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19.2 THE VISIT PROGRAM -- TRANSFERRING RESEARCH TO OPERATIONS

Daniel T. Lindsey[1*], Dan Bikos[1], John Weaver[2], Anthony Mostek[3]
[1]Cooperative Institute for Research in the Atmosphere
Fort Collins, Colorado
[2]NESDIS - RAMM Branch
Fort Collins, Colorado
[3]National Weather Service - Office of Climate, Water, and Weather Services
Boulder, Colorado

1. INTRODUCTION

The Virtual Institute for Satellite Integration Training (VISIT) program provides distance learning for operational forecasters in the National Weather Service (NWS) via teletraining. Begun in 1998, the VISIT program is comprised of staff from the Cooperative Institute for Research in the Atmosphere (CIRA), the Cooperative Institute for Meteorological Satellite Studies (CIMSS), the Warning Decision Training Branch (WDTB), and other NWS training centers. Teletraining topics are varied, but tend to stress the use of multi-sensor data types with a focus on weather satellites.

One of the primary goals of the VISIT program is to transfer research results to operations in a timely manner. Journal articles often take a year or more to appear after submission, and forecasters rarely take the time to sift through the details of technical papers. VISIT teletraining allows these significant time gaps to be avoided by presenting new material within months or even weeks instead of years.

This paper provides a general overview of the VISIT program in section 2, including some training statistics. Section 3 describes VISITview, the teletraining software tool used by the VISIT program. Section 4 provides several examples of VISIT session which have aided in the transfer of research results directly to NWS operational forecasters.

Corresponding author address: Daniel T. Lindsey, CIRA/Colorado State University, 1375 Campus Delivery, Ft. Collins, CO 80523-1375; email: lindsey@cira.colostate.edu

2. TELETRAINING SESSIONS - RESULTS

From April 1999 through September 2003, the training provided by the VISIT program has resulted in the following (see Figure 1):

- **711 sessions conducted**
- **Over 3500 participating offices**
- **Over 11,500 certificates issued**

The 3500 participating offices include the many offices that have participated in multiple sessions. All 121 NWS forecast offices have participated. The NWS offices include the 115 locations in the CONUS, plus San Juan, Puerto Rico, three offices in Alaska region and two in Pacific region. Most of the NWS National Centers for Environmental Prediction, River Forecast Centers and Central Weather Service Unit offices have participated along with other organizations (Navy, NESDIS, Emergency Managers, and the Meteorological Service of Canada).

Beginning in late 2000, the VISIT teletraining program experienced a rapid rise in the number of sessions offered and the number of certificates issued. Evaluations for the teletraining sessions are sent via e-mail to all offices upon completion of the session and are also available on the Web. The large number of evaluations received is the result of an incentive. Upon receipt of the evaluation, training certificates are sent to all students that participated in the session. The linkage of the evaluation to the certificates helps to explain the large number of evaluations received and the large number of certificates issued.

Figure 1. Cumulative number of VISIT training certificates issued from April 1999 through September 2003.

The evaluations have provided many useful insights into the teletraining program, including:

- High quality graphics are a big plus
- Interactions between instructors and students are very important
- Animations are very useful
- VISITview-based sessions are easy to install and use
- Make sure the training materials are at appropriate level of difficulty
- Scheduling is a challenge with 24x7 forecast operations that span several time zones, but it can be done
- Using phone conference call for audio works well but the audio quality and volume need to be monitored
- Linking the training to specific forecaster problems and cases is very positive
- Overall, most agree that VISITview is an effective tool and teletraining works

3. VISITVIEW – AN EVOLVING TELETRAINING TOOL

The VISITview teletraining software (www.ssec.wisc.edu/visitview/) is designed to provide instructors and students with a set of easy to use tools for creating, conducting and taking teletraining sessions. VISITview is written in Java and can be used in two modes: with the data files located on a central server or with these files residing on a local disk drive. In the former case, only the VISITview commands are sent over the Internet.

