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Dear Dr. Perera,

It is my pleasure to invite you to deliver the lectures to the 3-day training workshop "**Imagery Products and Applications of Moderate Resolution and Hyperspectral Remote Sensing**" held in HoChiMinh City Institute of Resources Geography from 04 – 06 November 2009. The aim of the workshop is to introduce products and applications of moderate resolution multispectral and hyperspectral remote sensing data and to discuss potential applications in Vietnam.

We are looking forward to meeting you in Ho Chi Minh City.

Best regards,

NGUYEN THANH HUNG
Director,
HCMC Institute of Resources Geography
Vietnam Academy of Science and Technology

**Moderate Resolution Imaging Spectroradiometer (MODIS) mission, sensor and image characteristics**

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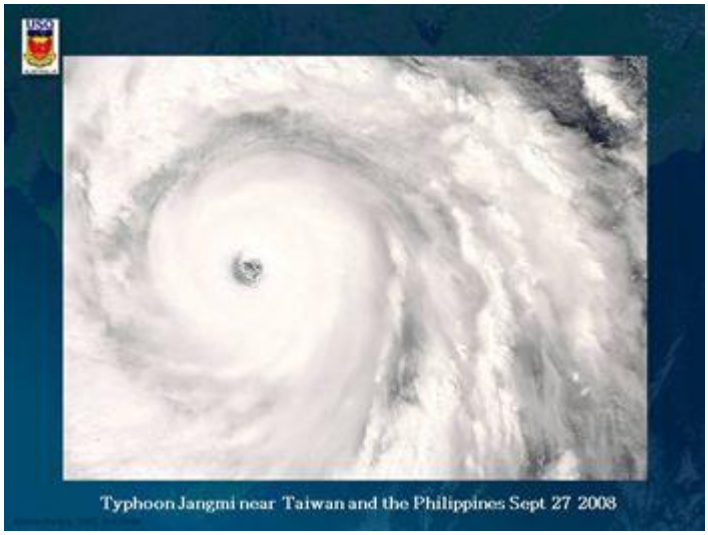



## What is MODIS? Why is it important?

MODIS (or Moderate Resolution Imaging Spectroradiometer) is the key instrument or sensor aboard the Terra and Aqua satellites.

Terra launched in December 19, 1999 opened a new era in earth observations with MODIS sensor.

Aqua, NASA's 2nd Earth satellite mission with MODIS launched in May 4 2002

## What is MODIS? Why its important?

- Better image resolution compare to AVHRR and SeaWiFS
- Higher number of channels (bands)
- Freely available ready products from NASA
- Special file format which needs bit of work

MODIS data is FREE and available without need for approval from NASA.

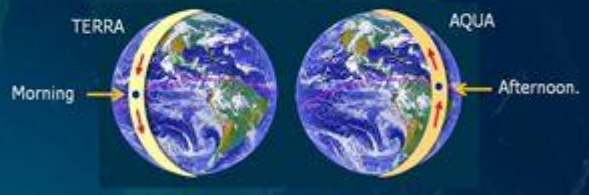
## The MODIS Mission

With MODIS data, we detect and map.

- Surface temperature (land and ocean) and fire
- Ocean colour (sediment, phytoplankton)
- Global vegetation maps and changes
- Cloud characteristics
- Aerosol concentrations and properties
- Temperature and moisture soundings
- Snow cover and characteristics
- Ocean currents

## The MODIS Mission

The MODIS sensors onboard Terra and AQUA satellites are successfully covering the complete earth surface every 1–2 days.




Terra passes north to south across the equator in the morning.
Aqua passes south to north across the equator in the afternoon.

## The sensor capabilities

Orbit: 705 km, 10:30 a.m. descending node (Terra) or 1:30 p.m. ascending node (Aqua), sun-synchronous, near-polar, circular

Swath Dimensions: 2330 km (cross track) by 10 km (along track at nadir)

Spatial Resolution:

250 m (bands 1–2)
500 m (bands 3–7)
1000 m (bands 8–36)

Design Life: 6 years

## The sensor capabilities

MODIS is acquiring data in 36 spectral bands, or groups of wavelengths.

