Satellite Meteorology Education Resources Freely Available from COMET

Patrick Dills and Wendy Abshire

The COMET® Program
Boulder, Colorado

8th Annual Symposium on Future Operational Environmental Satellite Systems, January 2012, New Orleans, LA

Cooperative Program for Meteorology, Education, and Training (COMET)
University Corporation for Atmospheric Research (UCAR)

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Recent Publications

Satellite Meteorology: GOES Channel Selection V2

This module is an update to the previous Satellite Meteorology: GOES Channel Selection module. It reviews the five GOES imager channels and their use, incorporating conceptual visualizations and numerous imagery examples. The module also includes updated information...

More Information »

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We're always creating new modules. Here are some upcoming publications:

- Flood Forecasting Case Study: International Edition
- Coastal Climate Change
- Community Tsunami Preparedness

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Module Listing » Satellite Meteorology

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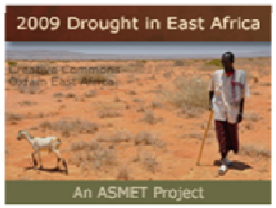
Satellite Meteorology

Topics: Satellite Meteorology Languages: English

In this topic area, find out how current and future satellites and their sensors work, how to interpret what they tell us, and how to make forecasts and other weather products from their data.

Modules | Courses Sort by: Date (Newest to Oldest)

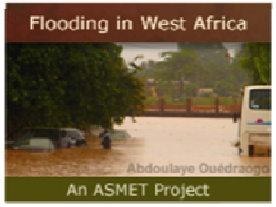
1 - 40 out of 54 results



ASMET: 2009 Drought in East Africa

Languages: English
Publish Date: 2012-01-17
Skill Level: 2
Completion Time: 1.00 - 1.25 h
Topics: Climate, Hydrology/Flooding, Satellite Meteorology, Tropical/Hurricanes

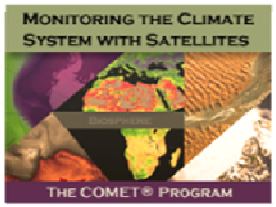
The module examines the 2009 drought in the Greater Horn of Africa (GHA), focusing on conditions in Kenya. The module begins by reviewing drought conditions in the years leading up to 2009. From there, it examines the seasonal climate forecast for the beginning of 2009 and ... Read more »



ASMET: Flooding in West Africa

Languages: English
Publish Date: 2012-01-10
Skill Level: 2
Completion Time: .75 - 1.00 h
Topics: Hydrology/Flooding, Satellite Meteorology, Tropical/Hurricanes

The rainy season in Sahelian West Africa extends from June to September and is tied to the position of the intertropical front. During this period, mesoscale convective systems (MCSs) often produce significant rainfall that can lead to flooding. This module examines an ... Read more »



Monitoring the Climate System with Satellites

Languages: English
Publish Date: 2012-01-10
Skill Level: 1
Completion Time: 1.50 - 2.00 h
Topics: Climate, Satellite Meteorology

The international science community has identified a set of Essential Climate Variables (ECVs) that should be monitored for measuring the climate system, how it is changing, and its likely impact on future climate. Environmental satellites play an important role in this ... Read more »

Special Interest

More on Satellite Meteorology

ESRC

The Environmental Satellite Resource Center (ESRC) provides easy access to a wide range of useful information, education, and training about low-earth orbit and geostationary satellites from trusted sources.

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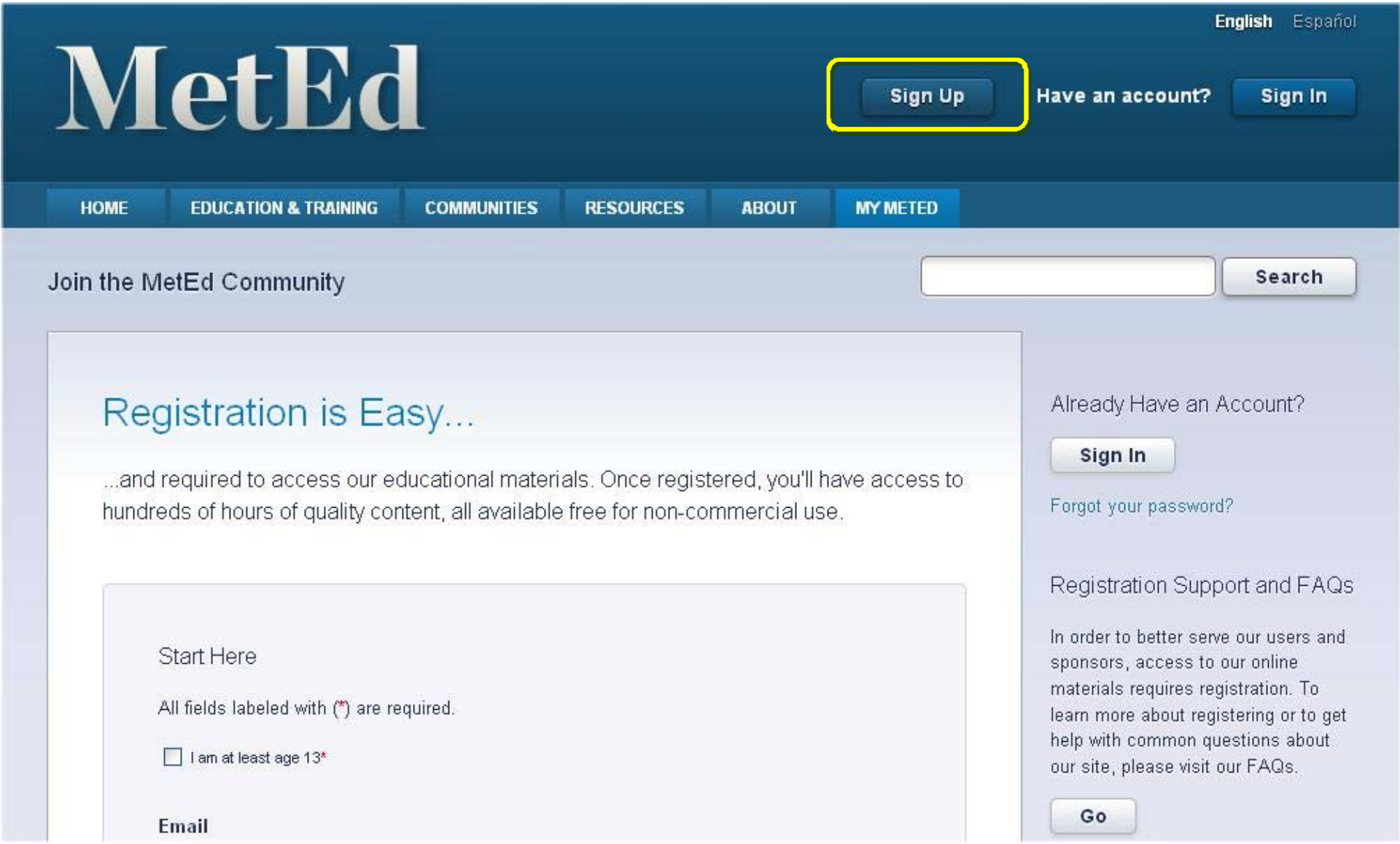
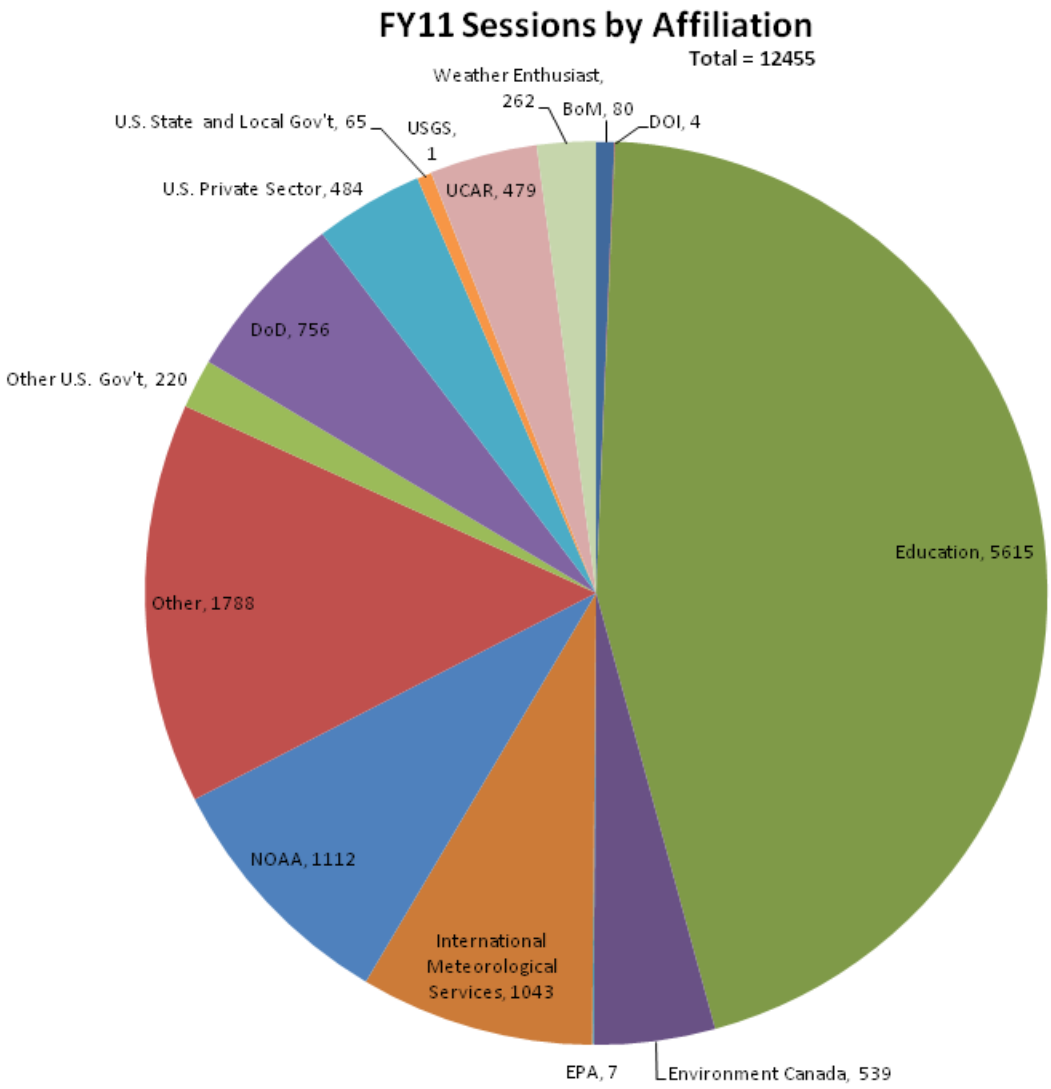


MetEd Registration Statistics
1 January 2012

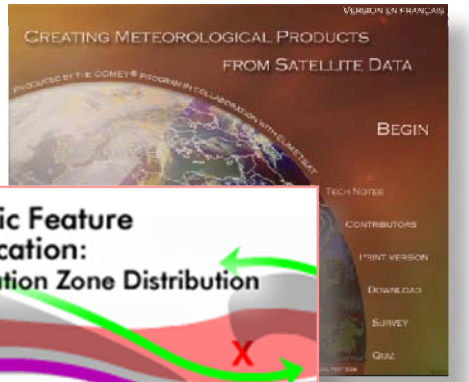
Total Registered Users	> 201,000
Total Users from outside United States	> 69,000
Total Countries (includes Dependencies and Territories)	> 200
Total Universities	> 1,300
Hours of Instruction	> 600
Hours of Satellite Instruction	> 60 (~10%)

