation which describes the relationship between the radiation recorded at the upper boundary of the atmosphere and the unknown vertical profile parameters T(p) and (p). The regression method of estimating T(p) and (p) is based on statistical estimates of the unknown parameters as functions of the measurements recorded.

The reliability of remote temperature sensing results depends in the main on the measurement composition and conditions. Remote temperature sensing data give the thermal structure of the atmosphere (below 10 Pa) with a mean accuracy of the order of 2.0-2.5°C in cloud-free or nearly cloud-free conditions, and can be used for partial compensation of traditional (radiosonde) data in numerical weather analysis and forecasting systems.

Remote temperature sensing data which have been edited by interactive processing procedures can supplement and refine the standard information on regions with small-scale meteorological element field structure.

Spectrometric information is processed operationally in the receiving and processing centres at Obninsk, Novosibirsk and Khabarovsk. The results of interpretation, in the form of SATEM summaries (relative geopotential and humidity data), are transmitted on a regular basis through the telecommunication channels of the automatic data transmission system to Moscow and are added to the hydrometeorological databases of the State Committee for Hydrometeorology. The volume of information from one orbit is 10^5 bytes, and up to 1.3×10^6 bytes may arrive per day. The information is received at the USSR Hydrometeorology Centre at about 5 and 1700 h for the main synoptic times of 0 and 1200 h (Moscow time).

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these regions and compilation of an SST regression estimate and numerical SST charts. Preliminary stages in putting these methods into effect are splitting the mass of satellite measurements into the headings "water-land" and "clear-cloudy".

The end product of the thematic processing of IR information is a numerical SST chart (disseminated over the automatic data transmission network by computer); the characteristics of these charts are shown in Table 1.

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2.3.4 In addition to the information mentioned above, the data receiving and processing stations provide users on a regular basis with the following materials:

- Photomontages of cloud and surface images of the northern and southern hemispheres, Eurasia and the tropics;
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- Photographic charts of sea ice conditions;
- Snow cover limit charts;
- Nephanalysis charts and development of cloud formations;
- Tabular data on cloud amount at regular grid mesh points;
- Tabular data on fluxes of penetrating radiation of various intensities;
- Summaries in SATEM code giving atmospheric temperature and humidity sensing data.

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3. DIRECT DATA TRANSMISSION

The METEOR-3 satellite orbital data needed for WMO member countries to receive visible spectrum television images in VHF direct transmission mode are transmitted over the GTS. The orbital data are disseminated in FANAS coded form every first and third Tuesday of the month.

Signals transmitted from the satellite to independent receiving stations have the following characteristics:

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Modulation type:	FM
Deviation:	± 15 kHz
Allocated bandwidth:	± 50 kHz
Radio transmitter output power:	At least 5 W

3.2. Characteristics of the low-frequency television image signal:

Subcarrier frequency:	2400 Hz ±10%
Subcarrier modulation:	AM with a modulation coefficient of up to 90%, maximum amplitude corresponding to "white" level
Automatic control signals:	A line phasing signal is transmitted by amplitude modulation of the subcarrier at 256 Hz with a relative instability of $5 \circ 10^{-6}$ or better and a modulation intensity of close to 100%: length of phasing signal 90-100 ms

3.3. Characteristics of the television image recording device:

Interaction index:	264
Scanning rate:	120 lines/min
Scanning density:	3.8 lines/mm
Image size:	195 x 290 mm
Number of grey levels:	At least 12
Scanning direction:	Right to left

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Subcarrier frequency:	2400 Hz
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3.5. Characteristics of the IR image recording device:

Interaction index:	70
Scanning rate:	20 lines/min
Scanning density:	1 line/mm
Scanning direction:	Right to left
Number of grey levels:	At least 9
Size of image:	148 x 290 mm

4. DATA COLLECTION AND DISTRIBUTION

There is no collection and dissemination of DCP data from METEOR-3 satellites.

CHANGES IN HIGH RESOLUTION IMAGE DISSEMINATION - JAPAN WP 9

CGMS-XVII WP 9
Agenda Item: F.1.1
Prepared by Japan

COORDINATION OF DATA DISSEMINATION

Dissemination via Satellite

High Resolution Dissemination

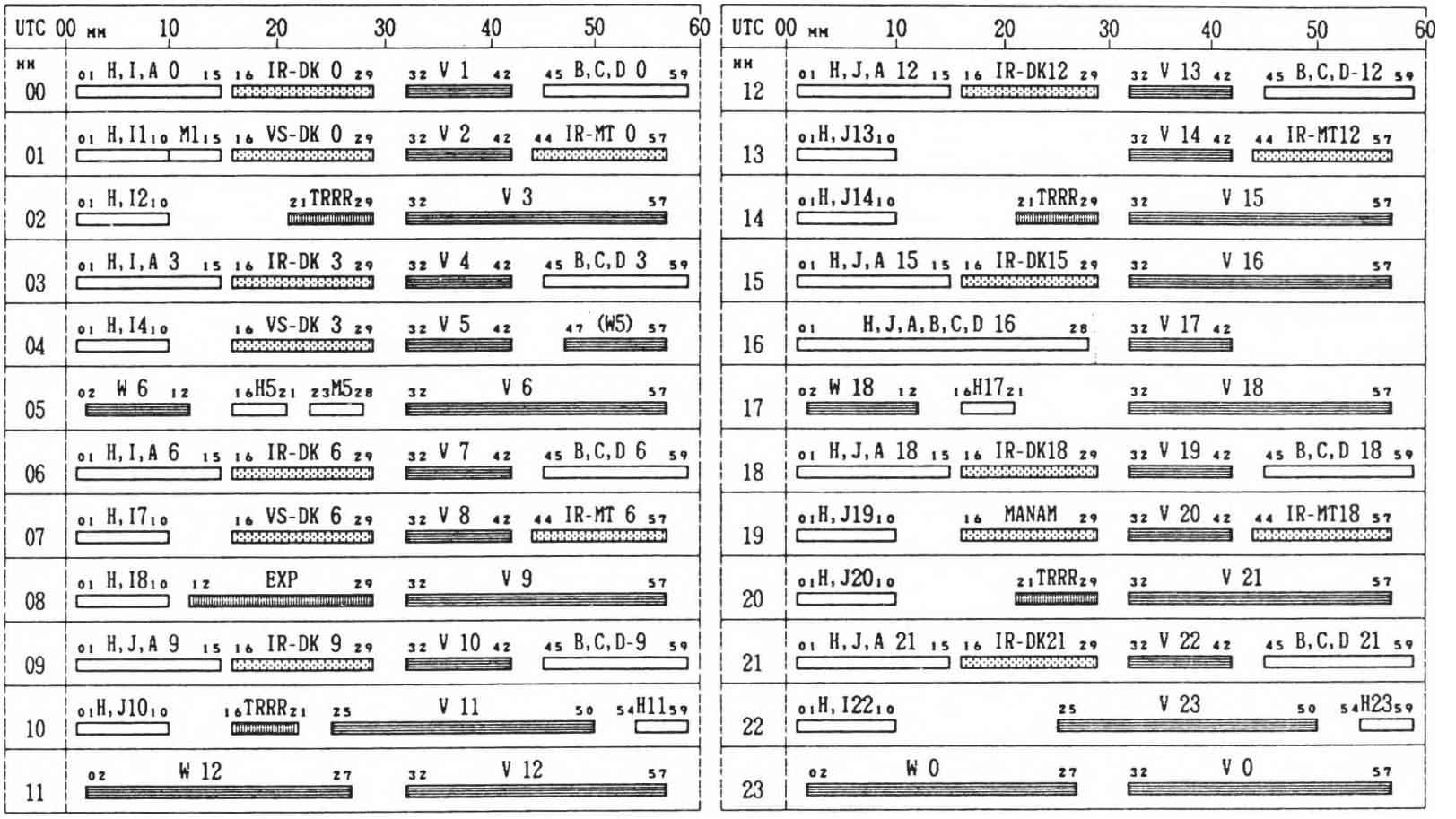
CGMS-XVII WP-9
Agenda Item: F.1.1
Prepared by Japan

Coordination of Data Dissemination

The stretched VISSR digital data dissemination has been carried out since March 1988. In WMO/RA II, there are 6 Members to have received HR-FAX. As of July 1988, 3 Members have received already the stretched VISSR data and the others are now under preparation.

From January 1989, full disk VISSR observation will be carried out for all observations and HR-FAX dissemination via GMS will be discontinued. In case of system maintenance (02UT) and 15 minutes interval special typhoon observation (05UT), full disk VISSR observation will be changed to northern hemisphere observation.

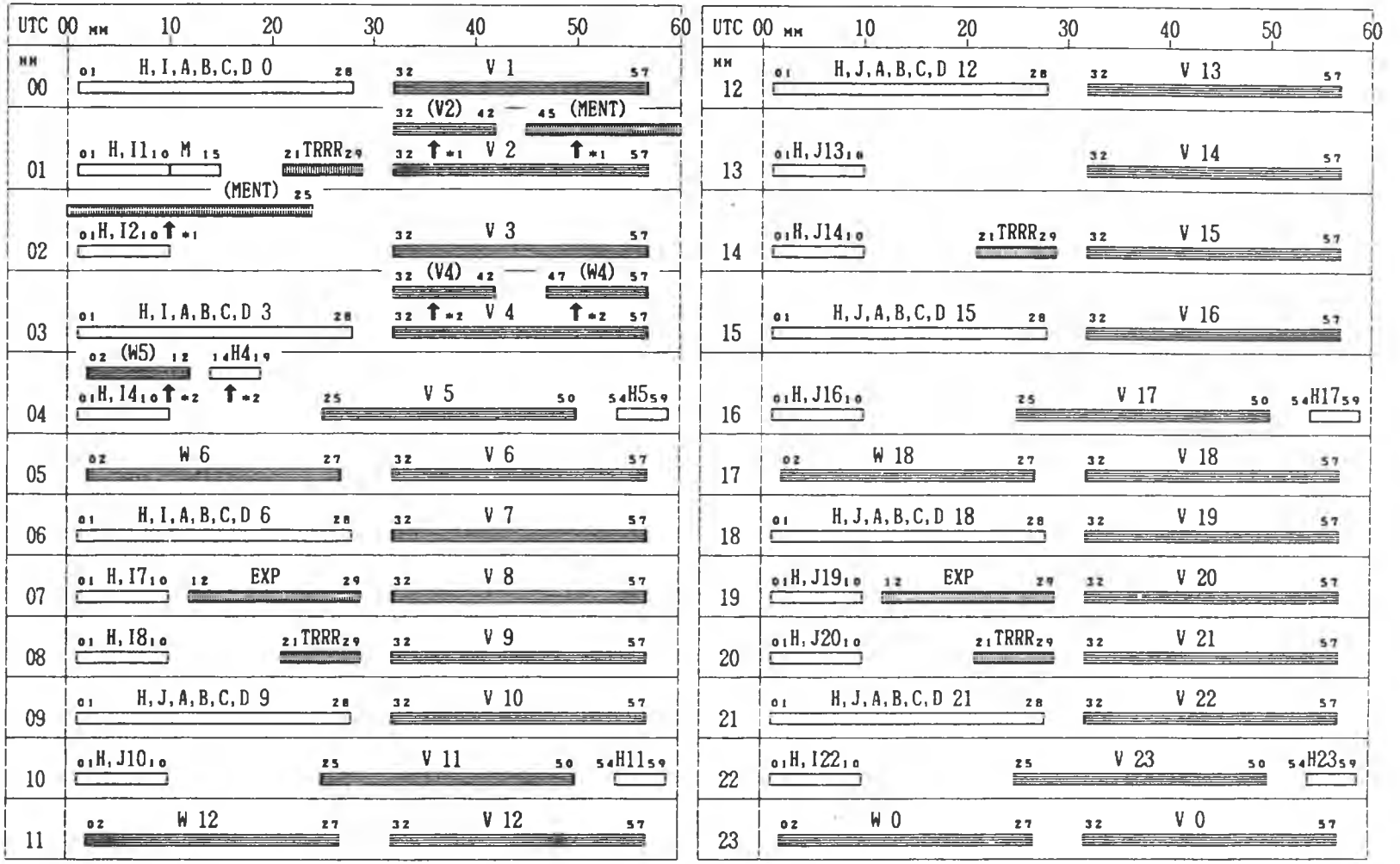
The current observation and dissemination schedule and the new schedule as from January 1988 are shown in Fig. 1 and Fig. 2 respectively.



ABBREVIATIONS:

VISSR OBSERVATION ----- V:REGULAR VISSR OBSERVATION, W:VISSR OBSERVATION FOR WIND EXTRACTION,
V5-(W5)-W6:15 MINUTES INTERVAL SPECIAL TYPHOON OBSERVATION.
HR-FAX DISSEMINATION -- IR:INFRARED, VS:VISIBLE, DK:DISK, MT:MERCATOR, MANAM:MANUAL AMENDMENT
WEFAX DISSEMINATION --- H,I,J:POLAR-STEREO AROUND JAPAN, A,B,C,D:FOUR SECTORIZED IR DISK, M:MANAM
OTHERS ---------- TRRR:TRILATERATION RANGE AND RANGE RATE, EXP:VISSR EXPANDED MODE.

Fig. 1 GMSS SCHEDULE (HR-FAX & SV OPERATION, ~ DEC. 1988)



ABBREVIATIONS:

VISSR OBSERVATION ----- V:REGULAR VISSR OBSERVATION, W:VISSR OBSERVATION FOR WIND EXTRACTION, (V4)-(W4)-(W5):15 MINUTES INTERVAL SPECIAL TYPHOON OBSERVATION.

WEFAX DISSEMINATION --- H,I,J:POLAR-STEREO AROUND JAPAN, A,B,C,D:FOUR SECTORIZED IR DISK, M:MANAM

OTHERS ---------- TRRR:TRILATERATION RANGE AND RANGE RATE, EXP:VISSR EXPANDED MODE, MENT:SYSTEM MAINTENANCE.

↑*1 IN CASE OF SYSTEM MAINTENANCE, V2 WILL BE CHANGED TO NORTHERN HEMISPHERE OBSERVATION.

↑*2 IN CASE OF 15 MINUTES INTERVAL SPECIAL TYPHOON OBSERVATION, V4 WILL BE CHANGED TO NORTHERN HEMISPHERE.

Fig. 2 GMSS SCHEDULE (SV FULL OPERATION, JAN. 1989 ~)

FURTHER IDEAS ON DIGITAL WEFAX - EUMETSAT WP 8

CGMS-XVII EUM-WP 8
Prepared by EUMETSAT
Agenda Item: F1.4

DISSEMINATION VIA SATELLITE

FURTHER IDEAS ON DIGITAL WEFAX

Introduction

The WEFAX standard used for the transmission of images and graphical information is one of the most successful and oldest standards applied in the meteorological community. The standard is based on the Automatic Picture Transmission (APT) service which was first used onboard American ESSA spacecraft in the early 1960's. The APT standard was developed for direct broadcast from polar orbiting spacecraft. WEFAX was an extension of this standard for the use on geostationary satellites and cable networks.

The original APT format was extended by start, stop, and phasing signals. Fixed length WEFAX formats were defined and internationally adopted.

With little technical variations the WEFAX standard is presently used by all operators of meteorological satellite systems.

The biggest advantage of the system was given by the simple analogue modulation techniques which enabled the production of low cost reception stations and allowed easy operations of these stations. The chosen transmission rate allowed the use of very small antennae which resulted in easy tracking of the satellite and avoided the need of autotracking facilities.

Originally the WEFAX standard was developed for user stations equipped with hardcopy units. The WEFAX products were used for visual applications only.

The advent of powerful microcomputer systems with image processing and display capabilities changed the character of WEFAX User stations. The role of the hardcopy recorder as the main output instrument was taken over by black and white or colour video screens, the storage media were floppy and hard discs instead of analogue tape recorders.

The availability of WEFAX information in digital form created the requirement to use the information numerically for quantitative applications including calibration of data. This operations mode indicated the shortcomings of the existing WEFAX standard, mainly given by the analogue modulation which was applied.

First discussions were started to introduce an international standard for digital WEFAX transmissions. The following sections contain some initial ideas from EUMETSAT on this subject.

