

University of Anbar

College of Science – Applied Geology Department

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2<sup>nd</sup> Stage

Remote Sensing

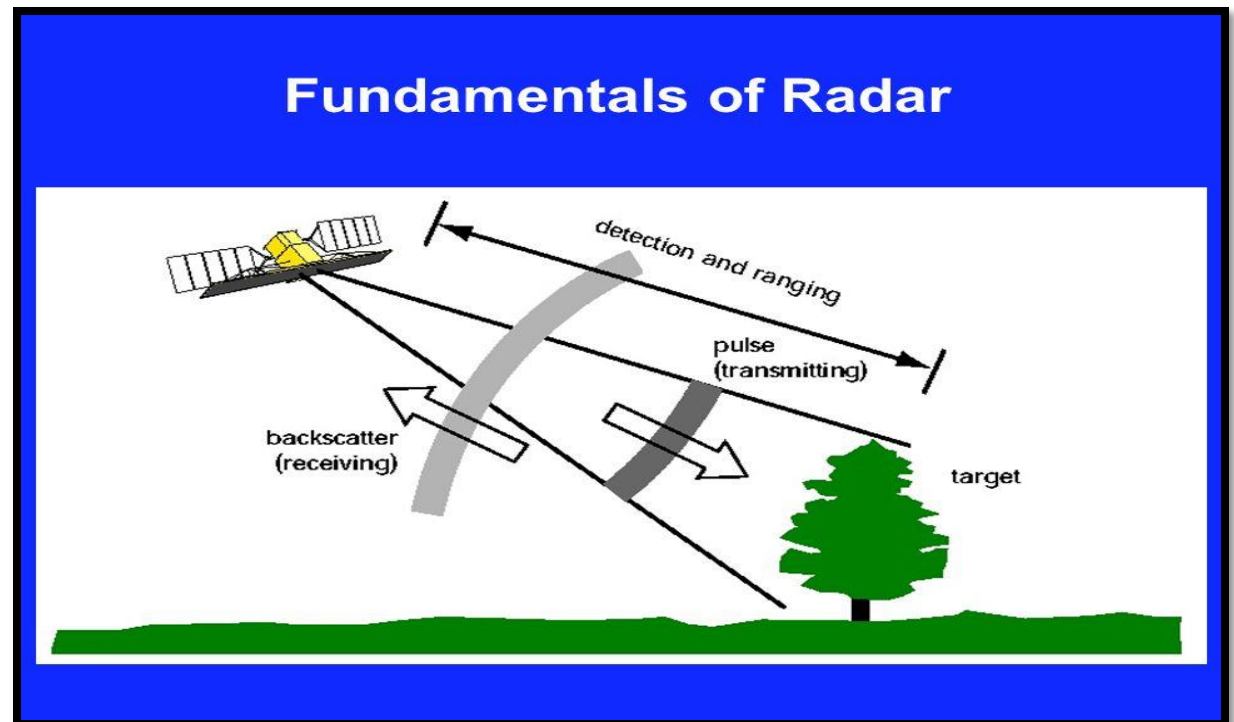
Lecture 10 : Radar Imagery



# Radar Imagery

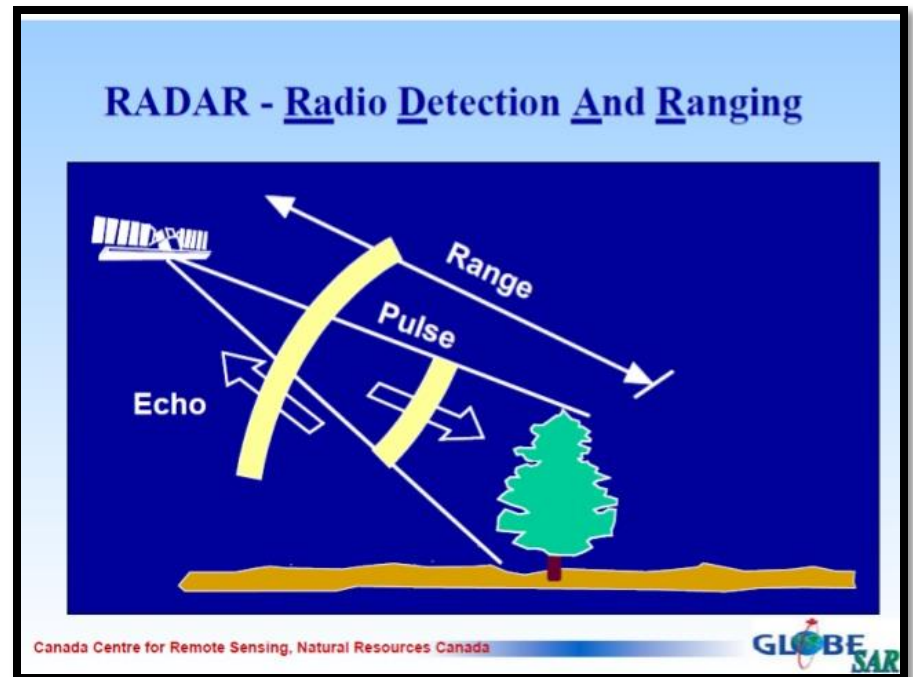
*Radar* is short for Radio Detection and Ranging. Radar is an active sensor systems .

