

# Overview of COMET's Online Satellite Meteorology Educational Resources

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UCAR's COMET Program

22 May 2015

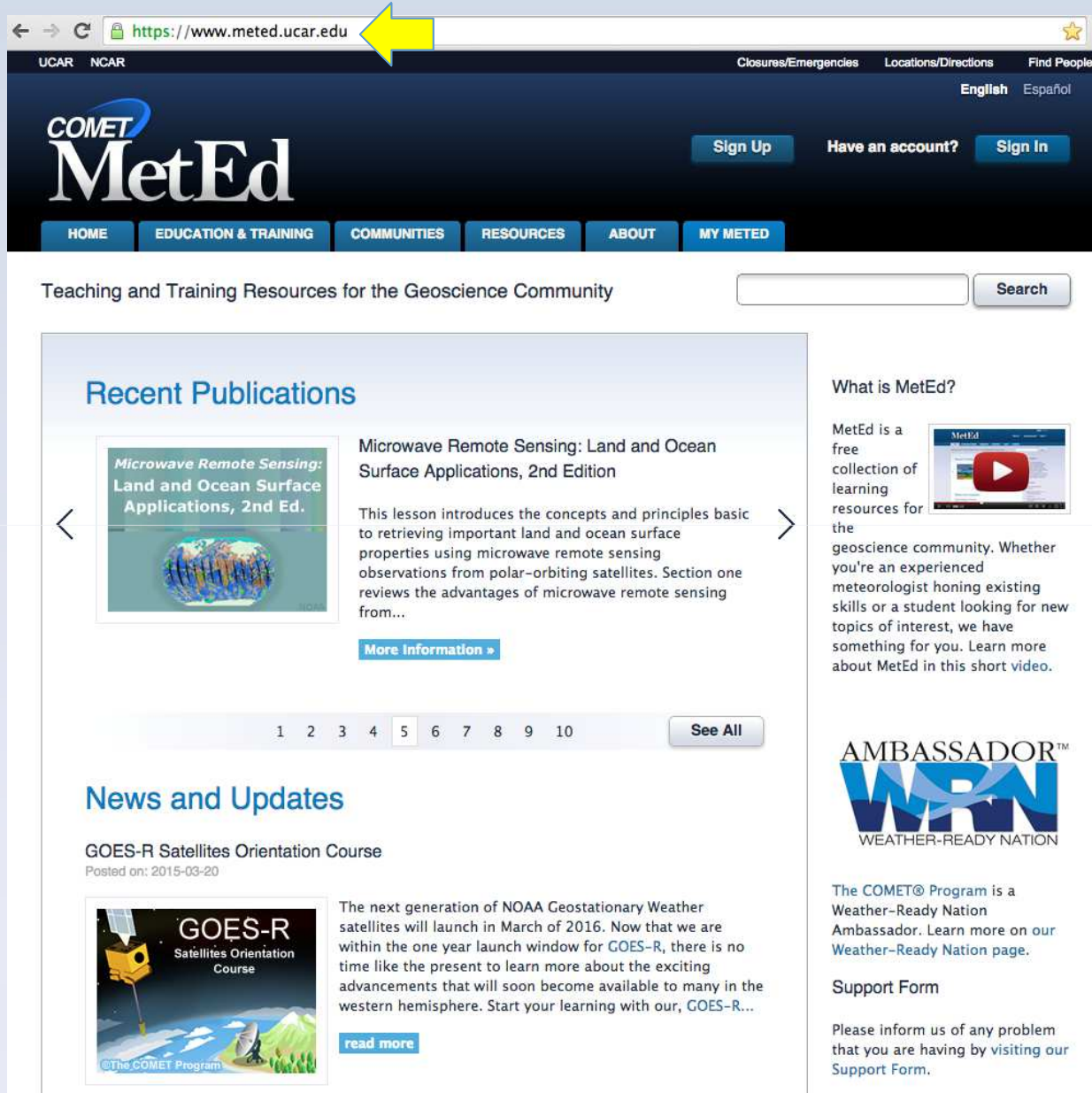


COMET Staff, February 2015



The Coordination Group  
for Meteorological Satellites

# The MetEd Website



The screenshot shows the MetEd website homepage. At the top, the URL bar displays <https://www.meted.ucar.edu>, with a yellow arrow pointing to it. The website header includes navigation links for UCAR, NCAR, Closures/Emergencies, Locations/Directions, and Find People. The main logo is "COMET MetEd" with "Sign Up" and "Have an account? Sign In" buttons. A secondary navigation bar contains "HOME", "EDUCATION & TRAINING", "COMMUNITIES", "RESOURCES", "ABOUT", and "MY METED". Below the header, the text "Teaching and Training Resources for the Geoscience Community" is followed by a search bar. The main content area features a "Recent Publications" section with a featured article: "Microwave Remote Sensing: Land and Ocean Surface Applications, 2nd Edition". The article includes a thumbnail image of a globe and a brief description. Below the article is a pagination bar with numbers 1 through 10 and a "See All" button. The "News and Updates" section features an article titled "GOES-R Satellites Orientation Course" with a thumbnail image of a satellite and a "read more" button. On the right side, there is a "What is MetEd?" section with a video player and the "AMBASSADOR™ W-R-N WEATHER-READY NATION" logo. At the bottom right, there is a "Support Form" section with a brief description.

