1. Orientation

Instructor Notes: This instructional component is designed to orient you the with the AWOC Winter Weather Track. My name is Brad Grant, Meteorologist Instructor for the Warning Decision Training Branch in Norman, Oklahoma, and this session will last about 30 minutes.

Student Notes:

2. Winter AWOC 2008-09 Update Team

Instructor Notes: These are the folks responsible for preparing the updates for the Winter AWOC in 2008-09.

Student Notes:

3. Here are the AWOC Winter Subject Matter Experts

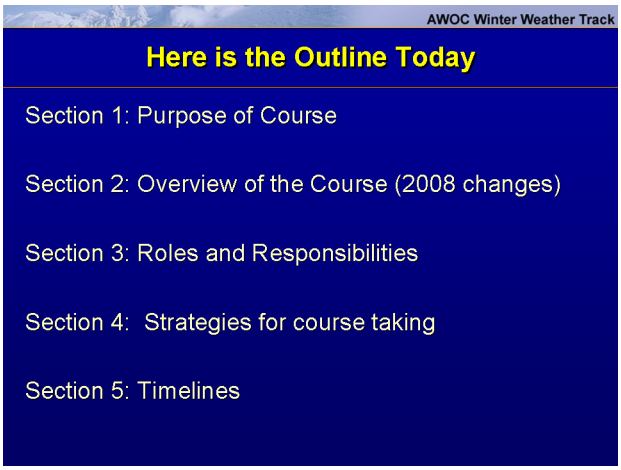
Instructor Notes: This was the 2006 gathering in Norman where we initially outlined the course content.

Student Notes:

4. Here is the Outline Today

Instructor Notes: Section 1 describes the purpose and goals of the course. Section 2 describes the basic structure of the course, such as IC breakdown and objectives. Section 3 describes the roles of the students , instructors, and local facilitation, and Section 4 reviews a new concept: flexible course learning path strategies, and section 5 takes a look at the course delivery schedule. The entire presentation will take only about 30 minutes.

Student Notes:

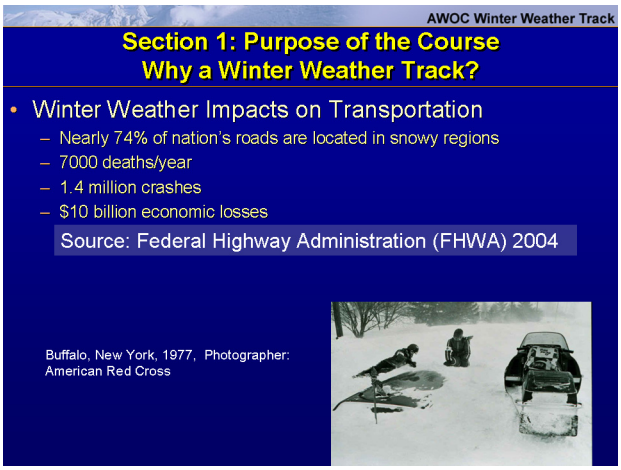


5. Section 1: Purpose of the CourseWhy a Winter Weather Track?

Instructor Notes: Recent statistics in 2004 on adverse weather impacts on transportation by the Federal Highway Administration (FHWA) indicate that: Winter weather dramatically impacts roadway safety Each year 18% of fatal crashes and 22% of injury crashes occur due to combination of adverse weather (rain, snow, sleet, hail, or fog) and poor pavement conditions. 74% of nation's roads are located in snowy locations (and

70% of pop) Reported economic losses of $42 billion from adverse weather from travel delays: 23% ($10 B) due to fog, snow , and ice, additional road operating costs, and maintenance costs Nearly 39% of road operating costs can be attributed to winter maintenance annually. Each year, state and local agencies spend over 2.3 billion dollars on snow and ice control operations and an est. $5 billion to repair roadway infrastructure (Paul Pisano, Lynette Goodwin, and Andrew Stern, 2004: Surface Transportation Safety and Operations: The Impact of Winter within the Context of Climate Change) The image at the right is of Red Cross workers searching for victims buried in cars following heavy snowfall. The picture shows the roof of a car. Location: Buffalo, New York Photo Date: February, 1977 Photographer: American Red Cross

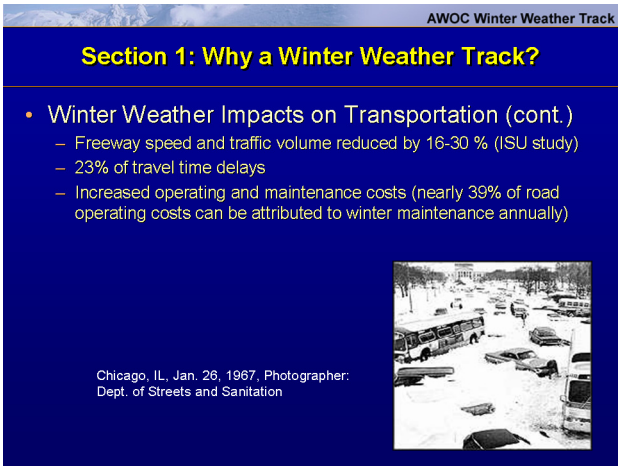
Student Notes:



6. Section 1: Why a Winter Weather Track?

Instructor Notes: The picture shown was taken from the Jan. 26, 1967 snowstorm in Chicago , IL. Picture taken from the Dept. of Streets and Sanitation.

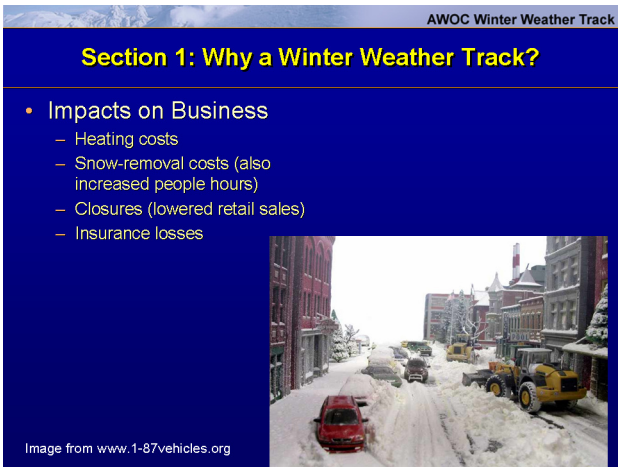
Student Notes:



7. Section 1: Why a Winter Weather Track?

Instructor Notes: Adverse winter weather impacts sectors of the economy in many ways, most notably with increased gas and electric consumption and inflated costs to heat businesses and homes. Over $3 trillion of the nation's annual economy is now directly affected by weather events (Freedman, 2003). Costs associated with snow removal industry are tied mostly to amounts and duration, which are linked to people hours. Also, property losses from winter storms can be significant, esp. with big snow-storms (March 2003, Denver Colorado $93 M) or ice storms (98 NE/Canada Ice Storm, $1.4 B USD, $3 B in Canada). When businesses close due to adverse weather, the local economies are affected. Insurance losses associated with one major winter storm can cost up to $6 billion (Kunkel et al, 99). There are some positive impacts when winter weather is lessened: "Nationally, an estimated $21 billion in benefits included lower heating costs, a reduction in snow-removal costs, increased construction income, reduced transportation costs, fewer insurance losses and increased retail sales. Most of the $0.5 billion in losses were realized by the tourism industry and by decreases in sales of snow-related equipment and winter clothing." (from a study by Stanley Changnon, Illinois State Water Survey, 2002)

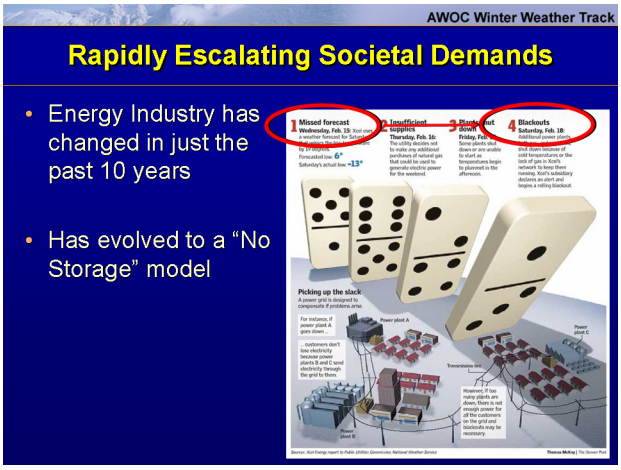
Student Notes:



8. Rapidly Escalating Societal Demands

Instructor Notes: This previously mentioned change of the energy industry to a "no storage" model has caused a situation with the energy availability always "on the edge" and flirting with crisis in consumption and availability. In a recent case, the industry was actually hit with a disaster. It started out with a missed 5-day forecast by 19 degrees. Then, 5 days later, power plants had to shut down because of cold temperatures or the lack of gas in the energy company's network.

