JP1.10 UTILIZING THE WEB TO ENHANCE AVAILABILITY AND UTILIZATION OF POLAR-ORBITING OPERATIONAL ENVIRONMENTAL SATELLITE (POES) DATA AND PRODUCTS

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1. INTRODUCTION

The overall mission objectives of the Polar-orbiting Operational Environmental Satellite (POES) system is to provide continuous daily global observations of weather patterns and environmental measurements of the Earth's atmosphere, its surface and cloud cover, and the proton and electron flux at satellite altitude. To fulfill these mission objectives, the National Environmental Satellite, Data, and Information Service (NESDIS), part of the National Oceanic and Atmospheric Administration (NOAA), has operated the current POES system since 1978, with a two satellite constellation in circular, near-polar, sun synchronous morning and afternoon orbits. Data, and the resulting products, are archived and made available to the user community. NESDIS currently offers a wide variety of web-based tools to enhance access and utilization of data and products. In addition, NESDIS is continually looking for new technology and other enhancements that will improve access and use of POES data and products.

NESDIS provides the user community a variety of opportunities to obtain POES data and products. Some users have real-time access to operational data via specialized user accounts. Data and products are also available through CD and paper media for some customized requests as well as less technologically advanced users. However, a large user community accesses POES data and products via the Web. NESDIS hosts numerous websites, which provide operational and experimental products in various formats. In addition, NESDIS provides a variety of tools which help users better utilize the data and

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products through its web sites, which provide education on satellite basics, product/satellite-specific data, and the ability to generate user-unique products. To ensure that NESDIS can continue to meet the growing demands of the user community, new technologies and methodologies are being explored which may improve access to and utility of POES data and products. This paper will provide an overview of current NESDIS web capabilities and briefly address potential future enhancements.

2. POES ACCESS

NESDIS provides POES data to a variety of government, international, academic, and industry customers. POES data is used in a multitude of arenas such as scientific research, travel, commerce, health and safety, insurance, and agriculture. And the uses for POES products continues to grow.

This paper focuses on POES data and products available on the web. However, numerous users access POES data through many other means. One such method is Direct User Readout. Users of this service must establish a receive station, which includes hardware, software, and a receiver. Once a receive station is developed, users can acquire 2 data streams in near-real time from the POES satellites. The High Resolution Picture Transmission (HRPT) contains data from nearly all instruments aboard the POES satellites. The Automated Picture Transmission (APT) provides infrared and visible imagery from the Advanced Very High Resolution Radiometer (AVHRR) instrument. Additional information on Direct User Readout services is available at http://noaasis.noaa.gov/NOAASIS/ml/satservices.html

A subset of the user community receives POES data via the Global Telecommunications System (GTS). The GTS provides the distribution of

POES products on a global scale, thus meeting the timeliness requirements of many users. Products on the GTS are available to meteorological data centers around the world.

Many POES users do not have a timeliness requirement for receiving POES data and products. Most do not have the capability to use data that has not been processed and formatted into a user friendly format. For those users, NESDIS provides a multitude of alternatives. Users can receive POES products via e-mail, internet, CD-ROM, fax, tape, and paper.

3. CURRENT WEB RESOURCES

The Web has presented many opportunities for making POES data and products available to the user community. The Web has also proved to be an excellent tool for disseminating learning tools as well as user support resources.

3.1 Existing Web Access

Users have multiple means of obtaining POES data and products via the web. The NESDIS websites can generally be divided into two categories: common access and product-specific.

Common Access: Common access websites provide a wide variety of operational data, products and resources for the user. Two examples of Common Access website is the Satellite Active Archive (SAA) and the National Virtual Data System (NVDS).