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Teaching and Training Resources for the Geoscience Community  Search

## Recent Publications

**Microwave Remote Sensing: Land and Ocean Surface Applications, 2nd Ed.**

This lesson introduces the concepts and principles basic to retrieving important land and ocean surface properties using microwave remote sensing observations from polar-orbiting satellites. Section one reviews the advantages of microwave remote sensing from...

[More information »](#)

1 2 3 4 5 6 7 8 9 10 [See All](#)

## News and Updates



**GOES-R Satellites Orientation Course**  
Posted on: 2015-03-20

The next generation of NOAA Geostationary Weather satellites will launch in March of 2016. Now that we are within the one year launch window for GOES-R, there is no time like the present to learn more about the exciting advancements that will soon become available to many in the western hemisphere. Start your learning with our, GOES-R...

[read more](#)

### What is MetEd?

MetEd is a free collection of learning resources for the geoscience community. Whether you're an experienced meteorologist honing existing skills or a student looking for new topics of interest, we have something for you. Learn more about MetEd in this short video.



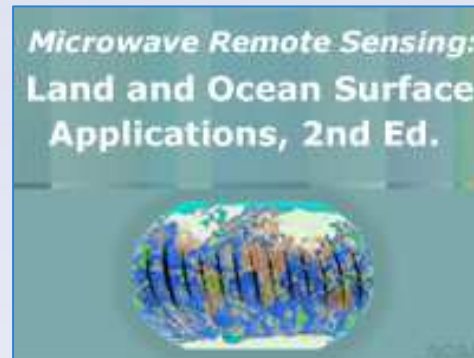
### Support Form

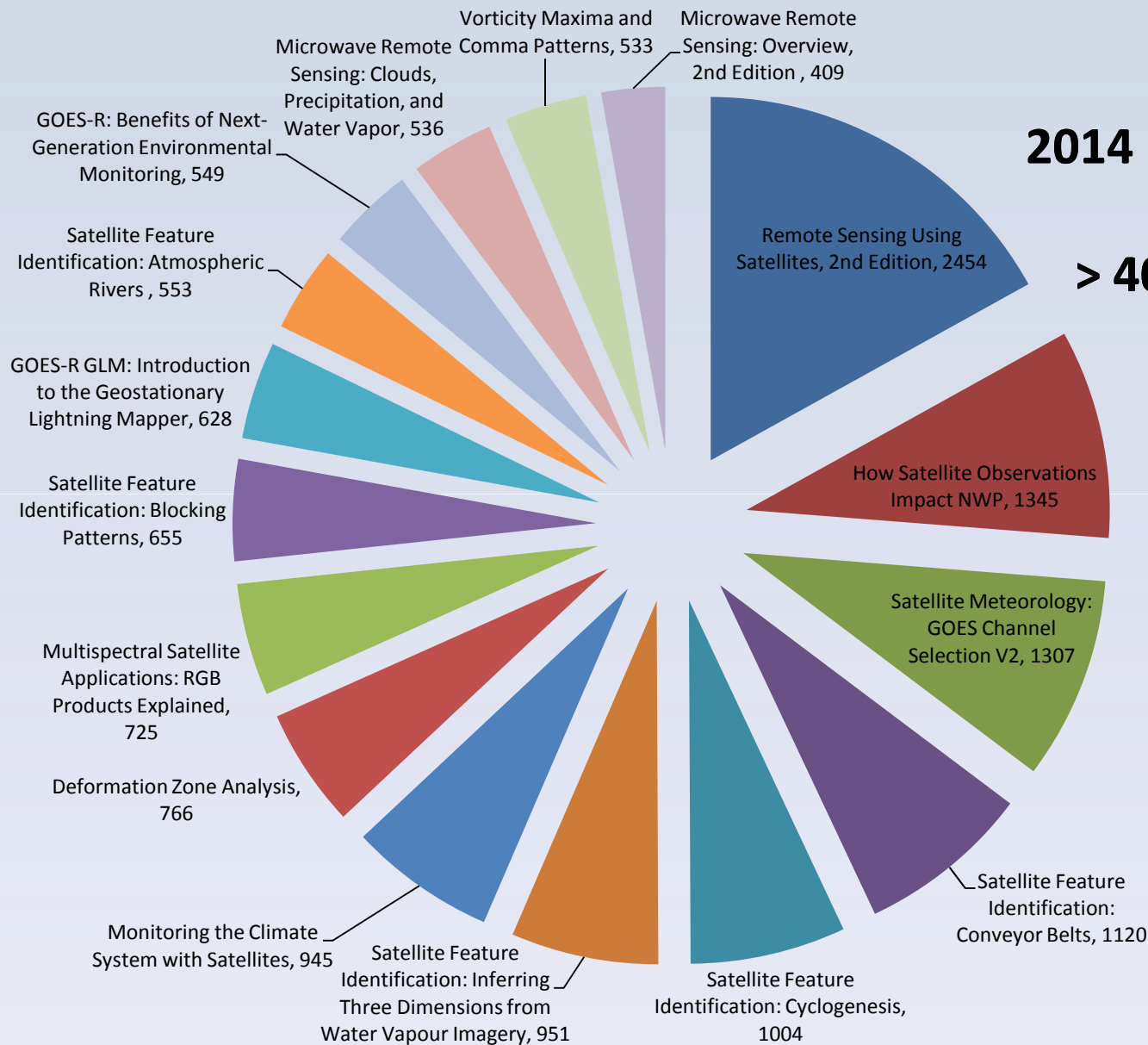
Please inform us of any problem that you are having by visiting our Support Form.

