VIEW FROM ABOVE

WATCHING THE WEATHER SATELLITES

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Using Primary Data

During November I was able to bring my METEOSAT Primary Data User Station (PDUS) back into operation. I originally bought the PDUS system in 1992 on a now-or-never basis (following the onset of unemployment). To receive Primary Data you require a large dish — a minimum diameter of 1.6m is essential. My original system operated satisfactorily for about a year until a severe storm blew the dish over and damaged its shape. Since that time my concerns have been elsewhere and the dish remained unusable, so I reverted to weather facsimile (WEFAX) reception.

A few weeks ago I set up a replacement C-band dish on a proper mount, and fitted a new S-band feed. For test purposes I obtained a WEFAX signal to align the dish. I connected the PDUS receiver and adjusted the dish to get the best signal. This was a long process.

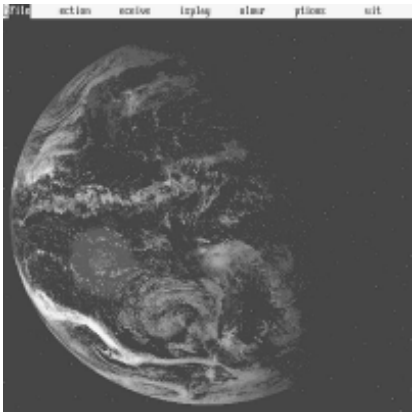
Unlike GOES, METEOSAT-7 transmits encrypted data in all but a few slots. This means that image quality can only be checked during the transmission of test formats and "foreign" images — unencrypted "home" images only being available every six hours! It is peculiar having to set up such an advanced system only during transmissions originating from GOES-8, GOES-10, GMS-5, or INDOEX. The result was worth the trouble of lengthy adjustments when images from GOES-8 and GOES-10 finally became available as you'll see later.

Operating WXSATs

On December 1, 1998, NOAA-15 became one of the two primary operational Polar Orbiting Environmental Satellites (POES) maintained by the National Environmental Satellite, Data, and Information Service (NESDIS). NOAA-12 then became a secondary (backup) satellite. The second primary operational POES is NOAA-14.

In backup mode, NOAA-12 will continue to transmit advanced very high resolution radiometer (AVHRR) data — high resolution picture transmission (HRPT) and automatic picture transmission (APT) — and support search and rescue operations. Steve Arnett of the Satellite Analysis Branch, NOAA/NESDIS/SSD supplied this information.

The sun's elevation is low during northern



winter days, so visible-light images from the northbound passes of NOAA-14 appear very dark. They actually contain much data, so applying mild contrast enhancement can work wonders. Near the end of each afternoon pass, ground illumination reduces to a level where the satellite switches the down-linked APT from the visible-light channel to the near-infra-red channel. This produces a significant change in the components that make up the final decoded 2.4 kHz tone that we hear as the characteristic weather satellite (WXSAT) sound. The APT sound changes from the *high-low* tones to *high-high* tones.

Another component that can readily be heard is the minute marker at the side of each of the two APT channel frames. Knowing how to interpret the audio content of APT signals seems to add greatly to the experience of satellite monitoring!

METEOR 3-5 has been passing southbound during the day, transmitting APT on 137.85 MHz as normal. Transmissions only occur in sunlight, so when the satellite comes over the North Pole during a southbound pass, it remains silent. On crossing into sunlight it resumes transmissions. At the beginning of its life Meteor 3-5 transmitted some excellent infra-red images, but these ended — as did those from earlier Meteors — within a few weeks. My understanding is that equipment failure was responsible.

Weather Data from the geostationary WXSATs

For many years we have had the benefit of the WXSATs located at specific longitudes at the geostationary orbit distance of 35,790 km. These satellites are owned by the United States of America, Europe, India, Japan, and the Russian Federation, and provide a continuous view of the weather from about 70 North to 70 South.