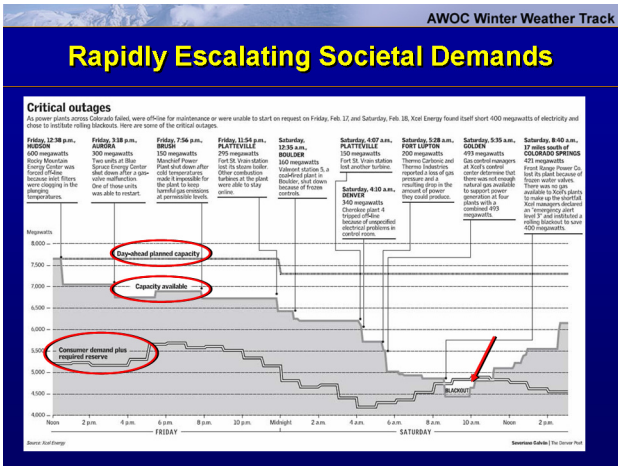
Student Notes:



9. Rapidly Escalating Societal Demands

Instructor Notes: This critical outage is chronicled here in a time series of events from Friday of that week in Feb., which culminated in a series of rolling blackouts in Denver and surrounding vicinities. All because, the consumer demand outstripped the available capacity.

Student Notes:



10. Section 1: Why a Winter Weather Track?

Instructor Notes: Winter weather affects our children, and slick roads can cause devastating accidents. All schools have a specific plan of action to mitigate winter weather impacts. Most schools do not close during the day because there is no one home to pick them up. Schools make their decisions on when to close usually 1-2 hours before buses are scheduled to leave which, in many districts is around 6 A.M. local time. School superintendents meet with local transportation officials and make a decision using direct observations, the current weather forecasts (from TV and internet), and what other districts are doing. There are other variables to the decision making process when events

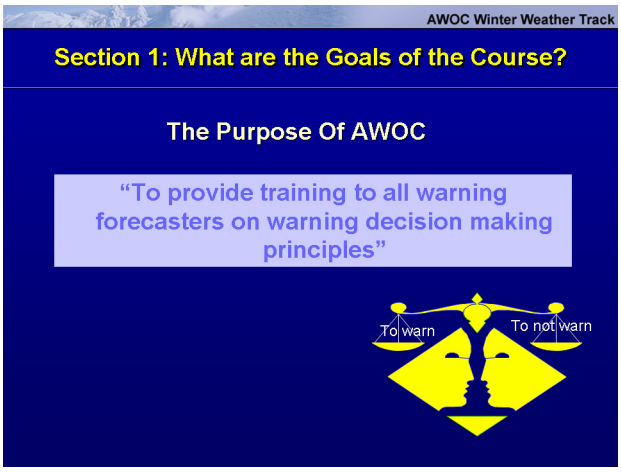
occur that are “unexpected” (such as a “rush-hour” storm).

Student Notes:

11. Section 1: What are the Goals of the Course?

Instructor Notes: This the overall training objective of the course.

Student Notes:

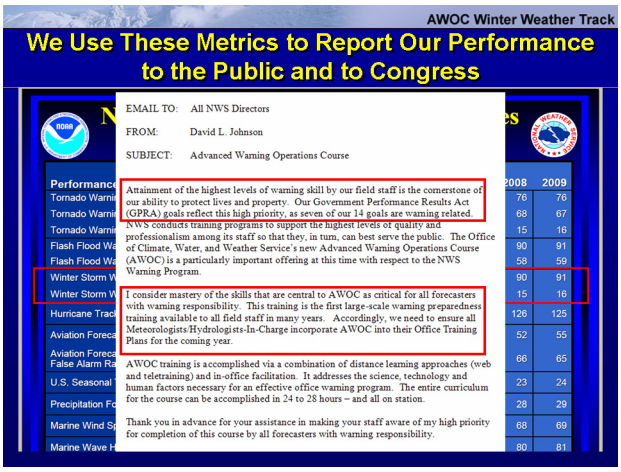


12. We Use These Metrics to Report Our Performance to the Public and to Congress

Instructor Notes: GPRA (Government Performance Results Act) goals for winter wx are shown here. These numbers are reported to Congress and the White House. The actual measures, which nationally the NWS are very close to meeting, are POD= 90%, and Lead Time = 15 hrs. These goals are specifically addressed by the AWWT. According to Dr. Uccellini, who appears on our orientation video, the GPRA measures posted here, are fairly conservative and do not reflect our stretch goals (for example, warning out to day 3). Also, the public expects better and better degrees of service with each warned event. They will not be complacent to what they have received in the past. So, user expectations are increasing with each winter event. This memo from the former

Director of the NWS for AWOC was significant and sent an important message : “this training is directly tied to skills necessary to perform our mission.” Many Regions make the completion of the AWOC mandatory training.

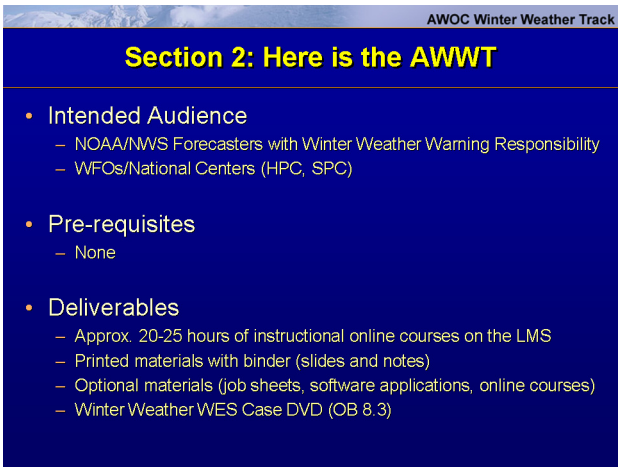
Student Notes:



13. Section 2: Here is the AWWT

Instructor Notes: Here is a description of the AWWT deliverables. The intended audience is NOAA/NWS Forecasters with Winter Weather Warning Responsibility at WFOs and winter weather forecasters at National Centers with public forecasting duties. (HPC, SPC) There are NO pre-requisites for Winter AWOC, although it is usually the case that you will have completed DLOC first. Deliverables include approx. 20-25 hours of instructional online courses on the LMS , printed materials with binder (slides and notes), some optional materials (job sheets, software applications, online courses), and a winter weather WES case (version OB8.3).

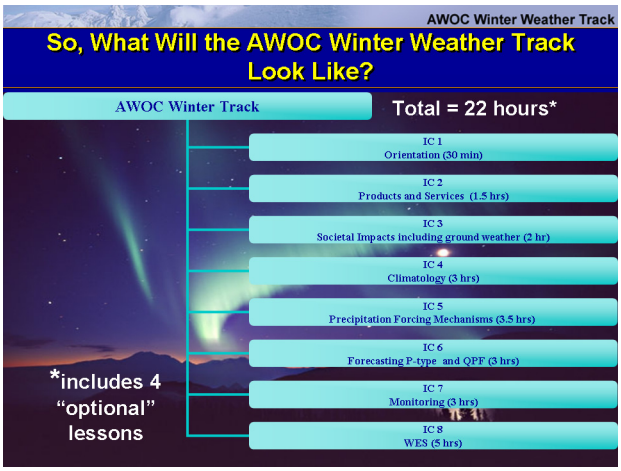
Student Notes:



14. So, What Will the AWOC Winter Weather Track Look Like?

Instructor Notes: This begins Section 2 of the Orientation. This is how the course breaks down into individual instructional components. The 25 Subject Matter Experts in Winter Weather have collaborated with WDTB in developing these ICs. It amounts to about 20 hours of instruction. That includes all 32 lessons. There are 4 lessons that are optional (using CPC/CDC products, applying climatic anomalies to EPS data, Orographic forcing, and Lake Effect Snows). If you don't take the optional parts of AWWT, it reduces the length of instruction to about 19 hours.

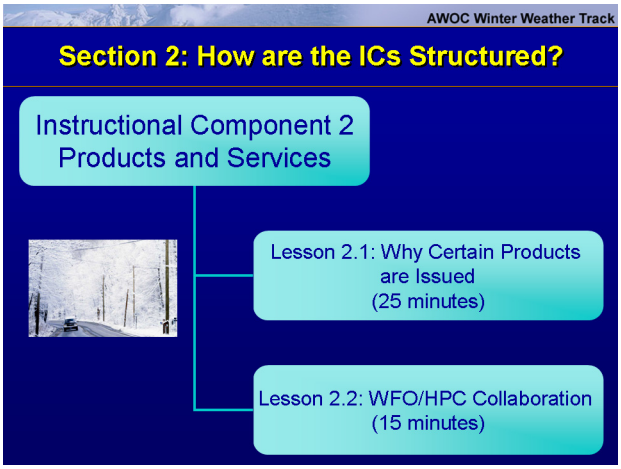
Student Notes:



15. Section 2: How are the ICs Structured?

Instructor Notes: There are multiple lessons within each IC, usually intended to be completed sequentially. Each lesson is about 15 to 30 minutes. After completing each IC, the student will need to take an exam in the LMS that addresses the learning objectives of the IC.