- Over 100 Satellite lessons on MetEd, and three multi-lesson courses (Approximately 69 in English, 25 in Spanish, 16 in French)
- Over 20,000 satellite lesson user sessions per year in English

NESDIS satellite training activities with COMET attract additional funding and training development from both EUMETSAT and the Meteorological Service of Canada

- Three new offerings shown below...





**2014 Lesson Usage  
(Eng):  
> 400 Sessions**



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.

Lessons/Resources

Courses

Sort by: Date (Newest to Oldest)

1 - 40 out of 69 results

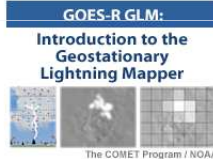


This content is not hosted on MetEd.

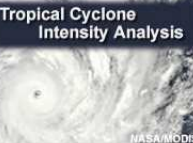
### VLab's Conceptual Models for Southern Hemisphere

Languages: English  
 Publish Date: 2014-10-21  
 Skill Level: 1  
 Completion Time: 5.00 - 6.00 h  
 Topics: Satellite Meteorology  
 (0 reviews)

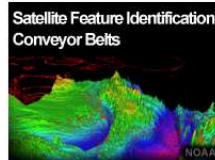
Conceptual Models for Southern Hemisphere is a joint project between four southern hemispheric regions: Argentina, Australia, Brazil and South Africa. The purpose of the project is to improve warnings and awareness of weather risks through the better understanding of ... Read more »



The COMET Program / NOAA



NASA/MODIS



NOAA

### GOES-R GLM: Introduction to the Geostationary Lightning Mapper

GOES-R GLM: Introduction to the Geostationary Lightning Mapper

Languages: English, Spanish  
 Publish Date: 2014-09-05  
 Skill Level: 1  
 Completion Time: .75 - 1.00 h  
 Topics: Mesoscale Meteorology, Satellite Meteorology  
 (1 review)

This extension of the COMET module "GOES-R: Benefits of Next Generation Environmental Monitoring" focuses on the Geostationary Lightning Mapper (GLM) instrument, the satellite's lightning mapper. The GLM will provide continuous lightning measurements over a large ... Read more »

### Tropical Cyclone Intensity Analysis

Languages: English  
 Publish Date: 2014-05-15  
 Skill Level: 2  
 Completion Time: 1.50 - 2.00 h  
 Topics: Satellite Meteorology, Tropical/Hurricanes  
 (3 reviews)

This lesson provides guidance for operational forecasters needing to combine different intensity methods to determine the intensity of a tropical cyclone. Each of the intensity methods is summarized, focusing on both strengths and weaknesses. These methods include the ... Read more »

### Satellite Feature Identification: Conveyor Belts

Satellite Feature Identification: Conveyor Belts

Languages: English, French  
 Publish Date: 2014-03-18  
 Skill Level: 2  
 Completion Times: .50 - .75 h  
 Topics: Satellite Meteorology  
 (2 reviews)

Conveyor belts highlight important atmospheric processes that can be advantageous for making forecasts. They can be used for identifying general temperature patterns, defining the extent of cloud cover, predicting moisture return, evaluating stability, forecasting wind ... Read more »

### Special Interest

[More on Satellite Meteorology](#)



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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Lesson/Resource Listing » Description

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## GOES-R ABI: Next Generation Satellite Imaging