The Coordination Group for Meteorological Satellites (CGMS) has provided a forum for satellite operators from members of the World Meteorological Organization to harmonize the technical and operational aspects of the global network. This should ensure the greatest effectiveness in the design of the satellites and in data acquisition and dissemination procedures. Satellite designs are still based on national and regional requirements for data and services, so some differences are inevitable.

The GOES spacecraft can view the 48 states, and major portions of the central and eastern Pacific Ocean, and the central and western Atlantic Ocean areas. Pacific coverage includes the Hawaiian Islands and the Gulf of Alaska, the latter known to weather forecasters as "the birthplace of North American weather systems." The Atlantic and Pacific basins strongly influence the weather affecting the United States, so coverage is provided by two GOES spacecraft, one at 75° west longitude (GOES East), and the other at 135° west longitude (GOES West).

At least one GOES spacecraft is always within line-of-sight view of earth-based terminals and stations. The Command and Data Acquisition (CDA) Station is in line-of-sight to both spacecraft and can uplink commands and receive downlinked data from each simultaneously. Ground terminals can receive processed environmental data and weather facsimile (WEFAX) transmissions.

Primary Data images from around the world

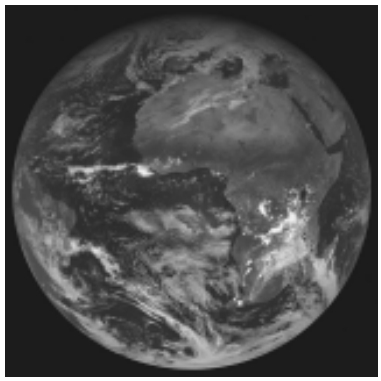
The weather satellite pictures shown in this edition were all obtained directly from my own PDUS equipment, not the Internet. METEOSAT-7 is positioned over longitude 0 (London, UK) from where it views the eastern Atlantic Ocean, South Africa, and parts of western Europe.

It uses two frequencies for image transmission: 1691.00 and 1694.5 MHz. The former is

used for WEFAX products, the latter for Primary Data and more WEFAX formats. Primary Data formats include images from METEOSAT-7 itself, together with those from GMS-5, METEOSAT-5, GOES-E and GOES-W. GOMS-1 is currently non-operational, and I have not been able to collect any FENG-YUN-2B images.

GVAR PDUS (GOES variable format primary data) is transmitted from GOES-E and GOES-W on 1685.7 MHz.

Technically, the images shown here are not as good as they should be; the software is a DOS program that does not currently provide a standard image format (such as GIF or JPG) for transport into a graphics program. I have therefore had to do a screen dump resulting in a considerable loss of image quality. Additionally, there is some noise present in the raw image despite a good signal strength from my 1.8m dish. I expect to have fixed these anomalies during the next few weeks, by which time the images should be much improved.

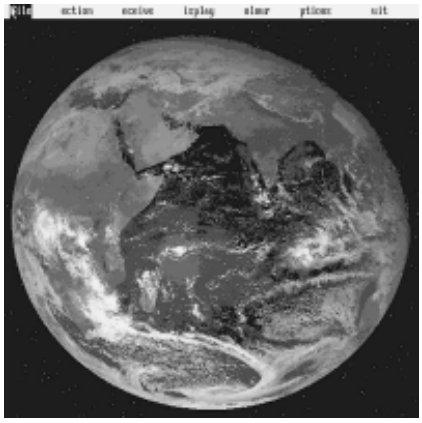


METEOSAT-7 at 0 longitude

This is the 1200 UTC native visible-light image from December 3, and is one of the very limited number of non-encrypted images. I am one of the many people who believe that all such images should be freely disseminated — but unfortunately EUMETSAT's policy involves charging a hefty fee for the decryption unit, as well as requiring the additional purchase of an interface for the unit to work with proprietary hardware. Maybe if my sister wins the lottery?

METEOSAT-5 at 63 east longitude

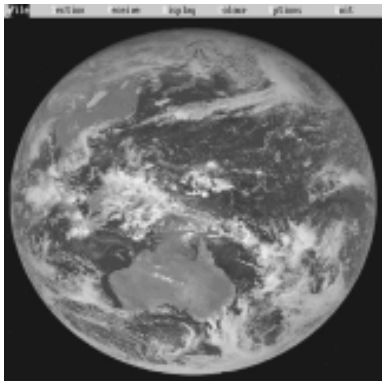
This is the imaging satellite used in the INDOEX (Indian Ocean Experiment), images from which are also disseminated by METEOSAT-7 at better than hourly intervals. Three spectral bands are provided, all unencrypted. Image detail in my originals is considerably better than that obtained from format conversion. However, our editorial staff would be unable to display a proprietary "mpg" format image!



GMS-5 at 140 east longitude

One of the first full-disc, visible-light images that "knocked me for six" was this image showing Australia in full sunlight. Seeing the whole continent, as well as the islands of Indonesia and the Far East, was most pleasing. This November image remains my best for that region.

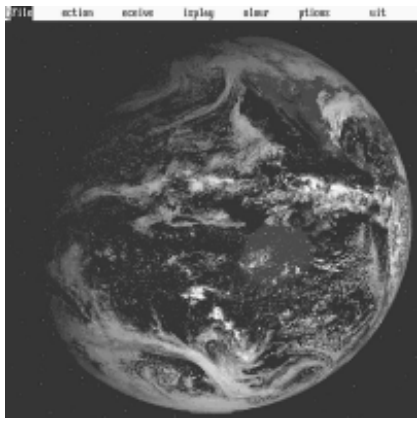
Current images of the Asian-Pacific region are available from the GMS-5 WXSAT and placed on the Internet from where they can be accessed from: **http://rsd.gsfc.nasa.gov/goesg/earth/Weather/main.html**



GOES-E and GOES-W at 75 and 135 longitude

The best visible-light images from the GOES constellation are received late in the day local time in Britain. Due to my own currently unidentified equipment problems I have not yet obtained a complete sequence of GOES images. GOES-W (currently GOES-10) provides an almost complete panorama of the Pacific Ocean, and an infrared image from both satellites is transmitted from Meteosat-7 every three hours — supplemented by a visible-light image when available.

For the latest images via the Internet, visit:



http://rsd.gsfc.nasa.gov/goesg/earth/Weather/main.html

For recent GOES news visit:
http://rsd.gsfc.nasa.gov/goes/text/geonews.html

Correspondence

I have received e-mails from several readers, but unfortunately my replies have bounced. Using false return addresses (to avoid spam) does mean that correspondence cannot be sent. One e-mail asked about "Thailand's weather satellite," and enquired whether any images would be available from the Internet.

I expect that "John" is referring to TMSAT — the first Thai microsat. Although it is not a weather satellite (because these transmit images in a specific format for reception on standard equipment), some images are being transmitted and placed on the Internet. TMSAT home page:
http://www.ee.surrey.ac.uk/CSER/UOSAT/missions/tmsat/index.html
http://www.ee.surrey.ac.uk/EE/CSER/UOSAT/amateur/tmsat/index.html

The TMSAT downlink is on 436.925 MHz and is presently transmitting at 9600 baud FSK. This compares with the 137 MHz WXSAT band used for APT, 1700 MHz band used for HRPT and 1691 MHz used for Primary Data. Thailand is one of the locations specifically listed, and images from all three wavebands (visible, infra-red and near-infra-red) are available.

FREQUENCIES

NOAA-14 transmits APT on 137.62 MHz
NOAA-12 and -15 transmit APT on 137.50 MHz
NOAAs transmit beacon data on 137.77 or 136.77 MHz
METEOR 3-5 transmits APT on 137.85 MHz when in sunlight
OKEAN-4 and SICH-1 sometimes transmit APT briefly on 137.40 MHz
GOES-8 and GOES-10 use 1691 MHz for WEFAX