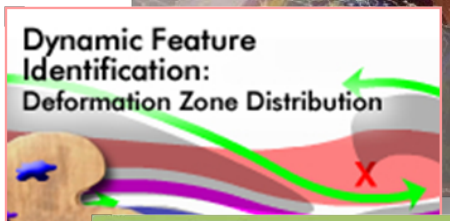
FY11 Satellite Module Usage

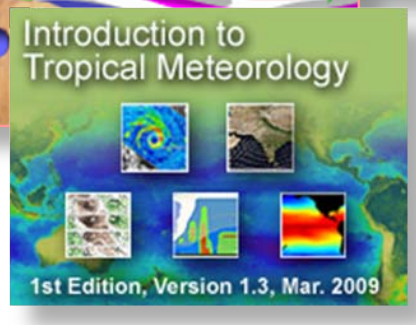


COMET Modules on Satellite Topics

- Advanced Satellite Sounding: The Benefits of Hyperspectral Observation
- Advances in Microwave Remote Sensing: Ocean Wind Speed and Direction
- An Introduction to POES Data and Products
- **An Introduction to the EUMETSAT Polar System**
- **ASMET: 2009 Drought in East Africa**
- **ASMET: Flooding in West Africa**
- **ASMET: Sat Precip Products for Hydro Mgmt in South Africa**
- Blowing Snow: Baker Lake, Nunavut, Canada 04-10 February 2003
- Creating Meteorological Products from Satellite Data
- **Deformation Zone Analysis**
- **Deformation Zone Diagnosis**
- **Deformation Zone Distribution**
- Dynamic Feature Identification: The Satellite Palette
- Feature Identification Exercises: Clouds, Snow, and Ice Using MODIS
- Feature Identification Using Environmental Satellites
- **Forecasting Dust Storms, Version 2**
- FORMOSAT-3/COSMIC
- **Satellite Meteorology: GOES Channel Selection, Version 2** **(NEW!)**
- **GOES-R: Benefits of Next-Generation Environmental Monitoring**
- Imaging with NPOESS VIIRS: A Convergence of Technologies and Experience
- **Introduction to Tropical Meteorology, 2nd Edition: Tropical Remote Sensing Applications**
- **Jason-2: Using Satellite Altimetry to Monitor the Ocean**

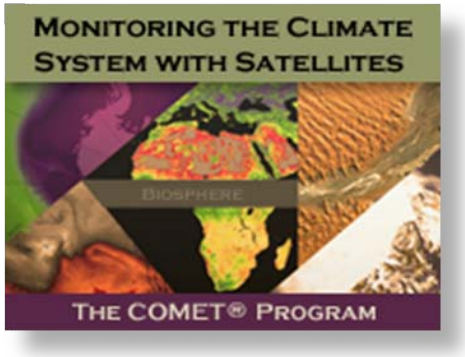




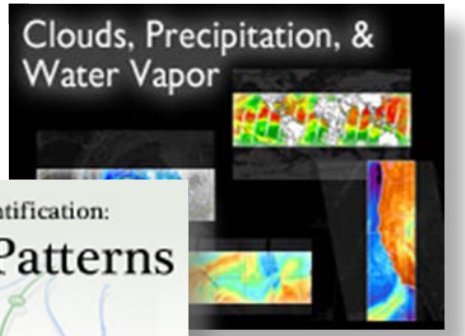


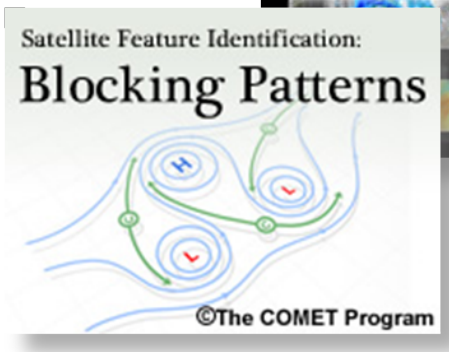
Bold = published over last 5 years

COMET Modules on Satellite Topics (continued)



- **Microwave Remote Sensing: Overview**
- **Microwave Remote Sensing: Clouds, Precipitation, and Water Vapor**
- **Microwave Remote Sensing: Land and Ocean Surface Applications**
- **Microwave Remote Sensing Resources**
- **Monitoring the Climate System with Satellites (NEW!)**
- **Multispectral Satellite Applications: Monitoring the Wildland Fire Cycle**
- **Multispectral Satellite Applications: RGB Products Explained**
- NexSat: Preparing Users for the NPOESS/VIIRS Era
- Polar Satellite Products for the Operational Forecaster (POES) Module 1: POES Introduction
- Polar Satellite Products for the Operational Forecaster (POES) Module 2: Microwave Products and Applications
- Polar Satellite Products for the Operational Forecaster (POES) Module 3: Case Studies
- Polar Satellite Products for the Operational Forecaster (POES) Module 4: Soundings
- Polar Satellite Products for the Operational Forecaster: Microwave Analysis of Tropical Cyclones
- **Recognition and Impact of Vorticity Maxima and Minima in Satellite Imagery**
- Remote Sensing of Land, Oceans, and Atmosphere with MODIS
- Remote Sensing of Ocean Wind Speed and Direction: An Introduction to Scatterometry
- Remote Sensing Using Satellites
- **Satellite Feature Identification: Blocking Patterns**
- **Satellite Feature Identification: Ring of Fire**
- Satellite Meteorology: Introduction to Using the GOES Sounder





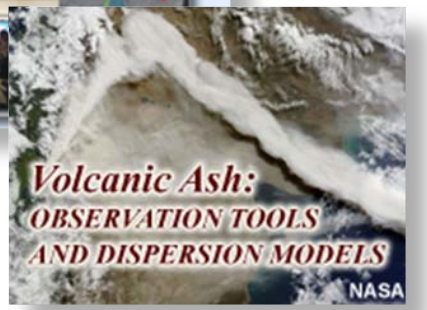
Bold = published over last 5 years

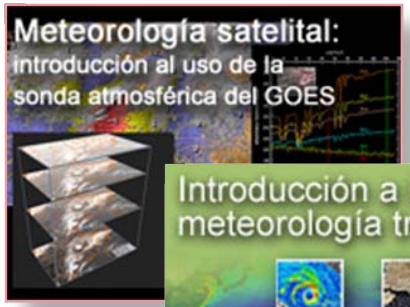
COMET Modules on Satellite Topics, including translations

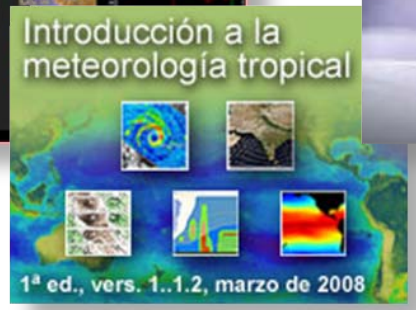
- The SPoRT Center – Infusing NASA Technology Into NWS WFO
- **Toward and Advanced Sounder on GOES?**
- Visible and Infrared Dust Detection Techniques
- **Volcanic Ash: Observation Tools and Dispersion Models (NEW!)**
- **Vorticity Maxima and Comma Patterns**
- **Vorticity Minima and Anticomma Patterns**
- **WMO Regional Satellite Workshop**