Basic Considerations

In order to guarantee the availability of low cost User stations for digital WEFAX, the following basic items should be considered:

- Digital WEFAX should become an international standard
- The standard should make use of existing international standards in telecommunications and data processing wherever possible
- The antenna size of User stations should not exceed a diameter of 2 m (desirable would be antenna sizes between 1 and 1.5 m)
- Packetized transmission techniques should be applied to allow the sequential transmission of data of various origin
- Forward error correction algorithms should be applied to improve the link quality

Technical Baseline

Frames

All data should be transmitted in data packets corresponding to an international standard. The most suitable standard with the maximum distribution is given by the OSI model. HDLC type frames could be used for the sequential transmission of the various data. Fields like "opening flag"," closing flag", control, and information fields could be used in the standard way, the address field could be used to indicate the type of data. The "frame check sequence field" would indicate data failures within the frame.

The selection of HDLC would allow that all tasks like formatting, generation of flags, frames and check sequences, zero insertion etc could be performed by commercially available large integrated circuits.

The frame size should be selected in such a way that there is a relation between line and frames. This does not automatically imply that the information of one image line has to be transmitted within one HDLC frame. Several frames could be used to transmit one image line information.

The frame size has to be determined as a trade off between the most effective data transmission and the acceptable loss of information before resynchronisation.

Formats

To allow for the time bit synchronisers need to acquire data each format should start with a sequence of opening flags.

After completion of this sequence the address field would be sent. This field would indicate which type of data is contained in the following information field.

The control field should be used as a frame counter.

The information field should contain the actual data, i.e. image, alphanumeric, or graphical data.

HDLC frames include a frame check sequence which is transmitted after the information field. All available HDLC processing equipment is able to decode this polynom automatically.

All frames should be concluded by the closing flag which is identical to the opening flag. Between consecutive frames the closing flag could be used as the opening flag of the next frame.

Data to be transmitted

The following data should be transmitted via digital WEFAX:

- Image Data of various spacecraft
- Alphanumeric Data (DCP, calibration figures, atmospheric soundings, cloud track wind data, sea surface temperatures, selected GTS type data etc)
- Grid and Coastline Information

Image Data

All image data frames should contain header information describing the content of the frame i.e. information on the geographical sector, pixel resolution, spectral band indication, etc.. This header information would enable the User to select on preprocessor level only frames which contain information of his individual interest.

Alphanumeric Data

Alphanumeric data frames should contain meteorological data (selected SYNOPS, TEMPS etc), DCP data, calibration figures, administrative messages,atmospheric soundings, cloud track winds, sea surface temperatures etc

Grid and Coastline Information

Grid and Coastline information should be transmitted separately to image information. This will enable the User to select only information of his interest and allows the replacement of this information by special User related files.

In case of transmissions of rectified image data it should be discussed whether regular transmission of grid and coastline information is necessary.

Data rate

It would be recommended to transmit all data at a rate of

64 kbit/sec

This is a standard transmission rate and would allow the use of commercial equipment.

As an example the transmission time for an image frame of 1024 x 1024 x 8 bits would be in the order of 2.5 minutes (including overhead).

Modulation

There are several candidates for the modulation of digital WEFAX information. The most suitable schemes seem to be

PCM/NRZ/BPSK or

PCM/NRZ/QPSK

Detailed studies on the relation between the selected modulation scheme, the available bandwidth, the power constraints and the acceptable User station front end specifications have to be performed before a final decision on the selected modulation scheme could be taken.

Forward Error Correction

Forward Error Correction should be applied on digital WEFAX transmissions. The addition of a Reed Solomon or Viterbi FEC will add approximately 20 % overhead to the data, but will increase the link quality in such a way that the original station design would have to cater for a bit error rate of 10 E-4 only. The FEC would improve in this case to a BER of 10 E-6 or even 10 E-7. The actual transmission rate to obtain a net data rate of 64 kbit/sec would therefore be around 76 kbits/sec.

User Station Layout

With the given spacecraft performance data a BER of 10 E-4 could be obtained for a data rate of 76 kbit/sec by a User station with a G/T figure similar to the present one for METEOSAT Secondary Data User Stations (G/T = 2.5). This would allow the use of fixed antenna with diameters less than 2 m.

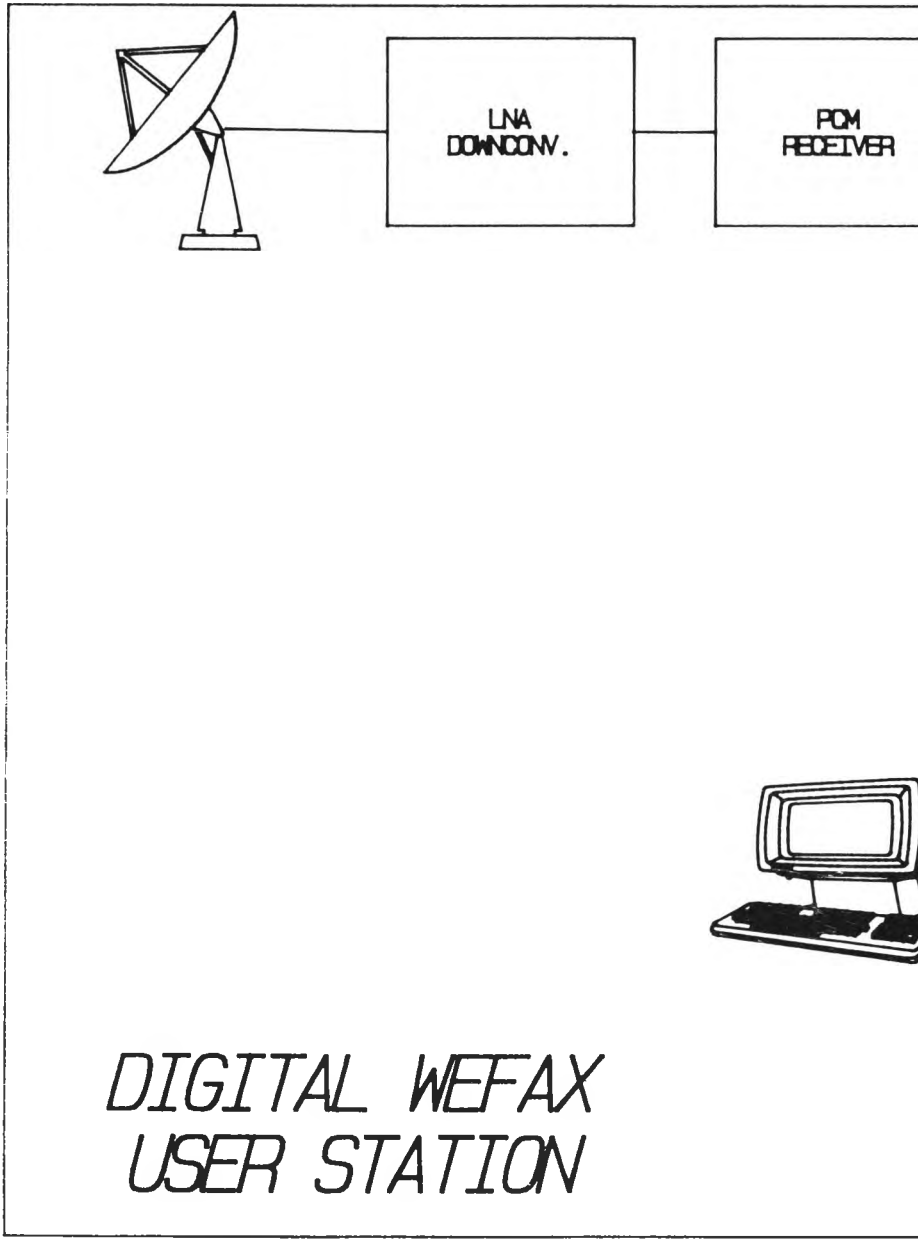
Although commercial receivers for the recommended modulation types are available it would be recommended to develop special WEFAX PCM-receivers with demodulators for BPSK or QPSK and suitable bit synchronisers or preprocessors. The reproduction costs of these digital WEFAX receivers should be slightly higher than commercial FM receivers as used for present WEFAX receptions.

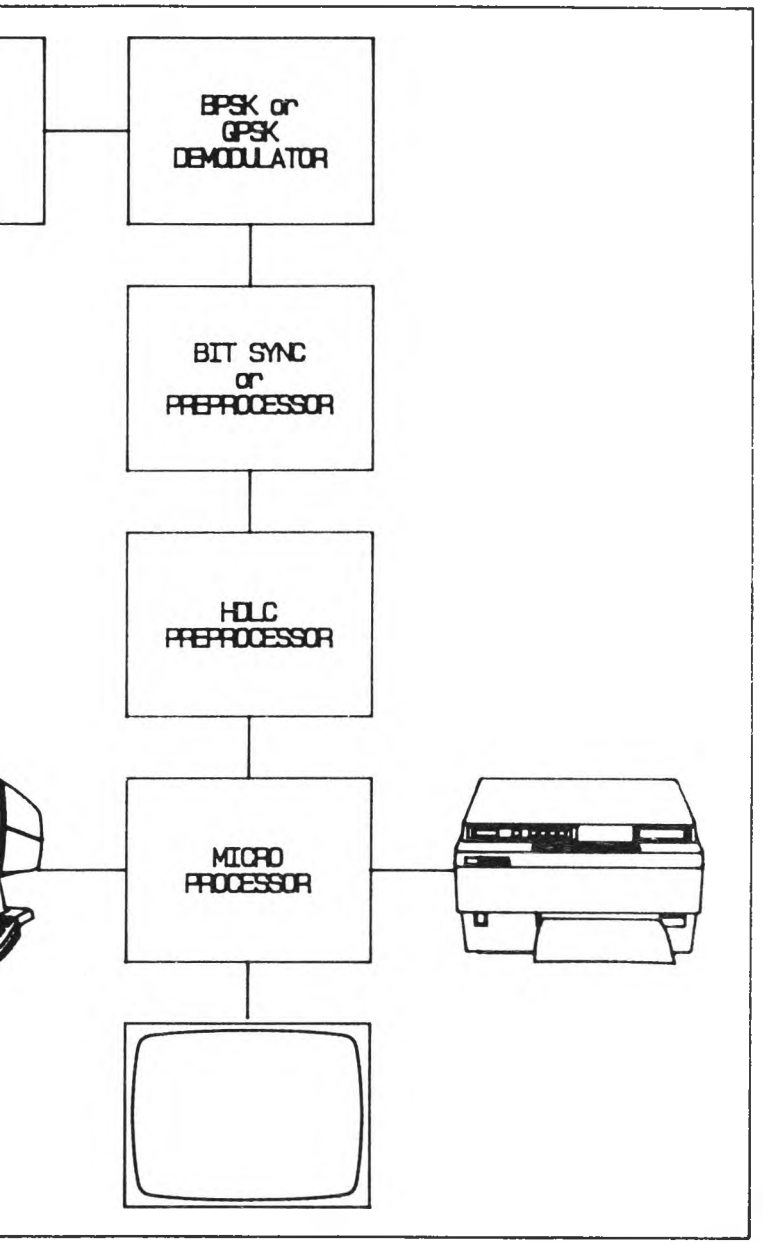
Present WEFAX satellite receiving stations could be modified by replacing the receiver/demodulator and by the addition of bit synchroniser and preprocessors. FEC and HDLC processors are commercially available. The processing part of existing WEFAX stations could be maintained and, if required, extended by additional hardware and software to cope with the higher data rate and additional information.

Strategy

If the basic specifications for digital WEFAX could be agreed, the development of User station modules like receiver, demodulator, and bit synchroniser should be jointly contracted. The same could apply for User station software packages to be operated on standard hardware.

Digital WEFAX could then be introduced in parallel to present WEFAX by making use of transmission capacity in a time sequential mode. After an introduction period the analogue WEFAX should be gradually reduced and digital WEFAX at the same time extended.


LNA
DOWNCONV.
PCM
RECEIVER
DIGITAL WEFAX
USER STATION


BPSK or
QPSK
DEMODULATOR
BIT SYNC
or
PREPROCESSOR
HDLC
PREPROCESSOR
MICRO
PROCESSOR

EUMETSAT

THE METEOSAT METEOROLOGICAL DATA DISTRIBUTION (MDD) MISSION - EUMETSAT WP 10

CGMS-XVII EUM-WP 10
Prepared by EUMETSAT
Agenda Item: F.3

The Meteorological Data Distribution (MDD) Mission of METEOSAT

1. The " Meteorological Data Distribution (MDD)" Mission

The " Meteorological Data Distribution (MDD)" mission is a new capability incorporated in the METEOSAT Operational Programme satellites to be flown from 1989 onwards. The mission implementation is scheduled for July 1989.

At the initial stage of the mission two ground stations, one in Rome (Italy) and another in Bracknell (UK), will be operated. Both stations transmit meteorological information to the satellite. The satellite transponds this information to small User stations.
More uplink stations could be implemented at a later time.

The service is primarily oriented to the needs of national meteorological services in Africa and the Near East.

Data are transmitted via up to four discrete transmission channels at a rate of 2400 bit/sec per channel.

The data set to be disseminated via MDD channels consists of meteorological information in form of alphanumeric characters, bit oriented data streams, and graphical information.

2. The MDD Payload

The transponder making up the MDD payload can be considered as an extension to the METEOSAT dissemination system and as such it uses the same amplifier as The one used for the dissemination of digital and analogue data towards METEOSAT User stations for image dissemination services.

The original MDD concept did allow the simultaneous broadcast of 12 data channels. In order to allow the design of low cost stations the available frequency band for MDD has been split into four channels of 30 kHz each. The channels have been separated within the transponder band in such a way that a minimum of interference between the channels can occur.

The transponder will operate simultaneously with the image dissemination utilizing the electronically despun antenna (EDA), hence the radiated power is shared between the two services. This power sharing will not have any effect on the performance of Primary Data User Stations (PDUS) and Secondary Data User Stations (SDUS) which meet the requirements for merit factor for the METEOSAT System specifications. These merit factors are

PDUS 10.5 dB/deg Kelvin

SDUS 2.5 dB/deg Kelvin.

The figure for MDD User Stations is:

MDD 6.0 dB/deg Kelvin.

The coverage area is expected to be approximately 78 degrees from the sub-satellite point at 0 degrees longitude and 0 degrees latitude.

The mission performance specification calls for 95% availability of the data link for User stations located at or within the 5 degree elevation contour.

