**SATELLITE METEOROLOGY TRAINING FOR THE NATIONAL WEATHER SERVICES –
MOVING TO DISTANCE TRAINING**

Summary and Purpose of Paper

To provide an overview of NWS satellite
meteorological training activities.

SATELLITE METEOROLOGY TRAINING FOR THE NATIONAL WEATHER SERVICES –
MOVING TO DISTANCE TRAINING

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The National Weather Service Satellite Meteorology Training Program has evolved from computer-based modules and the traditional classroom setting to distance learning in to provide cost-effective training. NESDIS is assisting the NWS in satellite training by providing funding for the COMET program and making resources available via the cooperative institutes at CIRA and CIMSS. In an effort to integrate satellite information with observations from other sensors, the Integrated Sensor Training (IST) PDS was established. VISIT and the IST PDS program are working together to make satellite meteorology distance training a reality. Through the development of various training materials, the operational forecaster and the on-station training officer can access a virtual classroom and laboratory. This virtual classroom is composed of a diverse and rapidly growing set of materials: tutorials, on-line classroom presentations, GOES gallery, Satellite Interpretation Discussions, technical attachments and Web-based modules. The Virtual Laboratory for Satellite Meteorology has been endorsed by the World Meteorological Organization (WMO) Commission for Basic Systems (CBS). The Web-based and teletraining approaches described in this document can be included into the development of the Virtual Laboratory for Satellite Meteorology.

INTRODUCTION

This article describes the evolution of satellite meteorology training from the conventional classroom to new distance learning strategies used by the National Weather Service (NWS) training program. Distance learning by the NWS is being utilized to provide cost-effective training to the operational weather forecaster. A review is presented on the transition from satellite meteorology training to Integrated Sensor Training (IST).

In the 1980's, the NWS undertook a major modernization program. The NWS modernization included the deployment of the GOES-I/M series (Menzel and Purdom, 1994), doppler radars, new computing systems, and the restructuring of the National Weather Service itself. Before the NWS modernization, satellite data were only available as analog images and were generally limited to data from the imager instruments. With the addition of new computers and communications associated with deployment of Advanced Weather Information Processing System (AWIPS), NWS forecast offices now have access to digital data (images and derived products) from the GOES-8 and –10 satellites. Some offices are also receiving derived image products from the GOES and Polar-orbiting Operational Environmental Satellite (POES) sounding instruments. With the rapid changes in the availability of new satellite products, the NWS needed to prepare the forecast staff on how to utilize these data.

BACKGROUND - SATELLITE METEOROLOGY TRAINING

To prepare for the arrival of new remote sensing datasets, the NWS in collaboration with the Cooperative Program for Operational Meteorology, Education and Training (COMET®) prepared a series of computer-based learning modules which addressed both doppler radar and satellite meteorology. COMET satellite meteorology education began in 1991 when a module was published entitled "Boundary Detection and Convection Initiation" (Spangler, 2000). This module presented information on the use of primarily GOES-7 data to detect the outflow boundaries from convective systems so areas of boundary collisions could be predicted. COMET module development was expanded beginning in 1995, when NESDIS joined the NWS in sponsoring the development of modules on the new GOES-I/M series. This effort led to the production of three modules on CDs:

- "Satellite Meteorology: Remote Sensing using the new GOES Imager" provides an introduction to the five-channel GOES imager.
- "Satellite Meteorology: Case studies using GOES Imager Data" with six short cases on a variety of applications.
- "Satellite Meteorology: Using the GOES Sounder" describes the sounding instrument data and products available from GOES.

These modules were distributed to NWS offices, Navy and Air Force weather offices, and NESDIS offices, and are available directly from COMET.

Beginning in 1998, NESDIS provided new funding to COMET to develop additional modules on POES. With the deployment of AWIPS and the launch of NOAA-15, NESDIS and NWS recognized the need for additional satellite training materials on POES. With the rapid advances in Web-based training, COMET proposed to develop a new series of modules on the Web. Four Web-based modules were produced:

- Polar Satellite Products for the Operational Forecaster, Module 1: Introduction and Background
- Module 2: Microwave Products and Applications
- Module 3: Data Integration and the Forecast Process
- Module 4: Soundings

The Web-based modules on POES (Dills et al 2000) provide a foundation for NWS forecasters that are beginning to get access the images, retrievals and derived products available from the imaging and sounding instruments. A major new emphasis is presented in Module 2 where the unique capabilities of the new Advanced Microwave Sounding Unit (AMSU) instrument are described. The Web-based modules are available off the Meteorology Education and Training site at: meted.ucar.edu/ist.