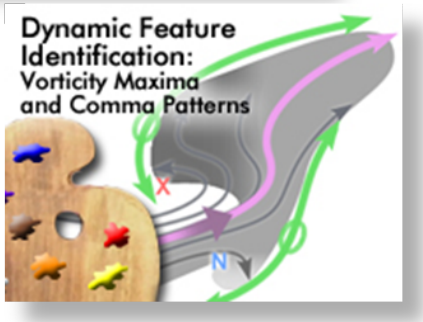
Translated Modules

- 20 en Español , 11 en Francais







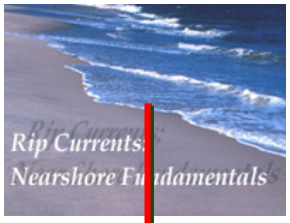


Module Topic Areas

Aviation

Climate

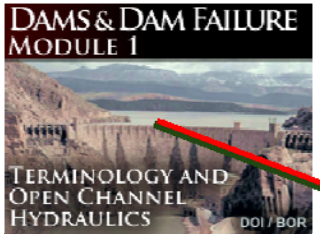
Coastal Weather



Environmental Education

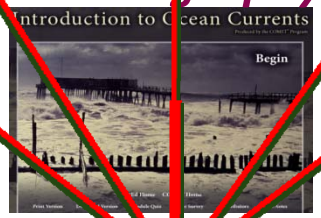
Fire

Hydrometeorology



International Activities

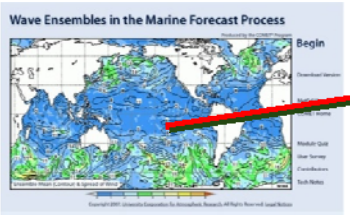
Marine Met & Oceanography



Mesoscale Meteorology

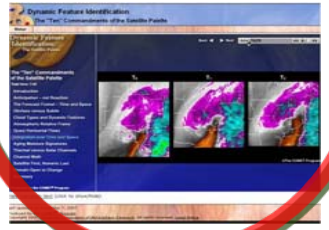
Northern Latitudes

Numerical Weather Prediction



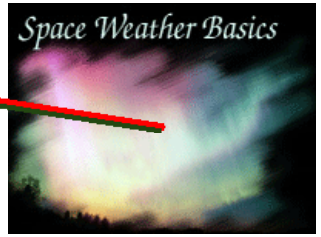
Road Weather

Satellite Meteorology

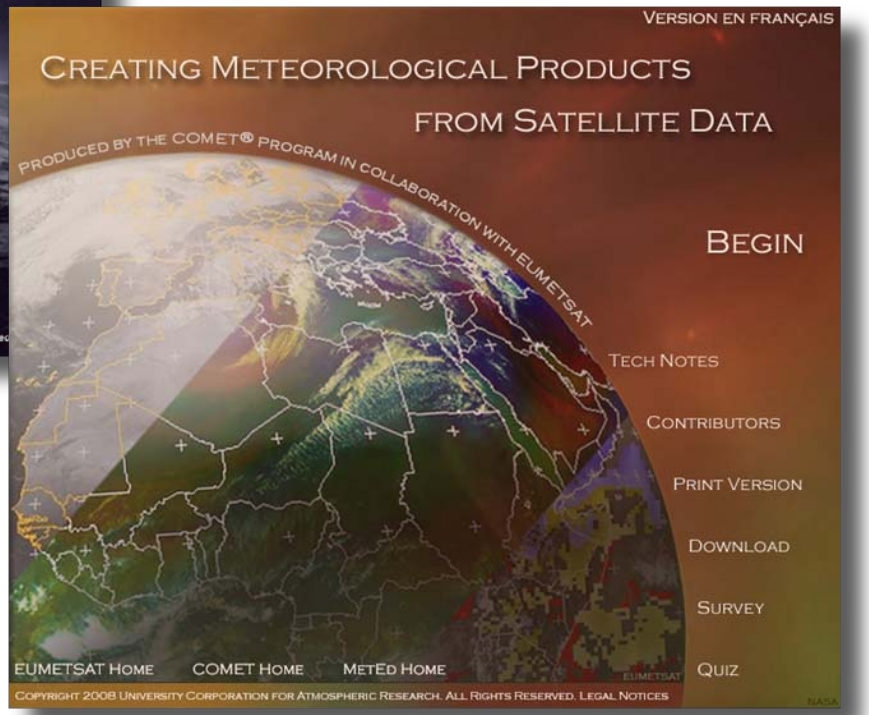


Tropical Meteorology

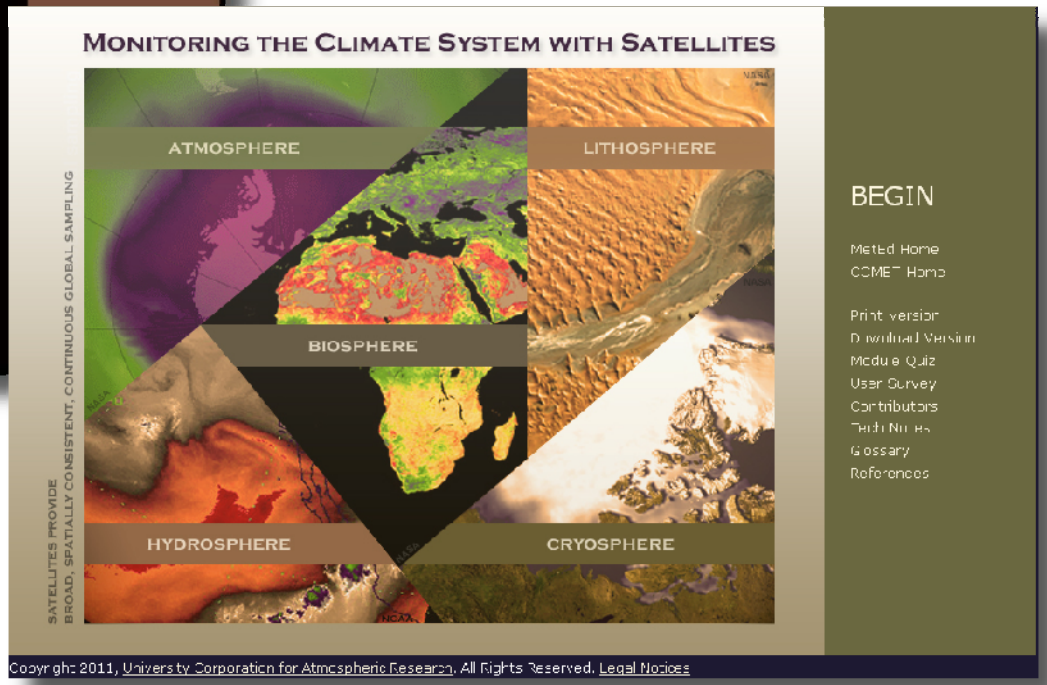
Space Weather



Published in Partnership with EUMETSAT



Satellites and ocean monitoring…

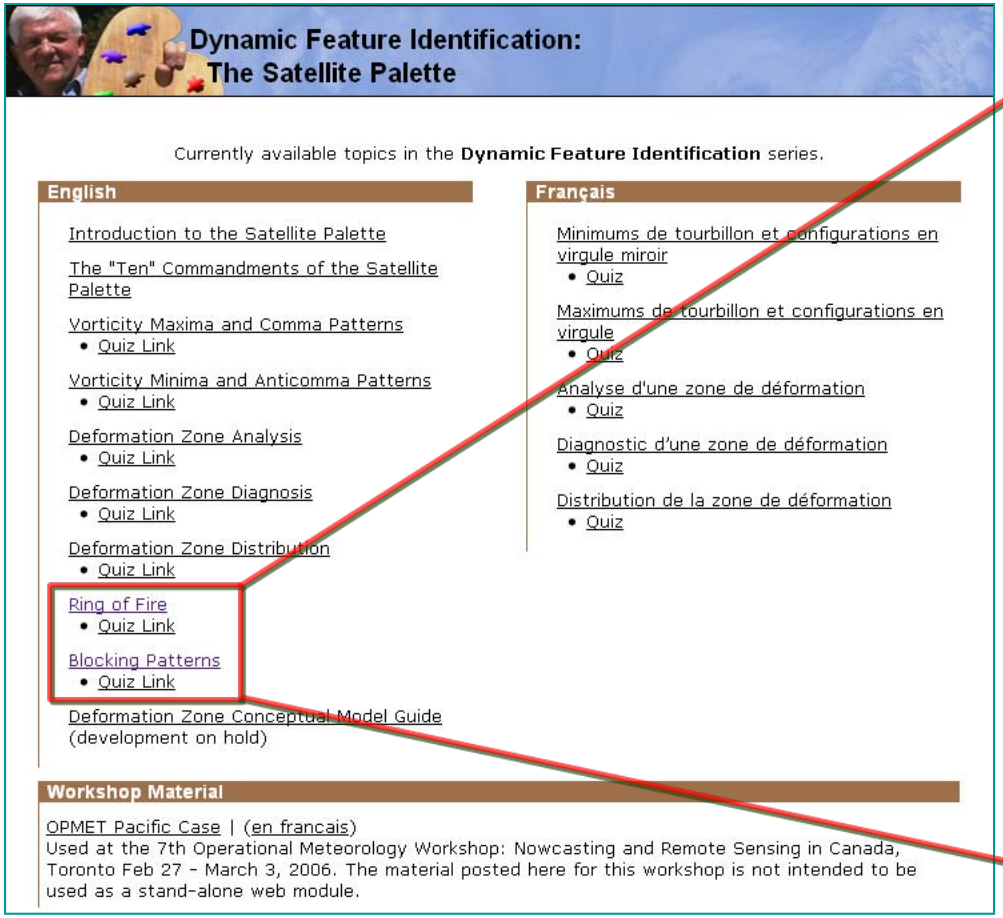


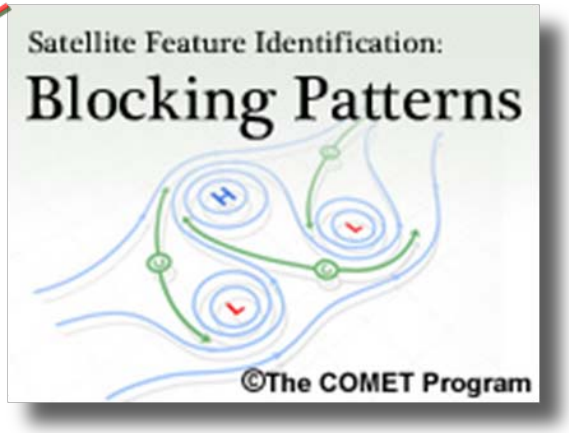
Satellites and climate monitoring…

Forecasting Dust Storms – Version 2
Published Dec 2010

- **Identify dust source area types**
- **Describe life cycle of a dust storm**
- **Id major synoptically forced storm types and those influence by mesoscale systems**
- **Satellite role in dust detection, monitoring, and forecasting using RGB products**
- **Define a 'generalized' dust forecast process**
- **…and apply to a case**

Dynamic Feature Identification: The Satellite Palette





- Coming next: "Short Waves and Cyclogenesis" and "Atmospheric Rivers"

Link to series interface…

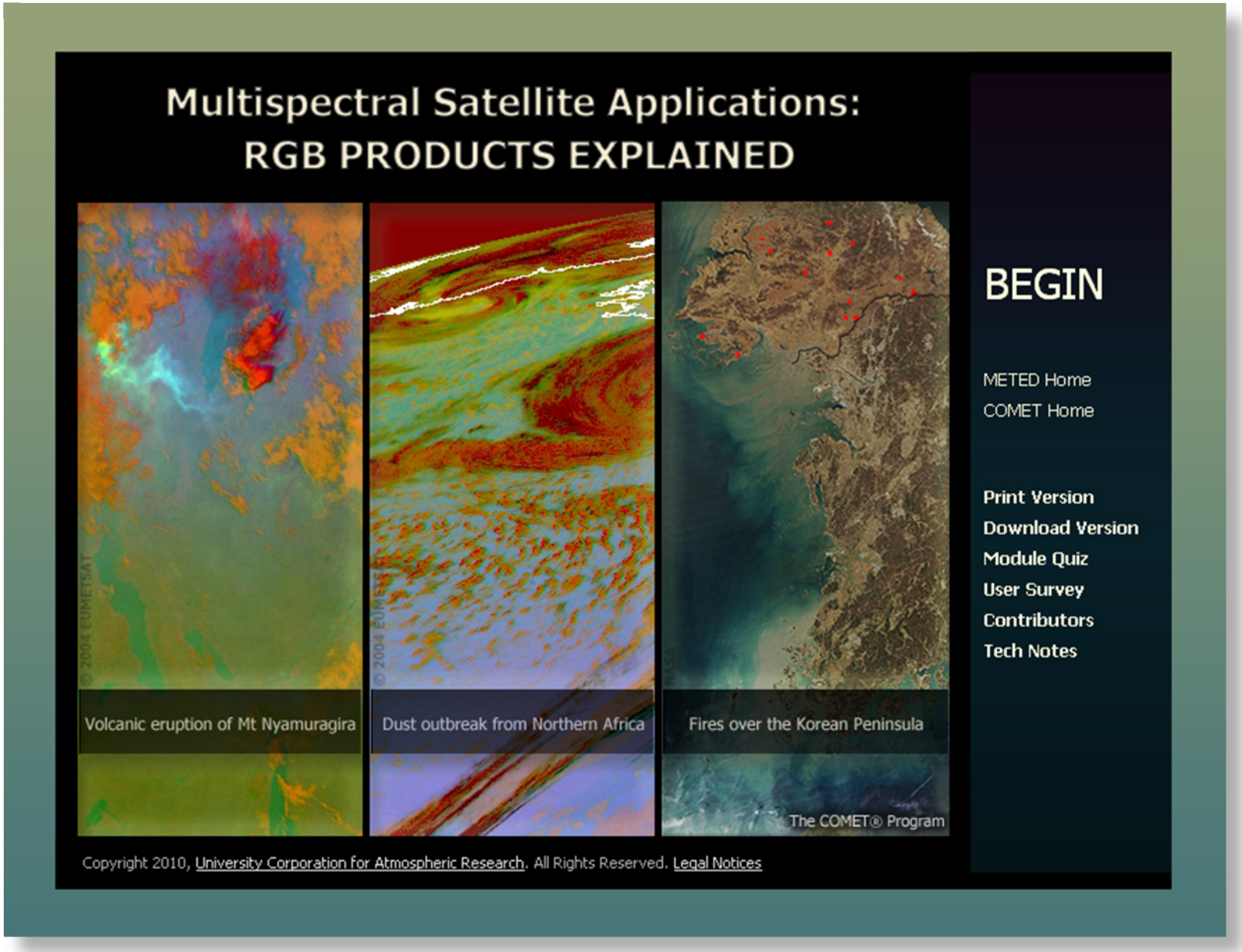
GOES-R: Benefits of Next-Generation Environmental Monitoring

- Three sections:
  - ***Overview***
  - ***Environmental Monitoring***
  - ***Resources***

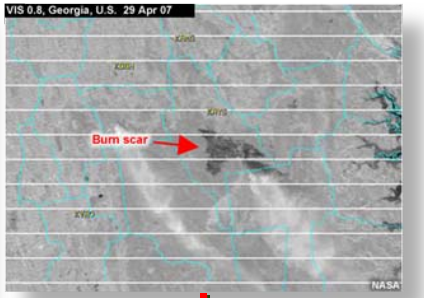
- GOES-R benefits and ability to monitor 13 unique hazards and phenomena

  Each topic area includes:
  - Background and Needs (**general public**)
  - Capabilities and Benefits (**decision makers**)
  - Technical Improvements (**forecasters**)

Published June 2010



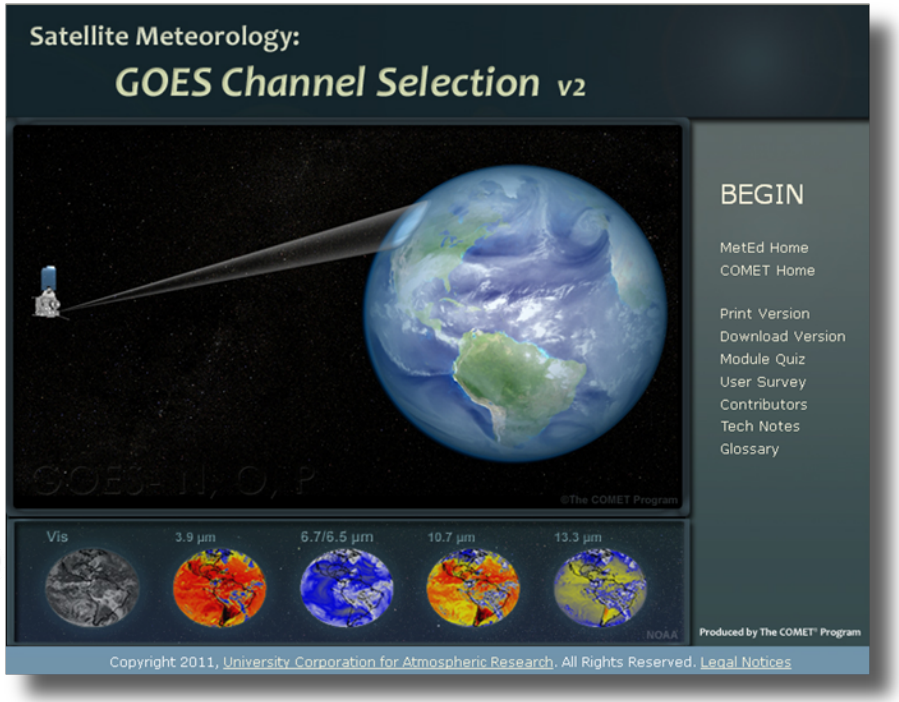
Multispectral Satellite Applications: RGB Products Explained