3. MDD User Station Design

The basic MDD User Station consists of

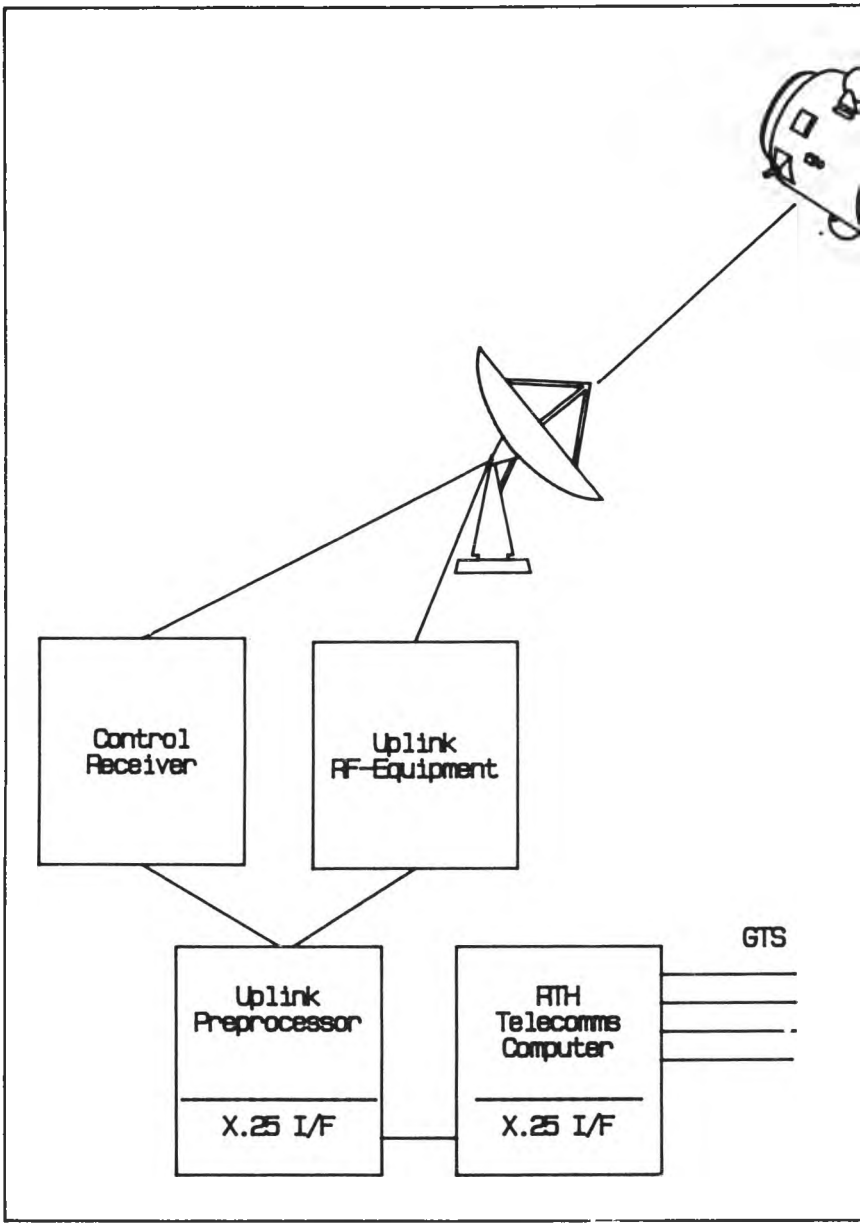
- Antenna (appr. 2m diameter)
- Low Noise Amplifier
- Downconverter
- PM Receiver and Demodulator
- Bit Synchronizer
- HDLC Frame Preprocessor
- Microcomputer
- Display Unit
- Printer
- Facsimile Hardcopy Unit

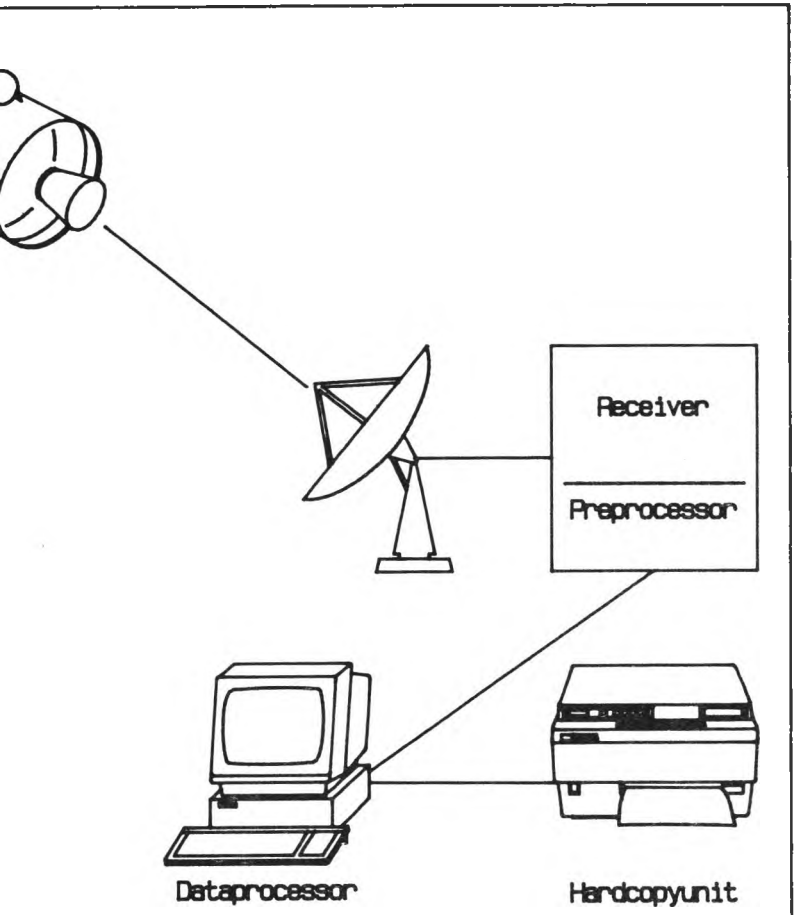
3.1 Antenna

The required merit figure G/T of 6 dB/Kelvin can be accomplished by usage of a parabolic antenna of approximately 1.8 to 2.4 m diameter with a linear polarized feed suitable for the MDD frequency band. The selection of the antenna size depends on the quality of the following front-end equipment and the location of the User station within the METEOSAT field of view.

Due to the fact that the MDD mission frequency band (1695.6938 to 1695.7874 MHz) is very close to the image dissemination frequencies (1691 and 1694.5 MHz) it is possible to share antenna and feed with existing SDUS and PDUS stations if the required merit figure can be satisfied.

The antenna pointing mechanism has to cover elevations from approximately 2 up to 90 degrees.


Control
Receiver
Uplink
RF-Equipment
Uplink
Preprocessor
X.25 I/F
RTH
Telecomms
Computer
X.25 I/F
GTS



MDD MISSION

EUMETSAT

ESTIMATION OF OCEAN SURFACE WIND FOR A TYPHOON FROM GMS CLOUD MOTION WINDS - JAPAN WP 15

CGMS-XVII WP-15
Agenda Item: H.1
Prepared by Japan

COORDINATION OF METEOROLOGICAL PARAMETER EXTRACTION

Satellite Winds

Estimation of Ocean Surface Wind for a Typhoon
from GMS Cloud Motion Wind

CGMS-XVII WP-15
Agenda Item : H.1
Attachment
Prepared by Japan

Estimation of Ocean Surface Wind for a Typhoon from GMS Cloud Motion Winds (Summary)

September 1988

Takashi Ohshima, Hiroyuki Uchida and Tadaaki Hamada
Meteorological Satellite Center, Kiyose, Tokyo
Shingo Osano
Japan Meteorological Agency, Chiyoda-ku, Tokyo

1. Introduction

A method of estimating ocean surface winds for a typhoon using the cloud motion winds derived from short-time interval images has been developed at Meteorological Satellite Center (MSC) of JMA.

The ocean surface wind in a typhoon area is one of the most important data of ship's safe sailing, and the most useful data when the Forecast Department of JMA issues the tropical cyclone forecast, warning and advisories. The ship reports and the radiosonde winds observed by stations on islands have been mainly used to estimate the ocean surface wind for a typhoon. However, those data are mostly available along ship routes and the islands.

The cloud motion winds from satellite images are useful source in the data sparse area over the ocean. If the low-level cloud motion winds can be used to estimate the wind field of a typhoon, it is expected to contribute to a better issue of the tropical cyclone forecast, warnings and advisories.

In order to use the cloud motion winds in a typhoon area, it should be considered that ; (a) number of the low-level cloud motion winds derived routinely is not sufficient to analyze the wind field for a typhoon and (b) conventional method of estimating the surface winds from the low-level cloud motion winds is not established in a typhoon area It has been investigated to solve these problems.

2. High Density Derivation of the Low-level Cloud Motion Wind from the Short-time Interval GMS Images.

The cloud motion winds are derived routinely using 30-minute interval sequential images from GMS at MSC. However, it is difficult to derive automatically the low-level cloud motion winds from 30-minute interval images in a typhoon area, because the low-level target clouds are liable to be covered by the cirrus and change considerably their shape in a typhoon area.

In order to increase the number of the low-level cloud motion winds in a typhoon area, thirteen sets of the short time interval images were taken

for seven typhoons in 1987 typhoon season. The low-level cloud motion winds for a typhoon were derived automatically from 7.5-minute, 15-minute and 30-minute interval images and three data sets in each different time intervals were produced. Examples of the derived winds in the typhoon area are shown in Fig.1. Each two sets among them were compared respectively.

It was found that the low-level cloud motion winds derived from the shorter time (7.5 or 15 minutes) interval images have more advantages than those from 30-minute interval images. The shorter time interval images make it possible ;

(a) to derive the low-level cloud motion winds in the nearer area of the typhoon center,
(b) to provide large number of the low-level cloud motion winds in the typhoon vicinity, and
(c) to express the ocean surface wind profile as a function of a distance from the typhoon center (Fig.2).

Moreover, it was indicated that the derived winds did not change their characteristics according to the different time intervals. Furthermore 15-minute interval imaging is suitable to be routinely used to derive the low-level cloud motion winds for a typhoon, because 15-minute interval imaging is not necessary to change the position of imaging according to a typhoon location and by other reasons.

3. Method of Estimating the Ocean Surface Wind from the Low-level Cloud Motion Winds

It has been generally shown that the low-level wind estimated from tracking a cumulus cloud represents the environmental wind at the height of its cloud-base.

Because the sample number of the winds derived automatically from the short time interval images described in previous section was not sufficient to compare with the ship observed winds, the low-level cloud motion winds were manually derived by analysts from 30-minute interval images which were used for routine wind derivation. Forty-three data sets of the low-level cloud motion winds were produced in the typhoon area, and were compared with the nearby ship observed winds.

These comparisons were carried out on the relative direction of winds (Fig.3(b)) and on speed as a function of a distance from typhoon center. It was found that ;

(a) the mean direction of the ship observed winds gets into the typhoon center about 30 degrees more than the cloud motion winds at the distance of 200km to 500km from the typhoon center (shown in Fig.3(a)), and

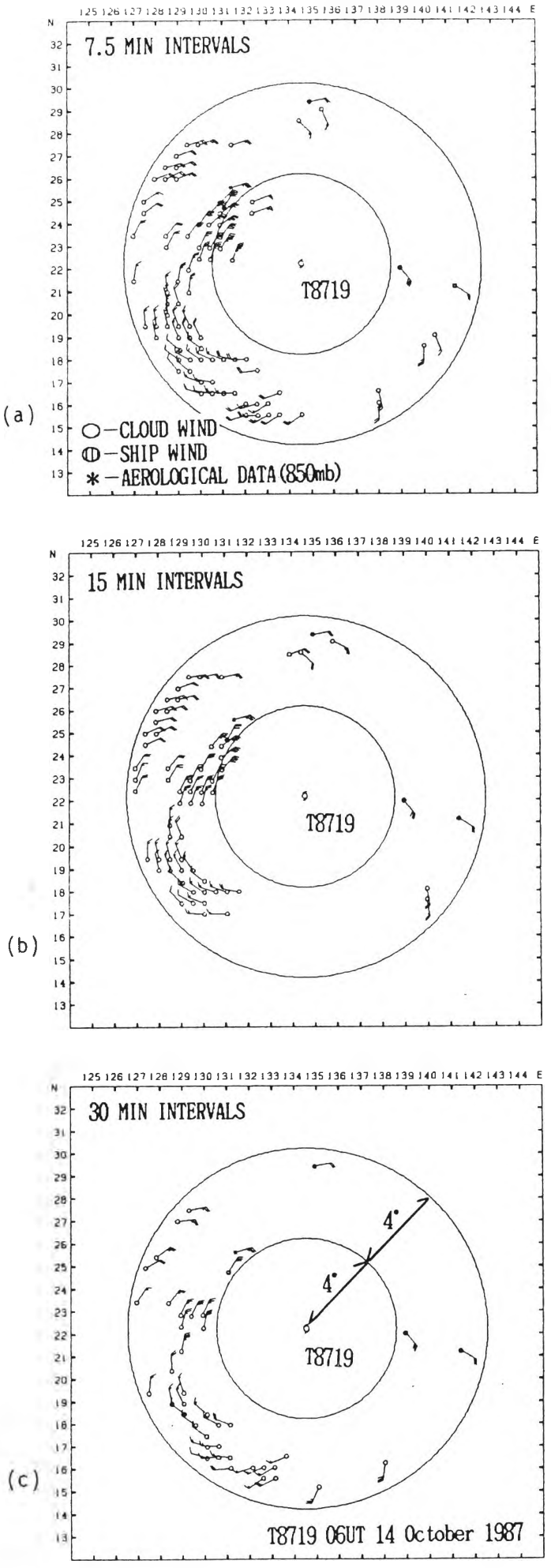
(b) the mean speed of the low-level cloud motion winds is almost a tenth again as fast as that of the ship observed winds at the distance of 300km to 700km from the typhoon center (shown in Fig.4).

These results show that the ocean surface wind can be estimated by correcting the cloud motion wind.

4. Conclusion

If the cloud motion winds for a typhoon are derived from the short time interval images, it is expected that a large number of them be derived automatically, and that ocean surface wind in the typhoon area be estimated from the cloud motion winds.

For further confirmation of the results described in this paper, the 15-minute interval imaging and the low-level cloud motion wind derivation have been routinely carried out whenever there is a typhoon in the western Pacific Ocean of the northern hemisphere in 1988 typhoon season.



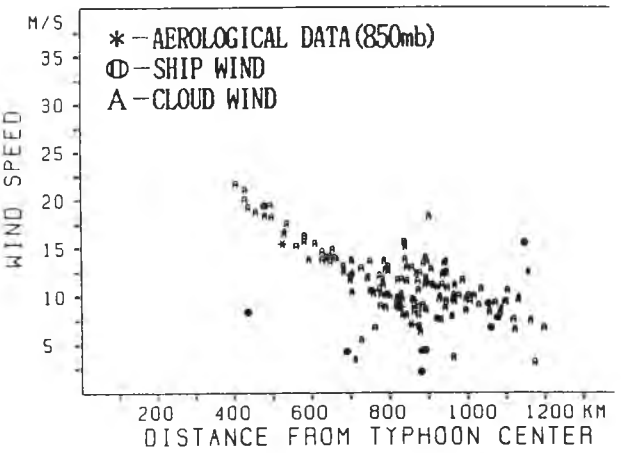


Fig. 2 The speed profile of the low-level cloud motion wind, the ship wind and the aerological wind as a function of a distance from the typhoon center.

The low-level cloud motion winds from the 15-minute interval images are plotted. The ship wind and the aerological winds are the same as in Fig. 1.

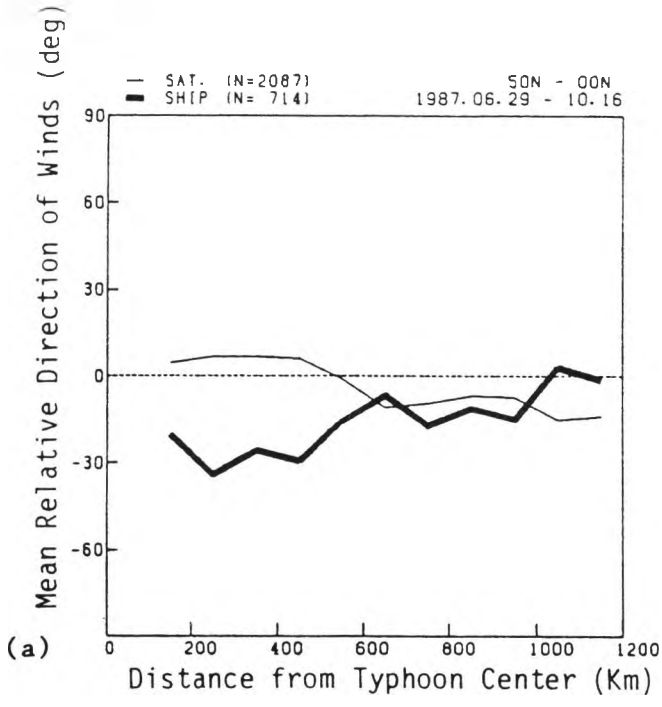
Fig. 1 The low-level cloud motion winds on 14 October 1987 for Typhoon Kelly, the ship wind and the aerological wind.

The ship winds and the aerological winds at 850mb level on 06 UT are used.

(a) The low-level cloud motion winds are derived from three consective images observed at an interval of 7.5-minute.

(b) Same as (a), except with an interval of 15-minute.

(c) Same as (a), except with an interval of 30-minute.