Along with the CD and Web-based modules, a two-week class on satellite meteorology was conducted at the COMET classroom facilities in Boulder, Colorado. The satellite class covered a broad range of satellite meteorology topics in an integrated manner by showing students how to combine the satellite products with other observations and models. Over 180 students, mostly from NWS, attended the satellite meteorology class since the first offering in May 1996. Students also attended from the Air Force, Navy and the Canadian Atmospheric Environmental Service (AES). In the future, new satellite products and techniques will be covered as part of a proposed series on integrated sensor training workshops.

DISTANCE LEARNING – WEB, TELETRAINING AND VIRTUAL LABORATORY

To assist with the movement towards distance learning, the NWS and COMET have established a set of professional development series (PDS) (Lamos 1998). Each PDS defines training requirements for the operational weather forecaster. Within each PDS, separate instructional components are developed to meet the training requirements. The PDS, which includes satellite meteorology, is the Integrated Sensor Training (IST) PDS. Information on the IST PDS can be accessed via the Web at meted.ucar.edu/ist. The IST PDS represents a concerted effort by the NWS to bring together diverse training activities, which have traditionally focused on individual sensors such as satellite, radar, and other observing systems. The IST PDS is supported by the Virtual Institute for Satellite Integration Training (VISIT), comprised of staff from the Cooperative Institute for Meteorological Satellite Studies (CIMSS), the Cooperative Institute for Research in the Atmosphere (CIRA), and the NWS training facilities. Both the NWS and NESDIS support the VISIT program.

VISIT and the IST PDS program are working together to make satellite meteorology distance training a reality. Through the development of various training materials, the operational forecaster and the on-station training officer can access a *virtual classroom and laboratory*. This virtual classroom is composed of a diverse and rapidly growing set of materials: tutorials, on-line classroom presentations, GOES gallery, Satellite Interpretation Discussions, technical attachments and Web-based modules. The Virtual Laboratory for Satellite Meteorology has been endorsed by the World Meteorological Organization (WMO) Commission for Basic Systems (CBS). At a meeting of the Expert Team on Improving Satellite Systems Utilization and Products held in Lannion, France in July 2000, the team proposed a structure and operating guidelines for the Virtual Laboratory. The Web-based and teletraining approaches described in this document can be included into the development of the Virtual Laboratory for Satellite Meteorology.

The training materials are available to all NOAA and DOD offices with no restriction, and can be available to all WMO member countries as part of the Virtual Laboratory. The training materials are available at several locations on the Web. To help training officers organize the materials, the various sites are easily accessed via the IST PDS page, the VISIT homepage: www.cira.colostate.edu/ramm/visit/visithome.asp, and the COMET satellite meteorology class homepage: www.comet.ucar.edu/class/satmet/home.html.

The use of strictly remote training sessions and tutorials runs into two major limitations at most weather offices: limited network bandwidth and limited instructor interaction. The bandwidth limitation is especially serious when loading large animation files. To address these limitations, an interactive training tool called VISITview was developed by the Virtual Institute for Satellite Integration Training (VISIT) at CIMSS and CIRA. VISITview is a platform- independent distance learning and collaboration software program that allows multiple users to view the same series of images containing graphics and text with a large number of user features.

A key aspect of VISITview teletraining sessions is they can be run locally or remotely. The datasets are preloaded to students' workstations in advance of the session. Preloading the files avoids the delays caused by limited bandwidth when loading over the Web. In addition, the sessions can be controlled either locally or remotely; thus, they are suitable for both distance- and on-site-learning applications. The on-site learning provides support for the train-the-trainer approach, which helps to

spread the instruction throughout the forecast staff. The VISITview tool (Whittaker 1999) provides instructors with a complete set of drawing and animation tools including image combination, enhancements, fading, and multiple panel displays. Several of the VISITview functions were developed to emulate selected AWIPS functions. For more information on the IST PDS teletraining sessions see Motta et al 2000. Information on the teletraining lessons is on the VISIT Web site - www.cira.colostate.edu/ramm/visit/visithome.asp.