It generates its own illumination as an outgoing signal that interacts with the target such that some of the signal is returned as backscatter that is picked up by the same antenna that emitted the radar beam. Radar operates in part of the microwave region of the electromagnetic spectrum, specifically in the frequency interval from 40,000 to 300 megahertz (MHz)



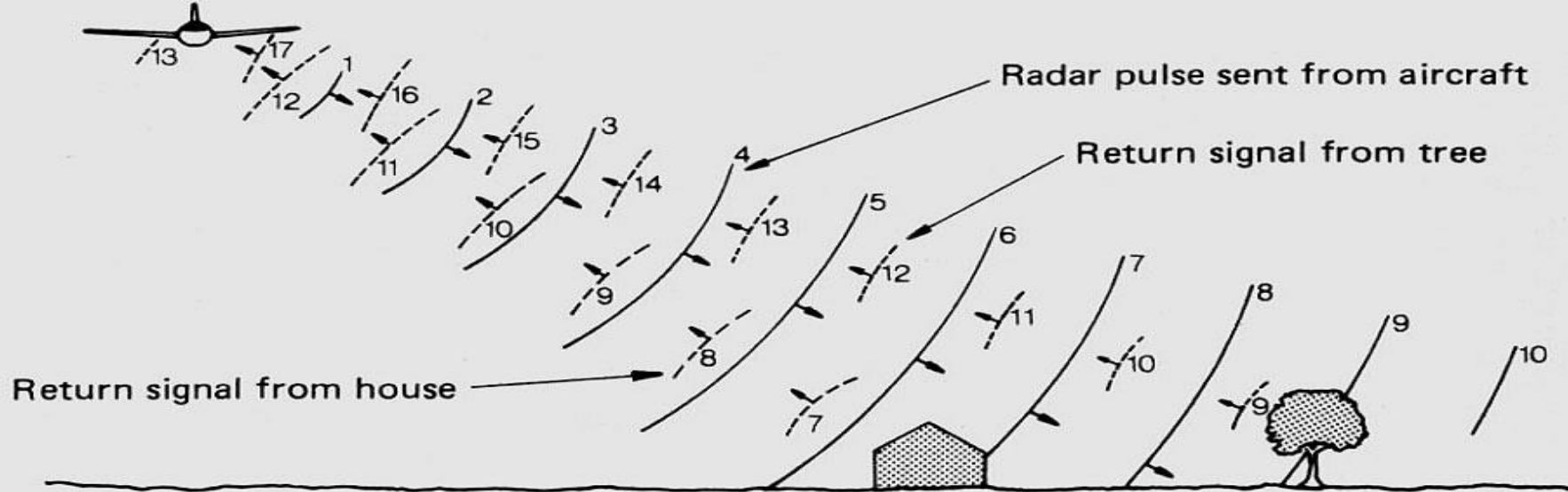
Commonly used frequencies and their corresponding wavelengths are specified by a band nomenclature, as follows:

- Ka Band: Frequency 40,000-26,000 MHz; Wavelength (0.8-1.1 cm)
- K Band: 26,500-18,500 MHz; (1.1-1.7 cm)
- X Band: 12,500-8,000 MHz; (2.4-3.8 cm)
- C Band: 8,000-4,000 MHz; (3.8-7.5 cm)
- L Band: 2,000-1,000 MHz; (15.0-30.0 cm)
- P Band: 1,000- 300 MHz; (30.0-100.0 cm)