- SAA: The Satellite Active Archive (SAA) provides near real-time access to POES operational data and products to the user community. The SAA provides the user access to all operational products as well as the level 1b data sets. The 1b data sets allow users an opportunity to manipulate the data to meet their individual product or research requirements. The SAA also provides access to archived POES data, allowing users access to POES data and archived products, with some products dating back as far as 1981. The SAA provides the added benefit of providing users with subscription service, providing automatic delivery of data within pre-determined parameters. The SAA website, http://www.saa.noaa.gov/,

provides many resources that support new users as well as experienced users.

- NVDS: The National Virtual Data System (NVDS) provides users with the ability to access archived POES operational data and products. Not only are operational products available but also an extensive amount of supporting data, i.e. metadata, data describing data, etc., as well as additional products created using these data by the NOAA National Data Centers. The 3 primary NOAA Data Centers are:
    o National Climatic Data Center (NCDC) in Asheville, NC,
    o National Geophysical Data Center (NGDC) in Boulder, CO,
    o National Oceanographic Data Center (NODC) in Silver Spring, MD

Each Data Center has a unique focus. As a part of their mission, each Center develops applications and products that supplement the operational suite of POES products.

NVDS, as well as all Data Centers, are accessible at http://www.nvds.noaa.gov/ .

Product-Specific: Product-specific information is available for a variety of experimental and operational products, including aerosols, atmospheric temperature and moisture soundings, imagery, ozone, precipitation, radiation budget, sea surface temperature, snow and ice cover, and vegetation. Operational products are supported on a 24 hour per day, 7 per week basis, and the internet is one form of distributing these products. Experimental products are generated on a routine basis and are often made available on the internet for user evaluation. Products are available at http://www.osdpd.noaa.gov/ and http://orbit-net.nesdis.noaa.gov/ora/.

3.2 Existing Tools

To better support the user community, numerous tools have been developed within NESDIS that provide a mixture of static and dynamic support to a wide variety of users.

On-Line Tutorials: Numerous resources are available on the web, which provide education on a broad array of topics. Providing a complete list of on-line tutorials is not possible within the scope of this paper. However, below are two examples of information available on the web.

- COMET- The Cooperative Program for Operational Meteorology, Education and Training (COMET) provides computer-based training for operational weather forecasters in the interpretation and effective use of POES data and products. Since its inception, the program has greatly increased information available through the internet and expanded its program to meet the training needs of a diverse user base.

    COMET provides a broad array of weather-related tutorials which provide forecasters and other users with instructions on understanding and using Polar products and data. Examples of training modules include:
    - o Polar Satellite Products for the Operational Forecaster, Module 1: POES Introduction and Background
    - o Polar Satellite Products for the Operational Forecaster, Module 2; Microwave Products and Applications
    - o Remote Sensing of Land, Oceans, and Atmosphere with MODIS

    These tutorials have been developed to assist the user community in understanding the many uses of POES and other Polar and Geostationary satellite data and thus, increase the use of these data in universities, industry, and various government organizations. COMET training modules are available at http://www.comet.ucar.edu/.

- SATPROD- The Satellite Product Overview Display (SATPROD) was developed as a tool to consolidate various data about satellites, instruments, products, and users. Since its creation, SATPROD has evolved from a single desktop program with limited accessibility to an internet application supporting all of NESDIS

and its user community.   SATPROD is used by product generators and users to understand the impact of anomalies on the various components throughout the product generation and distribution process.

SATPROD assists the POES user community in numerous ways. Within NESDIS, SATPROD is used to identify users impacted by spacecraft, instrument, channel, ground system, and operational product anomalies. Rapid identification of effected users allows for timely dissemination of information. It is also used within NESDIS to assess the impact of future satellite, product or instrument enhancements on the entire product processing flow.

For users, SATPROD provides a single source for obtaining information about all of the POES product's components. It is the only internet source that provides such a consolidated inventory. It is constantly updated to provide the most current and accurate data possible. As a learning tool, SATPROD enables uses to track products through their entire lifecycle, from spacecraft through distribution to the user. In addition, the tool can generate pre-defined reports on the data as well as user-unique reports.