Most NWS offices have reliable bandwidth connections but they usually are congested moving large data files. The high volume of data 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 distributed via FTP to the training sites. These files can be large (over 200 MB for some sessions). Once at the training site, the zip archive file is expanded into a local directory. The session may be previewed at the convenience of the office staff to ensure that the lesson runs properly. The 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 available on the web for each session.

The VISITview software provides the following functions (see Figure 1):

- a complete set of animation controls
- image zoom
- multiple panel displays with animation
- drawing tools with various color choices
- change enhancement or colorization of images
- add/remove overlays
- chat window
- quiz questions with feedback
- view status of all session participants
- recorded audio/graphics for future playback
- open web browser with link to selected site
- and image combinations with fade between images

In Figure 2, the low pressure and frontal symbols were drawn on the slide by the instructor using VISITview's drawing tools. During a live session, the annotations appear on each participating offices' screens as they're drawn by the instructor. To add instructor/student interaction, any participant can draw on the slide when prompted by the instructor.

Another new VISITview feature is the ability to include recorded audio and annotations with the session file. This asynchronous option allows the lessons to be played back in virtual real time with the voice and annotations of the instructor. For examples of sessions with instructor audio and annotations, choose the "training sessions" link on the VISIT homepage and select a session with the microphone icon next to the course title.

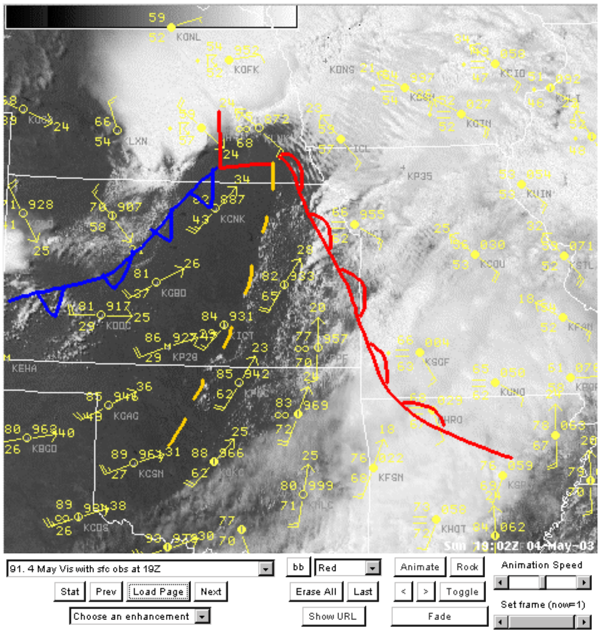

Figure 2. VISITview panel from a VISIT teletraining session showing the instructor's annotations displayed on top of a visible satellite image with station plots overlaid. The VISITview control panel is below the image.

4. RESEARCH TO OPERATIONS EXAMPLES

Ten to thirty teletraining sessions are administered each month (see example of calendar in Figure 3). Each session lasts between 30 minutes and 2 hours, depending on the subject. The majority of the sessions focus on satellite product interpretation, but data from a wide array of sensors are examined and discussed. Topics are chosen based on the development of new products, new research results, and occasionally requests from the field. Some examples of sessions which transfer research results to operations are briefly described below.

4.1 Use of GOES/RSO imagery with other remote sensor data for diagnosing severe weather across the CONUS (RSO 3)

This is the third in a series of VISIT teletraining sessions on GOES Rapid Scan Operations (RSO) Imagery. The first session is titled Using GOES Rapid Scan Operations (RSO) Imagery in AWIPS and concentrated on what RSO is and how to call it. The second session is titled Mesoanalysis of convective weather using GOES RSO imagery and concentrated on incorporating satellite data in the short-range forecast, nowcasting, and warning decision making processes. A portion of this session came out of a case study of severe thunderstorms on 31 May 1996 (Weaver et al., 1996), and another paper was published following VISIT teletraining about a supercell thunderstorm in Nebraska from 24 July 2000 (Weaver et al., 2002).