Languages: English, Spanish  
Publish Date: 2013-02-19

Skill Level: 1  
Completion Time: 1.00 - 1.25 h

Includes Audio: yes  
Required Plugins: none  
Topics:

Satellite Meteorology  
Included in Courses:  
GOES-R Satellites Orientation Course

Reviews:  
☆☆☆☆ (0 reviews)  
[Read or add reviews](#)

BEGIN LESSON

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Description

Objectives

Keywords

Media Gallery

Reviews

This extension of the COMET module "GOES-R: Benefits of Next Generation Environmental Monitoring" focuses on the ABI instrument, the satellite's 16-channel imager. With increased spectral coverage, greater spatial resolution, more frequent imaging, and improved image pixel geolocation and radiometric performance, the ABI will bring significant advancements to forecasting, numerical weather prediction, and climate and environmental monitoring.

The first part of the module introduces the ABI's key features and improvements over earlier GOES imagers. The second section lets users interactively explore the ABI's 16 channels. The third section contains movies that show the advancements that the ABI will bring to the following application areas: convection, flooding, land cover, hurricanes, climate, air quality, aviation, fog and low visibility, and coastal and marine. The final section contains additional resources pertaining to the ABI. The module has numerous takeaways, including ten application movies and an interactive spectrum.

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## Suomi NPP: A New Generation of Environmental Monitoring Satellites



**Languages:** English, Spanish

**Publish Date:** 2012-05-01

**Skill Level:** 1

**Completion Time:** .75 – 1.00 h

**Includes Audio:** yes

**Required Plugins:** Flash

**Topics:**

Satellite Meteorology

**Reviews:**

☆☆☆☆☆ (0 reviews)

[Read or add reviews](#)

[BEGIN LESSON](#)[Add to Queue](#) [Your Queue»](#)[Take the quiz?](#)[Begin Quiz](#)

**Share this resource:**

[Description](#)[Objectives](#)[Keywords](#)[Media Gallery](#)[Reviews](#)

The Suomi National Polar-orbiting Partnership or Suomi NPP satellite, launched in 2011, is the first of a new series of missions under NOAA's JPSS program. Suomi NPP has two major goals: global observing of the Earth's atmosphere, land, and ocean surface; and climate monitoring. Suomi NPP observations are used to create operational forecast products and provide input to numerical weather prediction models. They also provide continuity to the satellite climate record and other environmental datasets. This module provides an overview of the Suomi NPP satellite. The first half describes its mission, products, and instruments. The second half focuses on its role in environmental monitoring, offering examples of how it detects and monitors Earth's climate, land and ocean surfaces, atmosphere, and space weather.

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# Introduction to VIIRS Imaging and Applications

- VIIRS capabilities vs. earlier imagers
- Imaging strategy, 22 bands, resolution
- Key applications
- Introduction to the Day-Night Band

**Introduction to VIIRS Imaging and Applications**  
Produced by The COMET® Program

- Introduction
- Technical Advances
- VIIRS Products and Applications
  - Environmental Data Records
  - About VIIRS Imagery and Products
  - True Color Products**
  - Natural Color Products
  - Arctic Ice Motion
  - Convection
  - Fog and Low Clouds
  - Sea Surface Temperature
  - Tropical Cyclones
  - Volcanic Ash
  - Dust RGB for Volcanic Ash and Contrails
  - Multispectral Dust Enhancement
  - Ocean Color
  - Day Night Band
  - Summary
  - Lesson Summary

SNPP VIIRS True Color Composite From 15 Orbits 18 Jun 2012

Greenland Arctic Ice Pack Europe Asia Red Sea Arabian Sea

NASA

**Introduction to VIIRS Imaging and Applications**  
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Introduction

Technical Advances

VIIRS Channels and Resolution

VIIRS Imaging and Moderate Channels

VIIRS, AVHRR, and OLS Resolution

Edge-of-Scan Improvements

OLS Engineering

Additional Examples

Summary

VIIRS Products and Applications

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The extreme zoom below is of a shortwave infrared imaging channel of a nighttime fire using the I4 channel at 3.7 micrometers. Located near Ventura, California, the fire started inland and was blown toward the coast by offshore winds. At the time of this image, the fire had reached the coast. Notice the tiny 37-m pixels that make up the image. This channel is one of three VIIRS channels near this wavelength that are useful for fire detection. Pixels hotter than about 26 degrees C are colored red. Notice the fire-free corridor between two burning regions.