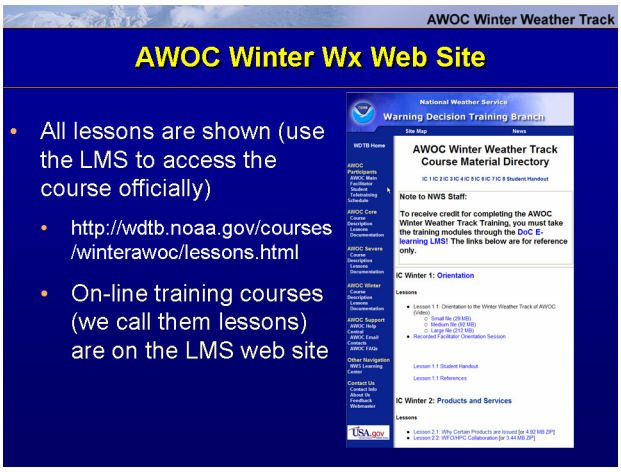
Student Notes:



16. AWOC Winter Wx Web Site

Instructor Notes: Here is our web site showing the winter AWOC outline of courses.

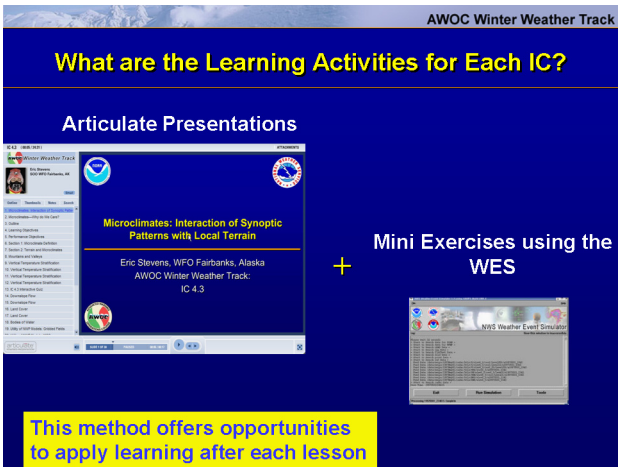
Student Notes:



17. What are the Learning Activities for Each IC?

Instructor Notes: There will be Articulates and some mini exercises to help apply the concepts from the learning.

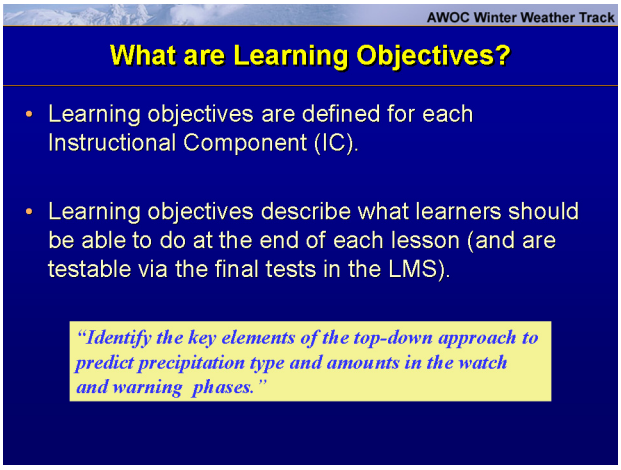
Student Notes:



18. What are Learning Objectives?

Instructor Notes: Learning objectives are defined and described in the ICs for each lesson. Learning objectives describe what learners should be able to do at the end of the lesson. Here is an example of one.

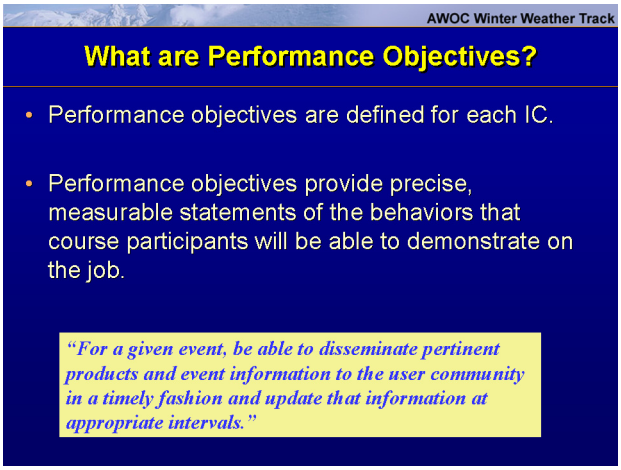
Student Notes:



19. What are Performance Objectives?

Instructor Notes: IC performance objectives are similar to the learning objectives and are defined for each lesson. Many of performance objectives will be included in IC 8, the Weather Event Simulator (WES) instructional case for the course. Facilitators should evaluate how well students can master specific performance objectives for each IC. After the entire course has been completed, students will be evaluated on the extent of training transfer to performance of the learning and performance objectives, to help determine behavioral changes. This is part of the level 3 training evaluation process.

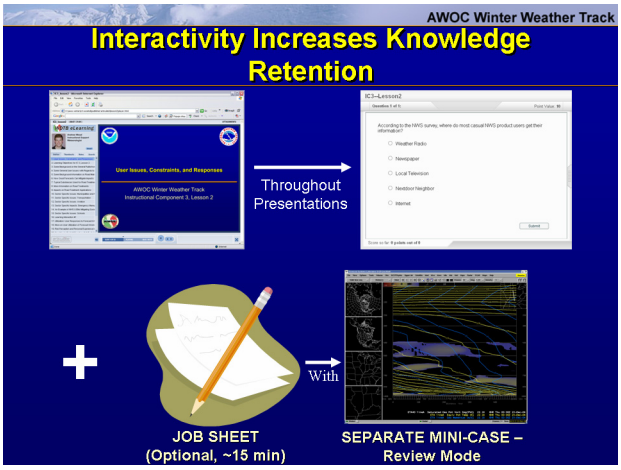
Student Notes:



20. Interactivity Increases Knowledge Retention

Instructor Notes: Most articulate presentations will contain increased interactivity with quiz questions, and some modules will have short 15 min optional job sheets along with mini-case data that are separate from the primary Simulation case.

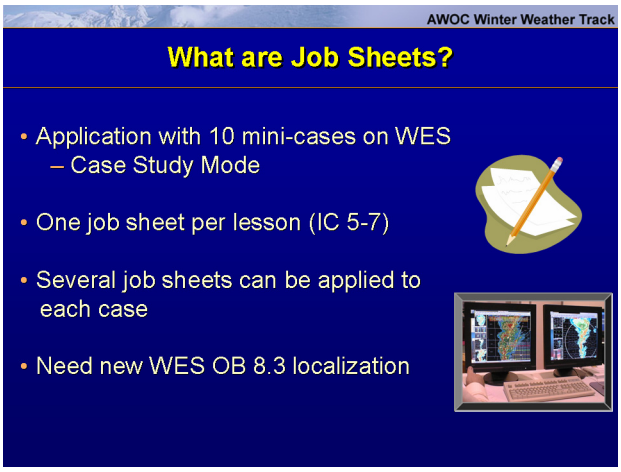
Student Notes:



21. What are Job Sheets?

Instructor Notes: The job sheets will take 10-15 minutes to run through and we'll look at an example on the next slide. We are producing job sheets for the ICs that lend themselves to such a tool, specifically, those ICs that examine AWIPS case data in the warning process. You will not need to run the WES in simulator mode. Since these will be for case review mode, all that will be required is setting the clock to the desired event time. We plan on having just one model run, a few satellite images, surface obs, and perhaps radar imagery for one event. Thus, case size will be small, and even more importantly, many lesson job sheets can be applied to the same event. So the number of cases will be fewer than the number of job sheets. The goal is to have the job sheet case data loaded on your WES machines by the time the WWAWOC training modules are released (June 1). We will have answer sheets available online.

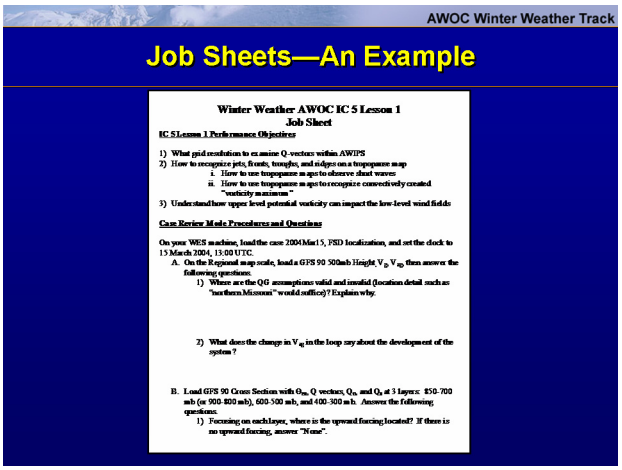
Student Notes:



22. Job Sheets—An Example

Instructor Notes: This is an example of one of the job sheets for AWWT. These job sheets are included in the student binders.

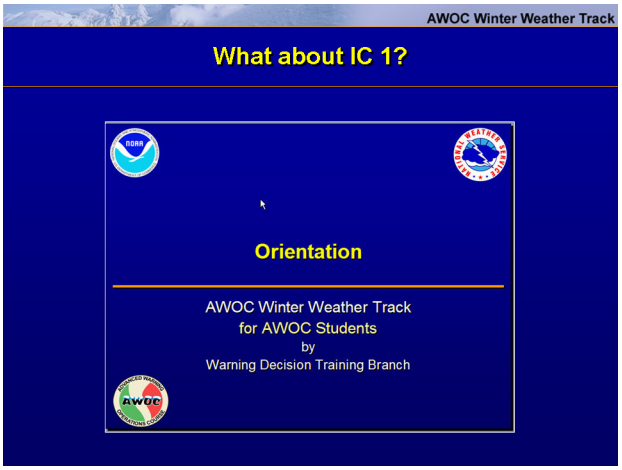
Student Notes:



23. What about IC 1?

Instructor Notes: The intro is a short video about why winter weather is so important to our mission. It contains some interesting dialogue by Dr. Louis Uccellini of the NCEP.

