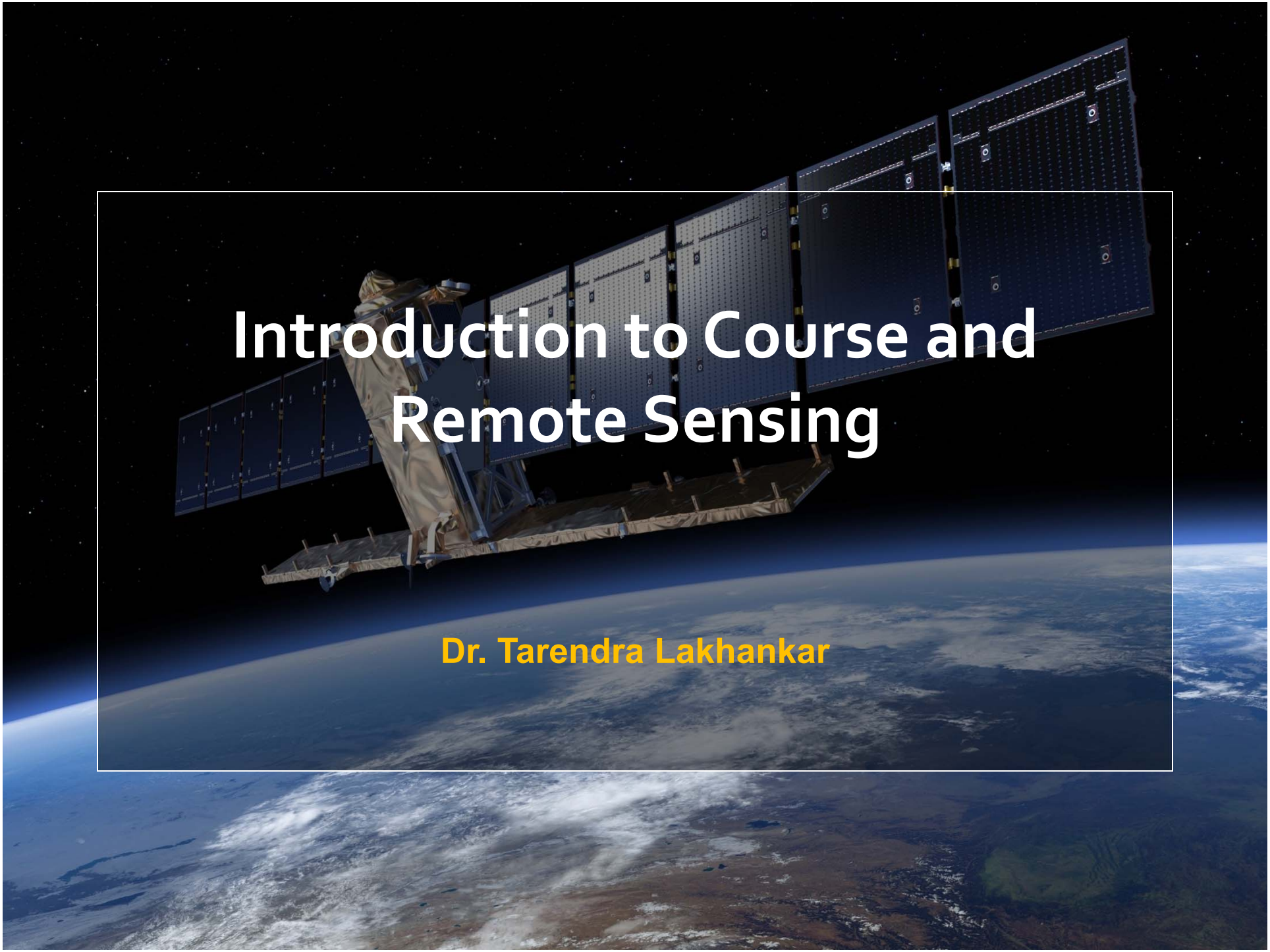


Introduction to Course and Remote Sensing

Dr. Tarendra Lakhankar

Introduction to satellite remote sensing and imaging

- Objectives of the course

- Overview of the course content

- Literature, web sites, other materials

- Assignments

- Requirements

What is Remote Sensing

Remote Sensing is…

"…the science and art of obtaining information about an object, area, or phenomenon through the analysis of data acquired by a device that is not in contact with the object, area, or phenomenon under investigation."

Lillesand and Kiefer"Remote Sensing and Image Interpretation"

"… group of techniques for collecting image or other forms of data about an object from measurements made at a distance from the object, and the processing and analysis of the data."

Canada Center for Remote Sensing (CCRS)

"… acquisition of information about an object without being in physical contact with it."