Suomi NPP VIIRS 0.375 km 3.74  $\mu$ m Channel 0949 UTC 03 May 2013

Between Santa Barbara and LA, CA

VIIRS Spot 0.37 km at Near "Sampling" Resolution

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VIIRS Products and Applications

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Natural Color Products

Arctic Ice Motion

Convection

Fog and Low Clouds

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Tropical Cyclones

Volcanic Ash

Dust RGB for Volcanic Ash and Contrails

Multispectral Dust Enhancement

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"Fog" or "low clouds at night" products have significantly improved the detection of stratus and fog. These products exploit the differential low cloud emissivities in two input infrared channels. When the channels are combined into a pixel-by-pixel image difference, low clouds and fog stand out distinctly, as we see in the images over Pennsylvania below. Use the slider to view both images.

Suomi VIIRS 10.6 - 3.74  $\mu$ m 0801 UTC 06 Jun 2012

With a spatial resolution of 0.37 km, the VIIRS "imaging" infrared channels enable much finer detail than AVHRR or MODIS. In the GOES comparison, the fog pixels are so "blocky" that it's hard to assess the extent and detail of fog coverage. In contrast, the detailed VIIRS product lets forecasters pinpoint the fog regions within individual valleys. For information on viewing fog at night, see COMET's Advances in Space-Based Nighttime Visible Observation lesson at [https://www.meted.ucar.edu/training\\_module.php?id=990](https://www.meted.ucar.edu/training_module.php?id=990).

**Introduction to VIIRS Imaging and Applications**  
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MODIS and VIIRS have special "ocean color" channels that provide spatial detail and have the ability to quantify and understand bio-optical properties of the ocean surface. Ocean color depends on the number of microscopic marine plants, called "phytoplankton." These plants contain chlorophyll, a green pigment. These images are season-long composites of ocean chlorophyll concentrations derived from visible measurements made by VIIRS. The purple and blue colors represent lower chlorophyll concentrations, the oranges and reds higher chlorophyll concentrations. The left composite shows summer in the Northern Hemisphere. The composite on the right shows summer in the Southern Hemisphere.

Suomi NPP VIIRS Global Chlorophyll Composite

Boreal Summer 21 Jun 2012 - 20 Sep 2012

Austral Summer 21 Dec 2011 - 20 Mar 2012

Chlorophyll (mg / m<sup>3</sup>)

NASA/Suomi NPP/Noaa/Kuring

Looking at the Northern Hemisphere-summer (left image), which statements are true of the bio-optical activity in the Arctic Ocean? (Choose the best answer.)

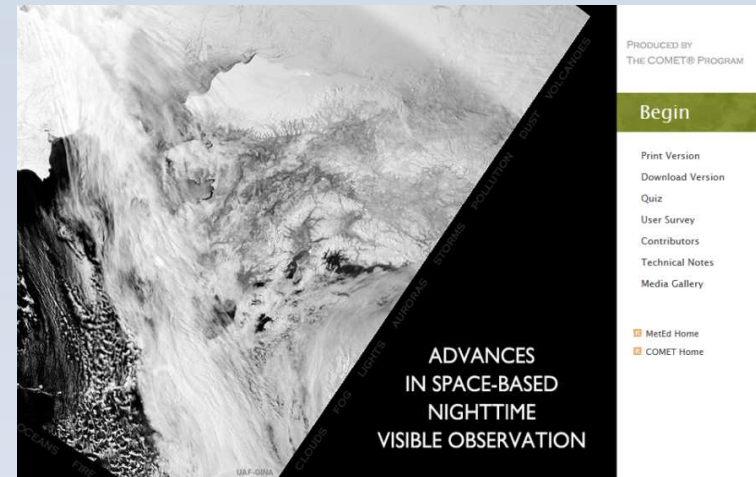
a) The reds along the land areas indicate high concentrations of chlorophyll

b) The Arctic is covered with ice, suppressing biological activity



# Advances in Space-Based Nighttime Visible Observation

- Technical Improvements with Suomi NPP VIIRS Day-Night Band
- Lunar cycle & modeling, constant contrast techniques for normalized imagery
- Meteorological and other applications
- Future improvements in NT visible imaging



**ADVANCES IN SPACE-BASED NIGHTTIME VISIBLE OBSERVATION**  
Produced by The COMET® Program

Introduction  
About Nighttime Imaging  
History of Nighttime Visible Observation  
About the Module  
Nighttime Visible Imaging With the DNB  
Lunar Phases and Modeling  
Applications of Nighttime Visible Imaging  
Future of Nighttime Visible Observation  
Interpretation Guidelines  
References

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NE Afghanistan, 29 Nov 2012: DMSOP NPP VIIRS DNB Moonlit Night Visible

Nighttime visible imaging complements and, in many cases, improves upon infrared (IR) images. Although nighttime products made from multiple infrared channels have improved in recent years, they still have limitations.