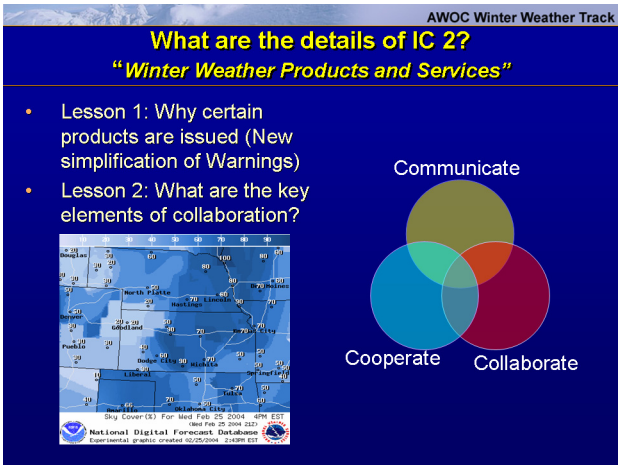
Student Notes:



24. What are the details of IC 2?“Winter Weather Products and Services”

Instructor Notes: The author for this IC is Paul Stokols from NOAA’s NWS Office of Climate , Water and Weather Services.

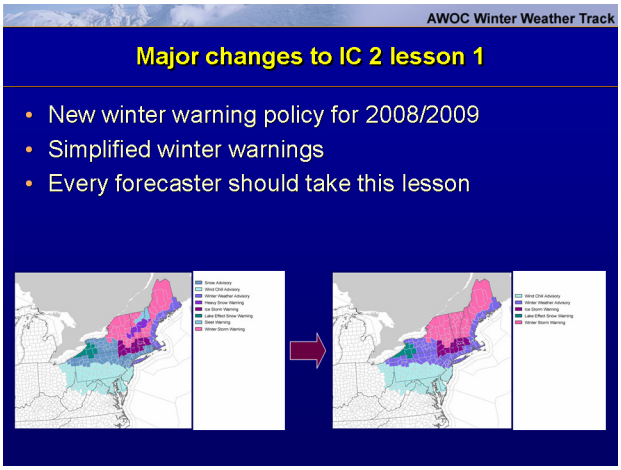
Student Notes:



25. Major changes to IC 2 lesson 1

Instructor Notes:

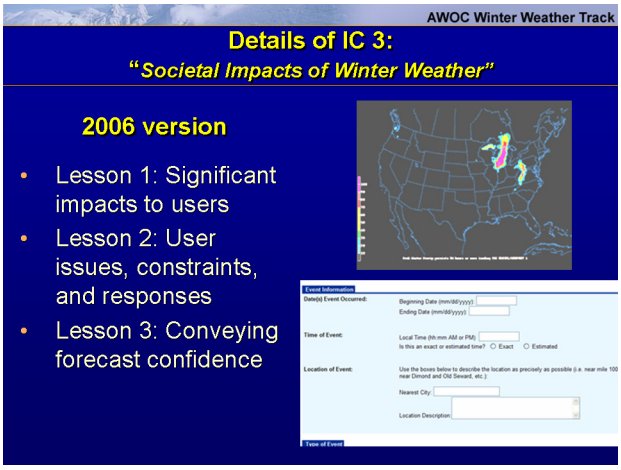
Student Notes:



26. Details of IC 3:"Societal Impacts of Winter Weather"

Instructor Notes: This IC was developed by Andy Wood of WDTB using input from the NWS and private sector. In 2006, there were 3 lessons in this IC, all on evaluating the end user's perspective to help mitigate the myriad of impacts from winter weather that provided some information on societal impacts, and conveying forecaster confidence.

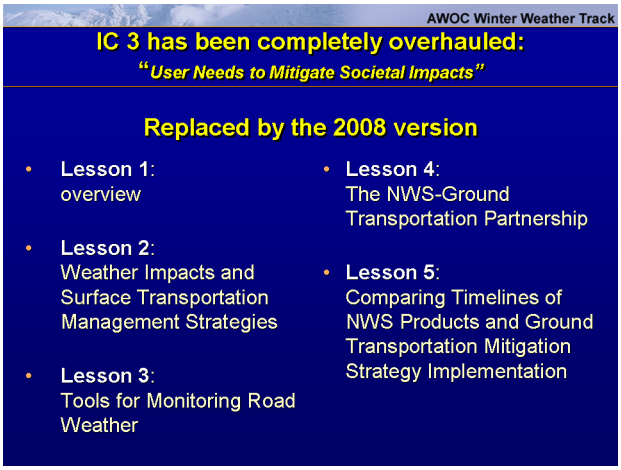
Student Notes:



27. IC 3 has been completely overhauled:"User Needs to Mitigate Societal Impacts"

Instructor Notes: In 2008, Andy Wood has completely overhauled IC3 in order to provide information on the one most overlooked societal impact from winter weather: Road weather. Now he provides you 5 lessons describing the impact of winter weather on road conditions, mitigation strategies, road weather observing systems, the NWS-ground transportation partnership, and comparing timelines of NWS products and ground transportation mitigation strategies. This IC should be taken as its own course for those forecasters having already taken winter AWOC and we provide a learning path to enable just that.

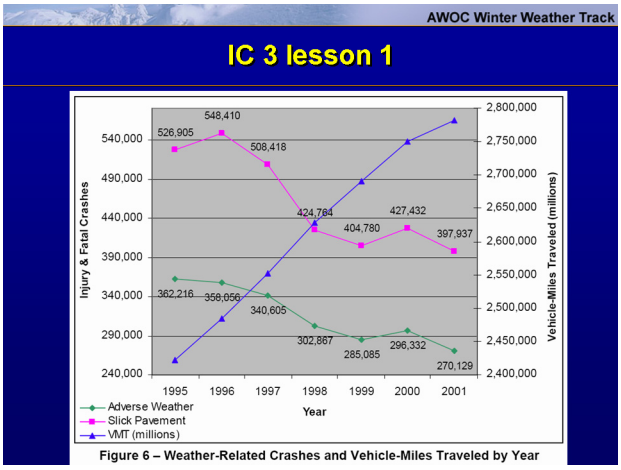
Student Notes:



28. IC 3 lesson 1

Instructor Notes:

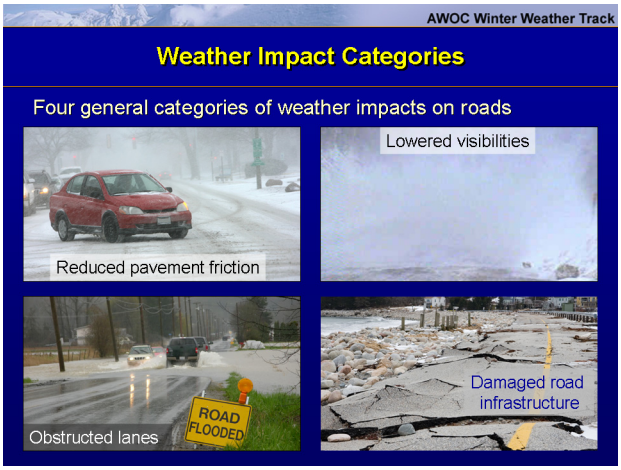
Student Notes:



29. Weather Impact Categories

Instructor Notes: There are many ways that adverse weather can impact surface transportation. From a transportation operators point of view, all adverse weather impacts can be categorized into four groups by how the road surface, near-surface, and sub-surface conditions change as a result of the weather (Pisano and Goodwin, 2004). These impacts are: [CLICK] 1. Reduced pavement friction (due to wet, snowy/slushy, or icy pavement), [CLICK] 2. Lowered visibilities (due to fog, smoke, or heavy precipitation), [CLICK] 3. Obstructed lanes (due to significant snow accumulations, water infiltration of the road surface, or even debris on the road due to strong winds/tornadoes), and [CLICK] 4. Damaged road infrastructure (potholes, washed out roads, or road restrictions due to freeze/refreeze conditions). The first three categories can generally be mitigated during the event using various techniques. The last category generally requires some form of maintenance that can take significant time after the event (days, months or year) to complete.