Important to note is that SATPROD data is not limited to POES instruments and data. SATPROD also includes data for the GOES satellites as well as other non-NOAA geostationary and Polar satellites such as DMSP, Meteosat, RADARSAT, and QuikSCAT. SATPROD will continue to support NESDIS and its user community by providing similar information for new satellites such as GIFTS, JASON, NPP, and NPOESS.

Figure 1 displays the products window within SATPROD, showing the global 100-km sea surface temperature product. The product window describes specific information for each product, as well as a description, a sample product, and a link to the real-time web page

within NESDIS. This window is one of many different displays available within the tool. The SATPROD tool is available at http://satprod.osd.noaa.gov.
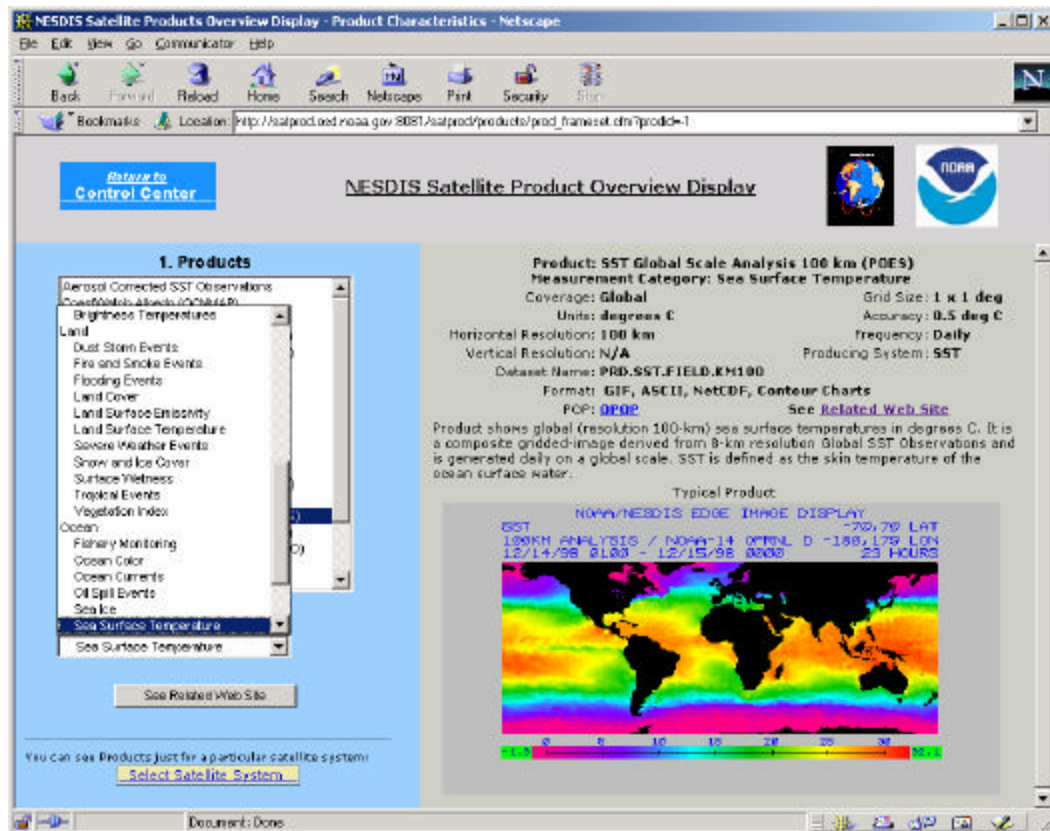

Figure 1. The SATPROD Products Window.

Interactive tools: While many of the NESDIS product websites offer the user the ability to select parameters for products, the parameters are very limited and typically restricted to geographical constraints. Few websites offer the user an interactive capability that allows the user to select the type of data to be displayed, amount of data to be displayed, and the source of the data. One NESDIS system which provides this interactive capability is the POSSE.