MODIS aims to improve our understanding of environmental dynamics of the earth surface and lower atmosphere.

## The sensor capabilities

The Usability of various MODIS bands

| Primary Use | Band | Bandwidth (nm) | Pixel Size (m) |
|---|---|---|---|
| Land/Cloud/Aerosols Properties | 1 | 620 - 670 | 250 |
| | 2 | 841 - 876 | 250 |
| | 3 | 459 - 479 | 500 |
| | 4 | 545 - 565 | 500 |
| | 5 | 1230 - 1250 | 500 |
| | 6 | 1628 - 1652 | 500 |
| | 7 | 2105 - 2155 | 500 |
| Ocean Colour/ Phytoplankton/ Atmospheric Water Vapour | 8 - 19 | 405 – 965 | 1000 |
| Surface/Cloud and Atmospheric Temperature, various cloud information | 20 - 36 | 3.660 - 14.385 | 1000 |
| | | Bandwidth (µm) | |

## Image characteristics and resolution

MODIS combines characteristics of AVHRR and Landsat sensors to provide improved monitoring of the Earth's surface at global scales.

MODIS, over Mekong, 30 Oct. 2009

MODIS, over Queensland, west to Toowoomba, 23 Oct. 2009

## Image characteristics and resolution

Commonly used MODIS band combinations,
Area: Tonle Sap 30 Oct 2009

True colour
1 (R) 4 (G) 3 (B)

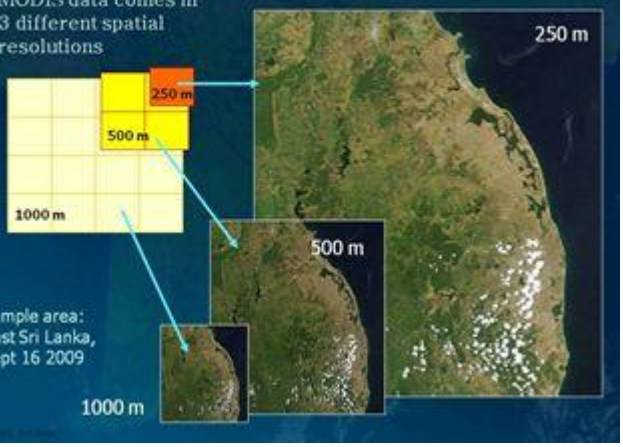
Band 7 (R) 2 (G) 1 (B)

NDVI

CHECK...! Read more about NDVI and Vegetation Indexes....

## Image resolution

MODIS data comes in 3 different spatial resolutions




## Searching MODIS data

The MODIS Rapid Response System provides daily satellite images of the Earth's landmasses in near real time.


http://rapidfire.sci.gsfc.nasa.gov/

CHECK...! Visit this site and search data for Vietnam

## Searching MODIS data

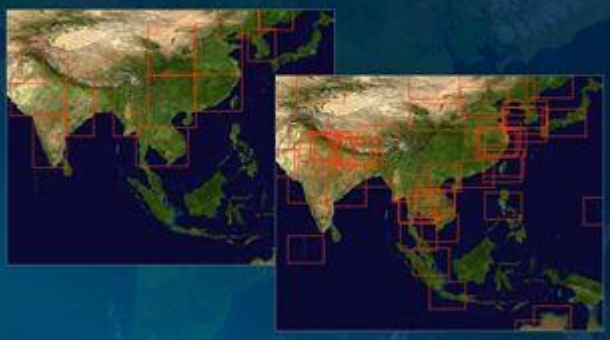
The MODIS Rapid Response System is the best place to search data.

## Searching MODIS data

Most of the important areas are covered in sub-set collections.

## Searching MODIS data

Vietnam includes in Indochina subset



## Searching MODIS data

Image presents in 3 band combinations.