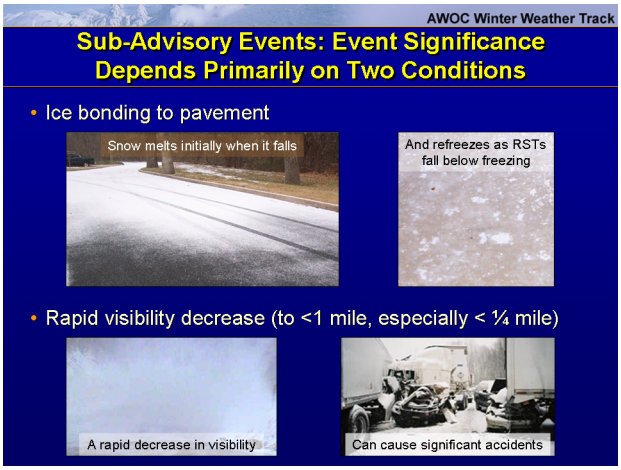
Student Notes:



30. Sub-Advisory Event Significance Traits

Instructor Notes: So what conditions are most likely to differentiate a mundane sub-advisory event from a significant one. While research on these events is not complete, several studies (Moore and Miller, 2008; DeVoir, 2008; Puhakka, 2005) have identified some common characteristics to significant sub-advisory events in different areas. [CLICK] What often separates significant sub-advisory events from mundane ones is the presence of ice on road surfaces. The ice formation can occur due to snow melting and re-freezing, freezing rain, or even the freezing of residual moisture on roadways. When that ice formation occurs quickly, or unexpectedly, a significant sub-advisory event can result in major impacts. [CLICK] In addition to ice on the roadway, near-zero visibilities (often due a sudden increase in snow rate) can also result in significant impacts during sub-advisory events. These events, referred to as High-Impact, Sub-Advisory (HISA; DeVoir, 2008) events, can occur under a variety of situations.

Student Notes:

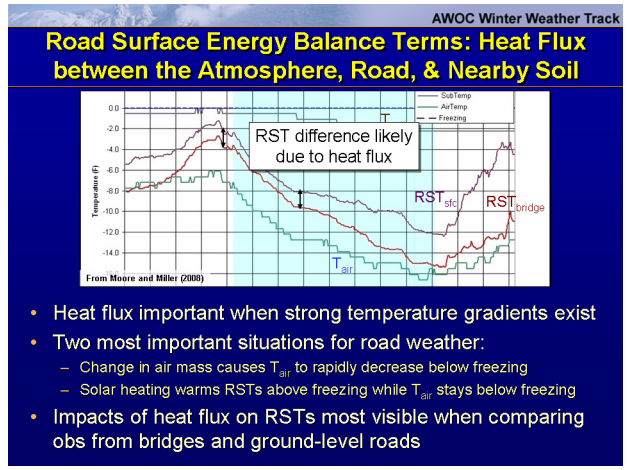


31. Heat Flux between the Air, Road, & Soil

Instructor Notes: The heat flux between the road, atmosphere, and surrounding soil can be very complex. For our purposes, however, NWS forecasters just need to understand how the heat flux works to equalize the temperatures of the road system. Remember that the magnitude of the heat flux depends on the temperature gradient. When there are significant temp differences in the system, the heat flux will work to bring the “road environment” into equilibrium. In other words, heat will transfer from the warmer parts of the system to the cooler parts of the system. [CLICK] Impacts to RSTs from heat flux are most important in two situations: [CLICK] – After a change in air mass causes rapid cooling of air temperature to below freezing and [CLICK] - When solar heating causes the road surface to warm above freezing during the day while air temperatures remain below freezing. These situations are important because the temperature gradients are maximized and the resulting heat flux impacts near-freezing RSTs. [CLICK] The impacts of heat flux are most evident near bridges and elevated roads. Soil temps change the slowest and are often a heat source or sink in the “road system”. The graphic shown illus-

trates this point very well as there is a substantial temperature gradient from the soil to the atmosphere. [CLICK] The RSTs for the surface based road sensor are warmer than those from a bridge-based sensor just a few hundred yards away. The difference in RSTs for this case varies between 2-4 deg C during overcast conditions with light snow, but becomes more dramatic the following morning as the sun breaks out.

Student Notes:



32. Road Weather Sensors

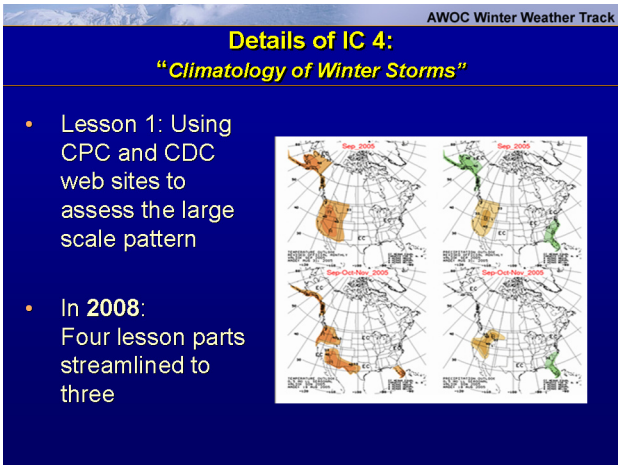
Instructor Notes:

Student Notes:

33. Details of IC 4: “Climatology of Winter Storms”

Instructor Notes: The IC 4 team includes the following: Julie Adolphson (lesson 1), Rich Grumm (lesson 2), and Eric Stevens (lesson 3), and Jim LaDue (WDTB). In 2008, Julie’s four lesson parts were combined and streamlined into three. Winter AWOC students need to take all three lessons. Since these lessons were streamlined, the original four parts are still valid for those wishing to experience a more thorough treatment of long-duration weather patterns.

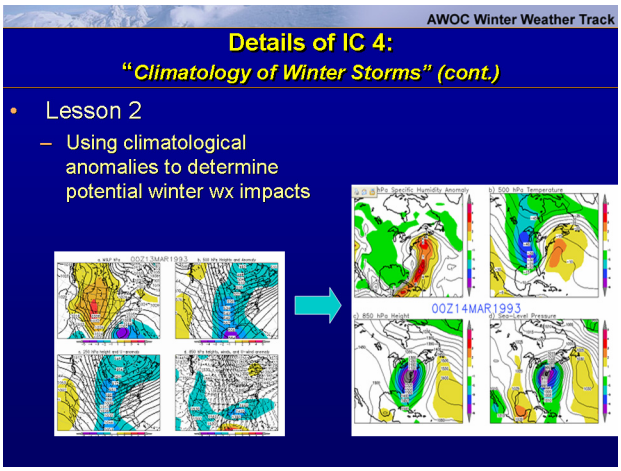
Student Notes:



34. Details of IC 4: "Climatology of Winter Storms" (cont.)

Instructor Notes: The learning objective for lesson 2 in IC 4 is show how to determine a climatological anomaly and potential impacts on anticipated weather.

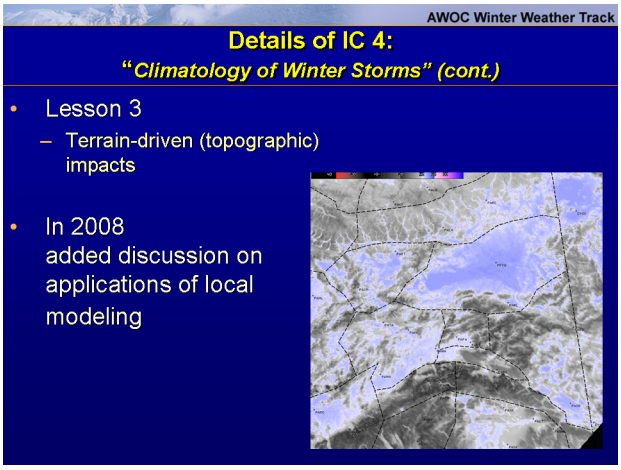
Student Notes:



35. Details of IC 4: "Climatology of Winter Storms" (cont.)

Instructor Notes: Lesson 3 of IC 4 focuses on how Synoptic Patterns Interact with Local Terrain to Impact Winter Weather. Eric added information in 2008 to include a discussion on local modeling.

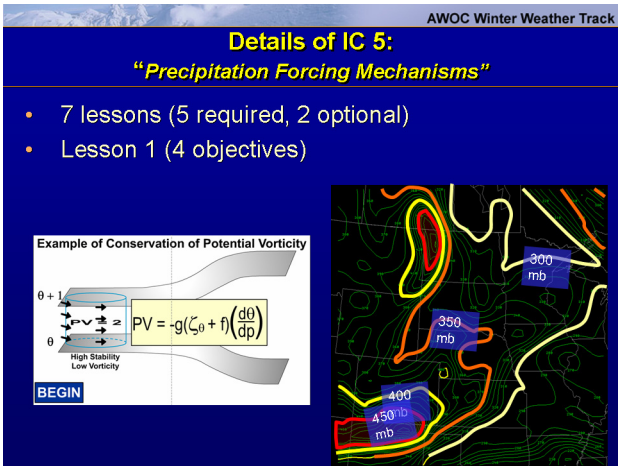
Student Notes:



36. Details of IC 5: "Precipitation Forcing Mechanisms"

Instructor Notes: Topic 5 deals with diagnosing precipitation forcing mechanisms. This topic discusses everything from PV diagnosis of shortwave troughs to topographically forced precipitation. We basically split this topic between internally, and externally forced precipitation.