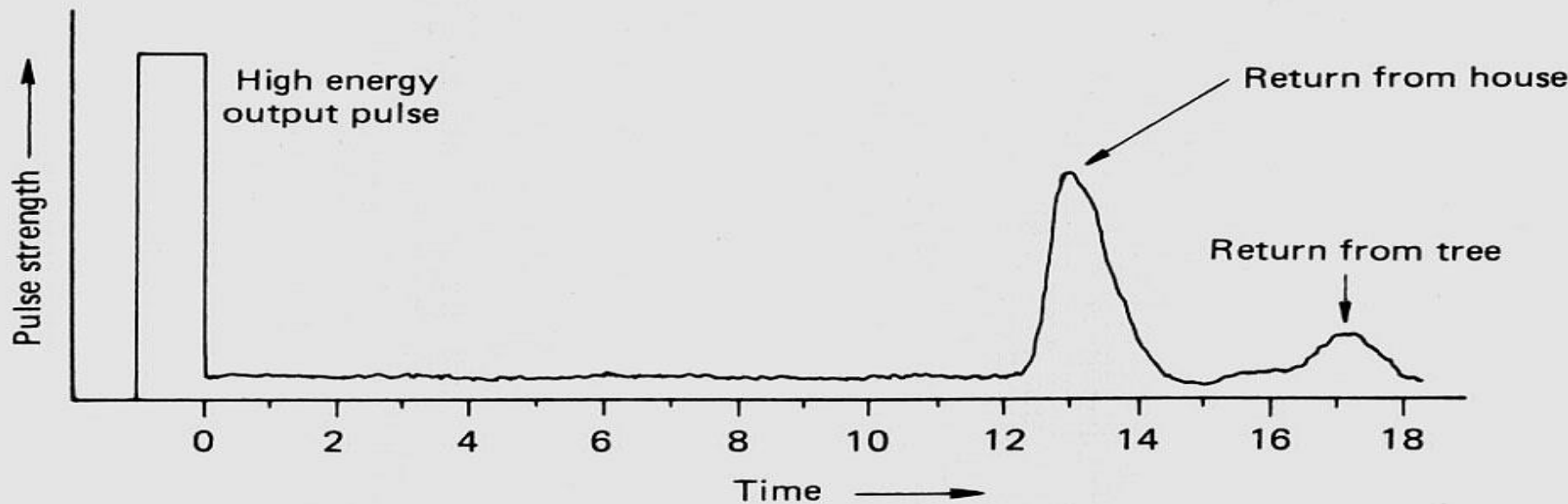


## **Parts of imagery Radar**

- 1 – Pulse Generating Device : this unit generate the energy of electromagnetic as sequence of pulses and arrange the sending pulses
- 2 – transmitter: arrange the energy and control the wave length and transmitted periods for each pulse .
- 3 - Duplexer : its electronic key open and close automatically to prevent the interface between the sending pulses and returned , this operation act periodically .
- 4 – Antenna : to send the wave length pulses and received them later , some satellite have 2 antennas but most of them only 1 .
- 5 – Receiver : it electronic unit receive from antenna the reflected pulses the magnified them because they very weak .
- 6 – Display unit and cameras : it units to show the reflected pulses appear as bright dots arrange as consequence lines , all that give the radar image of the area .