October 2003

Monday	Tuesday	Wednesday	Thursday	Friday
		1 RSO III Part 1 1:30 PM MDT 19:30 UTC SPC, PBZ, LZK, LMK, GYX, JAN, LSX	**2** Mesoanalysis RSO 9:30 AM MDT 15:30 UTC GJT	**3** Navigating CPC's Website 9:00 AM MDT 15:00 UTC EHU, TSA, ALY, SHV, CRP, MEG, GGW
6	**7** RSO III Part 1 9:30 AM MDT 15:30 UTC ABR, IWX, RLX, CAR, SGF	**8**	**9** RSO III Part 2 2:00 PM MDT 20:00 UTC IWX, PBZ, ILM, BOI, LMK, JKL, SGF	**10**
13	**14** Navigating CPC's Website 12:00 PM MDT 18:00 UTC ======FULL====== TUA, ABQ, LUB, JAX, OHX, MLB, BRO, PIH, GYX, ORN	**15** RSO III Part 2 9:30 AM MDT 15:30 UTC ABR, SPC, LZK, RLX, GYX	**16** ACARS weather data 10:00 AM MDT 16:00 UTC GYX	**17** Water Vapor Imagery 8:00 AM MDT 14:00 UTC ======FULL====== EPZ, OHX, ABR, IND, AKQ, IWX, GJT, DLH, OKX, EHU

Figure 3. Portion of VISIT's October 2003 scheduling calendar, as it appears on the VISIT website.

The objectives of the third and newest RSO session are to identify different air masses, analyze storm scale features, demonstrate how RSO imagery is used most effectively with other datasets such as lightning, radar, etc., and present severe weather cases that encompass a variety of regions across the CONUS. A paper has recently been submitted to *Monthly Weather Review* which discusses severe thunderstorm features which are visible from satellite. Figure 4 is an example slide from this session showing how a visible satellite image can be used to discern wind direction at different levels, atmospheric stability, and the locations of different air masses.

Since VISIT training began on RSO satellite imagery, requests for RSO by the NWS have risen dramatically. For example, there were 79 RSO calls for GOES-east in 1998, while in 2002 the total rose to 147. This is partly due to an automatic RSO call whenever the Storm Prediction Center (SPC) issues a moderate risk or greater of severe weather. This began shortly after a tornado outbreak in Oklahoma on May 3, 1999 (Bikos, et al., 2002). It was this event, along with pressure from CIRA/NESDIS, which helped initiate these automatic RSO calls for severe weather potential.

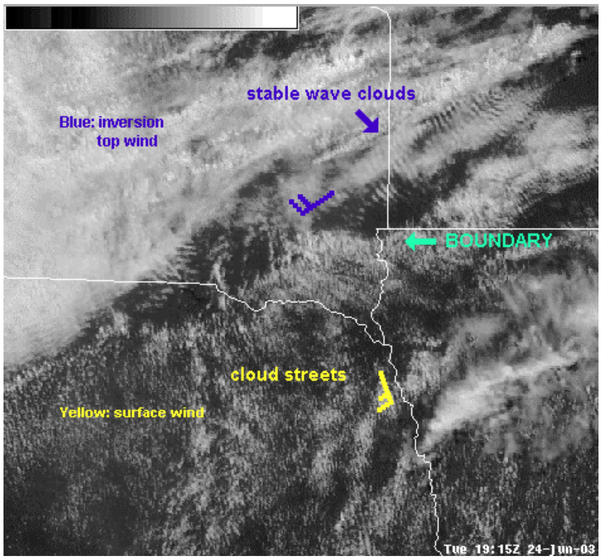

Figure 4. Example slide from the RSO 3 teletraining session showing a visible satellite image with different cloud types and air masses labeled.

4.2 Wildland fire detection using satellite imagery

This session focuses on the detection of fires using satellite imagery, particularly channel 2 3.9 micrometer GOES imagery. The objectives of the session are to briefly review the available NWS fire weather forecast products, establish where satellite imagery fits in the forecast/nowcast process, learn to utilize satellite imagery to augment spotter reports and increase probability of detection, and present examples and a case study of wildland fire detection using GOES satellite imagery. Figure 5 shows a GOES visible image from 9 June 2002 over Colorado. Multiple fires are ongoing and their smoke plumes are quite evident. This VISIT session came about in response to a paper which has been accepted to *Weather and Forecasting* (Weaver, et al., 2003).