Charles Elachi "Introduction to the Physics and Techniques of Remote Sensing":

Human Senses:

Which ones can be attributed to remote sensing ?

Why Remote Sensing

- Used in a large number of practical applications
- Scope of applications is growing
- Cover areas that hard/impossible to reach with contact measurements
- Can use frequencies/waves that we do not see or feel
  - ultrasound
  - x-rays
- Cost effective

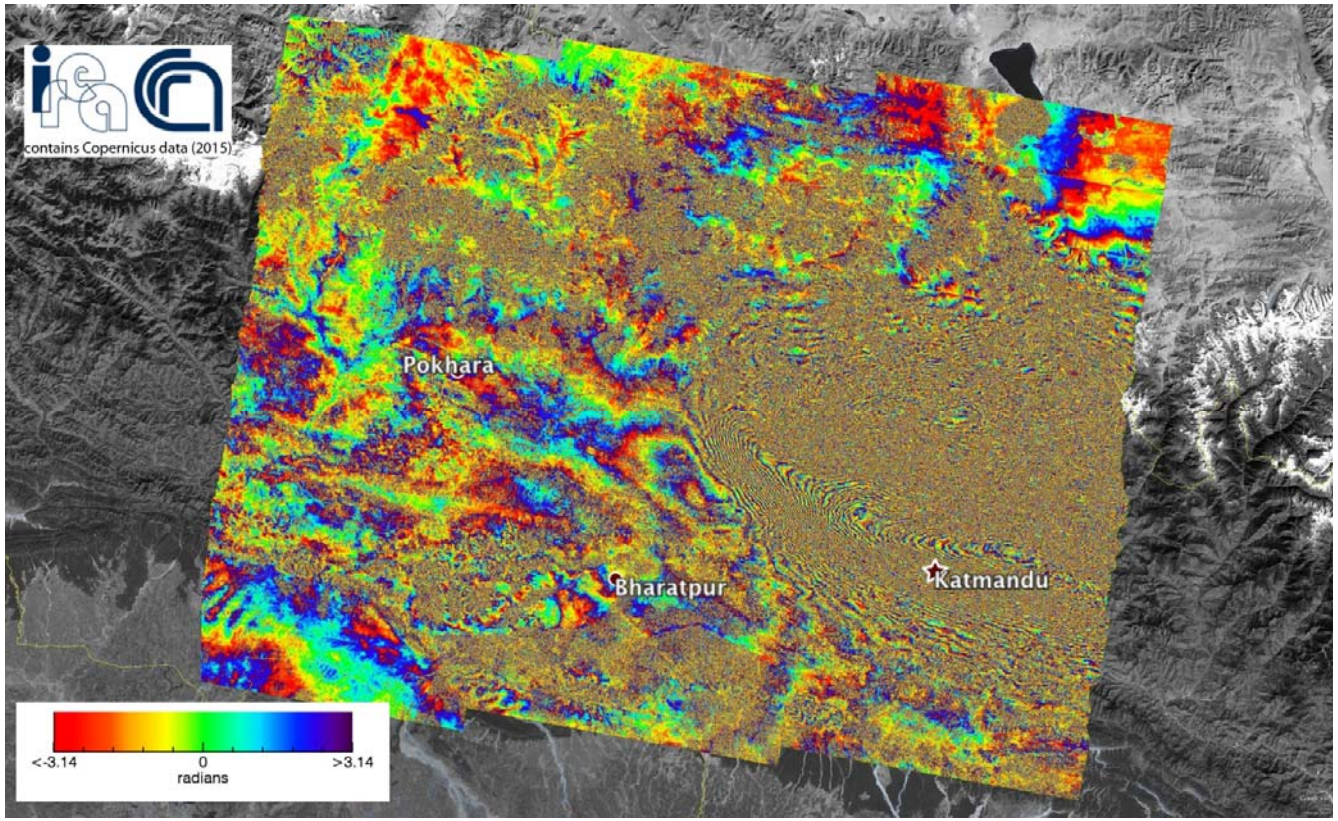
Thermal imaging: Helps to identify heat insulation problems and water leaks

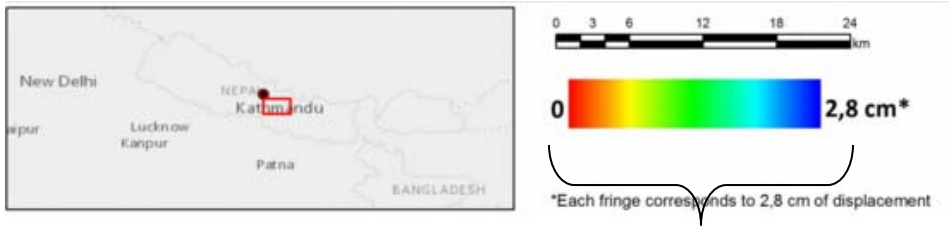
Laser distance meter: Another example of remote sensing technology