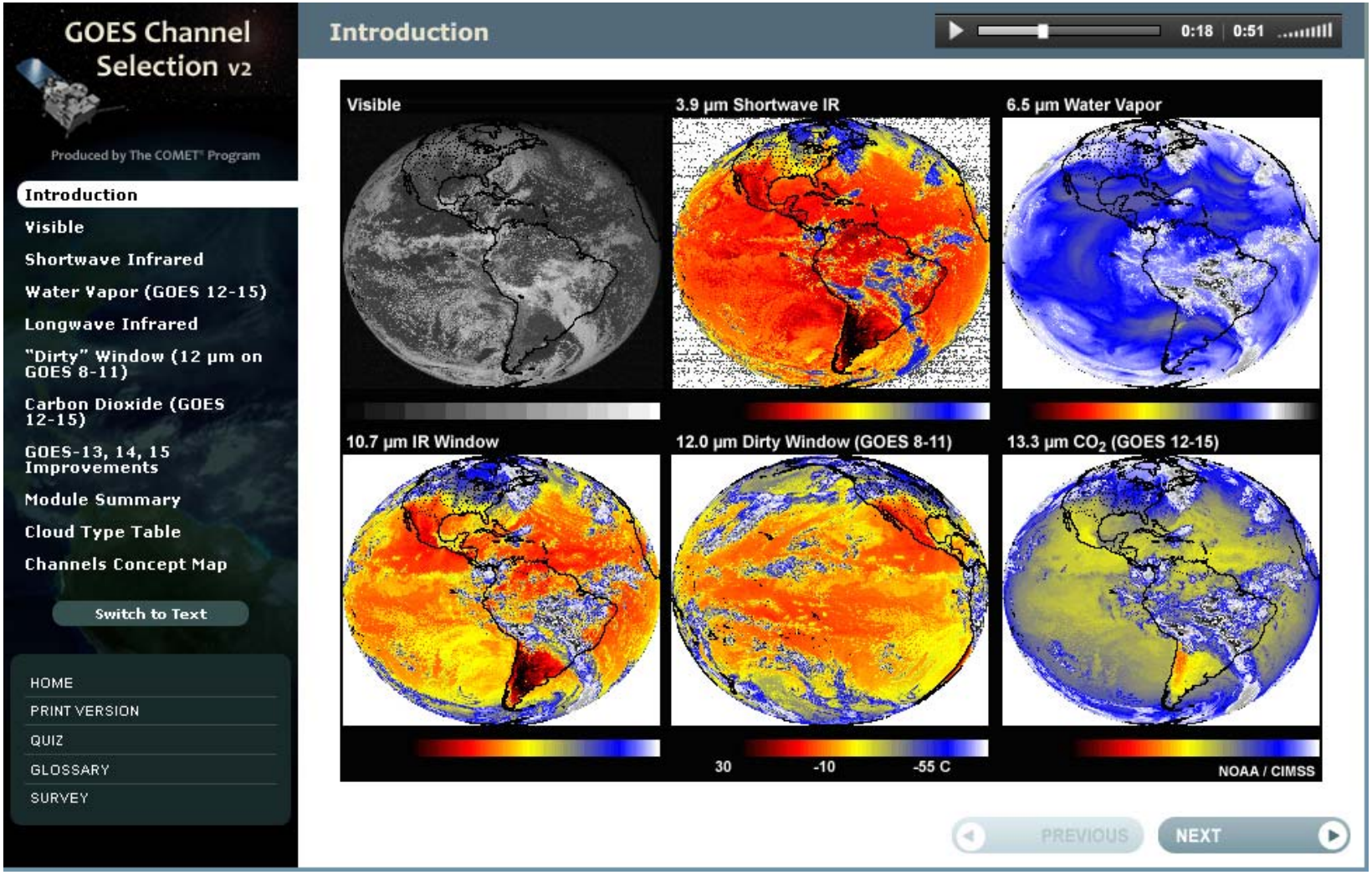
- **RGB compositing techniques are a powerful way to distill and highlight salient information**
- **Module provides an introduction to basic methods and "best practices"**
- **Also available in Spanish "Aplicaciones satelitales multiespectrales: explicación de los realces RGB"**

GOES Channel Selection, 2nd Edition Published May 2011

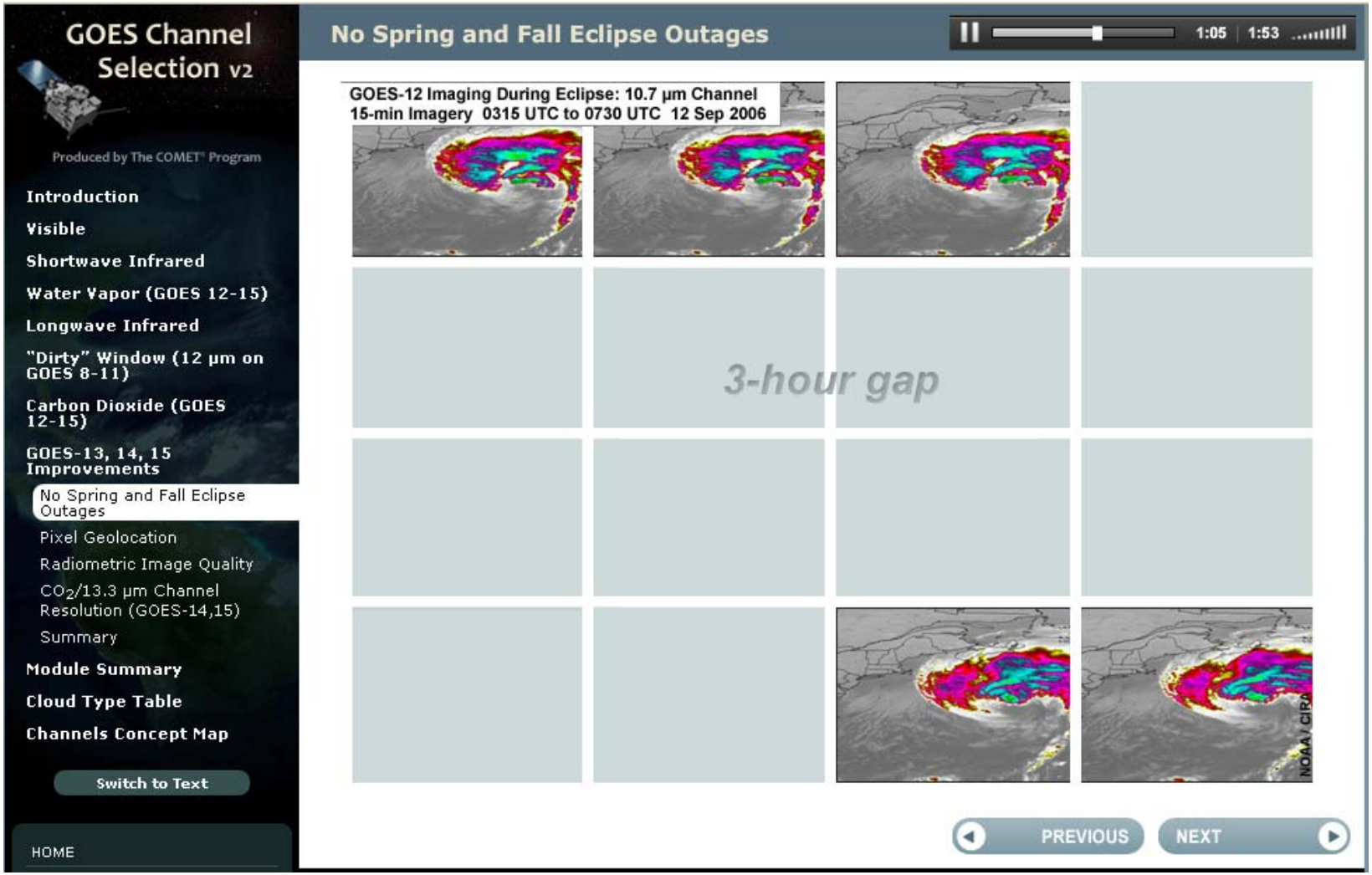
- Reviews imager channels and their use
- Updated examples
- Improvements to GOES-N/O/P (13/14/15)
  - 13.3 mm CO2 channel (GOES-14 & -15)
  - Vis channel spectral response
  - Radiometric performance
  - Pixel geolocation
  - Battery storage for shortened data outages – shorter fall and spring eclipse periods



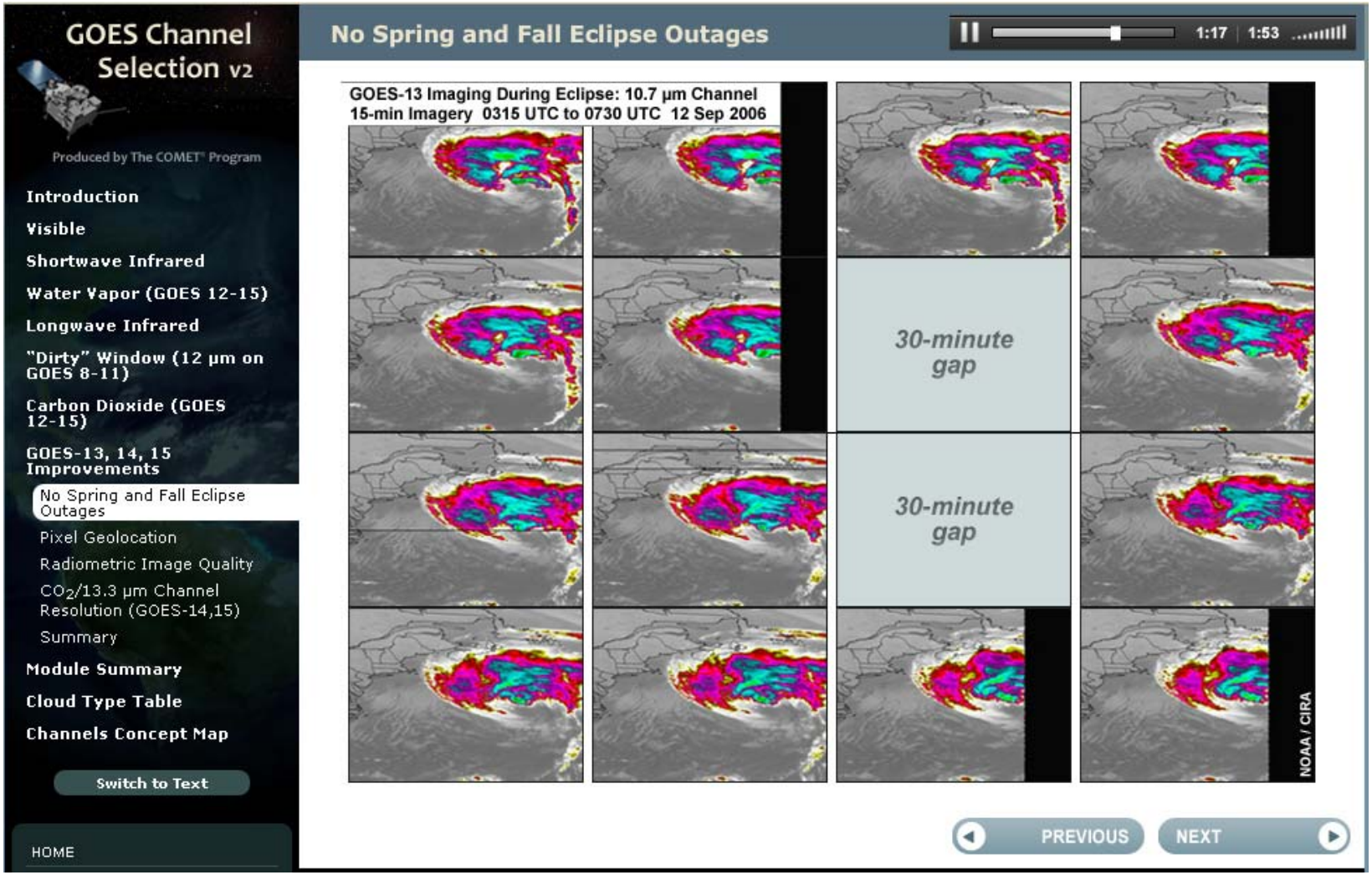
GOES Channel Selection, 2nd Edition Published May 2011