4.3 Lightning Meteorology

VISIT teletraining sessions entitled *Lightning Meteorology I* and *Lightning Meteorology II* were developed over the last several years in response to NWS forecaster's ability to view National Lightning Detection Network (NLDN) data on AWIPS, in addition to research focusing on the relationship between storm morphology and lightning activity (Zajac and Rutledge, 2001). The first session focuses on cloud-to-ground (CG) lightning activity in typical, non-severe warm season thunderstorms and mesoscale convective systems. Charging mechanisms and differences between negative and positive CG's are discussed. The second session includes cold season lightning and lightning activity in severe storms. Research results from Smith et al. (2000), which form a relationship between positive strike dominated storms and surface equivalent potential temperature values, are discussed. Figure 6 is an example slide which appears in both Lightning Meteorology sessions.

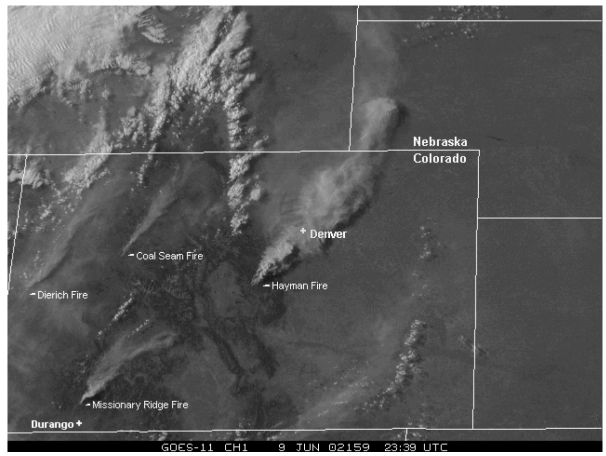

Figure 5. Example slide from the Fire Detection teletraining session showing a visible satellite image over Colorado with ongoing fires labeled.

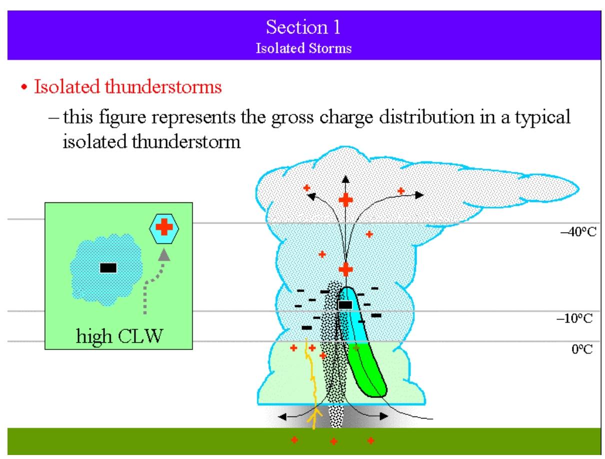

Figure 6. Example slide from the Lightning Meteorology I teletraining session showing a schematic of a mature thunderstorm and its associated charge distribution.

4.4 Anticipating mesoscale band formation in winter storms

In addition to teletraining sessions developed and presented at CIRA, VISIT occasionally assists groups elsewhere in the NWS with broadcasting their training to a wider audience. Dave Novak and colleagues at Eastern Region Headquarters (ERH) developed and began presenting this Mesoscale Banding session in November of 2002.

The session reviews deformation, frontogenesis, and stability concepts with a focus on the relationship between stability and the frontogenetical response, then exercises forecast strategy through interactive case examples of banded and nonbanded systems (Novak et al., 2003). Figure 7 is an example slide showing the ageostrophic response to frontogenesis.

This teletraining session was particularly timely, as a significant winter storm affected the northeast US beginning Christmas Day 2002 (see paper 8.1 by Novak et al. in this conference). This storm was characterized by many of the mesoscale banding features discussed in the VISIT session, and participating NWS offices from the northeast no doubt benefited from the training.