Why Satellites

- Satellite remote sensing is an effective way to get information on objects, environmental processes or parameters over the whole globe
- Applications
  - Military
  - Environmental monitoring
  - Transportation
  - Land management
  - Water resources management
  - Emergency operations support …. and many others -

Example: Land Deformation from Satellite





One fringe

Land surface deformation after earthquake in Nepal in 2015 estimated with satellite radar data

One fringe corresponds to 2.8 cm displacement

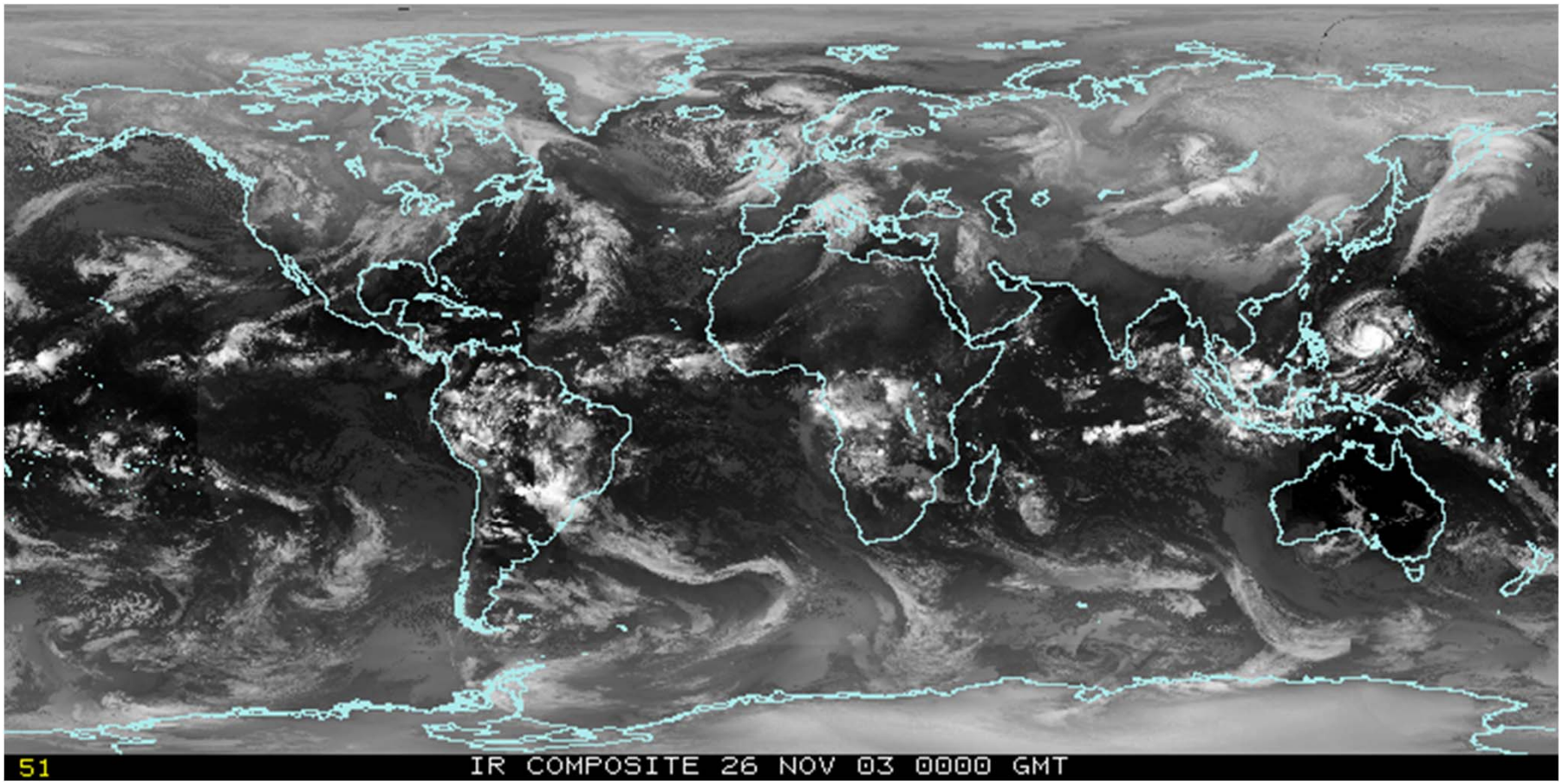
Larger density of fringes indicates larger vertical displacement

Total vertical displacement in Katmandu was about 60 cm

Why Weather Satellites

- Weather is important/interesting for everybody
- Exciting opportunity to see the Earth system in action
- Easy to get the data
- Easy to understand the images
- Many practical applications of weather satellite data besides weather due to
  - High spatial resolution: Up to 400-500m
  - High frequency of observations: Images available up to every 30 min – 1 hour
  - Long period of observations: more than 30 years

Satellite view on weather processes



- Image is composed of data from several geostationary weather satellites. Time step in the animation is 3 hours.

