EUMETCAST RECEIVING STATION INTEGRATION WITHIN THE SATELLITE IMAGE DATABASE INTERFACE (SAIDIN) SYSTEM

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Abstract – Within the tasks devoted to operational oceanography, Coastal Ocean Observatory at Institut de Ciències del Mar (CSIC) has acquired an European Organisation 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), 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 (World Meteorological Organization 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. Users of the service can take advantage of off-the-shelf, commercially available, and inexpensive equipment. 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 because EARS is composed of a network of existing HRPT systems. This network of stations acquire, process 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). The technology used makes it possible for end users to receive the data with regular off-the-shelf satellite TV equipment and a PC.

II. DATA ACQUISITION SYSTEM

The system is composed of a receiving subsystem, a computer subsystem of 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) and 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 station. 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. In addition, EUMETSAT distributes an optional software EFTS-Agents software that provides secure and reliable transfer of files from a source host to a number of target hosts.

During 2001 an HRPT receiving station was acquired and a near-real time system 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 bzipped 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]. The processing layer executes routines of radiometric, geometric and atmospheric corrections automatically with scripts that use SeaSpace Corp.'s (Poway, California) TeraScan® software [2]. The current routines for atmospheric correction are not sufficient, and sometimes under specific atmospheric conditions (like low clouds in a very dry atmosphere, sand advections or mists) do not output a product with therequired 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, quicklooks and metadata subproducts are also generated, providing complementary information useful for gauging the quality of temperature maps and allowing users to detect processing errors.

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 organisations 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 to writing some python scripts to concatenate the segments to construct a regional pass that can be considered equivalent to a pass of a HRPT station. These scripts allow to pass the satellite ID and the time range as arguments and log all the actions done.

The other part of the migration involves adapting the C-shell scripts done using Terascan software.

IV. CONCLUSSIONS

The SAIDIN interface is under continuous development to provide more functionality. Recently 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 a HRPT) to obtain similar data with only a slight delay of 30 minutes. It is intended to provide improved near-real time quality control using independent information, such as that supplied by an environmental array of buoys.

Additional improvements include migrating the Web site to a content management system to facilitate Web updating and decoupling the applet application using Web site supplementary information. New implementations will allow users to better integrate SAIDIN into the THREDDS catalog server as a viewer and increase 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. Next things to do is to migrate physical system to a virtual one to have a more robust service in case of crash.

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.

APLICATION OF REMOTE SENGING TECHNIQUES TO THE STUDY OF INTERNAL WAVES IN THE STRAIT OF GIBRALTAR

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Abstract. The generation and propagation of internal waves is one of the most interesting oceanographic processes in the Strait of Gibraltar. In this paper, radar (ASAR) and ocean colour images (MODIS y MERIS) have been used in order to characterize this phenomenon. The processing of instantaneous colour images has allowed the analysis of the relationship between physical processes of the internal waves and the biological implications. During internal waves generation, MODIS and MERIS images show a chlorophyll maximum structures in the coastal areas of Camarinal Sill. When these waves are located in Alborán Sea, the colour images illustrate the presence of chlorophyll maximum associated to the waves front. The results seem to indicate that a suction of coastal water take place during the internal waves generation and this rich chlorophyll water entry in Alborán Sea travelling joint to the internal waves.

Keywords internal waves, Gibraltar Strait, ASAR images, Ocean Colour images.

I. INTRODUCTION

The high amplitude and short period internal waves are generated at the western side of Camarinal Sill during maximum tidal outflow (toward Atlantic Ocean) when the flows reach 1 m s-1 (Vázquez et al., 2008). These remain there until the flow weakens. And then, the internal waves propagate towards the Mediterranean Sea. The internal waves produce a sea surface signal of roughness bands, named boiling water, (Bruno et al., 2002) which are detected from ASAR (Advanced Synthetic Aperture Radar) images.

The mixing processes associated to the internal waves are able to produce a recirculation of the Mediterranean Water nutrients towards Alborán Sea and, consequently, to increase the phytoplankton populations inside de Atlantic Jet (Macías et al., 2008). The main objective of this work is to characterize the waves processes and its biological implications in the study area using instantaneous radar and ocean colour images.

II. MATERIAL Y METHODS

In order to achieve the objective of this study, three tools have been used:

- Instantaneous ASAR and ocean colour images (MODIS and MERIS) to characterize the generation and propagation of the internal waves processes in the Strait of Gibraltar.
- Tidal velocity prediction in Camarinal Sill to identify the state of the internal waves.
- CTD data obtained from GIBRALTAR 08 Cruise on board of R/V Sarmiento de Gamboa to confirm the remote sensing information.

III. RESULTS

Generation

In the ASAR image of 2nd of June of 2008 (Fig. 1a) the roughness features confirm the generation of the internal waves in the Strait of Gibraltar. The tidal velocity prediction (Fig. 1b) shows that this image was captured during maximum outflow with a current intensity greater than 1 m s-1, when hydraulics conditions are favourable for the generation. On other hand, in MERIS and MODIS images (Fig. 1c), it can be seen an increase of surface chlorophyll in coastal area of Camarinal Sill. This chlorophyll maximum structure travels eastward according to the propagation of the internal waves toward Alborán Sea.

Propagation

In the ASAR image corresponding to 1st of October of 2008 (Fig. 2a) can be detected waves train propagating in Alborán Sea. The tidal velocity prediction in Camarinal Sill (Fig. 2b) confirms that the internal waves have been approximately one cycle late in coming to Alborán Sea from its generation in Camarinal Sill. In MERIS image (Fig. 2c), high chlorophyll values associated to waves train extracted of SAR image can be seen. In the CTD transect carried out 30 of September of 2008, a waves train in Alborán Sea was recorded. The isothermals and isohalines rise, joint to an increase of chlorophyll values (as colour images show) characterize the arrival of the internal waves in station 5 (Fig. 2d).

IV. CONCLUSSIONS

The combined analysis of images and in situ data reveal advection of North and South coastal water to the centre channel of the Gibraltar Strait and its entrance to Alborán Sea. This coastal water with higher chlorophyll concentration is incorporated to the Mediterranean Sea associated to the arrival of the internal waves train to this area.