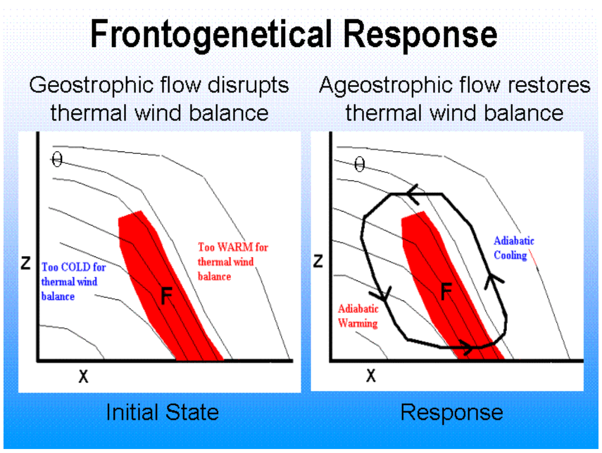

Figure 7. Cross-section showing the ageostrophic response to frontogenesis.

More information on these and other VISIT teletraining sessions is available on the VISIT homepage: http://www.cira.colostate.edu/ramm/visit/visithome.asp

5. SUMMARY

The National Weather Service training program has moved from the traditional classroom setting to an integrated distance learning approach to provide cost-effective training. Using VISITview, a new teletraining software tool that is flexible, platform independent, and extensible, the VISIT program is able to transfer research results to the operational forecasters in a timely manner. The VISIT program has been a great success and will continue to provide training for the NWS.

6. REFERENCES

Bikos, D., J. W. Weaver, and B. Motta, 2002: A satellite perspective of the 3 May 1999 great plains tornado outbreak within Oklahoma. *Wea. Forecasting*, **17**, 635-646.

Mostek, A., S. Bachmeier, T. Whittaker, D. Bikos, D. Lindsey, J. Weaver, M. DeMaria, B. Grant, and J. LaDue, 2003: VISITview - connecting instructors with operational forecasters. *International Conference on Interactive Information and Processing Systems (IIPS) for Meteorology, Oceanography, and Hydrology, 19th, Long Beach, CA, 9-13 February 2003 (preprints)*. Boston, MA, AMS, 2003. P1.44.

Novak, D. R., J. S. Waldstreicher, L. F. Bosart, and D. Keyser, 2003: A forecast strategy for anticipating cold season mesoscale band formation. Preprints, 20th Conference on Weather Analysis and Forecasting, American Meteorological Society, 11-15 January 2004, Seattle, WA, paper 8.1.

Novak, D. R., J. S. Waldstreicher, L. F. Bosart, and D. Keyser, 2003: An observational study of cold season mesoscale band formation in the Northeast United States. Preprints, 31st Conference on Radar Meteorology, American Meteorological Society, 6-12 August 2003, Seattle, WA, pp 969-972.

Smith, S. B., J. G. LaDue, and D. R. MacGorman, 2000: The relationship between cloud-to-ground lightning polarity and surface equivalent potential temperature during three tornadic outbreaks. *Mon. Wea. Rev.*, **128**, 3320-3328.

Weaver, J. F., J.F. Dostalek, B.C. Motta, and J.F.W. Purdom, 2000: Severe thunderstorms on 31 May 1996: A satellite training case. *National Weather Digest,* 3-19.

Weaver, J.F, J.A. Knaff, D. Bikos, G.S. Wade, J.M. Daniels, 2002: Satellite Observations of a Severe Supercell Thunderstorm 24 July 2000 made during the GOES-11 Science Test. *Wea. Forecasting*, **17 (1)**, 124-138.

Weaver, J. F., D. T. Lindsey, D. Bikos, C. C. Schmidt, and E. Prins, 2003: Fire detection using GOES rapid scan imagery. Submitted and accepted to *Wea. Forecasting*.

Whittaker, T. M., 1999: VISITVIEW- A Collaborative Distance Learning Tool for the Virtual Institute for Satellite Integration Training (VISIT). Preprints *15th International Conference on Interactive Information and Processing Systems for Meteorology, Oceanography, and Hydrology*, Dallas, Texas, AMS.

Zajac, B. A., and S. A. Rutledge 2001: Cloud-to-ground lightning activity in the contiguous United States from 1995 to 1999. *Mon. Wea.* Review, **129**, 999-1019.