- POSSE: The Polar Orbiting Satellite Sounding Evaluator (POSSE) system is a collection of programs that provides users with the ability to view and evaluate polar satellite data. The POSSE system allows access to atmospheric sounding data produced by the Advanced TIROS Operational Vertical Sounder (ATOVS) Processing System.

POSSE provides the user with the ability to select a variety of data input that greatly impact the product. For example, the user can select the system to choose which satellite's data will be used as input to the product. The user can also select parameters allowing limitations on the type of data to be used as input to the product.

Figure 2 shows a sample output from the POSSE tool. The 500-mb temperature from NOAA-15 is displayed, along with the selectable parameters. A complete list of types of data which can be selected, as well as the POSSE tool and instructions for its use, are available at http://orbit36i.nesdis.noaa.gov/posse/.
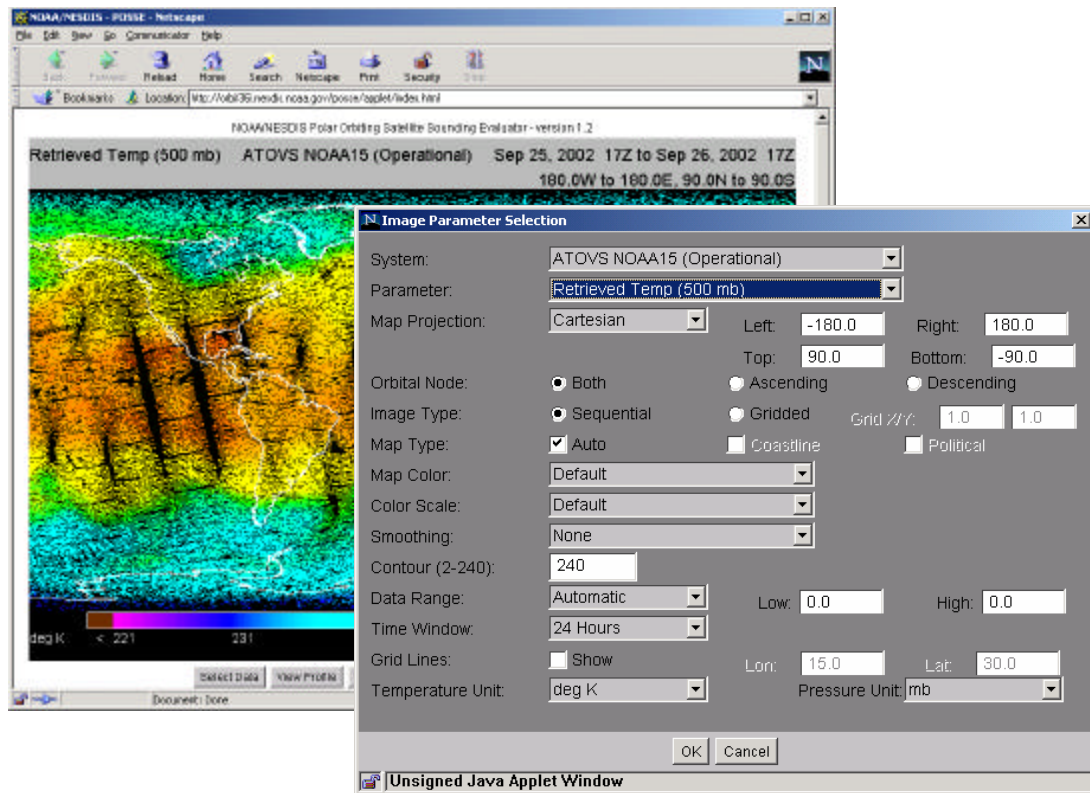
Figure 2. Output from the POSSE web page.

3.3 Existing Technologies

- The majority of POES products available on the web are available in standard formats. These formats include, but are not limited to, GIF, TIFF, and JPEG images. Providing products in these standard formats allows for maximum compatibility with user's systems.