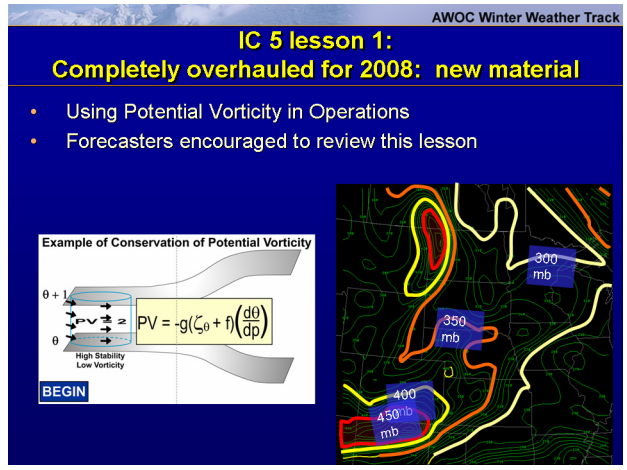
Student Notes:



37. IC 5 lesson 1: Completely overhauled for 2008: new material

Instructor Notes: The big change for 2008 is that lesson 1 has been completely rewritten and is a totally new lesson. It's now titled Potential Vorticity uses in Operations. It's a short lesson in pages but fairly rich in detail. There are flash-based popup windows that allow the student to interact with a case. Make sure the popups are allowed. We encourage all forecasters to review this lesson even if they've taken winter AWOC before.

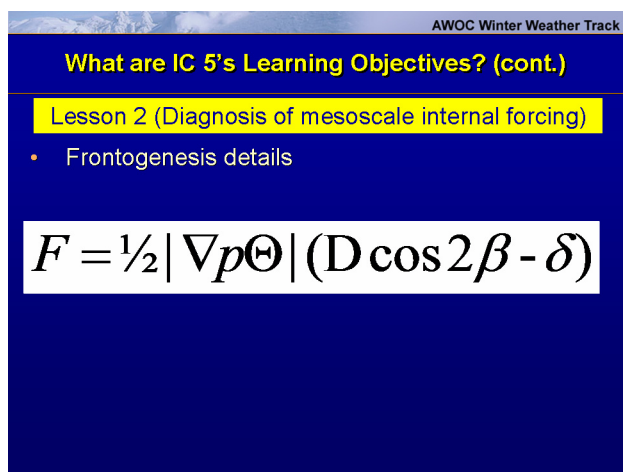
Student Notes:



38. What are IC 5's Learning Objectives? (cont.)

Instructor Notes: These are the objectives: List the two ways that frontogenetical circulations try to restore thermal wind balance. List the two types of wind flows from Pettersen's frontogenesis equation that are frontogenetical. List the one term missing from QG frontogenesis that is part of Pettersen frontogenesis. List two situations where of diabatic can result in frontogenesis. Describe how frontal circulations are impacted by upper-level forcing.

Student Notes:

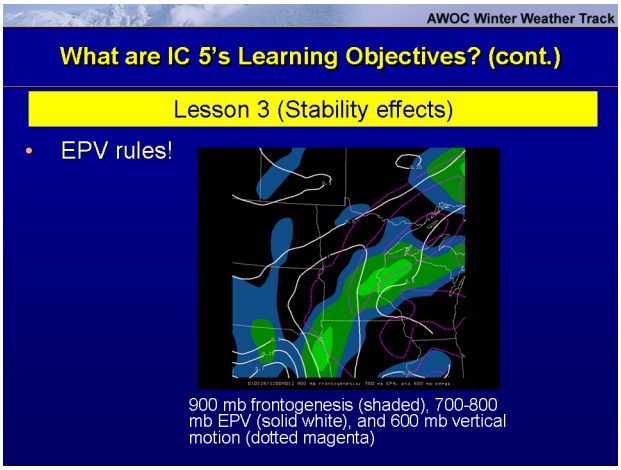


39. What are IC 5's Learning Objectives? (cont.)

Instructor Notes: Identify the two types of stability that can impact the vertical response to frontal and synoptic scale forcing Identify two conditions associated with weak symmetric stability (or symmetric instability). Describe one way that static-stability and one way that symmetric stability can be changed. List two advantages and one disadvantage of using EPV vs M- and theta-es surfaces for diagnosing symmetric instability. Describe the difference in the shape and width of the frontal circulation based upon changes in

symmetric stability. Identify two conditions that can help determine what layer to examine EPV.

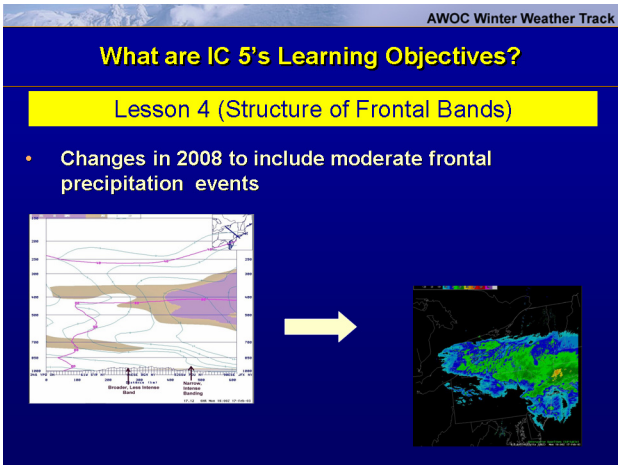
Student Notes:



40. What are IC 5's Learning Objectives?

Instructor Notes: Identify diagnostic and observational signatures associated with the development of intense, banded precipitation Identify diagnostic and observational signatures associated with the development of weaker, but still significant, bands of moderate to heavy precipitation. Mike Evans, SOO BGM, added some information on moderately forced precipitation events.

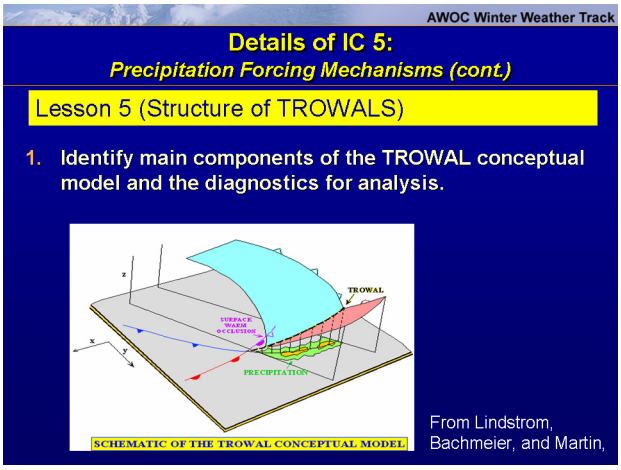
Student Notes:



41. Details of IC 5: Precipitation Forcing Mechanisms (cont.)

Instructor Notes: Lesson 5 details information on how to diagnose TROWALS.

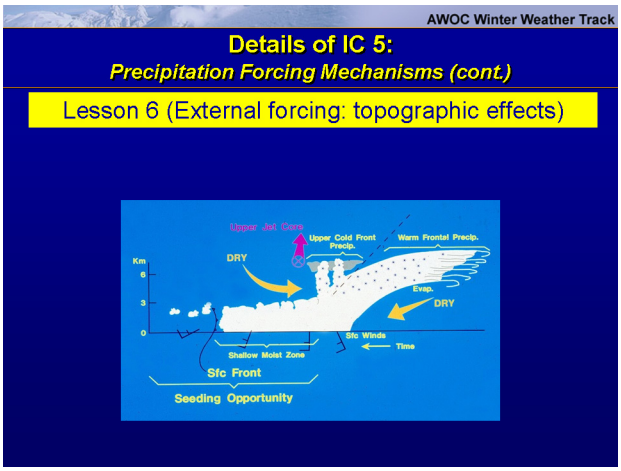
Student Notes:



42. Details of IC 5: Precipitation Forcing Mechanisms (cont.)

Instructor Notes: Identify the important physical processes for understanding the manifestations of terrain forcing on precipitation distributions. Identify the critical microphysical processes for understanding the manifestations of terrain forcing on precipitation distributions. Describe the primary orographic precipitation mechanisms. Demonstrate the various terrain-related forcing mechanisms for several mountain ranges. Discuss the various forms on terrain-induced convergence and the impacts on forcing of ascent. Describe some useful challenges associated with precipitation distribution in complex terrain.

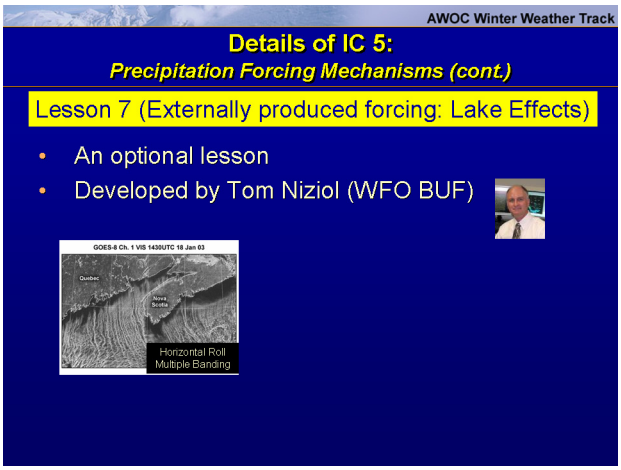
Student Notes:



43. Details of IC 5: Precipitation Forcing Mechanisms (cont.)

Instructor Notes: Identify the key components that contribute to local instability within the lake effect snow environment. Identify the key components to the morphology of snowband development. Identify the effects that the overlying synoptic pattern may have on adjusting the local forcing (stability) and flow fields (frictional and thermal convergence) within the mesoscale environment. Identify the role that precipitation microphysics plays in the lake effect snow environment. Examine the use of mesoscale models to aid in the prediction of steady-state lake effect snows. Identify various forecast procedures and tools that are used to predict lake effect snows.