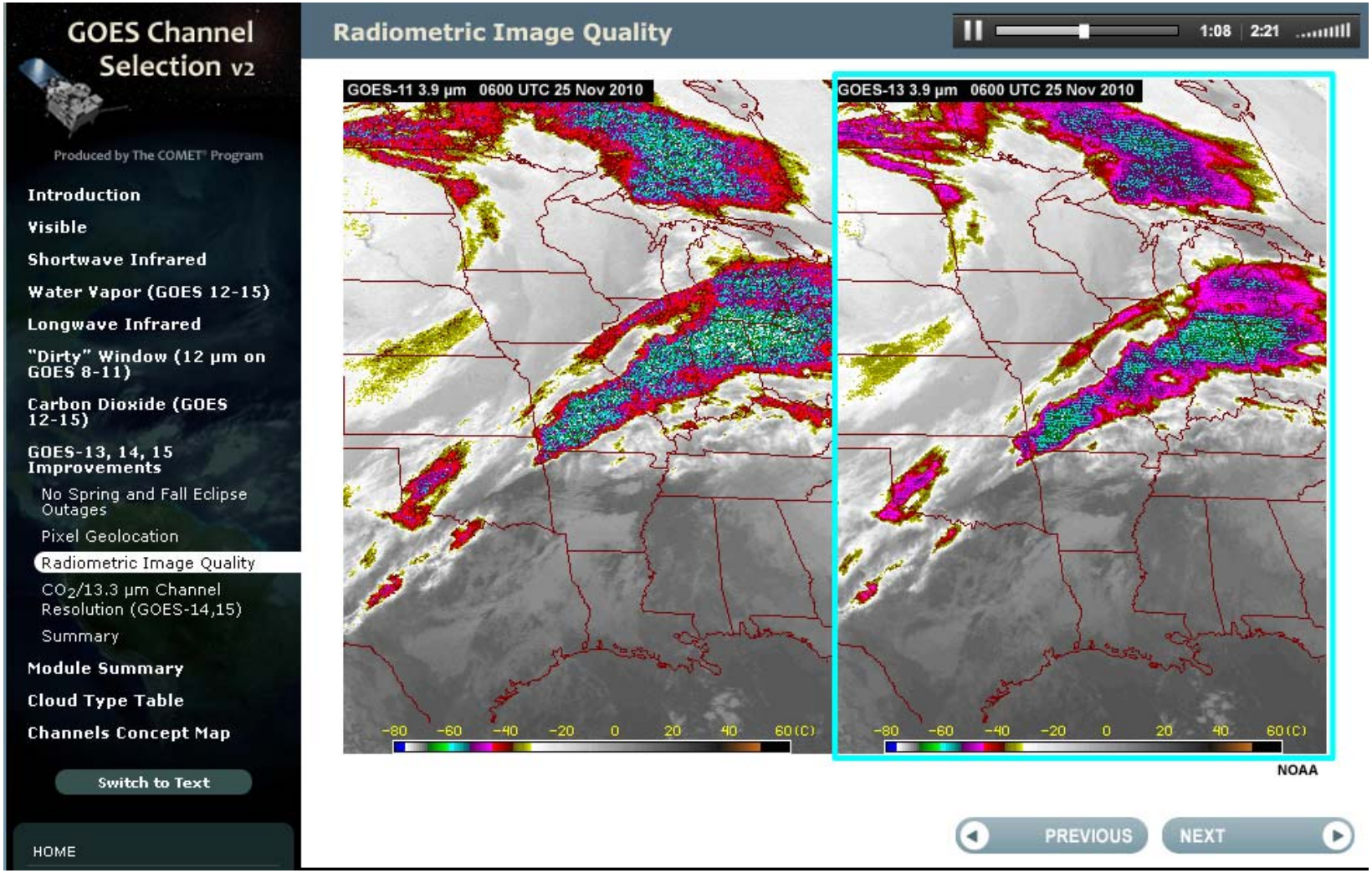
GOES Channel Selection, 2nd Edition
GOES-13, 14, 15 Improvements



GOES Channel Selection, 2nd Edition
GOES-13, 14, 15 Improvements



GOES Channel Selection, 2nd Edition Improvements con't



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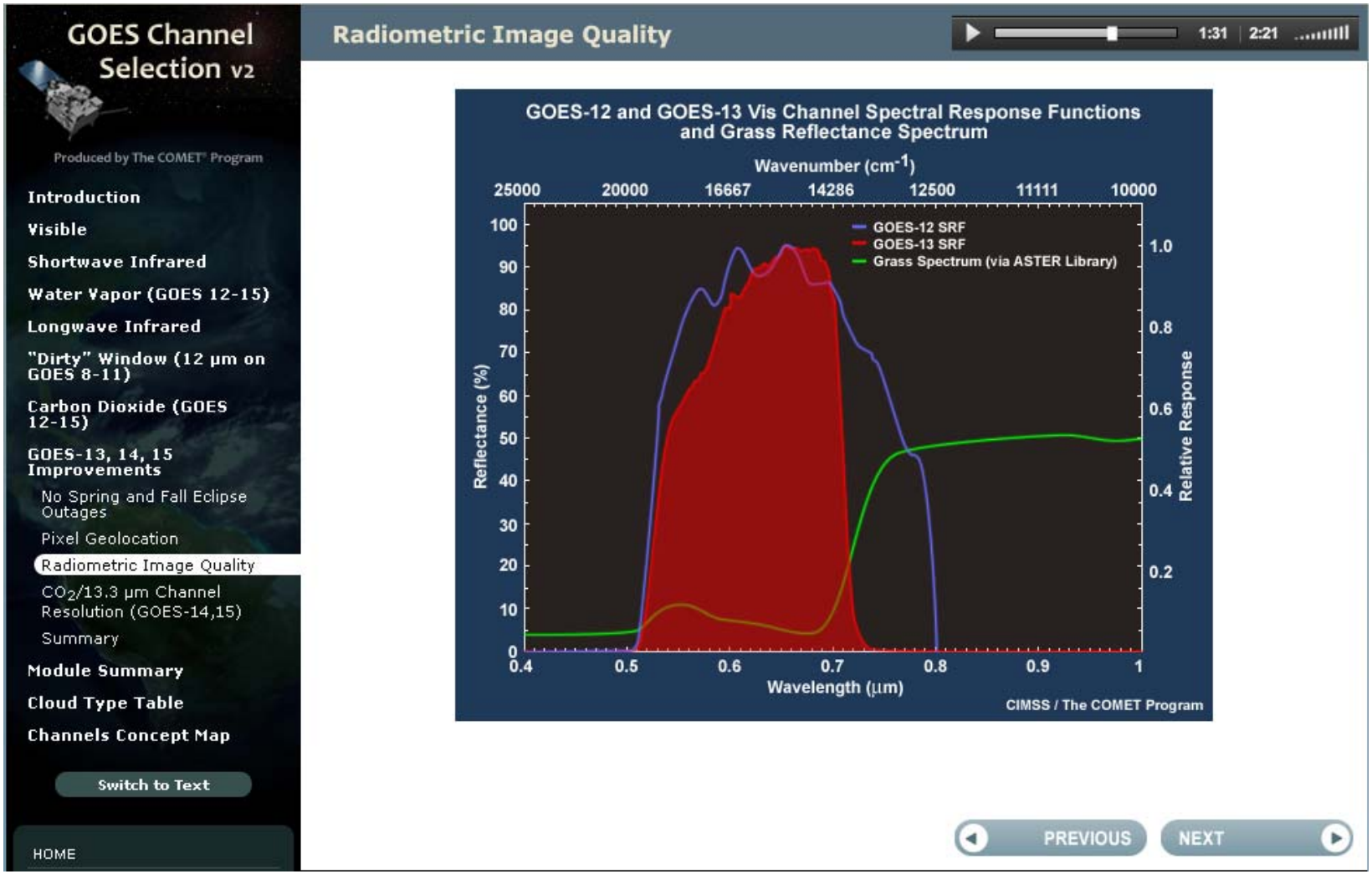

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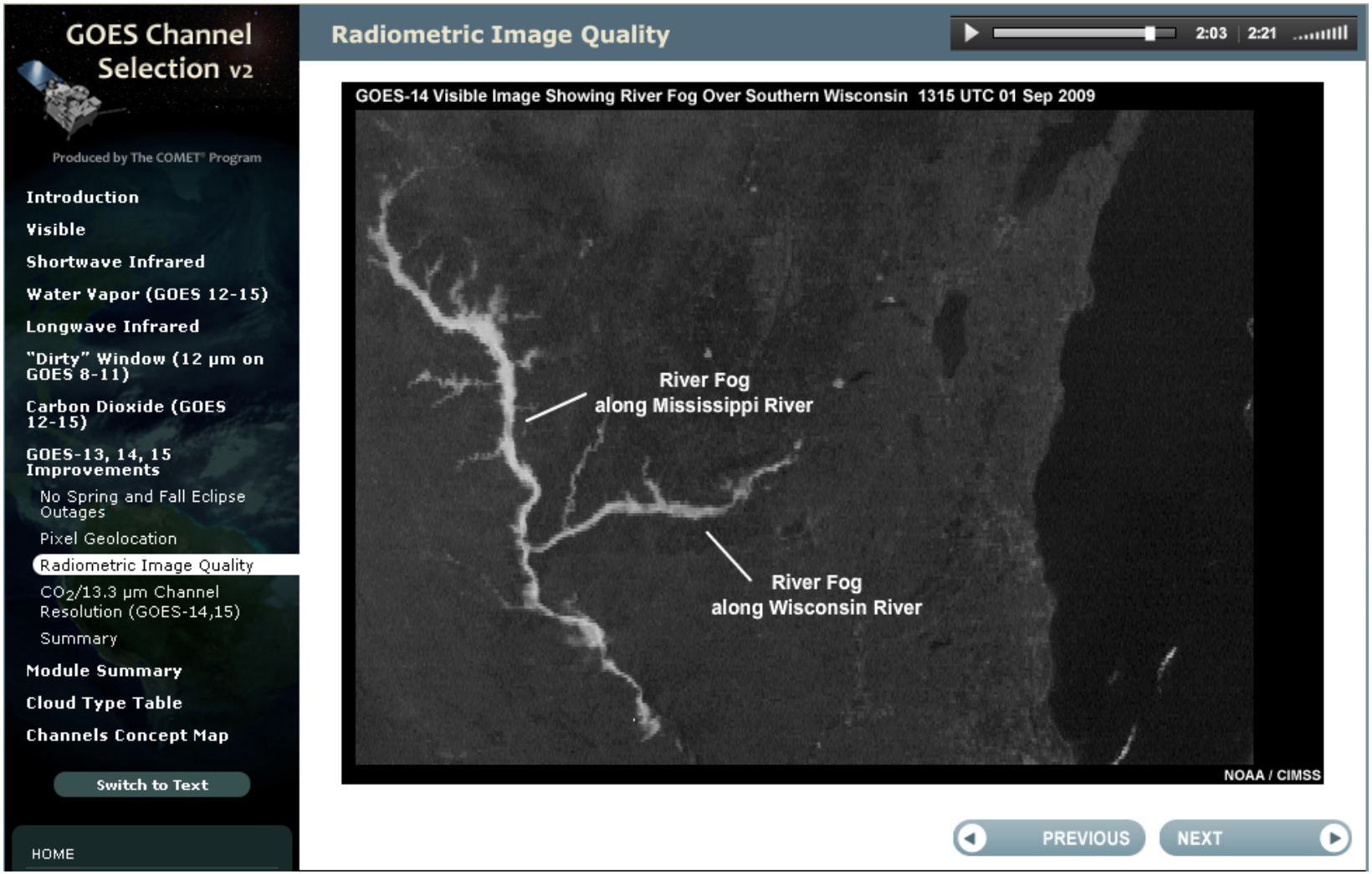