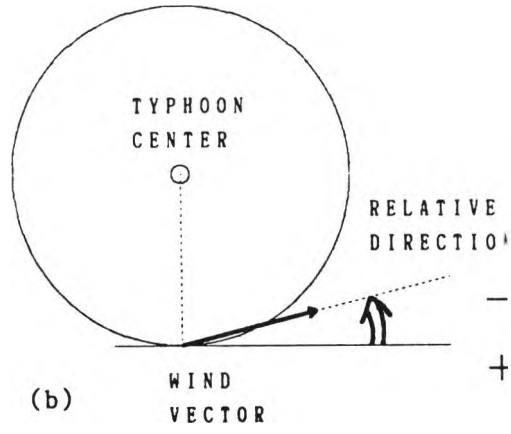


Fig. 3

(a) The mean 'relative direction (see Fig. 3(b))' of winds at interval of 100km from the typhoon center.

Thin line shows that of the low-level cloud motion winds and thick line that of the ship observed winds.

(b) Relative direction

This is a relative angle of the wind vector to the direction of the tangential line, drawing a circle round a typhoon center. The side which gets into the center of a typhoon at the base of tangential line is minus angle of direction.

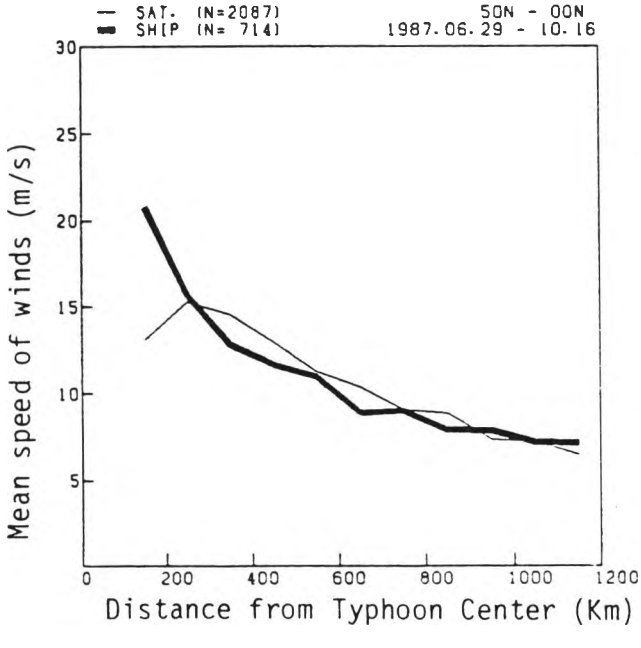


Fig. 4 Same as Fig. 3(a), but for the wind speed.

GMS METEOROLOGICAL PRODUCTS - JAPAN WPs 16, 17 AND 18

CGMS-XVII WP-16
Agenda Item: H.3
Prepared by Japan

COORDINATION OF METEOROLOGICAL PARAMETER EXTRACTION

Other Parameters

Status Report of GMS Meteorological Products

CGMS-XVII WP-16
Agenda Item: H.3
Prepared by Japan

Status Report of GMS Meteorological Products

MSC continuously produces several meteorological parameters from GMS VISSR data and NOAA data in regular basis. Products are listed in Table 1.

As concern to this table, product change with new computer system is described in CGMS XV Japan WP-17.

Contents of the products for domestic users in Table 1 are as follows.

Cloud Amount Data : Mean of the total, high-level and low-level cloud amount in 1°x 1° mesh.

Mean TBB Data : Mean and standard deviation of equivalent blackbody temperature (TBB) in 2.5°x 2.5° mesh.

Infra-red Mesh Data : Minimum TBB for whole area, cloud amount in five layers, mean and standard deviation of TBB for cloud area in 0.5°x 0.5° mesh.

Satellite Cloud Information Chart : Characteristics and temporal change of cloud distribution,TBB and other information.

Satellite Meteorological Analysis Information : Information for weather forecast (cloud distribution, characteristics and temporal change of cloud,etc.). Information on clouds of severe rain/snow fall.

Satellite-derived Index of Precipitation Intensity : Precipitation intensity estimated from GMS data

VTR of Image Movies : Infra-red image movie for cloud analysis.

VISSR Histogram Data : Histogram data calculated from VISSR infra-red/visible data in 0.25°x 0.25° mesh.

Cloud Mesh Data : Physical parameters (cloudy/open indices, mean of TBB and albedo, etc.) in 0.25°x 0.25° mesh.

Photographic Negative Film : IR and visible images for quality control of Satellite Cloud Information Chart and archive.

Sea-surface Temperature FAX : Enhanced picture for sea-surface temperature.

Sea-ice FAX : Enhanced picture for sea-ice detection.

NOAA Sea Surface Temperature Chart : Mean sea surface temperature map from NOAA data processing.

NOAA Sea Ice FAX : Enhanced picture for sea ice detection.

NOAA Vertical Sounding Data : Vertical temperature and humidity profiles.

Table 1 GMS METEOROLOGICAL PRODUCTS

Available on the GTS

PRODUCTS	OUTPUT FREQUENCY	DATA DISTRIBUTION
Cloud Motion Vectors	4 times/day	SATOB via GTS
Sea Surface Temperature	1 time/5 days and month	SATOB via GTS
Typhoon Analysis, center location (special hourly observation), typhoon intensity	8 times/day (24 times/day) 4 times/day	SAREP via GTS

For Domestic users

Cloud Amount Data	1 time/5 days, month and 3 months
Mean T_{BB} Data	1 time/5 days, month and 3 months
Infra-red Mesh Data	4 times/day
Satellite Cloud Information Chart	8 times/day
Sat. Meteor. Analysis Information	4 times/day and occasionally
Satellite-derived Index of Precipitation intensity	24 times/day in preparation
VTR of Image Movie	8 and 24 times/day
VISSR Histogram Data	8 times/day
Cloud Mesh Data	8 times/day
Photographic Negative Film	8 and 24 times/day
Sea Surface Temperature FAX	1 time/day
Sea Ice FAX	2 times/day
NOAA Sea Surface Temperature Chart	1 time/5 days
NOAA Sea Ice FAX	2 times/day
NOAA Vertical Sounding Data	2 times/day

For WMO/WCRP

ISCCP AC Data B1 and B2 Data	5 times/month 8 times/day
GPCP Data	1 time/5 days

CGMS-XVII WP-17
Agenda Item: H.3
Prepared by Japan

COORDINATION OF METEOROLOGICAL PARAMETER EXTRACTION

Other Parameters

Satellite-derived Index of Precipitation Intensity

CGMS-XVII WP-17
Agenda Item: H.3
Prepared by Japan

Satellite-derived Index of Precipitation Intensity

MSC has been developing a technique to estimate precipitation intensity from GMS data. The value estimated is called Satellite-derived Index of Precipitation Intensity (SI).

In advance, several look-up tables are calculated based on the regression analysis of GMS data and digital radar reflectivity data. Detailed technique is reported in CGMS XV Japan WP-14.

After GMS raw data is converted to 5km x 5km grid value fully covering Japanese Islands (see Figure 1), the SI is calculated referring to the look-up tables. The SI is disseminated to the Forecast Division of JMA within a few minutes after the GMS observation and is utilized for short-range forecast of precipitation as supplemental data outside of the effective radar coverage.

The SI will be started in hourly operational basis from March 1989.

CGMS-XVII WP-18
Agenda Item: H.3
Prepared by Japan

COORDINATION OF METEOROLOGICAL PARAMETER EXTRACTION

Other Parameters

Cloud Amount Anomaly Chart

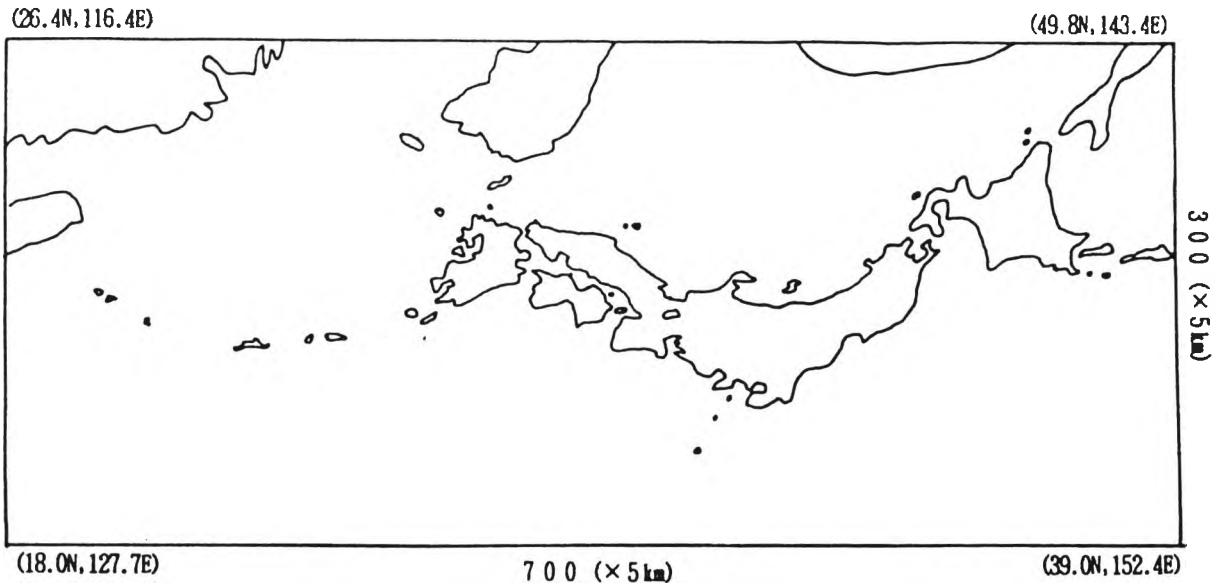


Figure 1 The calculated area of the SI consists of 700 x 300 grids. Grid interval is 5km everywhere.

CGMS-XVII WP-18
Agenda Item :H.3
Prepared by Japan

CLOUD AMOUNT ANOMALY CHART

This is a new product aiming to monitor the climate system. MSC produces three kind of high cloud anomaly charts in the period of 5-day, monthly and 3-monthly by using GMS infrared data. Those charts has been disseminated in quasi-real-time via land line since July 1988 and has imparted a reliable information for various range forecasts.

The derivation of normal is shown in Attachment.

Caption

Fig. 1 As a sample, high cloud monthly mean anomaly chart for January 1983 in the most remarkable El Nino period in our own century is shown. It is well indicated that active convective area in the tropics shifts from the western Pacific to the central Pacific with the degeneration of the Walker circulation.

TCPA33 RJTD
JAN01-JAN30, 1983

GMS HIGH CLOUD AMOUNT

MONTHLY MEAN ANOMALY : (%)

JAPAN METEOROLOGICAL SATELLITE CENTER

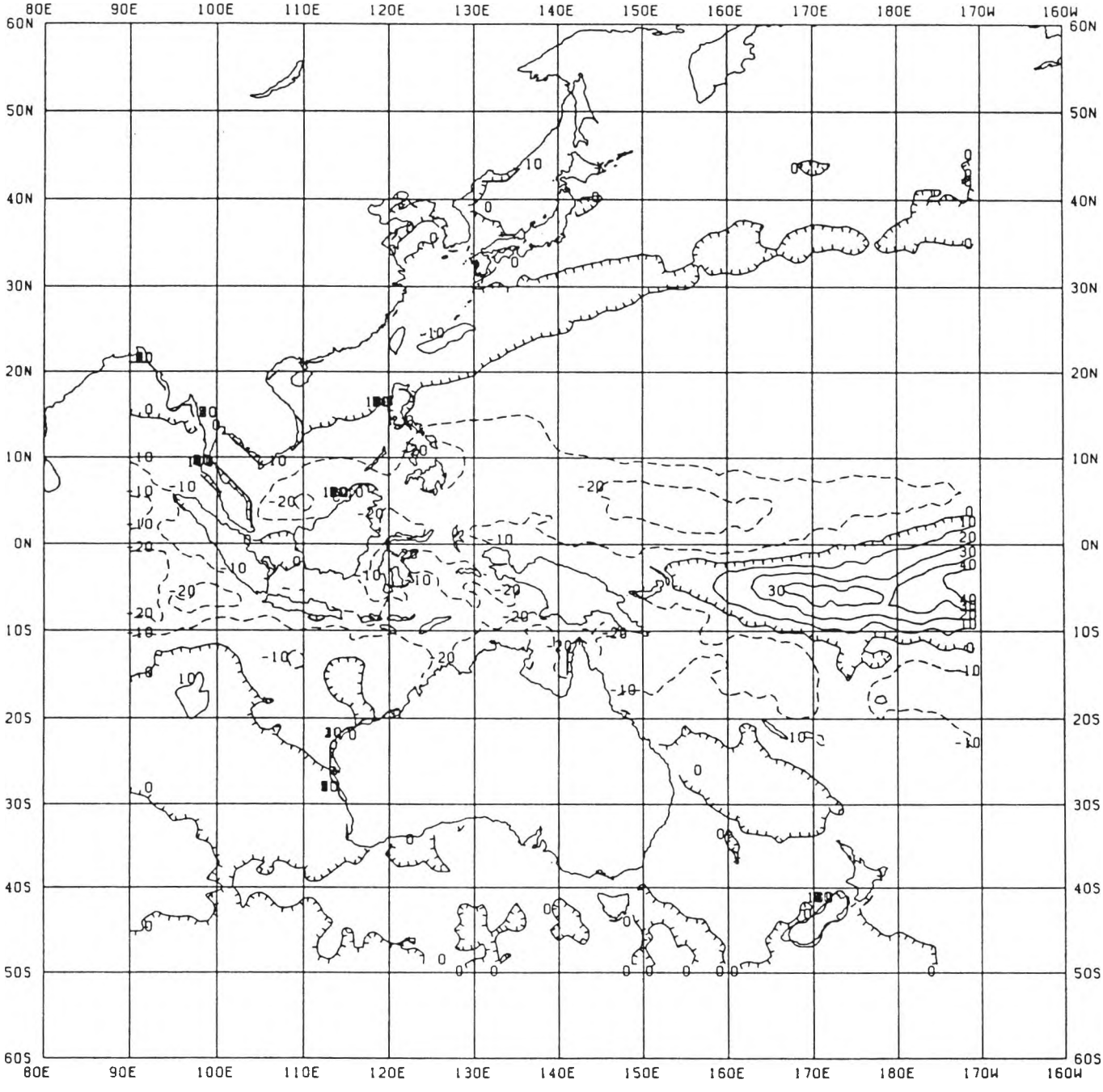


Fig. 1

CGMS-XVII WP-18
Attachment
Agenda Item: H.3
Prepared by Japan

DERIVATION OF CLOUD AMOUNT NORMAL CHART

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1. INTRODUCTION

Recently special attention has been paid to the utilization of satellite data from climatological point of view and MSC is equipping some climatological data sets to watch the climate system such as fluctuation of convective activities in the tropics associated with El Nino and Southern Oscillation (ENSO). On a part of the plan, MSC has made cloud amount normal charts by using GMS data for nine years in early summer 1988 as follows.

2. METHOD

The data to derive normals are 5-day average cloud amount based on 6-hourly infrared data produced routinely in MSC. It contains high (< 400mb), low (> 400mb) and total cloud amount at 1x1 (lat./long.) grid points in the area between 50N and 49S, and 90E and 171W except over land for the periods from Feb. 1978 to Feb. 1987.

To begin with, mean cloud amounts for nine years are calculated at each grid and pentad. The time series of average has large fluctuation with short period due to its own discontinuous nature, so these are inappropriate for normals as it stands (Fig. 1).

Thus, the average are made smooth by Fourier method at each grid for the time series. Spatial distribution of the amplitude of each component is investigated to decide useful components to compose. As a result, 5-day normals are calculated by composing components with a periodic time longer than two months to represent obviously middle latitude frontal cloud band such as Baiu-front (Fig. 1).