VISITVIEW – AN EVOLVING TELETRAINING TOOL

As previously stated, the VISITview (www.ssec.wisc.edu/visitview/) teletraining software is being developed by VISIT with support from the IST PDS program. The VISITview program is not proprietary and is freely available. VISITview is designed to provide the instructors and students with a set of easy to use tools for creating and conducting teletraining sessions. VISITview is Web-based, but may be used in two modes: with the graphics files on a central server or with these files residing on a local disk. In the latter case, only the commands are sent over the Web. These two modes can be used together, if desired.

Most NWS offices have relatively slow bandwidth connections, which restricts the amount of information that can be transmitted in real-time to support live teletraining sessions. To avoid this limitation, the files used for the sessions are put into a zip archive file and then distributed via file transfer protocol (FTP) to the participating sites. These files can be rather large (over 60 MB for some sessions). The zip file is unzipped and saved into a local directory. The session can then be previewed at the convenience of the office staff to ensure that the session runs properly. Students can view the session at any time after the live interactive session to review the materials or for local training. There is a user's guide on the Web, which helps the students prepare for each session.

In developing the VISITview program, the following functions have been incorporated:
- For ease of use, different instructor and student controls (Fig. 1)
- A complete set of animation controls to emulate AWIPS functionality, including zoom and fade
- Multiple panel displays (with animation)
- The ability to draw (both line and text entry) with color choices
- The ability to erase previous drawing
- The ability to change enhancement or colorization of images
- The ability to add/remove overlays
- An option to open a chat window
- An optional quiz question
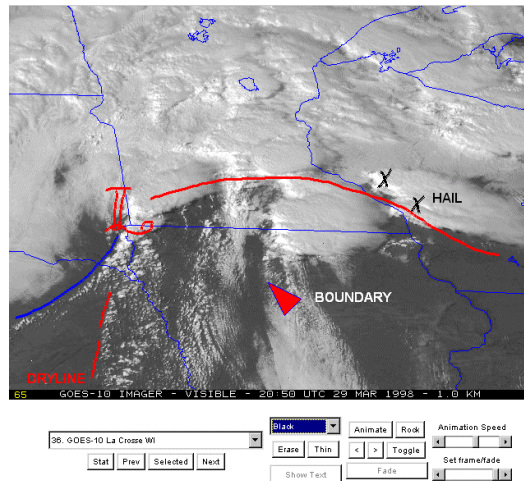
Fig. 1 VISITview panel from GOES Rapid Scan Operations training session showing instructor's annotations on a standard 640x480 pixel image.

VISITview is evolving as additional techniques for distance learning are included. For example, one VISITview "session" was created and is available on-line at CIRA (http://visit.cira.colostate.edu/vview/vmeast.html), which uses the RAMSDIS on-line database of real-time data. This approach encourages experimentation with distance collaboration, facilitates discussions of real-time weather events, and supports coordination among various offices. Also, the incorporation of a recorded speech option allows the lessons to be "played back" in virtual real time right along with the voice and annotations of the instructor.

SUMMARY

The National Weather Service Satellite Meteorology Training Program has evolved from computer-based modules and the traditional classroom setting to distance learning in to provide cost-effective training. NESDIS is assisting the NWS in satellite training by providing funding for the COMET program and making resources available via the cooperative institutes at CIRA and CIMSS. In an effort to integrate satellite information with observations from other sensors, the Integrated Sensor Training (IST) PDS was established. VISIT and the IST PDS program are working together to make satellite meteology distance training a reality. Through the development of various training materials, the operational forecaster and the on-station training officer can access a virtual classroom and laboratory. This virtual classroom is composed of a diverse and rapidly growing set of materials: tutorials, on-line classroom presentations, GOES gallery, Satellite Interpretation Discussions, technical attachments and Web-based modules. The Virtual Laboratory for Satellite Meteorology has been endorsed by the World Meteorological Organization (WMO) Commission for Basic Systems (CBS). The Web-based and teletraining approaches described in this document can be included into the development of the Virtual Laboratory for Satellite Meteorology.

To connect directly with the staff in the forecast offices, some of these materials require an active component to allow the student to interact with an instructor. To meet this need, the IST PDS and VISIT programs have developed VISITview, a new teletraining tool, which is flexible, platform

independent, and extensible. VISITview allows for the expansion of teletraining functionality needed in today's environment of rapidly evolving technology. For more information on the evolution of satellite meteorology training as part of the IST PDS, see the homepage at meted.ucar.edu/ist.

ACKNOWLEDGEMENTS:

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