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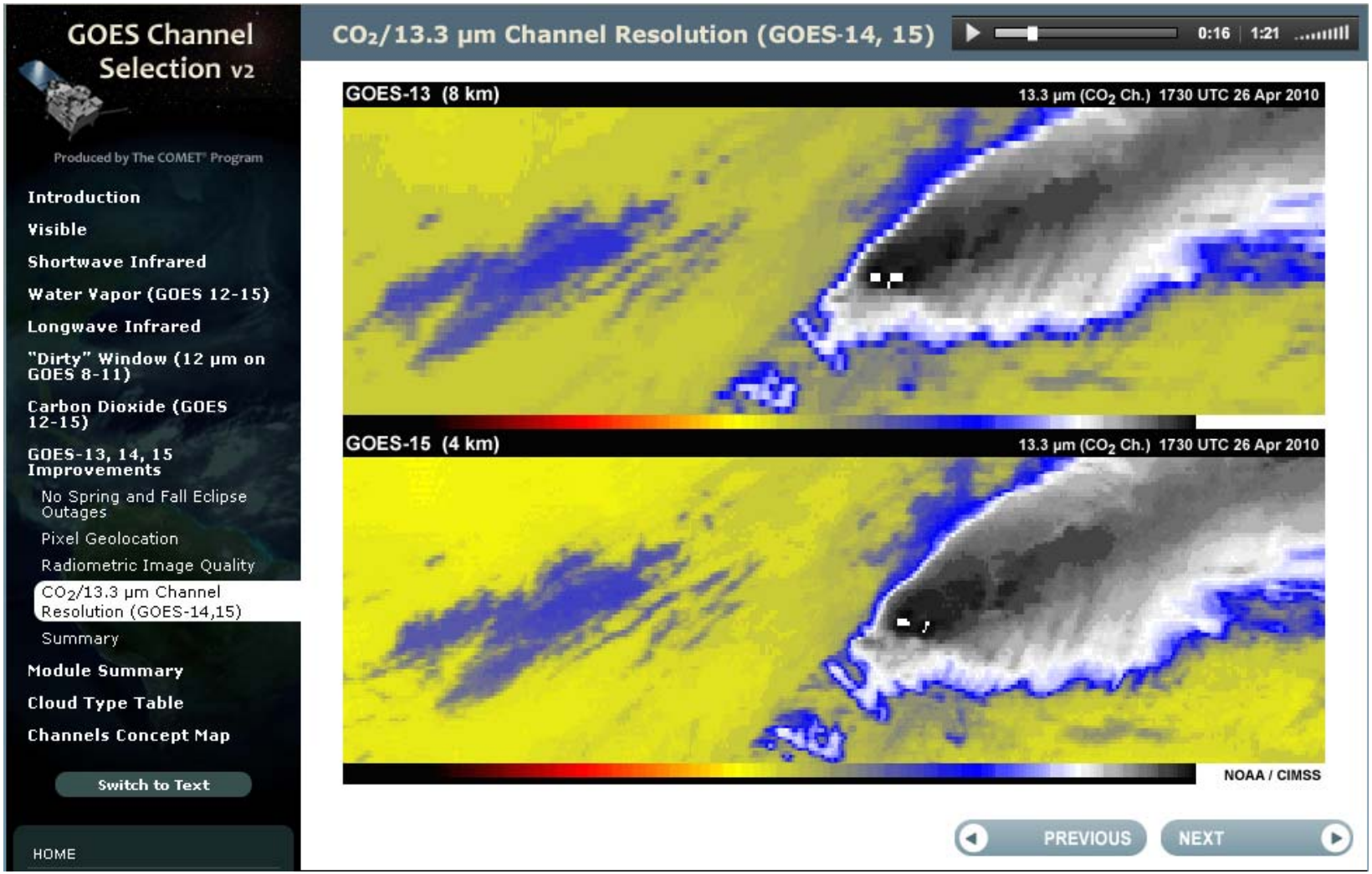

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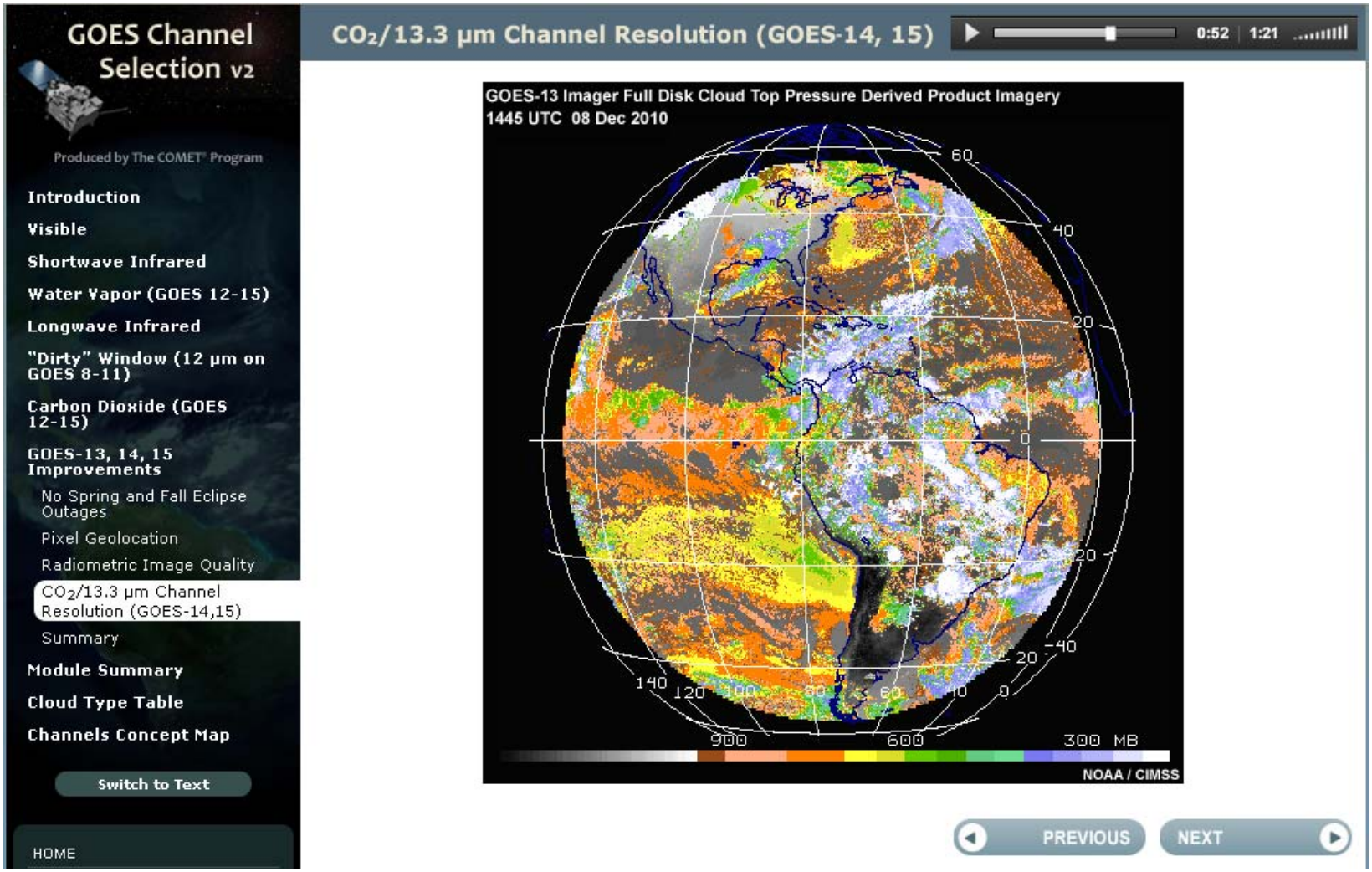

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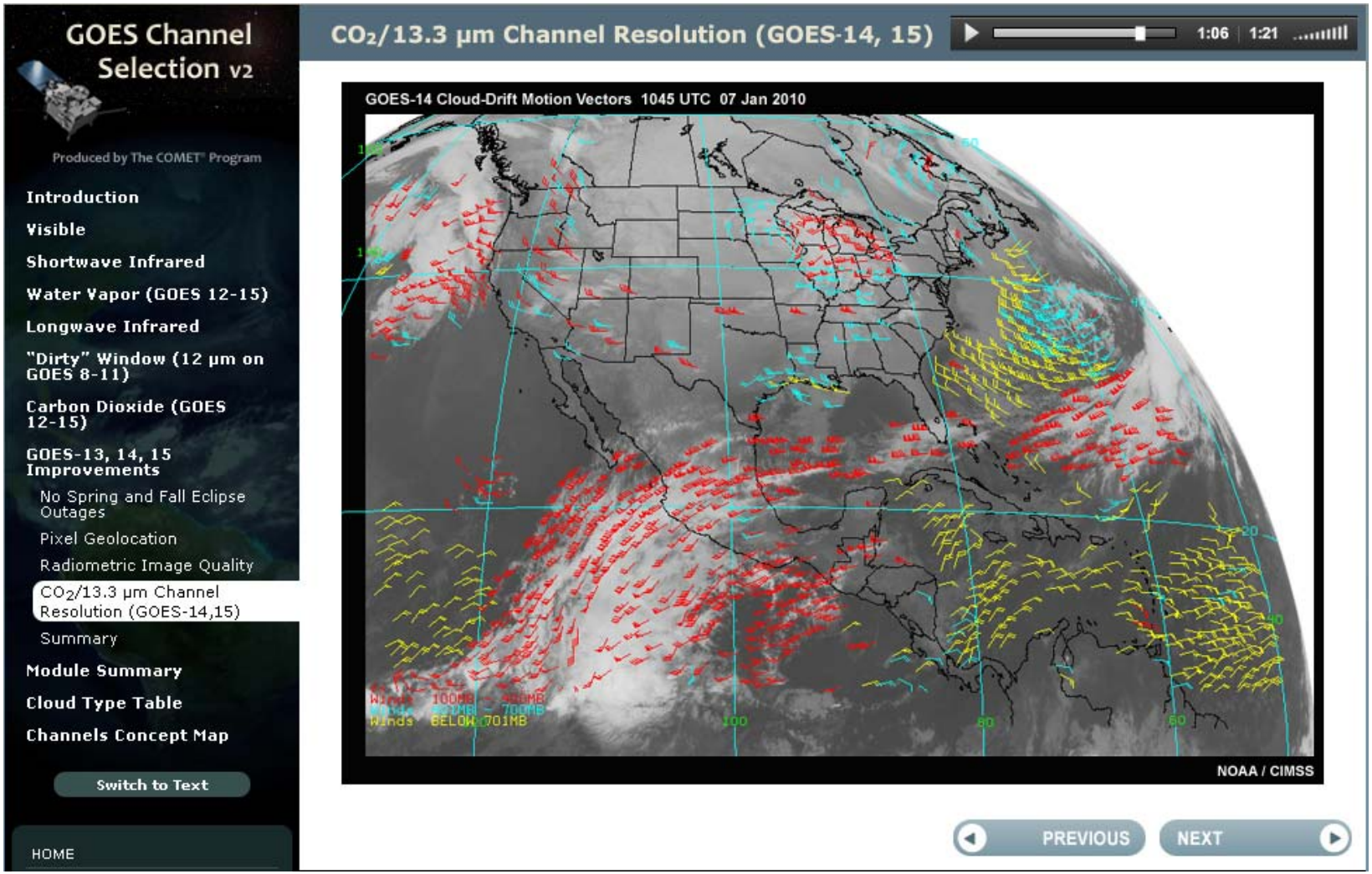
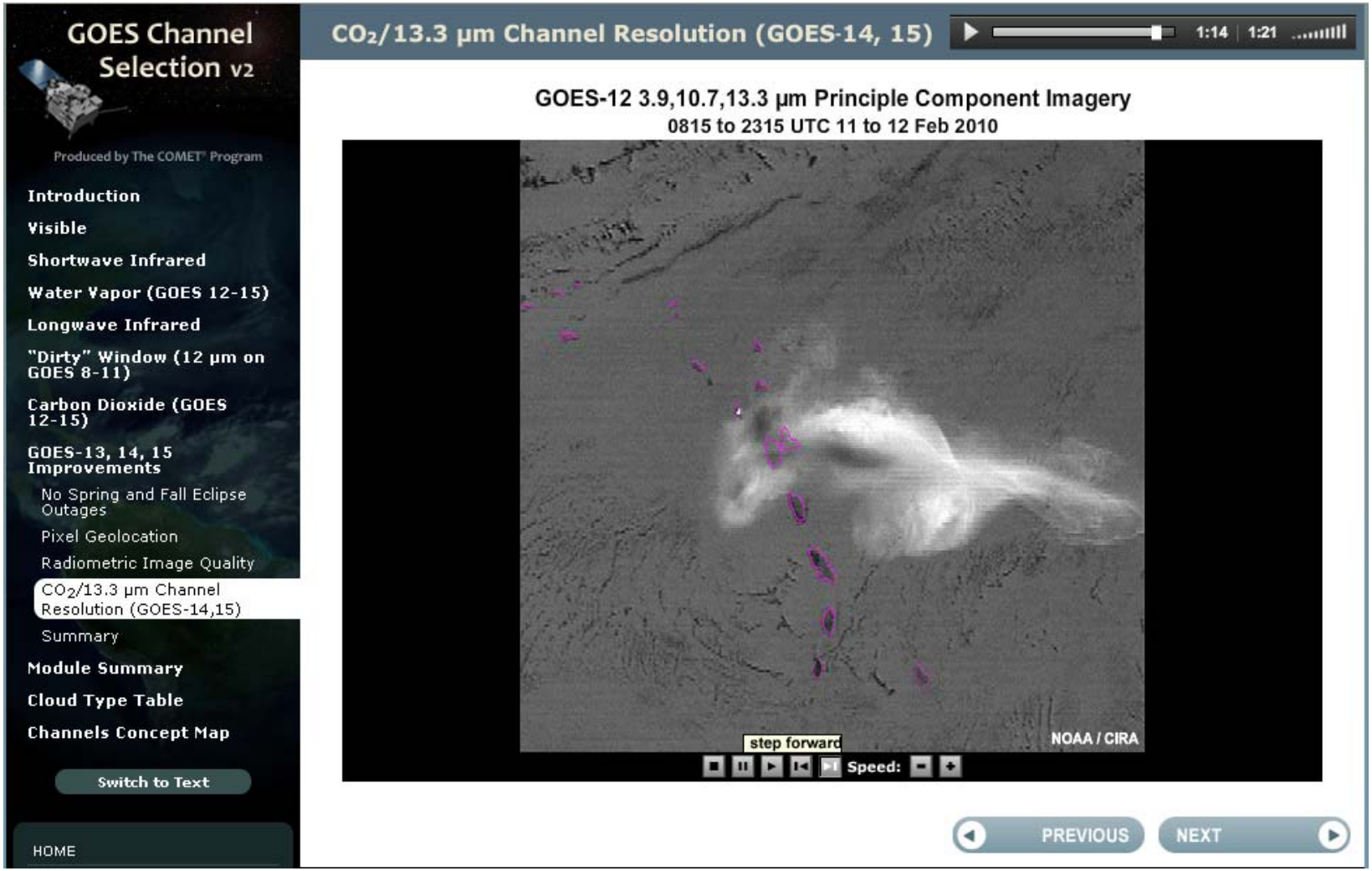