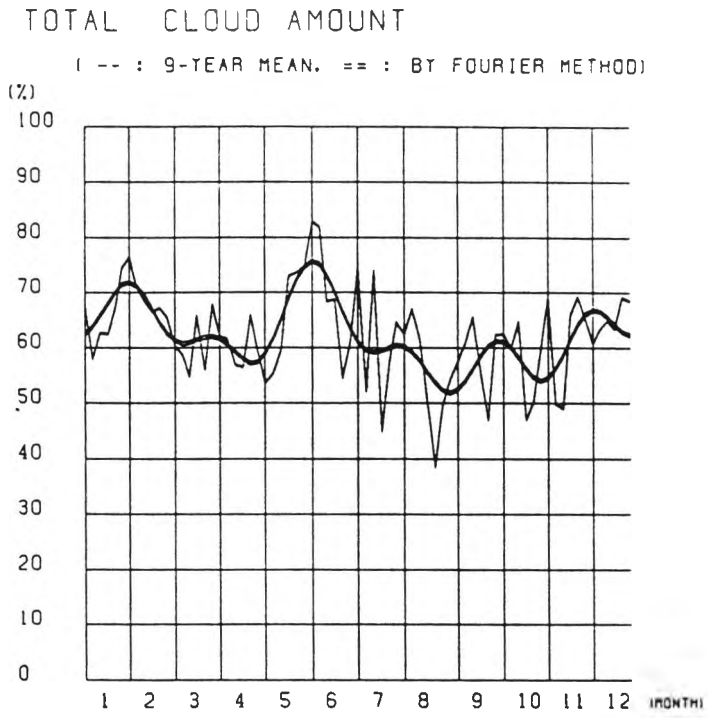
Monthly and 3-monthly normals are the average of 5-day normals for a month and three month respectively (Fig. 2).

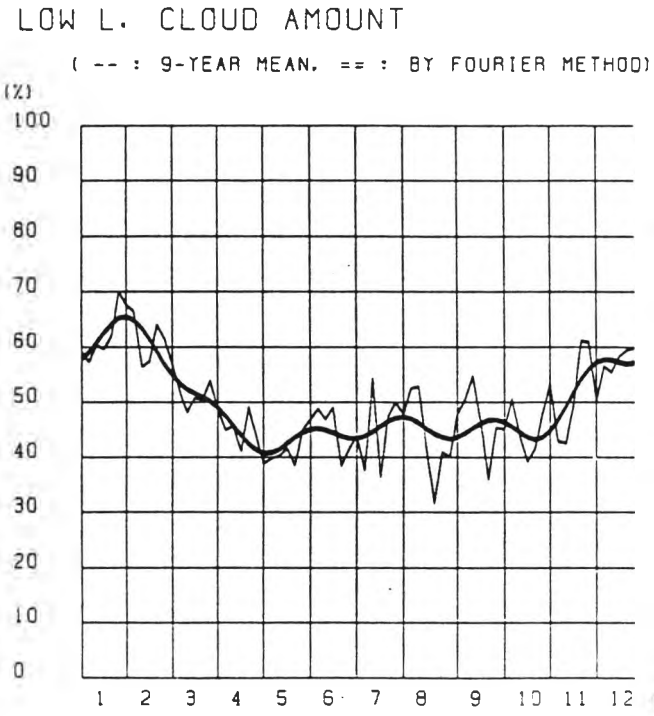
Captions

Fig. 1: The time series of mean cloud amount for nine years (solid line) and composite cloud amount by Fourier method (bold line).

Fig. 2 (a)-(l): High cloud monthly mean normal charts.

LATITUDE = 30 N
LONGITUDE= 140 E





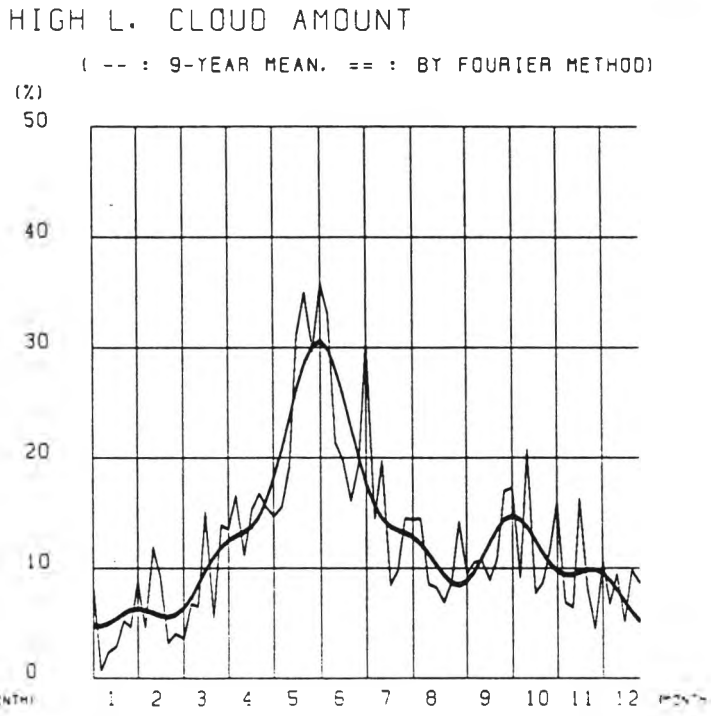
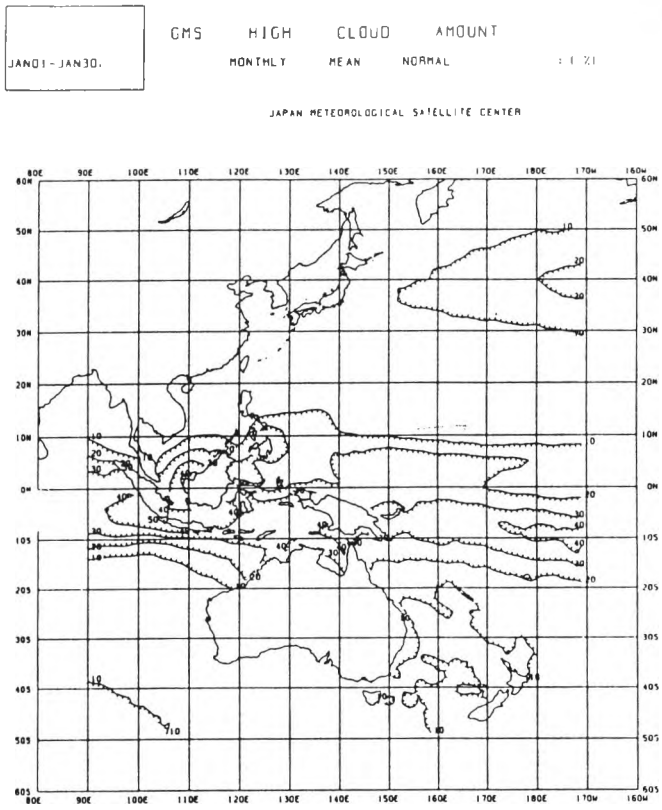
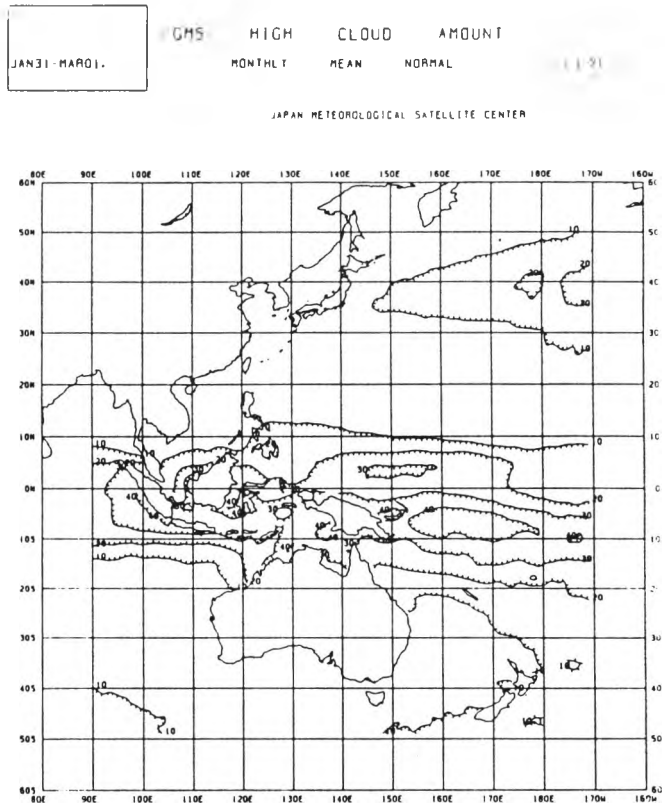


Fig. 1


JAN01-JAN30.
GMS HIGH CLOUD AMOUNT
MONTHLY MEAN NORMAL
JAPAN METEOROLOGICAL SATELLITE CENTER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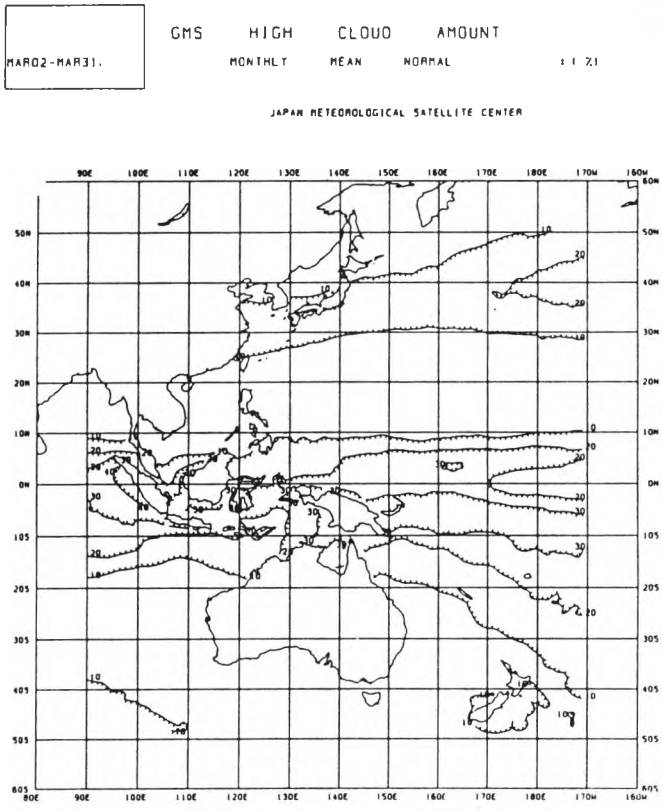
GMS HIGH CLOUD AMOUNT
MONTHLY MEAN NORMAL
JAPAN METEOROLOGICAL SATELLITE CENTER


MAR02-MAR31.
GMS HIGH CLOUD AMOUNT
MONTHLY MEAN NORMAL
JAPAN METEOROLOGICAL SATELLITE CENTER

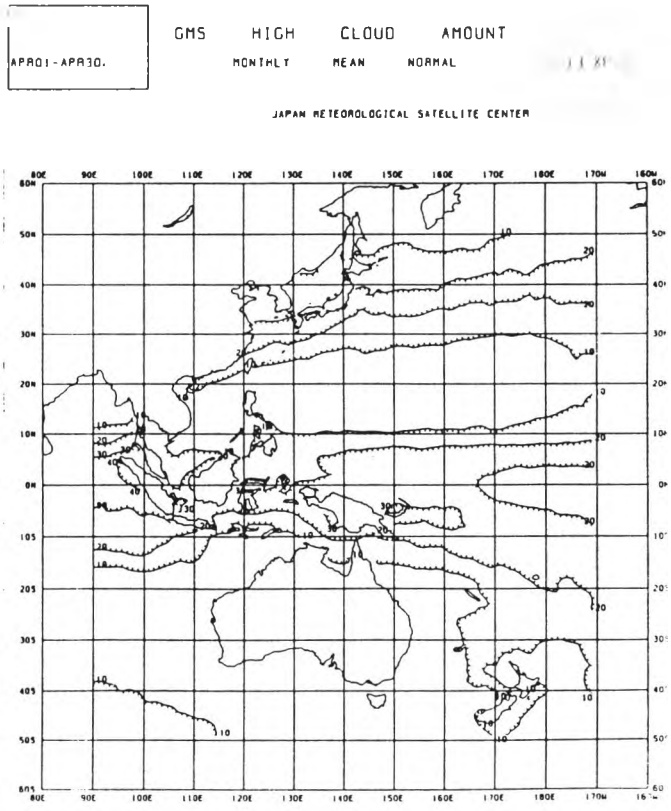
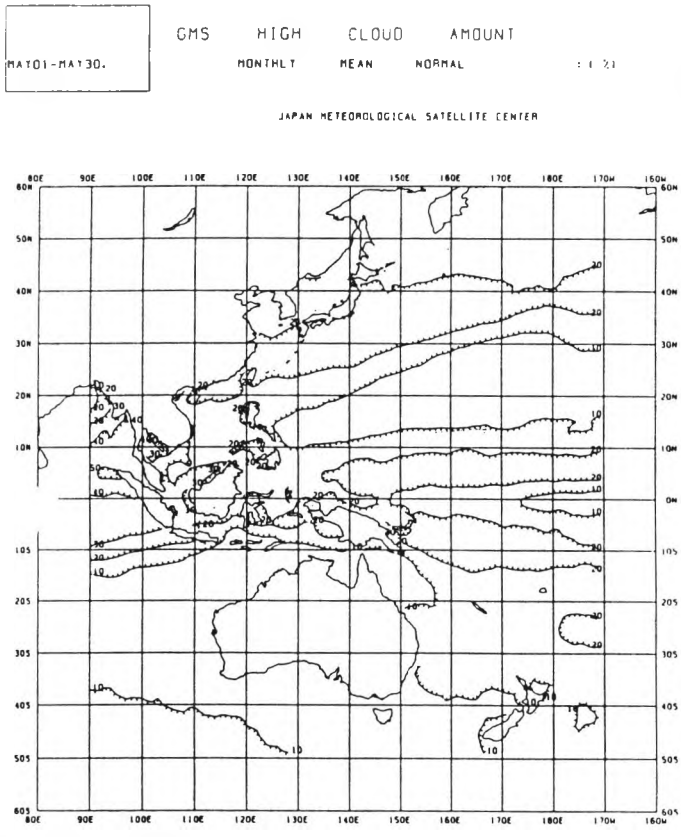

APR01-APR30.
GMS HIGH CLOUD AMOUNT
MONTHLY MEAN NORMAL
JAPAN METEOROLOGICAL SATELLITE CENTER

Fig. 2 (a),(b),(c),(d)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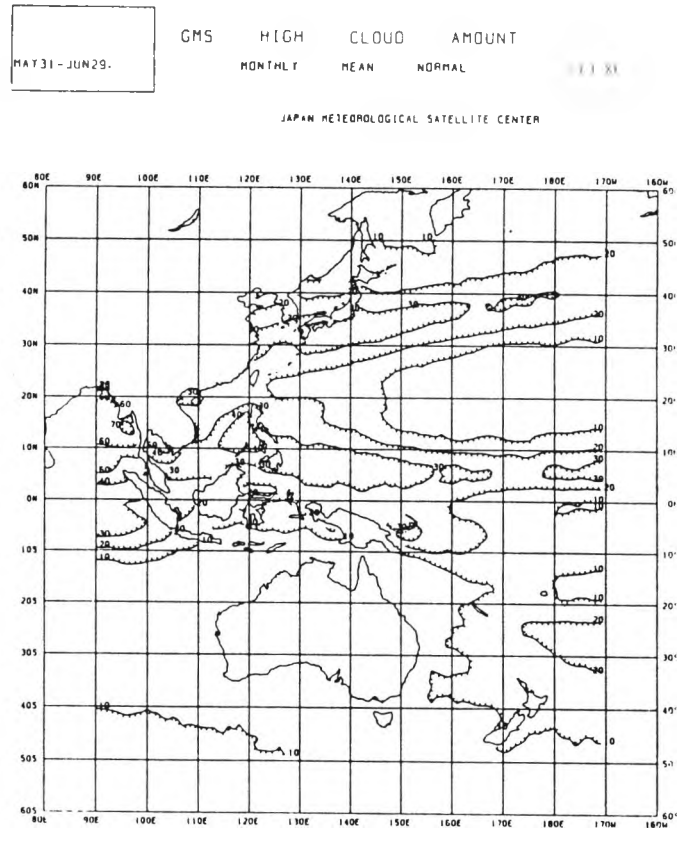
GMS HIGH CLOUD AMOUNT
MONTHLY MEAN NORMAL
JAPAN METEOROLOGICAL SATELLITE CENTER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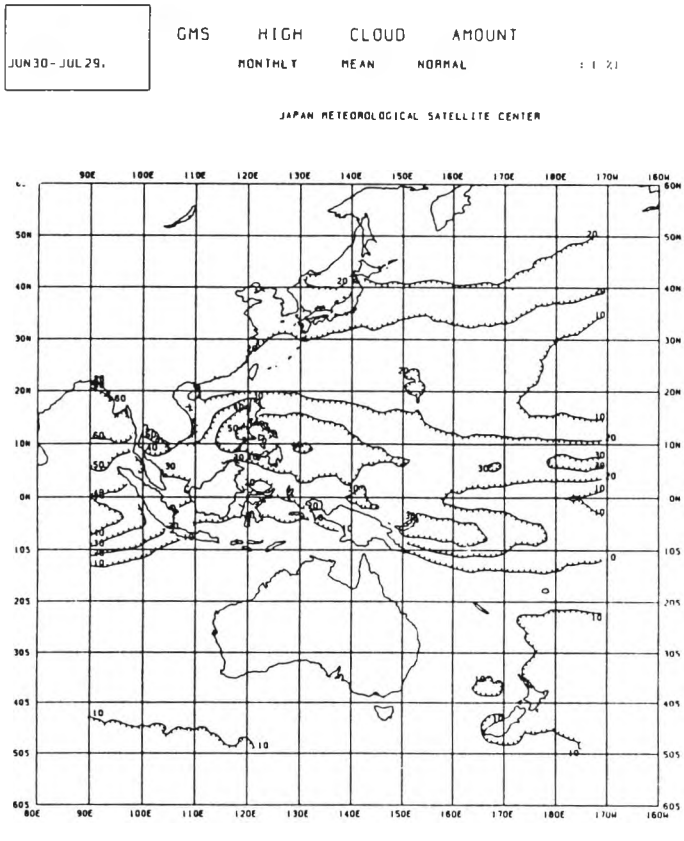
GMS HIGH CLOUD AMOUNT
MONTHLY MEAN NORMAL
JAPAN METEOROLOGICAL SATELLITE CENTER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GMS HIGH CLOUD AMOUNT
MONTHLY MEAN NORMAL
JAPAN METEOROLOGICAL SATELLITE CENTER