**ADVANCES IN SPACE-BASED NIGHTTIME VISIBLE OBSERVATION**  
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Introduction  
Nighttime Visible Imaging With the DNB  
Lunar Phases and Modeling  
Lunar Phases  
Lunar Model  
Exercise 1  
Exercise 2  
Applications of Nighttime Visible Imaging  
Future of Nighttime Visible Observation  
Interpretation Guidelines  
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Illumination varies tremendously throughout the lunar cycle. For example, the full moon is about nine times brighter than a quarter moon and hundreds of times brighter than a crescent moon. To account for these huge variations in lunar illumination, some groups use a lunar model to normalize the data. This approach accounts for highly variable input lunar illumination and outputs constant illumination. This greatly improves the quality of imagery and the capacity to build quantitative products.

Here's a sample image before the lunar model is applied. The cities of South Africa are visible but we can't see many clouds because of the low illumination from the first quarter moon that's about 22 degrees above the horizon. Applying the lunar model brightens the data as if the moon were full and directly overhead. **HOVER OVER THE IMAGE AND MOVE THE SLIDER TO SEE THE NORMALIZED IMAGE. (ON TOUCH SCREEN DEVICES, TAP THE IMAGE SIDES.)** So many more clouds are evident! This is known as "near constant contrast" (NCC) imagery. It looks the same regardless of the lunar phase or elevation and enables us to process effective images even with marginal lunar conditions.

Suomi NPP VIIRS DNB Night Visible Over South Africa With Normalization  
0030 Local Time 20 Jun 2012

**ADVANCES IN SPACE-BASED NIGHTTIME VISIBLE OBSERVATION**  
Produced by The COMET® Program

Introduction  
Nighttime Visible Imaging With the DNB  
Lunar Phases and Modeling  
Applications of Nighttime Visible Imaging  
Interpretation Guidelines  
References

City Lights  
Tropical Cyclones  
Fog/Stratus  
Airglow  
Polar Nights and Auroras  
Wildland Fires  
Volcanoes  
Dust Storms  
Air Pollution  
Moonlight  
Lightning  
Gas Flares  
Ships and Boats  
Population/Economic Geography

Future of Nighttime Visible Observation  
Interpretation Guidelines  
References

This section explores the use of nighttime visible images and derived products to detect and monitor a variety of meteorological and other features at night. The derived products are made from VIIRS DNB visible images and infrared channels. As of 2013, some are currently available while others are still experimental.

**Suomi NPP VIIRS DNB Nighttime Visible Images & Products**

If you are not familiar with RGB products, we recommend that you take COMET's Multispectral Satellite Applications: RGB Products Explained module at [https://www.meted.ucar.edu/training\\_module.php?id=568](https://www.meted.ucar.edu/training_module.php?id=568).

## Course Listing » Satellite Meteorology

Topics:



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.

Lessons/Resources

Courses



Sort by:

1 - 4 out of 4 results



### Curso de orientación sobre los satélites GOES-R

Languages: Spanish, English  
Time to Complete: 3-5 h  
Topics:

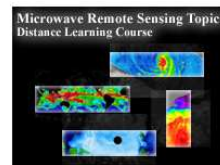
Este curso a distancia brinda a cualquier pronosticador, estudiante, investigador u otra persona interesada la oportunidad de explorar a su propio ritmo las prestaciones, los productos y las aplicaciones que los satélites GOES-R de próxima generación pondrán a nuestra ...  
[Read more »](#)



### GOES-R Satellites Orientation Course

Languages: English, Spanish  
Time to Complete: 3-4 h  
Topics: Satellite Meteorology

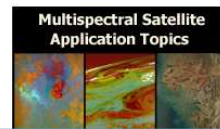
This self-paced distance learning course introduces forecasters, students, researchers, and other interested learners to the capabilities, products, and applications anticipated with the next-generation GOES-R satellites. The three core lessons in this course are: GOES-R: ...  
[Read more »](#)



### Microwave Remote Sensing Topics Distance Learning Course

Languages: English  
Time to Complete: 4-6 hrs  
Topics: Satellite Meteorology

This self-paced distance learning course provides forecasters, students, researchers, developers, and other interested learners with a foundation in the science, products, and applications of space-based satellite microwave remote sensing. The three core modules that ...  
[Read more »](#)



### Multispectral Satellite Application Topics Course

Languages: English  
Time to Complete: 6 to 8 hrs  
Topics: Satellite Meteorology, Satellite

This self-paced distance learning course provides forecasters, students, researchers, and other interested learners with a foundation in the products and applications from multispectral satellite observations and various

### Special Interest

#### More on Satellite Meteorology

Did you know that our individual GOES-R+ lessons are organized into their own distance learning course? Learn more on the GOES-R Satellites Orientation Course page.



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Languages: English  
 Completion Time: 3-4 h  
 Topics:  
 Satellite Meteorology

Enrollment Information:

Enroll

Description

Objectives

Overview

Additional Resources

### Description

This self-paced distance learning course introduces forecasters, students, researchers, and other interested learners to the capabilities, products, and applications anticipated with the next-generation GOES-R satellites.