GOES Channel Selection, 2nd Edition Improvements con't



Tropical Remote Sensing Applications Chapter

Introduction to Tropical Meteorology *2nd Edition*

Produced by The COMET® Program

Chapter 2: Remote Sensing

Table of Contents

2.0 Overview

CHAPTER MENU

2.0 Overview

Learning objectives

2.1 Introduction to Remote Sensing

2.2 Weather Radar in the Tropics

2.3 Satellite Detection of Water Vapor

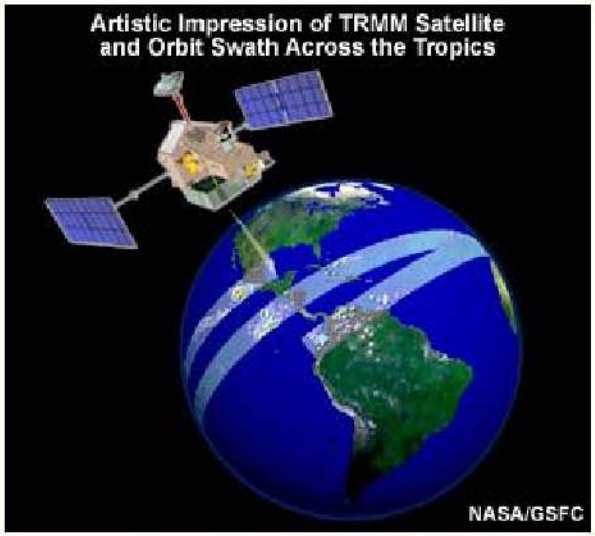
2.4 Satellite Soundings

2.5 Satellite Detection of Clouds and Precipitation

2.6. Lightning Detection from Space

2.7 Scatterometry

This chapter focuses on remote sensing—the primary method of observing weather and climate across the global tropics. We will explore how remote sensing is used and examine the types of information that it provides over formerly data-void regions. For example, recent airborne and spaceborne radar images show the detailed structure of tropical cyclones, helping us better understand intensity changes. Satellite microwave sensors are providing surface wind velocity over the oceans. Dust and volcanic ash tracking, measurement of ocean, soil and land surface help in hazard mitigation. We will also explore the use of non-meteorological satellites for meteorological purposes.



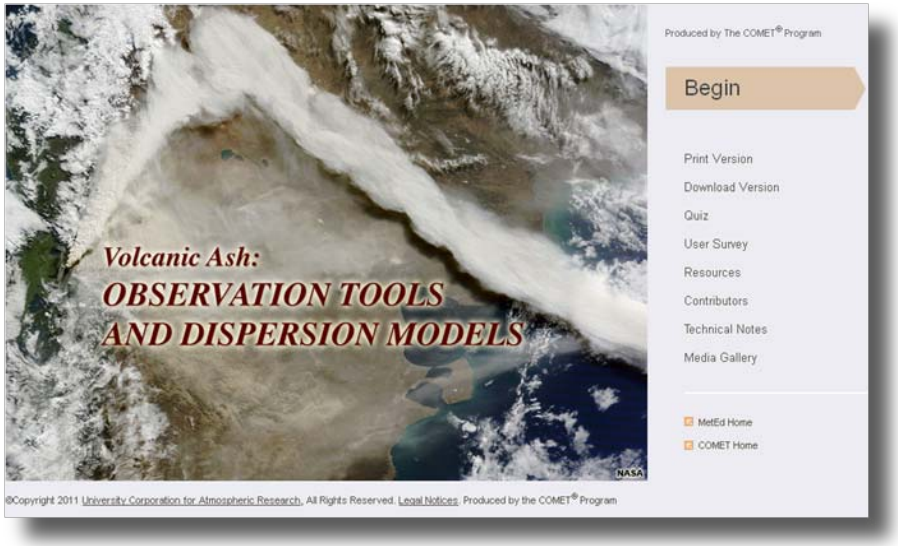
ONLINE CHAPTER

View full chapter in order or individual sections listed in the menu to the left

http://meted.ucar.edu/tropical/textbook

Volcanic Ash: Observation Tools and Dispersion Models (published Sep 2011)

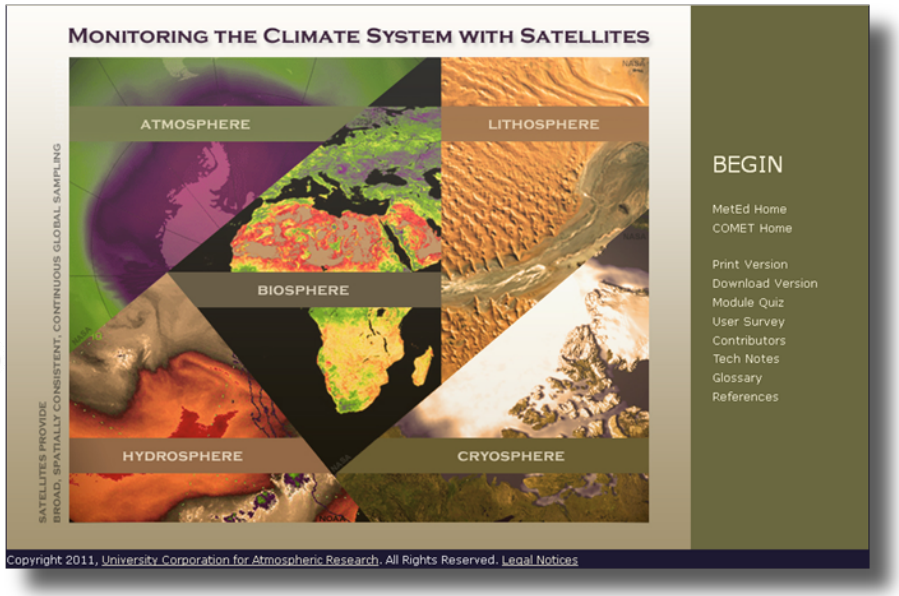
- **Fourth in the Volcanic Ash Series**
  - **Introduction**
  - **Volcanism**
  - **Impacts**
  - **Observing Tools & Dispersion Models**
- **Tools and techniques for identifying and forecasting volcanic ash transport**
  - **Strengths & weaknesses**
- **Use satellite, radar, observations, and model output (HYSPLIT) to identify and help forecast ash transport, and produce forecast products**



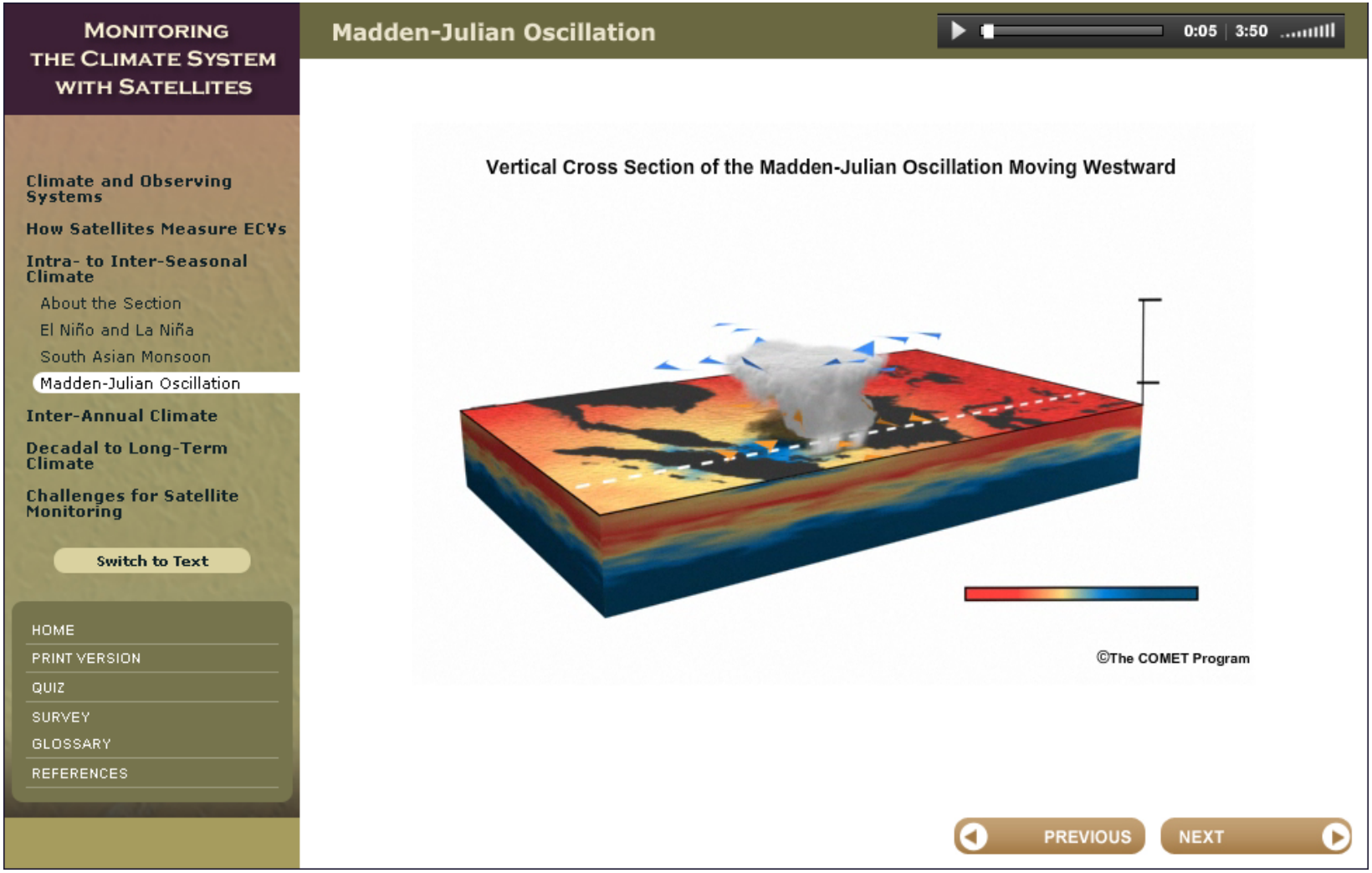
- **Visible imagery**
- **Thermal IR imagery**
- **Shortwave IR imagery**
- **False-color imagery**
- **Split-window imagery**
- **Principal component imagery**
- **SW IR Reflectance product**
- **SO2 product**

Monitoring the Climate System with Satellites (published Jan 2012)