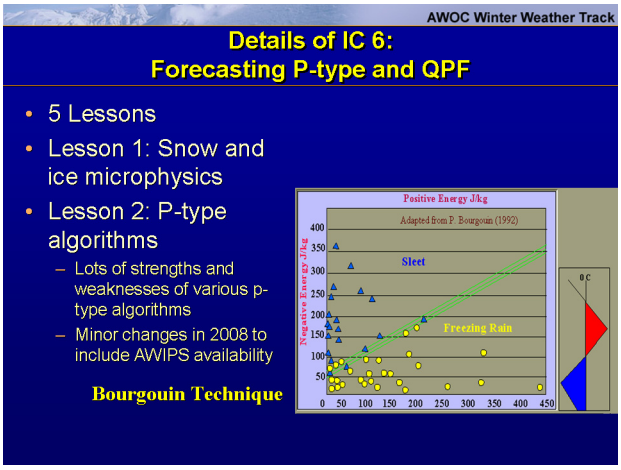
Student Notes:



44. Details of IC 6: Forecasting P-type and QPF

Instructor Notes: For lesson 1, the learning objective is: identify the key elements of the top-down approach to predict precipitation type and amounts (including depth) in the watch/warning phases. For lesson 2, the learning objective is: Identify the strengths and weaknesses of various p-type algorithms , such as Baldwin, Ramer and Bourgouin.

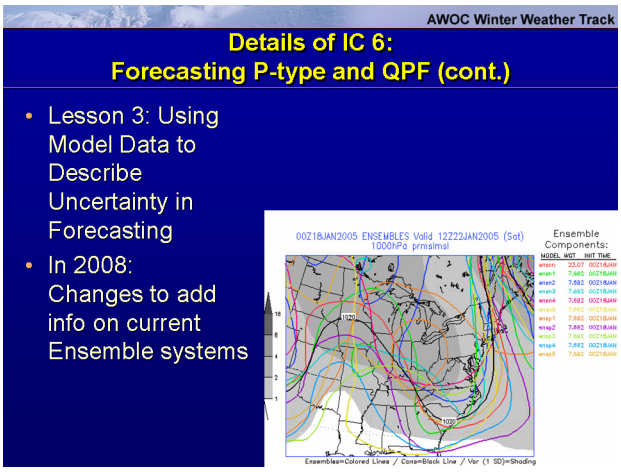
Student Notes:



45. Details of IC 6: Forecasting P-type and QPF (cont.)

Instructor Notes: There are 6 objectives for IC 6 lesson 3: Demonstrate why you should use ensemble forecast information during winter storms in the outlook, watch, and warning phase. Identify the strengths and limitations of EPS products such as mean, spaghetti, spread, plume charts, and probability of exceedance. Demonstrate how to recognize uncertainty /high probability outcomes in EPS data. Demonstrate how probabilistic forecasting duties in winter weather are related to ensemble forecasting. Changes in 2008 include information on the current ensemble systems. Rich and I also streamlined some graphics.

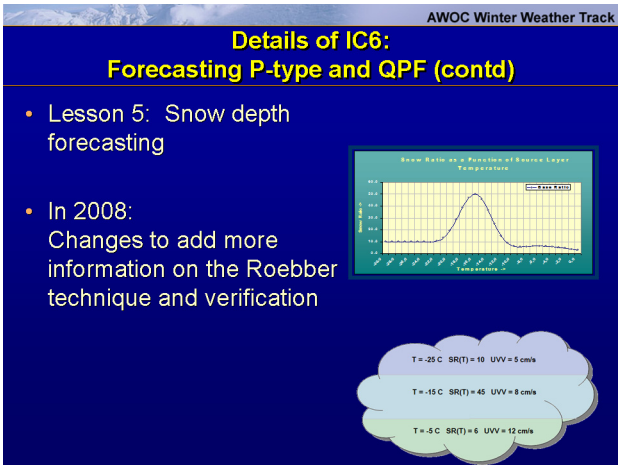
Student Notes:



46. Details of IC6:Forecasting P-type and QPF (contd)

Instructor Notes: Lesson 5 is all about snow depth forecasting including an introduction on two popular snow ratio forecasting tools: The Caribou, and the Roebber technique. Dan Petersen added information on the verification on both techniques.

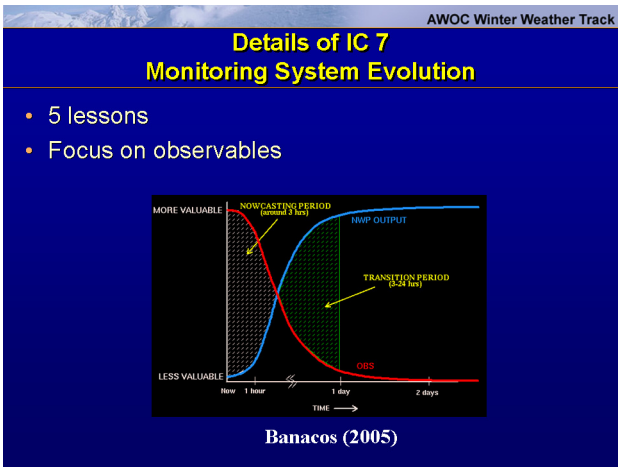
Student Notes:



47. Details of IC 7Monitoring System Evolution

Instructor Notes: There are many objectives for IC 7, monitoring system evolution. These can be summarized as follows: Identify strategies where observations can be used to assess model accuracy, and therefore clues as to how to modify model forecasts. Determine where the radar is overestimating precipitation due to overshooting. Identify usages of spotter and webcams as observational platforms for estimating precip. rate and visibility. Identify the major classes of instruments and their strengths and weaknesses in measuring visibility and precipitation rate. Identify a methodology to efficiently diagnose and assess future behavior of unexpected precipitation areas.

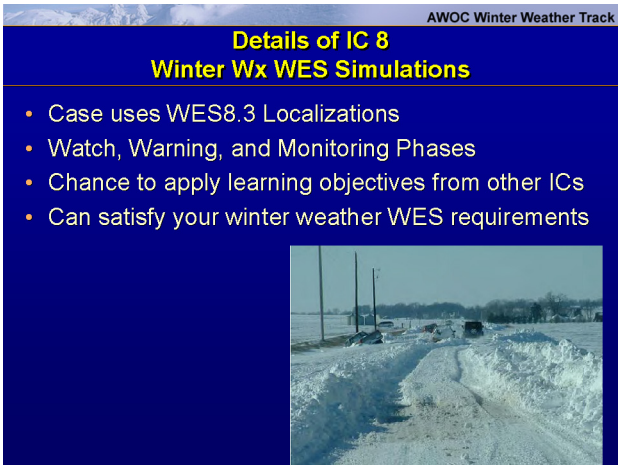
Student Notes:



48. Details of IC 8Winter Wx WES Simulations

Instructor Notes:

Student Notes:



49. AWOC winter development plans

Instructor Notes: We've created 3 development plans in the LMS. The first one is for students already in the middle of AWOC winter. We only ask that if they've taken IC2.1 already, they'll need to take it again because of radical changes to winter weather warning policy. The middle plan is for those that haven't taken winter AWOC yet and would like to start and DLOC graduates from this year. The third plan is for students interested in taking the lessons that have major changes. Note IC2.1 in there again.

Student Notes:

AWOC Winter Weather Track

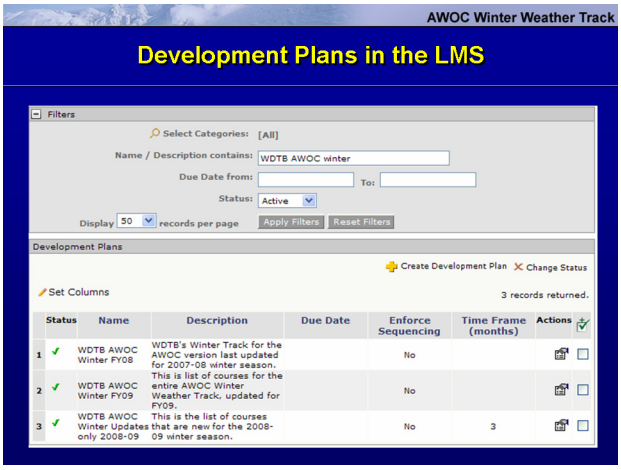
AWOC winter development plans

Development Plan in the LMS	Target audience	notes
WDTB AWOC Winter FY08	➢ Forecasters in the middle of AWOC winter 2008	➢IC's 1-8 v 2007
WDTB AWOC Winter FY09	➢ Forecasters that have not taken AWOC winter ➢ DLOC 2008/2009 graduates	➢IC's 1-8
WDTB AWOC Winter updates only 2008-2009	➢ Forecasters having taken AWOC winter previously	➢ IC's 2.1, 3, 5.1

50. Development Plans in the LMS

Instructor Notes: The development plans in the LMS appear as so.