Course Focus

- Course concentrates on the Earth's surface and atmosphere remote sensing from weather satellites
  - Physics
  - Data
  - Approaches
  - Applications

Course Goal

- Satellite remote sensing terminology and basic concepts
- Physics of processes involved
- Approaches to data interpretation/retrievals
- Data and products available from weather satellites
- Possible applications of available data and products
- Most recent advances in satellite Remote Sensing

The goal is also for students to gain experience…

.

Working on short-term research projects individually and in teams

Working fast !

Preparing and making short research presentations

Participating in discussions, asking questions

Critically evaluating the work of your colleagues

Course Approach

MOSTLY QUALITATIVE DESCRIPTION OF PHYSICAL PROCESSES INVOLVED

SIMPLE, EASY TO UNDERSTAND EXAMPLES

INDIVIDUAL/TEAM ASSIGNMENTS AND PRESENTATIONS

ACTIVE PARTICIPATION IS EXPECTED AND APPRECIATED !

Course Overview

23 Days/Classes (Jun 1- July 23, 2020)

20 Presentation sessions/day
40-60 min each.

Followed by some exercise and Lab work

Group Assignments, HomeWorks

Group project

Examinations

Mid-term 24 June 2020
Final 23 July 2020

Reading, Viewing, Learning

Textbooks, Tutorials

- **Remote Sensing Applications with Meteorological Satellites** by W. Paul Menzel, https://cimss.ssec.wisc.edu/rss/benevento/source/AppMetSat06.pdf

- **Fundamentals of Remote Sensing. Natural Resources Canada**

http://www.nrcan.gc.ca/earth-sciences/geomatics/satellite-imagery-air-photos/satellite-imagery-products/educational-resources/9309

- **Fundamentals of Remote Sensing. Canada Center for Remote Sensing**

http://www.ldeo.columbia.edu/res/fac/rsvlab/fundamentals_e.pdf

Reading, Viewing, Learning

- **Textbooks, Tutorials (cont'd)**

- **Remote sensing Tutorial. Federation of American Scientists (FAS)** . http://fas.org/irp/imint/docs/rst/

Reading, Viewing, Learning

Online courses

CIMSS Satellite Meteorology Learning Modules (easy reading)
http://cimss.ssec.wisc.edu/satmet/index.html

CIRA Meteorology Training Sessions page
http://rammb.cira.colostate.edu/training/visit/training_sessions/

MetEd (Meteorology Education)
https://www.meted.ucar.edu/training_detail.php

Some sites require registration, but access is free

Additional Reading

Blogs

- **VIIRS Imagery and Visualization Team Blog**

http://rammb.cira.colostate.edu/projects/npp/blog/

- Additional online publications or short communications may be suggested for reading at home.

Web-based Satellite Image Viewers

- **WorldView**: Easy viewing of global imagery from MODIS and VIIRS sensors. Near real time data. Overlays of different derived environmental parameters. Static datasets are available.
- https://worldview.earthdata.nasa.gov/

- More links to various online satellite data viewers are at
- https://earthdata.nasa.gov/

Web-based Satellite Data Analysis Tools

- **ORNL**: Subsetting tool for land products. Allows for time series analysis of satellite data for selected small areas.

https://modis.ornl.gov/globalsubset/

- **GIOVANNI** NEESPI. Monthly averaged satellite-derived products for Eurasia. Allows for generating time series, correlations, scatterplots of various satellite-derived parameters.
- https://giovanni.gsfc.nasa.gov/giovanni/

Assignments

Assignments will be given for the work in teams (3 students per team)

Team assignments will involve computer lab work and reporting on the results.

Reports will be in PowerPoint format, typically 4-6 slides.

Be prepared to present your report and answer questions.

Group Project

TBD….

Oral presentation on 22 July 2020 (Day 22)

10 min + 2-3 min for questions/answers

Slides for the presentation are due 9:00 pm, July 21, 2016

Evaluation

ATTENDANCE, PARTICIPATION: 5%

ASSIGNMENTS : 20%

GROUP PROJECT: 20%

MID-TERM EXAM: 20%

FINAL EXAM: 35%