4. FUTURE CAPABILITIES

As the quantity of POES data and complexity of POES products grows during the next century, the number of POES users will continue to grow as well. The size of data sets from the POES and other Polar satellites will increase exponentially and new data streams will provide a wealth of new, advanced products as well as numerous enhancements to current products. New products will attract new users and new uses for the data. To meet this anticipated increase in demand, NESDIS is researching various options for maximizing POES data availability via the web.

4.1 Access Enhancements

NESDIS is currently looking at methods for improving user access to POES data. One approach is to identify methods that will simplify a user's search for POES products. As mentioned earlier in this paper, POES data is located at various sources. Knowing where to go to look for data is very often the key to success.

To facilitate this search process, NESDIS is currently developing a capability to allow for "one stop shopping" for POES data. CLASS, the Comprehensive Large Array-data Stewardship System, is currently under development. The CLASS concept is to provide users with the ability to access all data via a single interface. The system will be capable of extracting the requested data from its source and delivering it back to the interface. CLASS is still under development. However, once fully operational, the system should alleviate the need for multiple access points thus simplifying the search process for the user community.

4.2 Technology Upgrades

As part of NESDIS's ongoing commitment to improve user access to POES data and products, several new technologies are currently being researched. These new technologies will be analyzed for their robustness, benefits, and impact on the user community.

Grid Technology: Grid technology has been researched for its potential to help maximize the utility of NESDIS resources. Grid is an integrated system of parallel and distributed processing that facilitates the sharing, selection, and aggregation of distributed resources. Within NESDIS, this technology would allow data to be maintained within various sources; yet, be accessible through a single, virtual source. The benefit of utilizing Grid technology is that it will allow NESDIS to maximize the potential of its current and future web access and delivery resources. To the user, this means the potential for new or increased system functionality and the capability to support more users and products.

GIS: Geospatial Information Systems (GIS) are currently being used by a wide variety of government, academic, and industry entities. GIS provides the capability for assembling, storing, manipulating, and displaying geographically referenced information, i.e. data identified according to their locations.

GIS technology provides numerous benefits. Graphic display techniques in GIS's make relationships among map elements visible, thus facilitating the information extraction and analysis process. Through a function known as visualization, a GIS can be used to produce images - not just maps, but drawings, animations, and other cartographic products. These images provide a new perspective on data for scientists and a more user-friendly view for novices.

Within a GIS, various map and satellite information sources can be combined in modes that simulate the interactions of complex natural systems. The condition of the Earth's surface, atmosphere, and subsurface can be examined by feeding satellite data into a GIS. GIS technology gives researchers the ability to examine the variations in Earth processes over days, months, and years.

Numerous product areas within NESDIS are utilizing GIS to enhance products. One such product area is the Satellite Services Division's (SSD) Fire Program Hazard Mapping System. This GIS Web site has an interface in which a user works with navigation tools and layers and legend controls to display different information related to active fires. Users can zoom in and out, pan, or measure the distance between two points to get more details on fire locations and to better understand and interpret the data. In addition, a user can select from a number of different layers to the display, including counties, states, interstates, lakes, and rivers, and several different fire data sets.

The GIS system for fires can be accessed from http://nhis7.wwb.noaa.gov/website/SSDFire/viewer.htm.

5. CONCLUSION

NESDIS uses the web as a means of making POES data and products available to a broad user community. Through the Web, NESDIS also offers numerous training and educational resources. One use of the Web not discussed within this paper was the Web's ability to facilitate general communications with the user community. Not only can the web provide a means of collecting user's comments and questions, it can also be used as a tool for disseminating information to users. This is typically information pertinent to the user, i.e. problems with data, products, or instruments, and may include notification of upcoming events or changes that may impact the data or products.

Additional POES data and product information are available at the NESDIS website: http://www.nesdis.noaa.gov/.

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