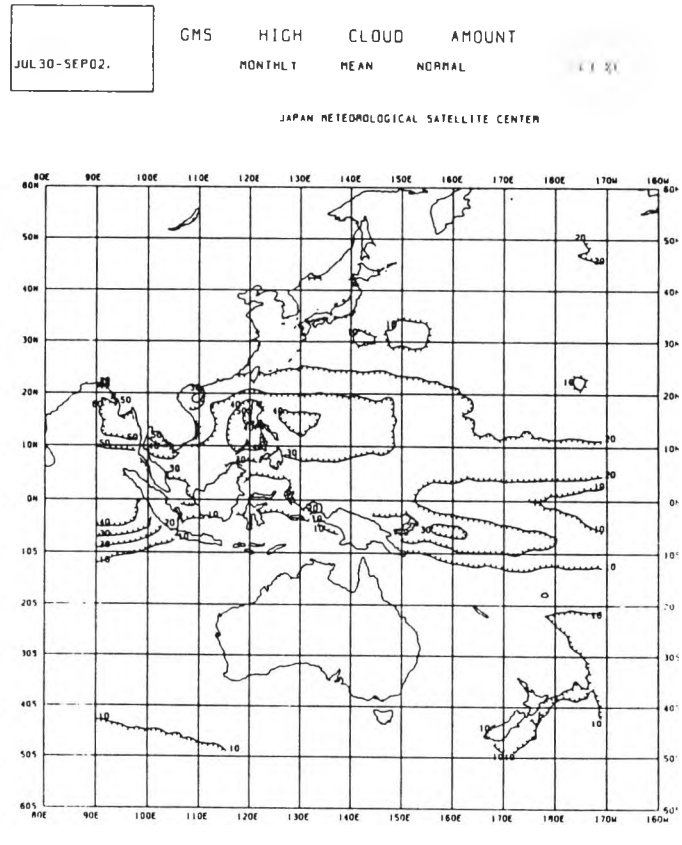
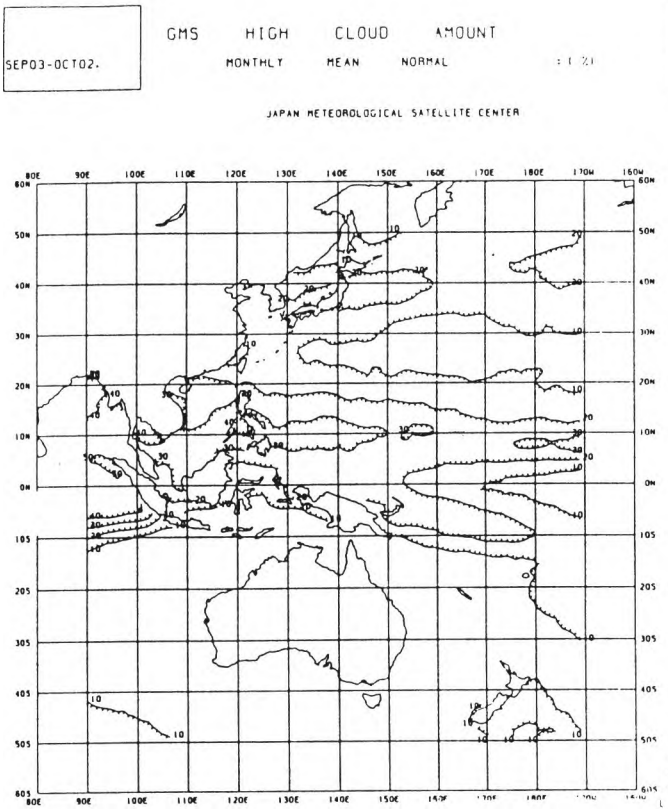
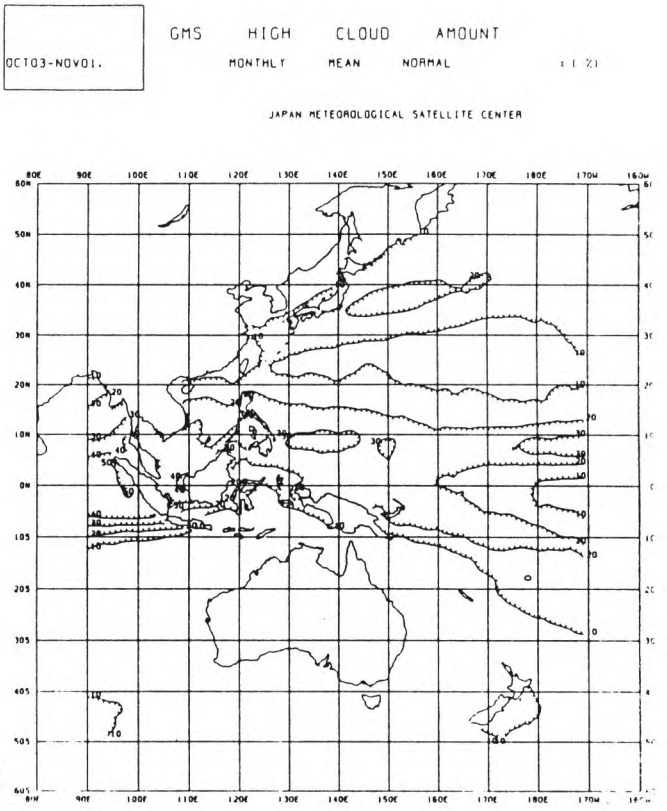
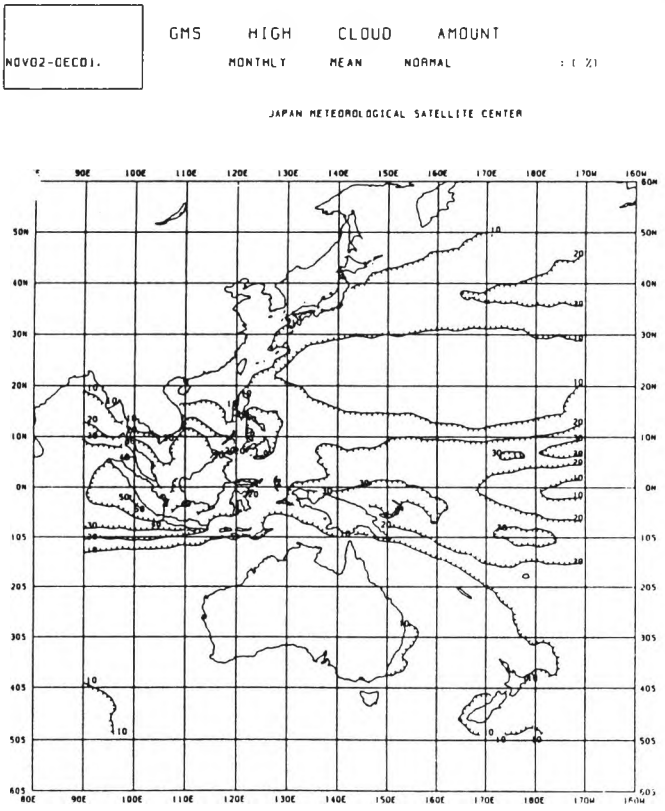

JUL30-SEP02.
GMS HIGH CLOUD AMOUNT
MONTHLY MEAN NORMAL
JAPAN METEOROLOGICAL SATELLITE CENTER

Fig. 2 (e),(f),(g),(h)


SEP03-OCT02.
GMS HIGH CLOUD AMOUNT
MONTHLY MEAN NORMAL
JAPAN METEOROLOGICAL SATELLITE CENTER


OCT03-NOV01.
GMS HIGH CLOUD AMOUNT
MONTHLY MEAN NORMAL
JAPAN METEOROLOGICAL SATELLITE CENTER


NOV02-DEC01.
GMS HIGH CLOUD AMOUNT
MONTHLY MEAN NORMAL
JAPAN METEOROLOGICAL SATELLITE CENTER

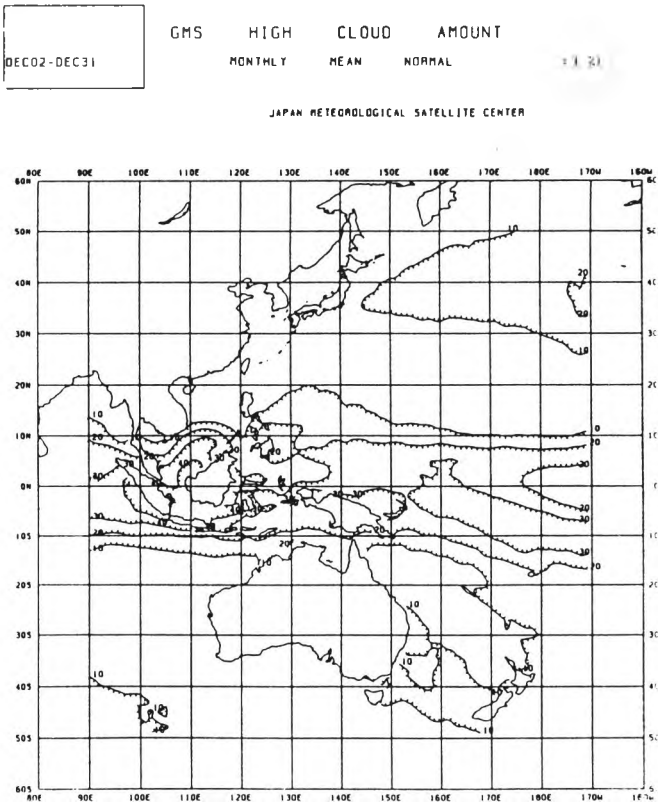

DEC02-DEC31
GMS HIGH CLOUD AMOUNT
MONTHLY MEAN NORMAL
JAPAN METEOROLOGICAL SATELLITE CENTER

Fig. 2 (i),(j),(k),(l)

PLANS FOR THE DISSEMINATION OF WWW DATA VIA GMS - JAPAN WP 21

CGMS-XVII WP-21
Agenda Item: J
Prepared by Japan

TELECOMMUNICATIONS

Plan of Dissemination of WWW data via GMS

CGMS-XVI WP-21
Agenda Item: J
Prepared by Japan

Plan of Dissemination of WWW data via GMS

1. Purpose

To widely disseminate WWW/GDPS data, Grid Point Value(GPV) and pictorial forms from RSMC/Tokyo, JMA plans to use GMS's WEFAX frequency band by multiplexing the WWW data.

2. Merit

If an additional processing system be attached to the present WEFAX receiving equipment at S-DUS station in the GMS coverage, large amount of WWW data can be disseminated without upgrading the current meteorological telecommunication system.

3. Time schedule

The future schedule of information service via GMS is shown in Table 1.

4. Technical back ground

Basically, we will use a multiplexed system for S-band transmitting both the cloud image (WEFAX) and WWW data in the same band width (See Fig.1).

At a receiving station, the antenna of S-DUS receives the multiplexed signal on S-band. In order to process and obtain WEFAX cloud pictures, the present S-DUS equipment can be used without any change or modification, regardless to reception of the multiplexed signal.

On the other hand, for picking up the WWW/GDPS data, one needs to have an additional system to detect and process the latter signal and to obtain WWW/GDPS products in GPV and FAX (G3)forms (See Fig.2).

The planned signal characteristics of WWW data transmission is as follows;

(1) Bit rate : 4800 BPS
(2) Modulation : PSK(Differential encoding)
(3) Sub carrier frequency : 20 KHz
(4) Main carrier frequency : 1691.0 MHz (WEFAX)

The system block diagram of the WWW data transmission is shown Fig.3.

5. Plan for Experiment

Before the decision of the specification of the WWW data multiplexed WEFAX channel, JMA planned to examine the characteristics of the multiplexed signal.

Using the test equipment, which consists of modulator, processor, FAX recorder, e.t.c., the following items will be examined.

(1) Transmission

a. Output power
b. Subcarrier Frequency
c. Frequency Deviation

(2) Reception

a. Electric interference in the WEFAX and WWW data
(a) S/N (b) Linearity (c) e.t.c.
b. Characteristics of the filter to extract the WWW data subcarrier.
c. Reliability of the communication link
(a) Link Budget (b) Bit Error Rate
(c) Quality of G3 FAX

6. Test Result

The examinations of above mentioned experiment have been conducted by the MSC of the JMA. The brief outline of the test result are as follows.

(1) Parameters of multiplexed signal

(a) Subcarrier Frequency : 20 KHz
(b) Frequency Deviation : 126 KHz
(c) Power : Radiated total power was same as existing WEFAX

3 relative power levels were examined, such as,
WEFAX - WWW data = 17, 20, 23 db.