The three core lessons in this course are:

- GOES-R: Benefits of Next-Generation Environmental Monitoring
- GOES-R ABI: Next Generation Satellite Imaging
- GOES-R GLM: Introduction to the Geostationary Lightning Mapper

### Course Outline



#### Core Topics/Modules

GOES-R: Benefits of Next-Generation Environmental Monitoring

Languages: English, Spanish  
 Publish Date: 2008-12-19  
 Last Updated On: 2013-04-18  
 Skill Level: 1

Topics:  
 Emergency Management, Satellite Meteorology  
 ★★★★★ (2 reviews)

GOES-R ABI: Next Generation Satellite Imaging

Languages: English, Spanish  
 Publish Date: 2013-02-19  
 Skill Level: 1

Topics:  
 Satellite Meteorology  
 ★★★★★ (0 reviews)

GOES-R GLM: Introduction to the Geostationary Lightning Mapper

Languages: English, Spanish  
 Publish Date: 2014-09-05  
 Skill Level: 1

Topics:  
 Mesoscale Meteorology, Satellite Meteorology  
 ★★★★★ (1 review)

#### Optional Topics/Modules

Multispectral Satellite Applications: RGB Products Explained Optional

Languages: English, Spanish  
 Publish Date: 2013-07-08  
 Last Updated On: 2013-07-22  
 Skill Level: 2

Topics:  
 Satellite Meteorology  
 ★★★★★ (6 reviews)

Multispectral Satellite Applications: Monitoring the Wildland Fire Cycle, 2nd Edition Optional

Languages: English  
 Publish Date: 2013-06-11  
 Skill Level: 2

Topics:  
 Fire Weather, Satellite Meteorology  
 ★★★★★ (0 reviews)

How Satellite Observations Impact NWP Optional

Languages: English  
 Publish Date: 2014-03-12  
 Last Updated On: 2013-06-14  
 Skill Level: 2

Topics:  
 Numerical Modeling (NWP), Satellite Meteorology  
 ★★★★★ (2 reviews)

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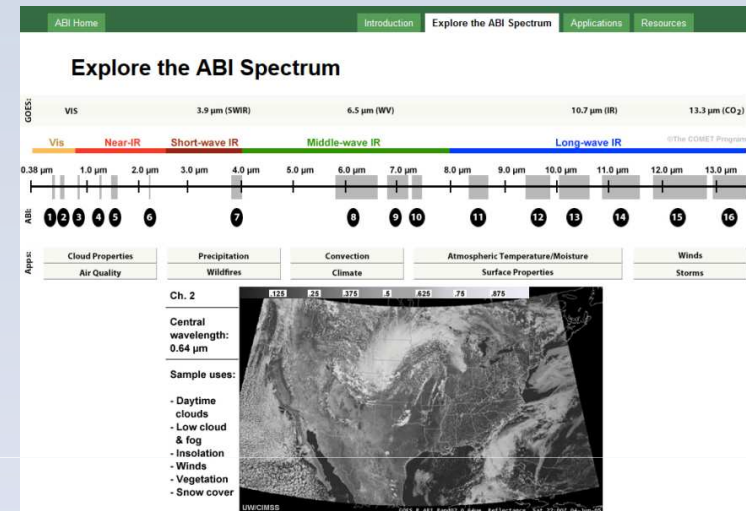
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# GOES-R ABI: Next Generation Satellite Imaging

- Interactive exploration of ABI's 16 bands, linking bands to observable phenomena
- Movies describing advancements in ten application areas (e.g. analysis, forecasting, NWP, climate and environmental monitoring)



ABI Home Introduction Explore the ABI Spectrum Applications Resources

## GOES-R ABI Applications

Click each application to learn about the improvements that GOES-R ABI will bring.


GOES-R ABI Applications

Click each application to learn about the improvements that GOES-R ABI will bring.

GOES-13 Water Vapor Images, Lightning Strikes, and PIREP Turbulence Reports

# GOES-R GLM: Introduction to the Geostationary Lightning Mapper

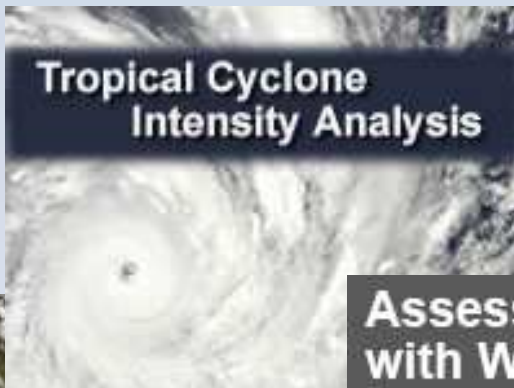
- Conceptual exploration of lighting and detection
- Movies describing improvements that the GLM is expected to bring to a variety of applications