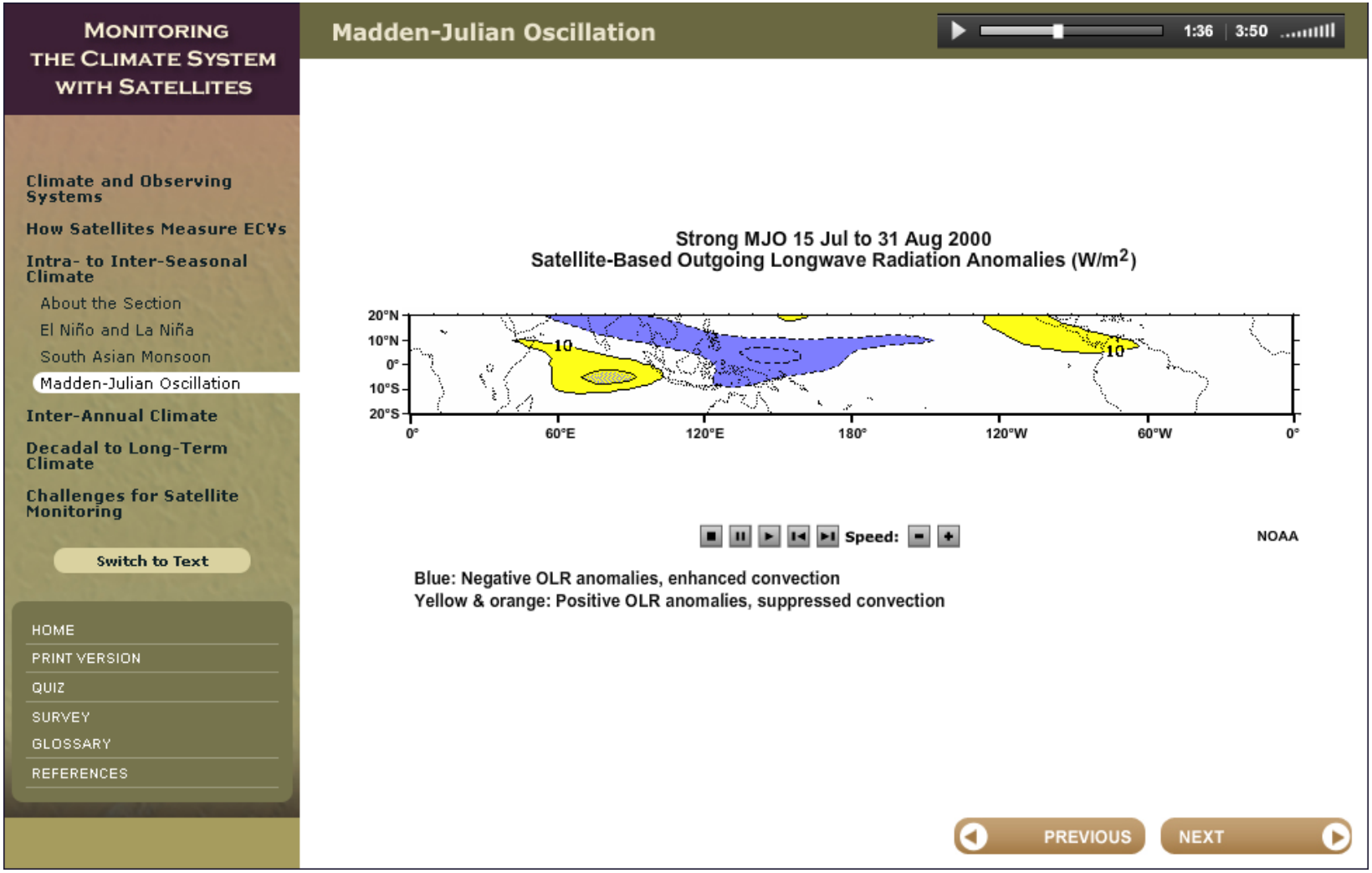
- Satellite role in observing key atmospheric elements and features
- Monitoring Essential Climate Variables (ESVs)
- Explore events and climate cycles at different scales (seasonal to long-term)
- Satellite contributions to improving understanding, monitoring, and prediction capability
- Challenges and needs
- Importance of international coordination



Monitoring the Climate System with Satellites (published Jan 2012)



Monitoring the Climate System with Satellites (published Jan 2012)



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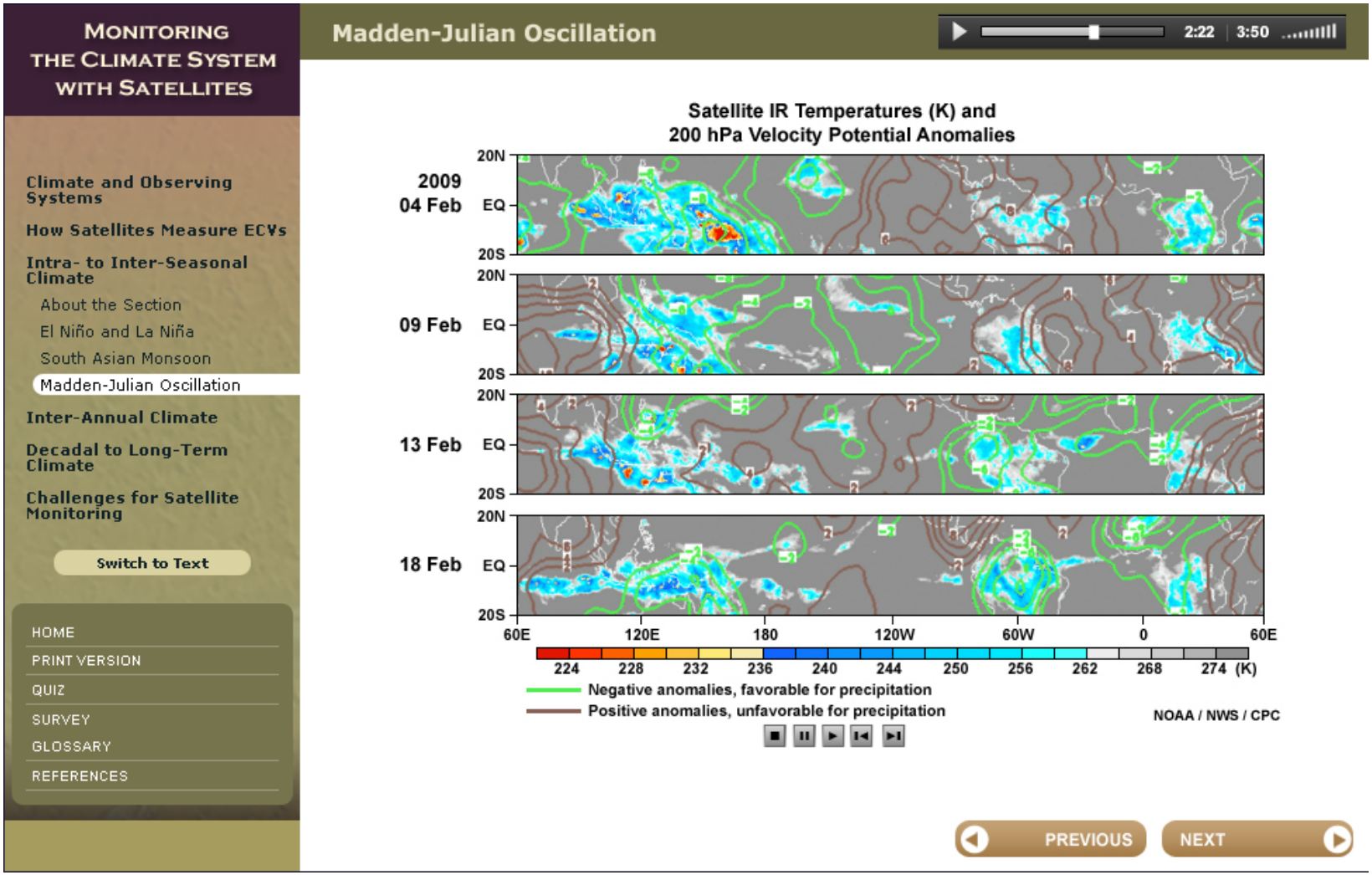
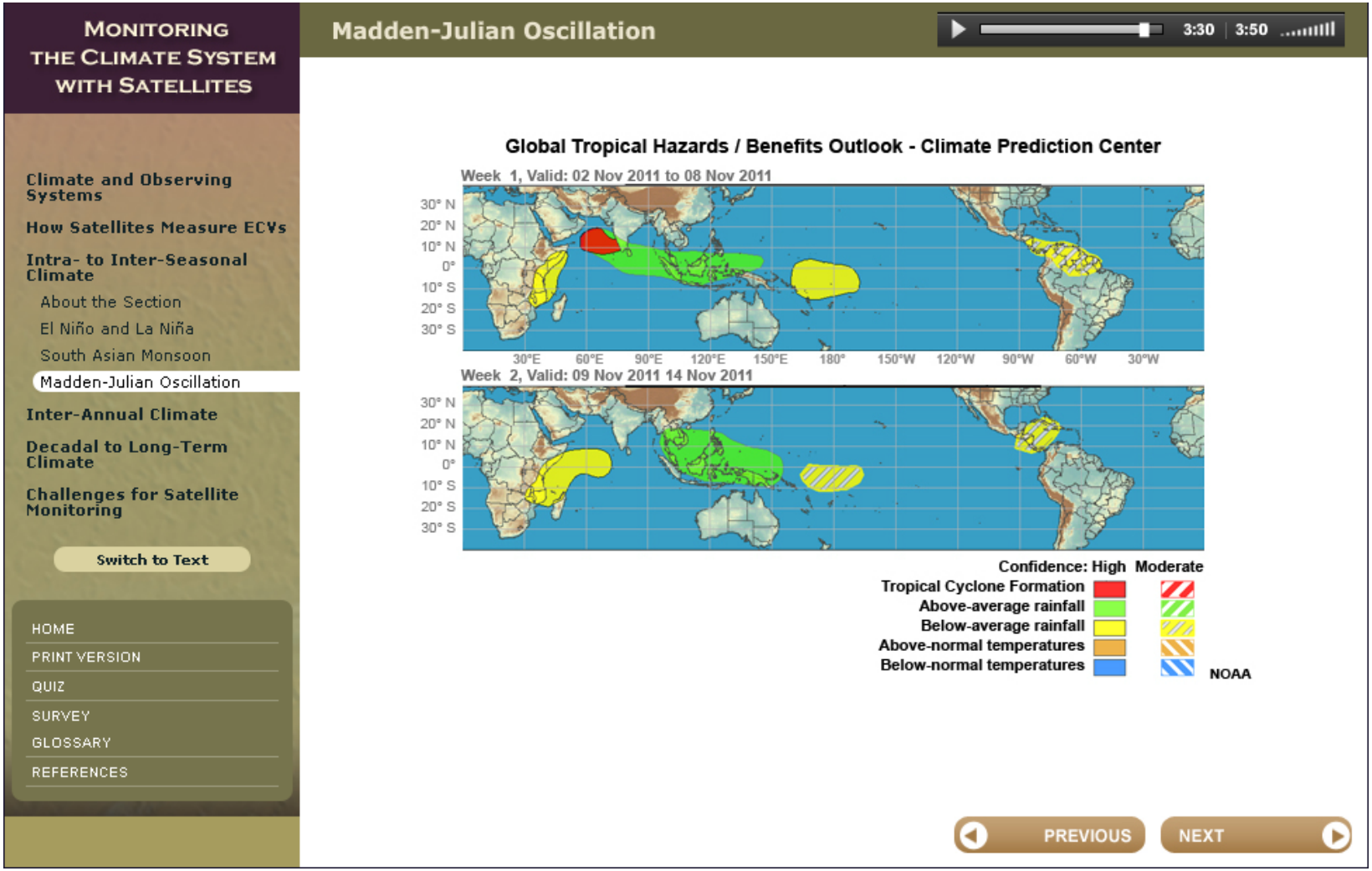


Monitoring the Climate System with Satellites (published Jan 2012)



The ESRC:

Environmental Satellite Resource Center

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The ESRC:
COMET's Role

1. Maintain the ESRC Web site
2. Populate it with our own materials, including smaller, focused learning-objects derived from our larger training modules
3. Provide the necessary quality assurance and monitoring to ensure that all resources are appropriate and well described before being made available

Community's Role in the ESRC

1. Use the site
2. Populate it with materials that you know and trust using the online submission form

Coming Soon / In Progress / Next

- ***Atmospheric Dust*** (including international focus) (Feb 2012)
- ***Imaging with VIIRS: A Convergence of Technologies and Experience, 2nd Edition*** (winter-spring 2012)
- Additional collections of satellite modules into DL Courses:
  - Multispectral Applications
  - Polar-orbiting Satellite Basics
  - Satellite Sounding
- ***Introduction to NPP*** (spring 2012)
- ***Microwave Remote Sensing Overview***, 2nd Edition (spring 2012)
- ***Remote Sensing Using Satellites***, 2nd Ed. (for K-12) (spring 2012)
- New GOES-R instrument focused mini-modules (ongoing)
- ***Environmental Satellite Resource Center*** (ongoing)

Questions?

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URLs:

- **http://meted.ucar.edu**
- **http://meted.ucar.edu/topics/modules/satellite**
- **http://meted.ucar.edu/esrc**