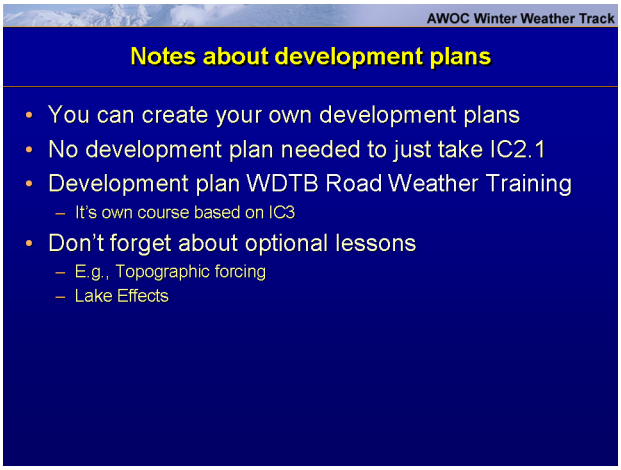
Student Notes:



51. Notes about development plans

Instructor Notes:

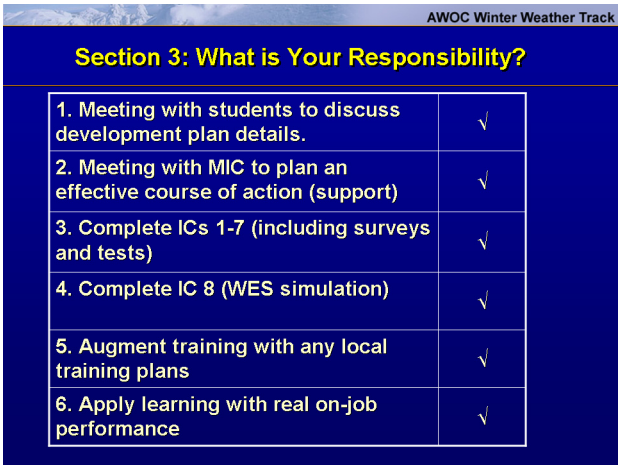
Student Notes:



52. Section 3: What is Your Responsibility?

Instructor Notes:

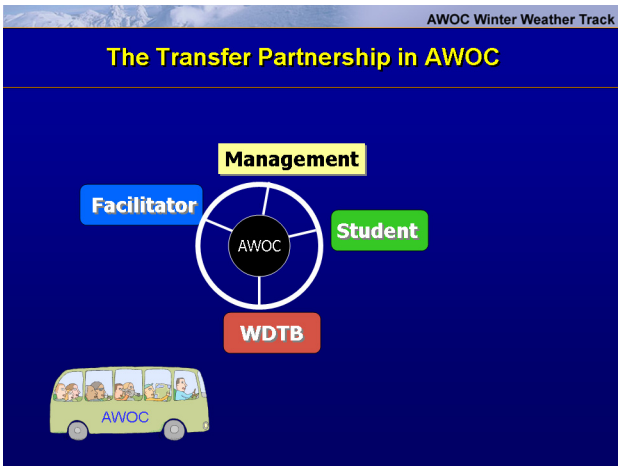
Student Notes:



53. The Transfer Partnership in AWOC

Instructor Notes: All 4 parties in the vehicle must be working together to make the AWOC "bus" ride smoothly. Training is a partnership between all the folks. Initially, the trainee (forecaster or whoever) must recognize a need for new skills. They must have their "hands" out with an open mind set. Perhaps there is a new theory out there on supercell development and some operational guidance that will help recognition and maybe (given the right circumstances) it will lead to improved warning lead times. When folks see hear about that guidance, most (but not all) will want to learn about it and find out how to use it. This is the first step in the transfer process, recognition that there is a need. The 2nd step is that the trainer must design and or deliver the learning experiences that will support learning. WDTB provided a flexible learning schedule in AWOC that supported different learning styles, abilities, and times for learning. The 3rd step, and this is most critical part, is that the manager must support the learning and application on the job. The manager in the NOAA's NWS situation, is not only the SOO and MIC; it's the all chain of commands above the local forecast office. For the most part, this was demonstrated with AWOC with only a few exceptions.

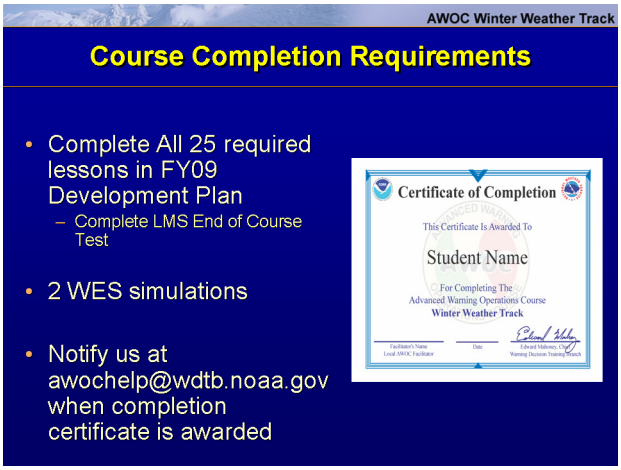
Student Notes:



54. Course Completion Requirements

Instructor Notes: These are the AWWT completion requirements. Be sure and complete the courses on the LMS in the 2009 Development Plan. And, please notify WDTB when completion certificate is awarded.

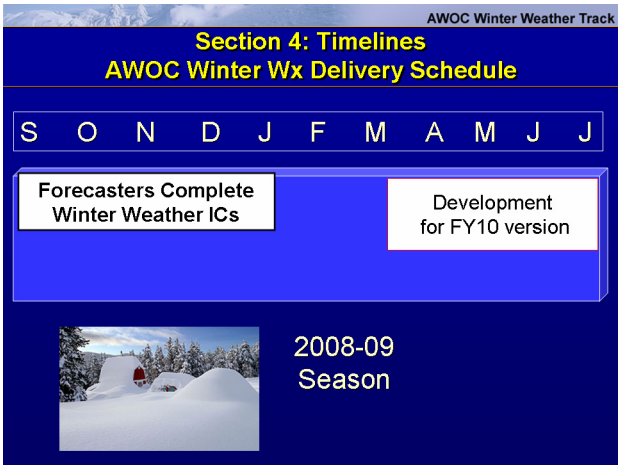
Student Notes:



55. Section 4: TimelinesAWOC Winter Wx Delivery Schedule

Instructor Notes: Students can complete the AWWT course through the end of the calendar year, at which point we begin to make course updates.

Student Notes:

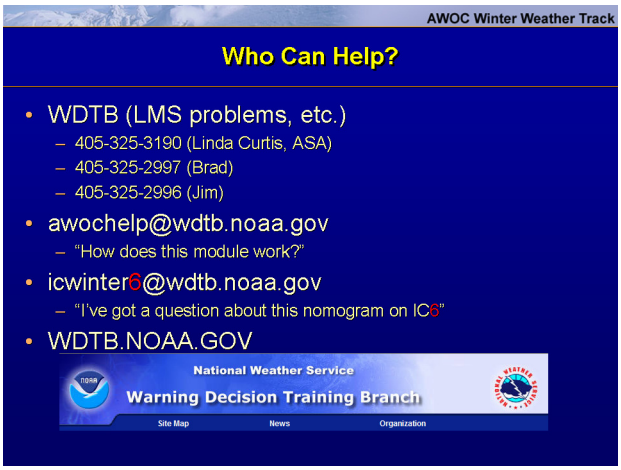


56. Who Can Help?

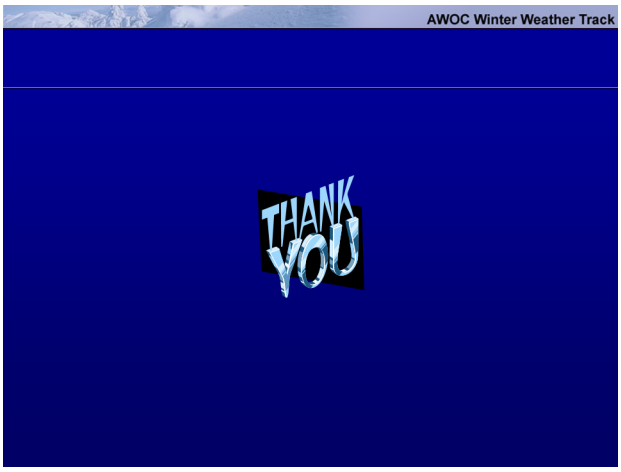
Instructor Notes: “We have designed a potential very rewarding learning experience for all participants in the AWOC Winter Wx Track. It is an exciting course that encompasses critical elements in the winter weather decision making process. Success will

depend on how well the entire training team (trainers, students, facilitators, and management) work together in achieving the goals of the course. We do provide a number of options to help alleviate potential problems in executing this course. Take advantage of these mechanisms to make the learning easier and enjoy the course. “

Student Notes:



57. Slide 57

Instructor Notes:

Student Notes: