

# EUMETCast Receiving Station Integration within the Satellite Image Database Interface (SAIDIN) System

Oscar Chic

Coastal Ocean Observatory  
Institut de Ciències del Mar, ICM-CSIC  
P. Marítim de la Barceloneta, 37-49 E-08003 Barcelona, Spain  
phone: 342309500, fax: 3432309555  
http://www.icm.csic.es/  
e-mail: [ochic@icm.csic.es](mailto:ochic@icm.csic.es)

**Abstract** – Within the tasks devoted to operational oceanography, Coastal Ocean Observatory at Institut de Ciències del Mar (ICM-CSIC) has acquired an European Organization for the Exploitation of Meteorological Satellites (EUMETSAT) Broadcast System for Environmental Data (EUMETCast reception system) to replace a satellite direct broadcast system that receives data via High Resolution Picture Transmission (HRPT). EUMETCast system can receive data based on standard Digital Video Broadcasting (DVB) technology using commercial telecommunication geostationary satellites with regular off-the-shelf satellite TV equipment and a PC and has great advantages over a satellite direct broadcast system. A pilot project has started to manage and integrate satellite data acquired through EUMETSAT's Advanced Retransmission Service (EARS)-AVHRR data stream with Satellite Image Database INterface (SAIDIN, <http://saidin.cmima.csic.es/>), a tool developed 4 years ago to access, visualize and distribute satellite data.

**Keywords** – EUMETCast, SST, AVHRR, EUMETSAT

## I. INTRODUCTION

EUMETCast is a multi-service dissemination system based on standard Digital Video Broadcast (DVB) technology operated by EUMETSAT. It uses commercial telecommunication geostationary satellites to multicast files (data and products mainly satellite based) to a wide user community. EUMETCast is a contribution to GEONETCast and IGDDS (Integrated Global Data Dissemination Service) and provides data for Global Earth Observation System of Systems (GEOSS) and Global Monitoring for the Environment and Security (GMES).

Before this new dissemination system was operational, satellites provides meteorological and oceanographic data only to user community that have one very expensive and complex ground receiving station via direct broadcast (HRPT station). Nowadays, EUMETCast data are sent on via commercial telecommunication satellites to individual users. The technology used makes it possible for end users to receive the data with regular inexpensive off-the-shelf satellite TV equipment and a PC. This results in the possibility to use relatively low cost reception stations. In addition, time delay of global services and spatial coverage of

local HRPT system is improved with a delivery timeliness of ca. 30 minutes after the time of measurement because EARS is composed of a network of existing HRPT systems. This network of stations acquires, processes and forwards the generated meteorological products (e.g. the NOAA satellite HRPT telemetry data) to central office. EUMETSAT collects the products and disseminates them to the users via a commercial satellite broadcast service. It's expected that in the near future, most of the users of direct readout reception systems will migrate to EUMETCast. About transmission technology, EUMETCast uses the DVB-S MPEG2 stream for encapsulating IP frames (IP over DVB). At this IP layer, IP Multicast techniques are used for distributing the file based content. For this purpose, TELLICAST (an IP multicast software from Newtec (formerly Tellitec)) is used. The primary transmission via Eutelsat's Eurobird 9 satellite can be received by most end users in Europe and is relayed via Eutelsat's Atlantic Bird 3 (Europe and Africa) and SES New Skies' NSS-806 (covers both Americas).

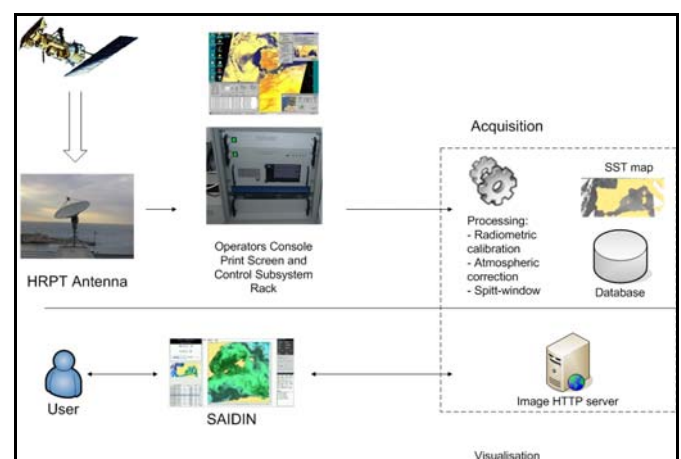


Fig. 1. Near real-time acquisition system block diagram (SAIDIN)

## II. DATA ACQUISITION AND PROCESSING SYSTEM

During 2001 an HRPT receiving station (Fig.2) was acquired and a near-real time system called SAIDIN (Fig.1)

was developed, allowing users to acquire data, process them to obtain temperature maps of the Western Mediterranean at its maximum resolution (nadir) of 1.1 kilometers and publish them to the Web in approximately one hour. Additionally, a bziped netCDF file with AVHRR channels, latitude, longitude, land mask and multichannel sea surface temperature (MCSST) variables is created and added to a Thematic Realtime Environmental Distributed Data Services (THREDDS) catalog [1] (<http://ers.cmima.csic.es/thredds>). The processing and publishing subsystem executes routines of radiometric, geometric and atmospheric corrections automatically with scripts that use SeaSpace Corp.'s (Poway, California) TeraScan® software [2] in GNU/Linux CentOS 4 computer. The current routines for atmospheric correction are not sufficient, and sometimes under specific atmospheric conditions (e.g., low clouds in a very dry atmosphere, sand advections or mists) do not output a product with the required quality. Therefore, it is recommended that users reprocess this data manually. After these corrections, maps of temperature are produced using McClain split-window equations [3] and made available for the scientific community on the Web. During the initial processing, quick looks and metadata sub-products are also generated, providing complementary information useful for gauging the quality of temperature maps and allowing users to detect processing errors.



Fig. 2. HRPT old receiving system

In April 2009, an EUMETCast system (Fig.3) was acquired to Prodetel S.A. company by the Institut de Ciències del Mar (ICM) and Unitat de Tecnologia Marina (UTM) to substitute the old HRPT acquisition system. The system is composed of a receiving subsystem, a computer subsystem of acquisition, control and data archiving, and a processing and publishing subsystem. The receiving subsystem consists of a 1.0-meter-diameter antenna with V/H Low Noise Block (LNB). The control and data archiving subsystem is a Dell Precision T3400 CPU 2Gb RAM and 750 Gb disk with GNU/Linux

Fedora 8 and DVB Skystar2 card of Technisat. Data and products are encrypted by the EUMETCast uplink and could be decrypted by the EUMETCast Client Software that must be installed on the reception station. Those data controlled in accordance with EUMETSAT Data Policy are only accessible by users who have been given the necessary decryption keys for the EUMETSAT service/s they have been licensed to receive. To access these services in addition to the decryption keys users will need to operate a station equipped with a EUMETCast Key Unit (EKU). The EKU decryption device is connected, via USB, to the reception computer. The decryption device is used by the EUMETCast Client Software to decrypt the data key of the next transmission. EUMETSAT manages the distribution of the decryption devices to registered users. EUMETSAT distributes optional EFTS-Agents software that provides secure and reliable transfer of files from a source host to a number of target hosts. In addition, Prodetel S.A., also manufactures software to monitors the most important acquisition processes, announcement channels and the EKU status and, after this information was processed, takes suitable actions like report or reboot some daemons which represent an improvement over the original EUMETCast system. After the replacement of the old HRPT acquisition system, a process of integration of EUMETCast station [4] with the old processing subsystem must be done.

### III. MIGRATION TO THE NEW ACQUISITION SYSTEM

The network of EUMETSAT stations acquire data as station segments of three-minute duration from the satellite as it passes over the station locations. These segments are sent to the EUMETSAT computers located at organizations site. These computers then create user segments of one-minute duration. For each segment a message is sent reporting the availability of the segment and its completeness and quality to the central 'decision maker' computer at EUMETSAT. The decision maker will wait a short time to receive messages about available segments at the various remote computers and identify if there are any duplicate segments for the same time slot (duplicates arise due to station coverage overlaps). Finally, a decision is made as to which station has the best segment and this decision is sent to the particular remote computer instructing it to send the segment to the EUMETCast uplink server and on to users. This means that overlaps between stations are removed and end users should get a continuous set of 'best quality' segments for the regional pass.

One part of the migration has consisted of writing a python script (can be downloaded from: <http://argus.cmima.csic.es/svn/codi/teledeteccio/eumetcast/naa.py>) to concatenate the segments to construct a "regional pass" that can be considered equivalent to a pass of an HRPT

station so the same processing algorithms can be used. The script accepts two input arguments: satellite name (e.g., noaa17 to filter avhrr\_20090916\_120100\_noaa17.hrp.bz2 pass) and time range mode (0 : two hours before, 1 : today and yesterday, 2 : all satellite data) and logs all the filename segments, time gaps found (segments not present) and pass filename created. At present, there are scheduled two cron jobs that run each hour and process data acquired in the last 2 hours (e.g., “5 \* \* \* \* python noaa.py noaa17 0”).



Fig. 3. EUMETCast receiving system

Another cron job is scheduled in the processing machine, running each hour (e.g., “30 \* \* \* \* eumetcast.scr”, script can be downloaded from: <http://argus.cmima.csic.es/svn/codi/teledeteccio/scripts/eumetcast.scr>). This script mounts via NFS the filesystem exported by the acquisition computer where there are the “regional passes” created by noaa.py script and runs a C-shell script (that can be downloaded from: <http://argus.cmima.csic.es/svn/codi/teledeteccio/scripts/sst-eumetcast.sh>) that processes the pass to get SST image, netCDF file with raw data, metadata of the pass and a quick look image. All this data can be browsed using SAIDIN web and THREDDS catalog. This script uses TeraScan functions ([http://ers.cmima.csic.es/seaspace/functions\\_list.html](http://ers.cmima.csic.es/seaspace/functions_list.html)).

Another part of the migration work was adapting the previous C-shell script to obtain a quick look from the “regional pass”.

#### IV. CONCLUSIONS

The SAIDIN interface is under continuous development to provide more functionality and recently has been updated with an EUMETCast receiving station, which can receive data based on standard digital video broadcast technology using commercial telecommunication geostationary satellites. This allows a low cost and very simple system (compared with an HRPT) to obtain similar data with only a slight delay of 30 minutes on the other hand not far from the delay to acquire a pass via direct readout.

Additional improvements include migrate all the Web sites to a Drupal Content Management System (CMS) to facilitate Web updating and uncoupling static information of dynamic web applications. In that sense, the new web site it is not only a CMS that integrates all the documentation but it

is a pilot project of the new Coastal Ocean Observatory recently created at ICM.

New implementations will allow users to better integrate SAIDIN into the THREDDS catalog server as a new viewer and increasing SAIDIN’s capabilities as a light geographic information system, allowing users to overlay data from several sources and to implement new products, such as ocean surface velocity fields derived from SST maps. From a technical point of view, SAIDIN will provide flexible file name conventions, image formats and database server dependency.

Other needs of the project are the migration of physical systems machines to virtual ones to strengthen the services as much as possible as well as monitoring the same.

It is intended to provide improved near-real time quality control using independent information, such as that supplied by an environmental array of buoys.

EUMETCast has great possibilities still to develop. Searching EUMETCast using the Product Navigator Collection Discovery Service of EUMETSAT results in more than a hundred products.

#### REFERENCES

- [1] B. Domenico, J. Caron, E. Davis, R. Kambic, and S. Nativi, “Thematic Real-time Environmental Distributed Data Services (THREDDS): Incorporating Real-time Environmental Data and Interactive Analysis Tools Into NSDL,” *Journal of Digital Information*, vol. 2, pp. 11 587–11 601, 2002.
- [2] F. Monaldo, “Primer on the Estimation of Sea Surface Temperature Using TeraScan Processing of NOAA AVHRR Satellite Data,” 1997, version 2.0 S1R-96M-03. The Johns Hopkins University Applied Physics Laboratory.
- [3] E. P. McClain, W. G. Pichel, and C. C. Walton, “Comparative performance of AVHRR-based multichannel sea surface temperature,” *Journal of Geophysical Research*, vol. 90, pp. 11 587–11 601, 1985.
- [4] EUM.TD.14. TD 14 - EUMETSAT Advanced Retransmission Service Technical Description. [http://www.eumetsat.int/idcplg?IdcService=GET\\_FILE&dDocName=PDF\\_TD14\\_ATOVS-RETRANS&RevisionSelectionMethod=LatestReleased](http://www.eumetsat.int/idcplg?IdcService=GET_FILE&dDocName=PDF_TD14_ATOVS-RETRANS&RevisionSelectionMethod=LatestReleased)