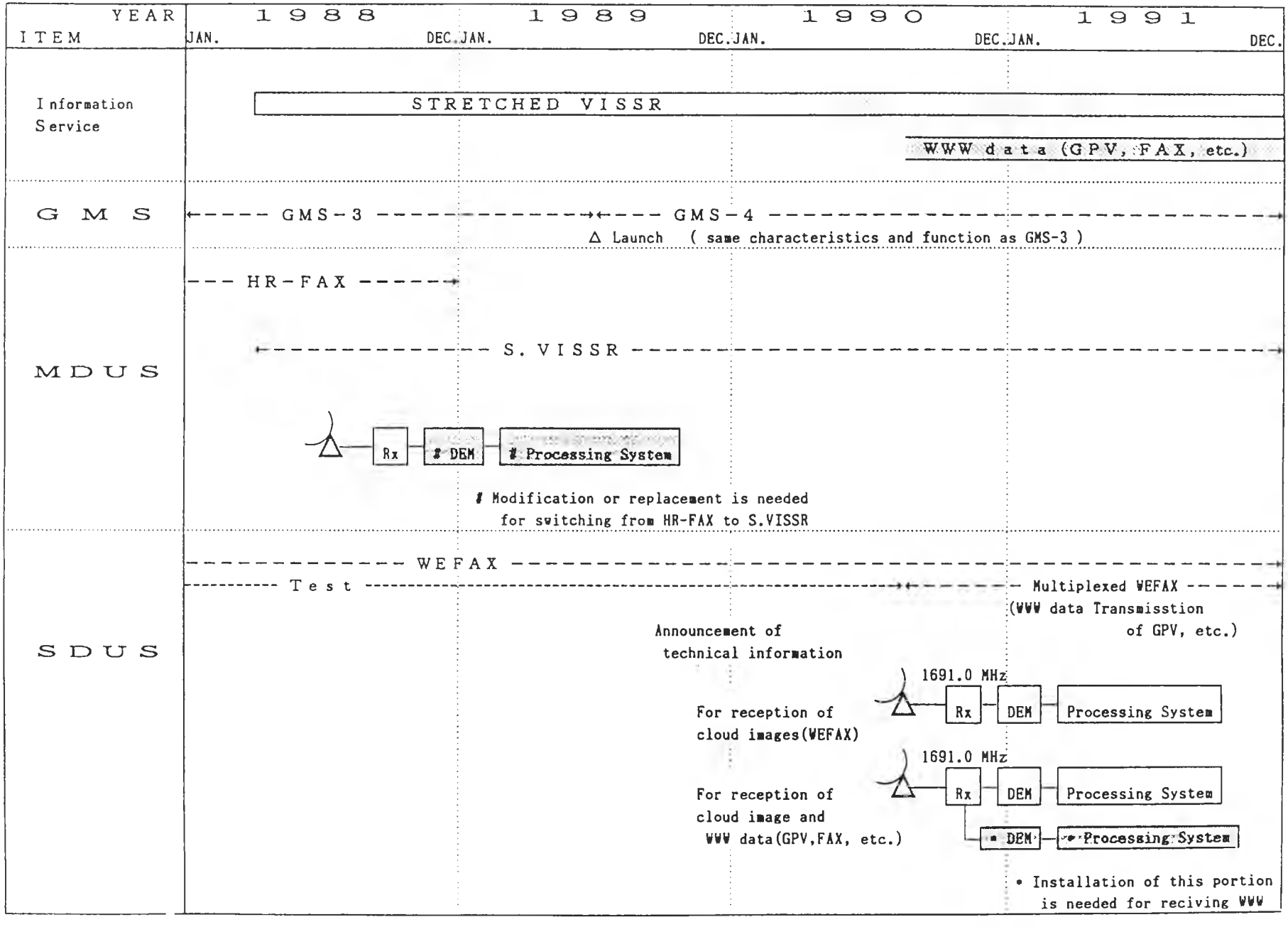
(2) Results

Case 1. WEFAX - WWW = 17 db
In this case, WWW data was suspected to interfere the WEFAX. But no degradation of WEFAX and no data error were recognized. (See Figs. 4 and 5)

Case 2. WEFAX - WWW = 23 db
In this case, the degradation of WWW data quality was anxious, but no data error was recognized. (See Figs. 6 and 7)

Before the final decision of the specification further experiments will be done to establish the optimum WWW/GDPS data dissemination system.

TABLE 1 FUTURE SCHEDULE OF INFORMATION SERVICE VIA GMS



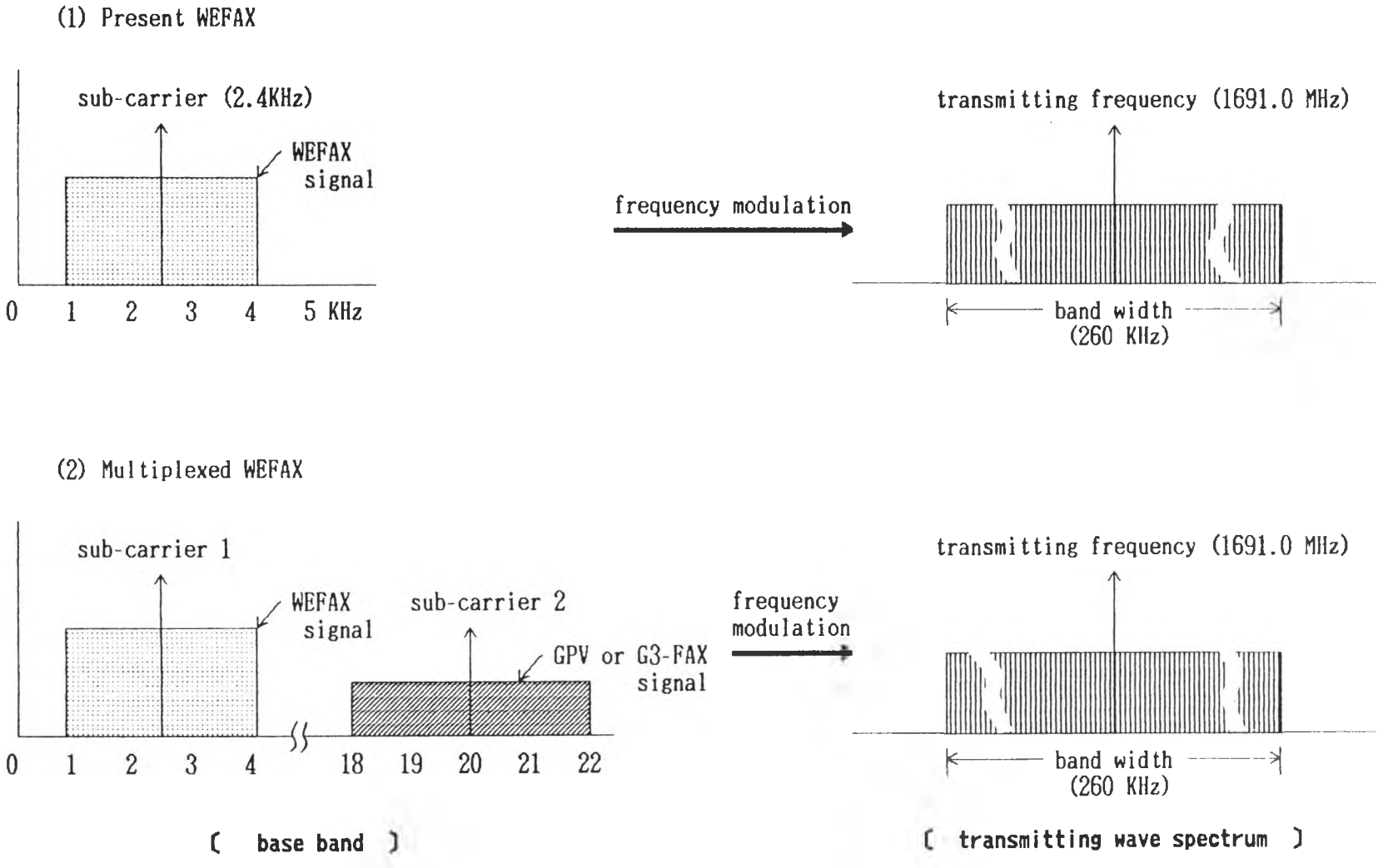


Fig.1 S-band Transmission of WEFAX and WWW data

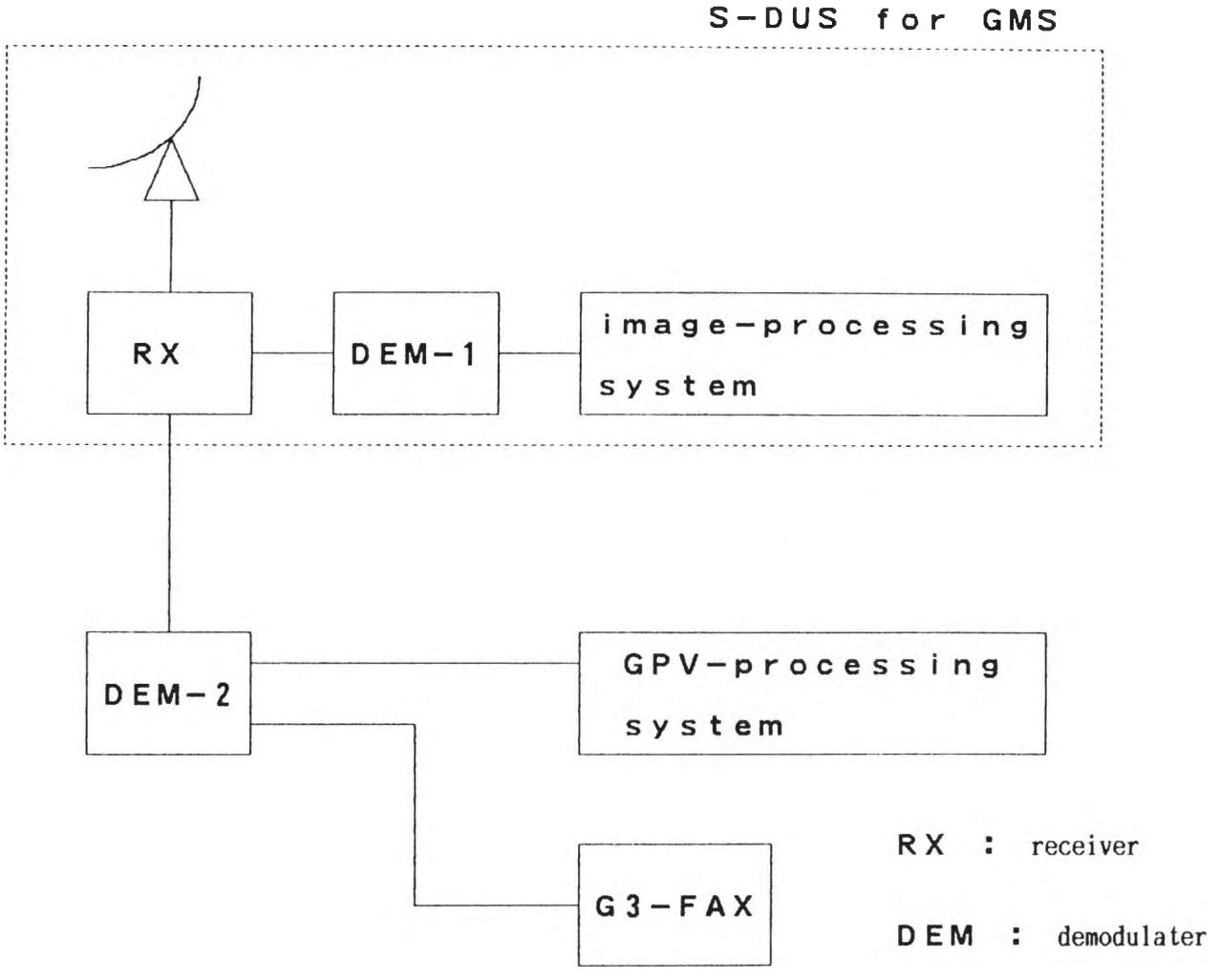


Fig.2 Multiplexed WEFAX Receiving system

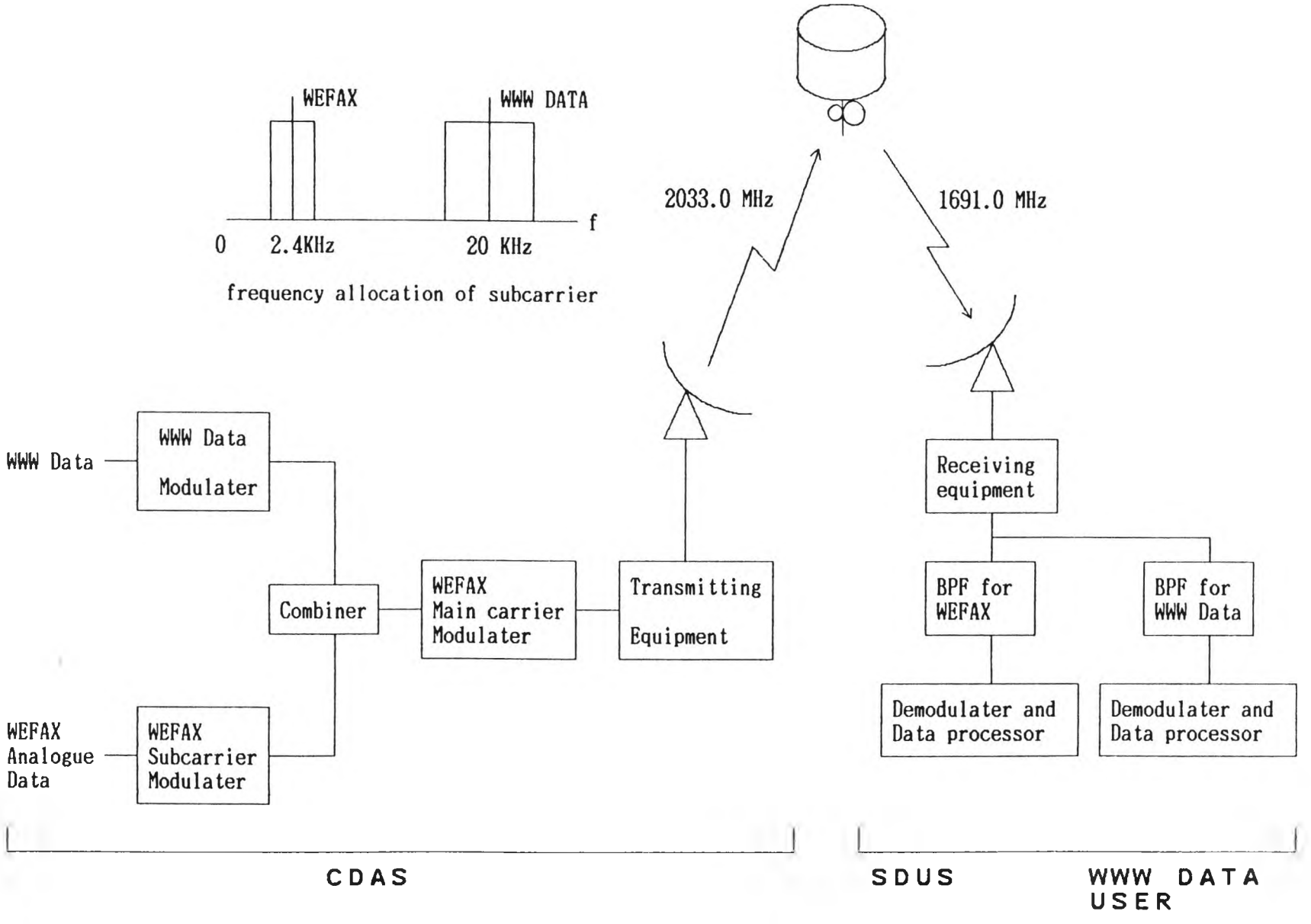


Fig.3 WWW DATA TRANSMISSION BLOCK DIAGRAM

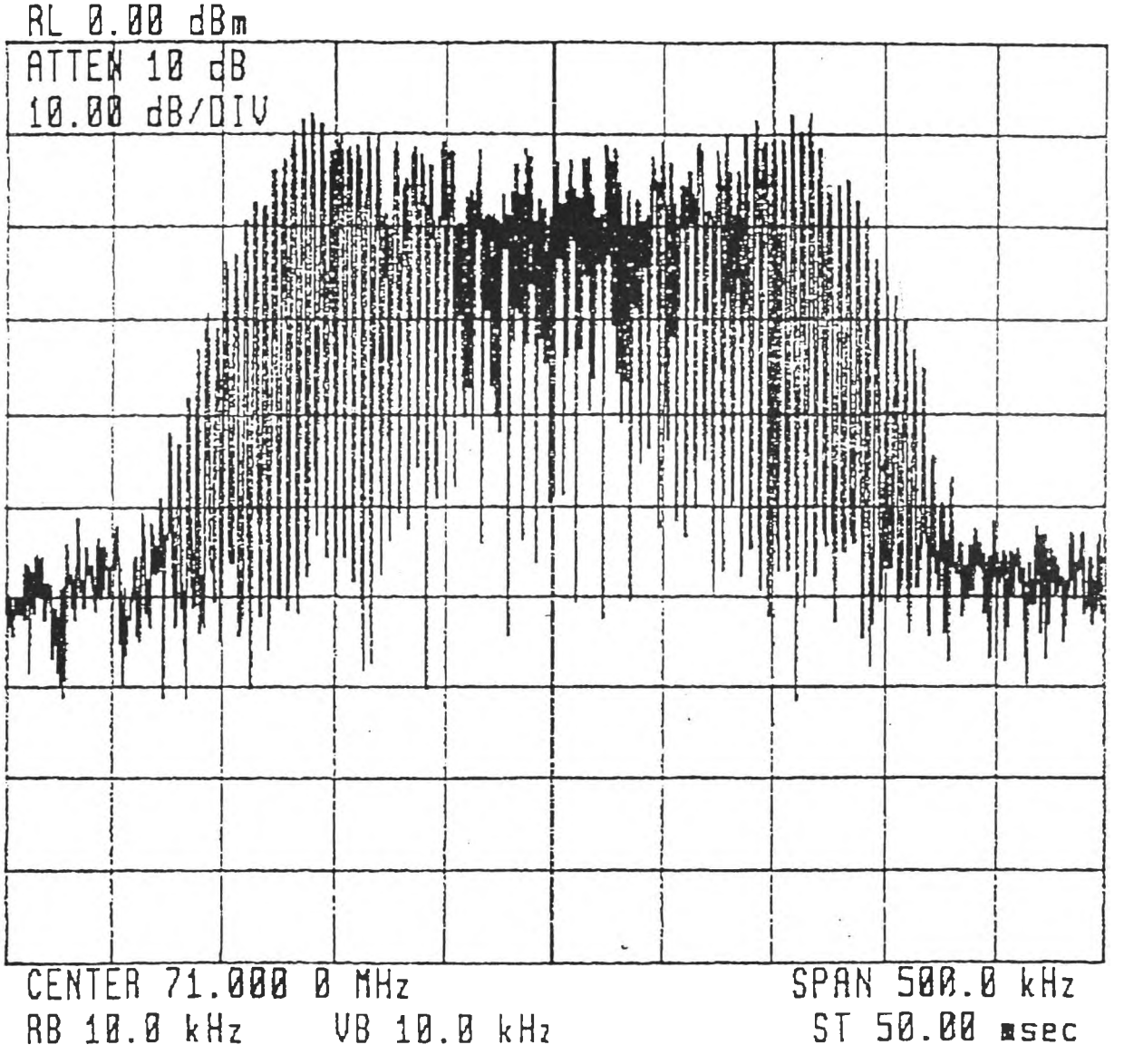


Fig.4 Spectrum of IF Signal (WEFAX-WWW = 17dB)