# Recently Published Satellite Application Training Topics

*Microwave Remote Sensing:  
Land and Ocean Surface  
Applications, 2nd Ed.*



**Tropical Cyclone  
Intensity Analysis**



**Introduction to VIIRS Imagery  
and Applications**



**Assessing NWP  
with Water Vapour  
Imagery**



*Volcanic Ash:  
OBSERVATION TOOLS  
AND DISPERSION MODELS*



**Multispectral Satellite  
Applications:**



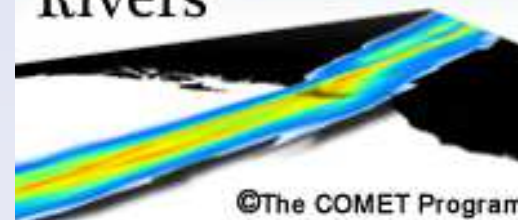
**RGB PRODUCTS  
EXPLAINED**

**MULTISPECTRAL  
SATELLITE  
APPLICATIONS:  
MONITORING  
THE WILDLAND  
FIRE CYCLE  
2ND ED.**



Satellite Feature Identification:

**Atmospheric  
Rivers**



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# Water Vapour Interpretation Training - Short Course

## Satellite Water Vapour Interpretation -- Short Course



**Satellite Water Vapour Interpretation Short Course**

NOAA / The COMET Program

**Languages:** English, French  
**Completion Time:** 3-5 hrs  
**Topics:** Satellite Meteorology, Winter Weather

**Enrollment Information:**

[Enroll](#)

Description

Objectives

Overview

Additional Resources

### Description

This self-paced distance learning course introduces the power of dynamical thinking. To apply this thinking to the real-time atmosphere is a challenge, even to seasoned atmospheric scientists. This short course is your first step toward dynamical reasoning using satellite water vapour imagery.

## Cours sur l'interprétation de l'imagerie satellitaire de vapeur d'eau



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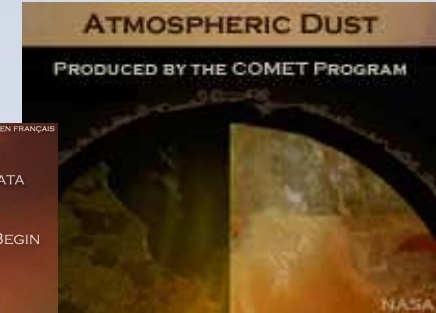
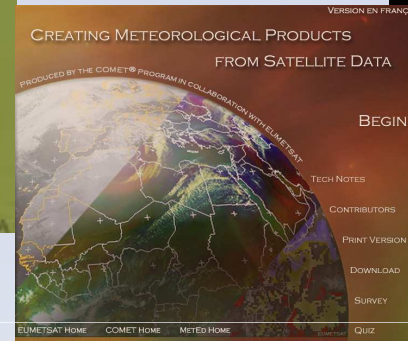
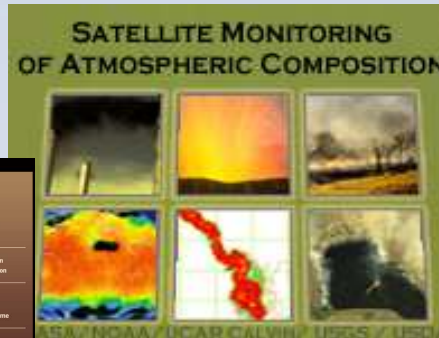
### Description

Ce cours à progression autocontrôlée introduit le concept de puissance de la pensée dynamique. Afin d'appliquer ce mode de pensée à l'atmosphère en temps réel est un défi, même pour les scientifiques les plus aguerris. Ce cours constitue la première étape vers la pensée dynamique grâce à l'imagerie satellitaire de vapeur d'eau.

- Available in English and French
- 5 required lessons
- 3 to 5 hours to complete
- Will become available in Spanish later in 2015
- Does NOT include all the lessons in the:



# EUMETSAT-Sponsored Lessons (many translated)



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ASMET Lessons

About ASMET

Development Process

Other Resources

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## Welcome to ASMET

The ASMET (African Satellite Meteorology Education and Training) project produces online and CD-based learning lessons that teach African forecasters how to enhance their forecasts by making better use of meteorological satellite images and products. The lessons are produced by the ASMET team, which consists of meteorology instructors from the South African Weather Service (Pretoria), Institute for Meteorological Training and Research (Kenya), and EAMAC/ASECNA (Niger), and staff from EUMETSAT (Germany) and The COMET® Program (UCAR, USA). The project is funded by EUMETSAT and managed by EUMETSAT and COMET.

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