1. True colour
2. Band 721
3. NDVI


## Near-real time image of Vietnam region

## Global fire map

Product available since 2000

Latest fire map available: 10/18/09 - 10/27/09

## How to get MODIS data

When you order original MODIS data (download), it comes in a Hierarchical Data Format (HDF) file (a file format for storing multi type datasets).

Here, it requires a lot more than a simple import filter to read.

## How to get MODIS data

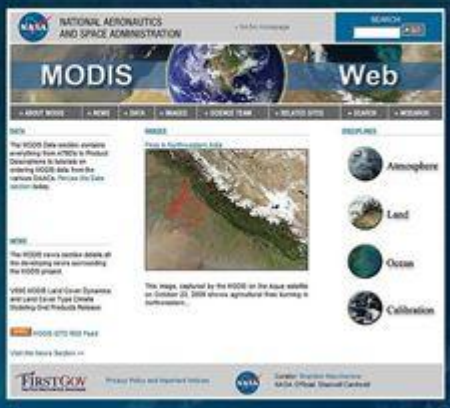
The HDF-EOS To GeoTIFF Conversion Tool (HEG) is a tool developed to allow a user to reformat, re-project and perform stitching/mosaicing and subsetting operations on MODIS data.
The output GeoTIFF file is suitable for commonly used GIS applications.

http://newsroom.gsfc.nasa.gov/sdptoolkit/HEG/HEGHome.html

## How to get MODIS data

You can find nearly all needed information about MODIS from its main web site.

http://modis.gsfc.nasa.gov/index.php




## How to get MODIS data


Land Processes Distributed Active Archive Centre at USGS Centre for Earth Resources Observation and Science
(LP DAAC at EROS)

https://lpdaac.usgs.gov/lpdaac/get_data/wist

CHECK...! Visit these sites and see the contents....

## Surface feature identification
EXERSICE

Carefully watch following 2 images.
What you see as the difference?
(images will display two times)

Write down your observation (at least one).

## Surface feature identification

## Surface feature identification

## Surface feature identification


## Surface feature identification

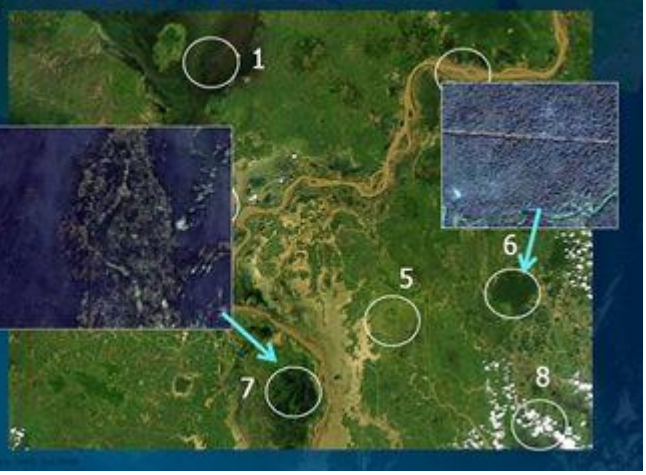
There are 8 spots circled in next image.

Try to identify each place and select the closest answer.

## Surface feature identification


## Surface feature identification


## Surface feature identification




## Surface feature identification

Have another look at spot 1 and 2

Why these places came in different colours?
Suggest at least one reason.

## Vietnam from Space, through MODIS


## Vietnam from Space, through MODIS

2003 July floods, around Mekong Delta

## Vietnam from Space, through MODIS

2003 July floods, around Mekong Delta

## Concluding remarks

- We have gone through various aspects of MODIS system to give you an overview of it.
- MODIS supplies a promising data platform to conduct fundamental studies to identify key locations of interests and also to deal with some near-real time data requirements.
- Hence, MODIS has huge potentials to use in Vietnam, in areas of land cover management to disaster mitigation.
- This workshop will help you to find starting points for your research activities through the daunting task of searching relevant data in the jungle of remote sensing products.