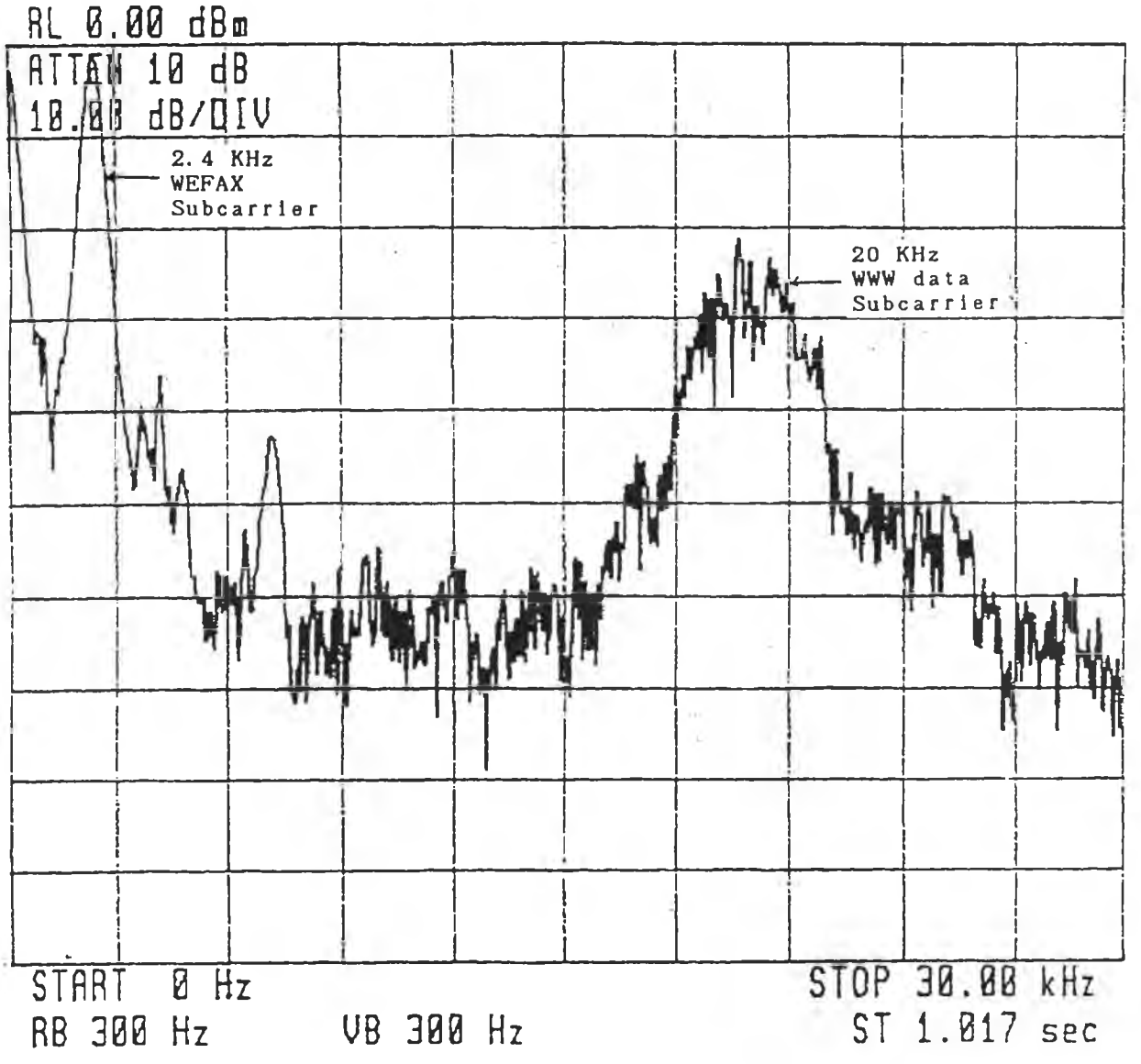


Fig.5 Spectrum of Demodulated Signal
(WEFAX-WWW =17 dB)

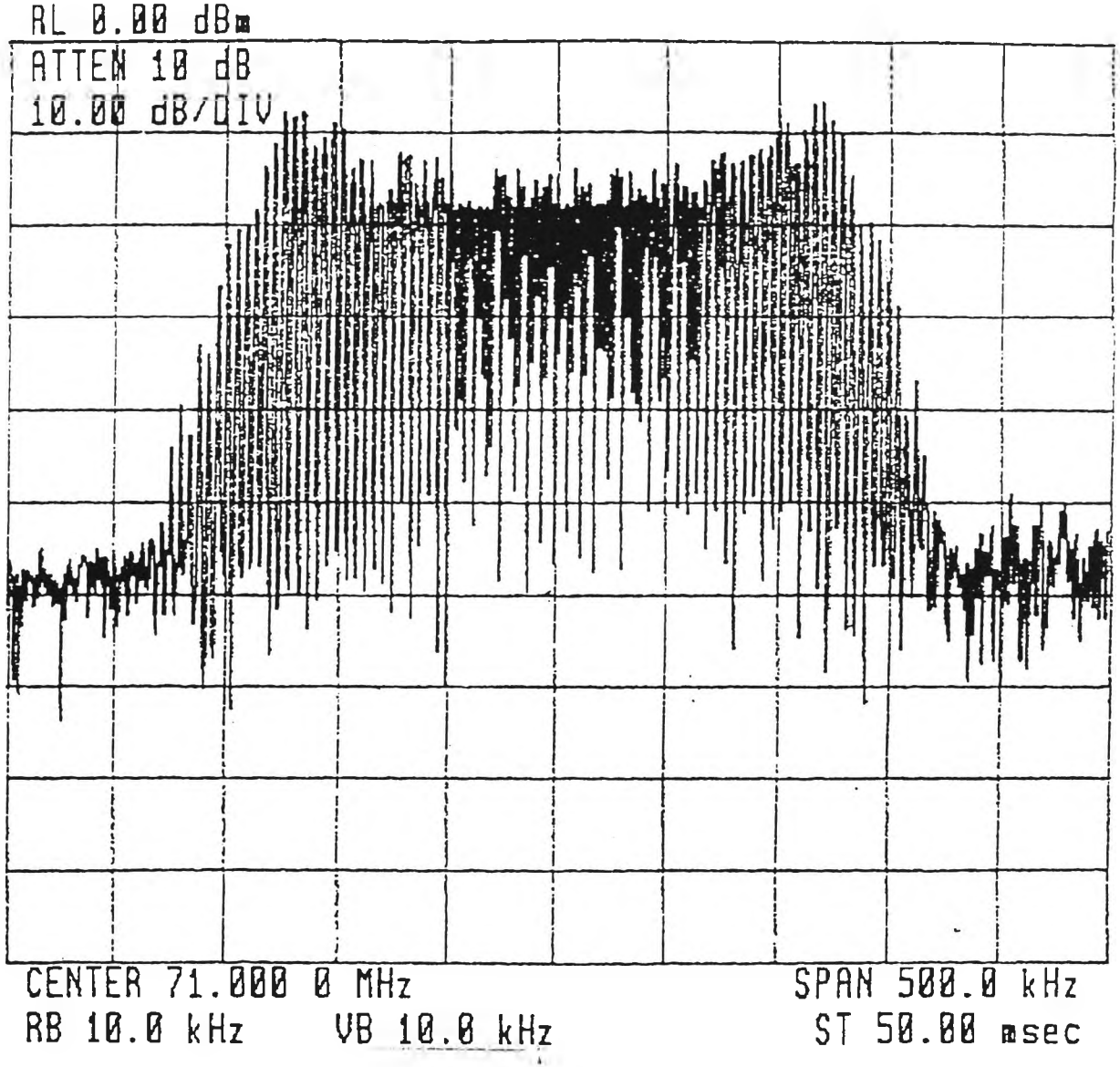


Fig.6 Spectrum of IF Signal (WEFAX-WWW = 23dB)

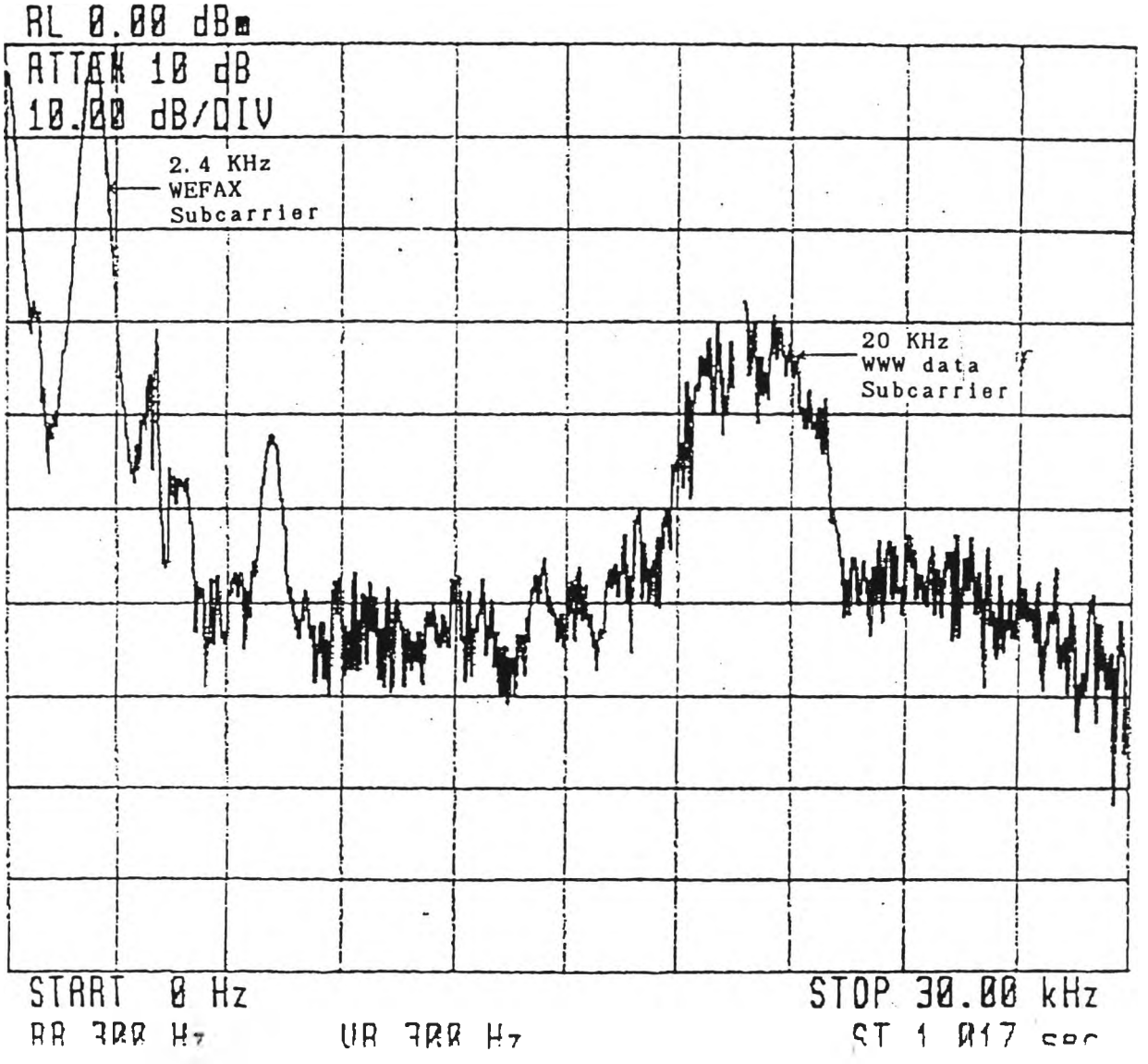


Fig.7 Spectrum of Demodulated Signal
(WEFAX-WWW = 23dB)

ADDRESSES FOR THE PROCUREMENT OF ARCHIVED DATA

ADDRESSES FOR PROCURING ARCHIVE DATA

ESA **(specific requests for Meteosat imagery and data tapes)**

METEOSAT EXPLOITATION PROJECT - Data Service,
ESOC,
Robert Bosch Str. 5,
6100 Darmstadt
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The Director
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6100 Darmstadt-Eberstadt
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CGMS XVII

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AGENDA FOR CGMS XVII

AGENDA FOR CGMS XVII, 3 - 7 OCTOBER 1988

A. PRELIMINARIES

- A.1 Introduction
- A.2 Election of Chairman
- A.3 Drafting Committee
- A.4 Adoption of Agenda
- A.5 Review of Action Items from Previous CGMS Meetings
- A.6 Review of Consolidated Report

B. REPORT ON STATUS OF SATELLITE SYSTEMS

- B.1 EUMETSAT
- B.2 India
- B.3 Japan
- B.4 USA

C. REPORT ON FUTURE SATELLITE SYSTEMS

C.1 Geostationary Meteorological Satellite Systems

- C.1.1 EUMETSAT
- C.1.2 India
- C.1.3 Japan
- C.1.4 People's Republic of China
- C.1.5 USA
- C.1.6 USSR

C.2 Polar Satellite Systems of Interest

- C.2.1 EUMETSAT
- C.2.2 India
- C.2.3 Japan
- C.2.4 People's Republic of China
- C.2.5 USA
- C.2.6 USSR

C.3 Operational Continuity and Reliability

- C.3.1 Inter-Regional Planning
- C.3.2 Global Planning
- C.3.3 Commonality of Standards

D. GEOSTATIONARY SATELLITES AS PART OF WMO PROGRAMS

D.1 World Weather Watch
D.2 Other Programs
D.3 The role of CEOS

E. COORDINATION OF DATA COLLECTION

E.1 Status and Problems of IDCS
E.2 Ships
E.3 ASDAR
E.4 Review of IDCS User's Guide

F. COORDINATION OF DATA DISSEMINATION

F.1 Dissemination via Satellite

F.1.1 High Resolution
F.1.2 Low Resolution (WEFAX)
F.1.3 DCP Data
F.1.4 Digital WEFAX

F.2 Dissemination via GTS
F.3 Other Dissemination

G. COORDINATION OF SATELLITE DATA CALIBRATION

H. COORDINATION OF METEOROLOGICAL PARAMETER EXTRACTION

H.1 Satellite Winds
H.2 Sea Surface Temperatures
H.3 Other Parameters

I. COORDINATION OF ARCHIVING AND RETRIEVALS

J. TELECOMMUNICATIONS

K. MISCELLANEOUS

L. DATE AND PLACE OF NEXT MEETING