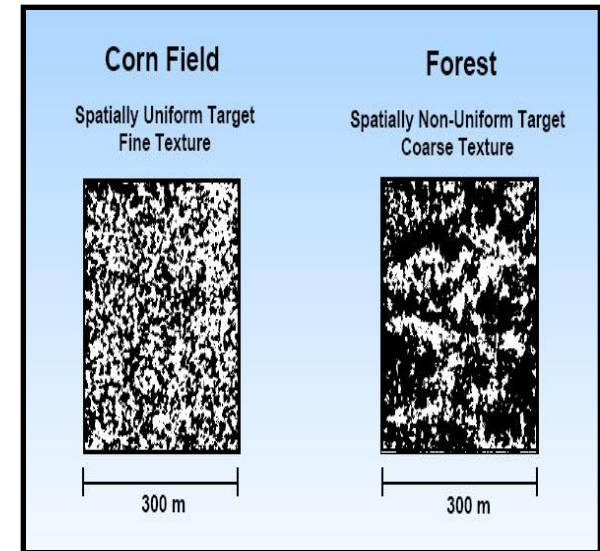
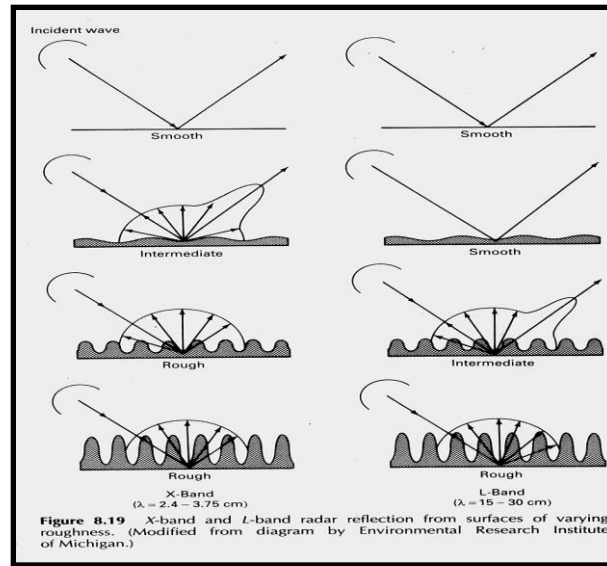
(a) Propagation of one radar pulse (indicating the wavefront location at time intervals 1-17)



(b) Resulting antenna return

# The characteristics of Radar imagery

1 – recognize the roughness of bodies : the reflected waves effect directly by roughness of bodies , when the body smooth can reflect strong waves and bright dots show at the image .

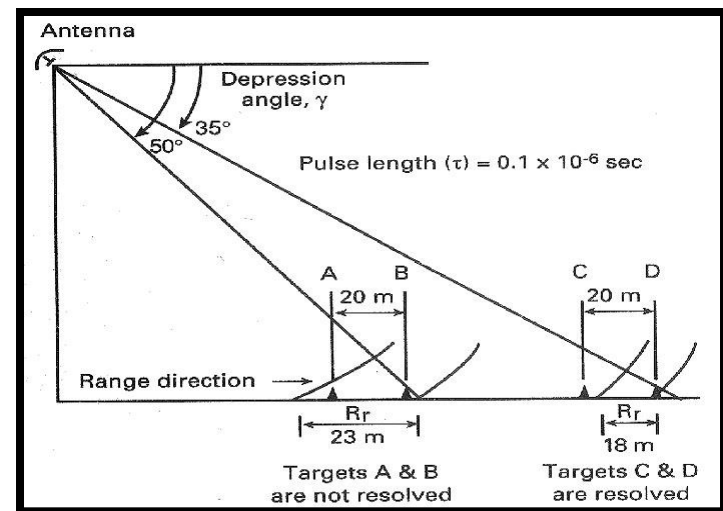


2 – Ability to detect the water content of lands :

The radar waves effect strongly by water were its absorbed and give dark areas , but the dry areas can give bright areas

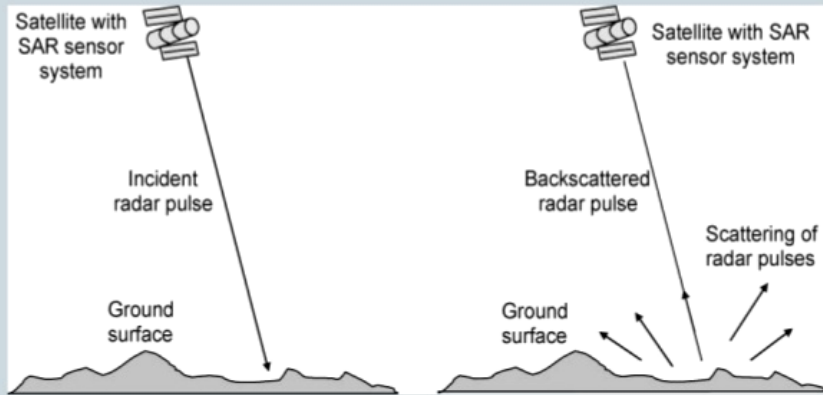


3 – ability to record side looking or vertical : we can transmit the wave vertically or side looking with different angles . Were at low angel we can recognize the bodies better that high angels .

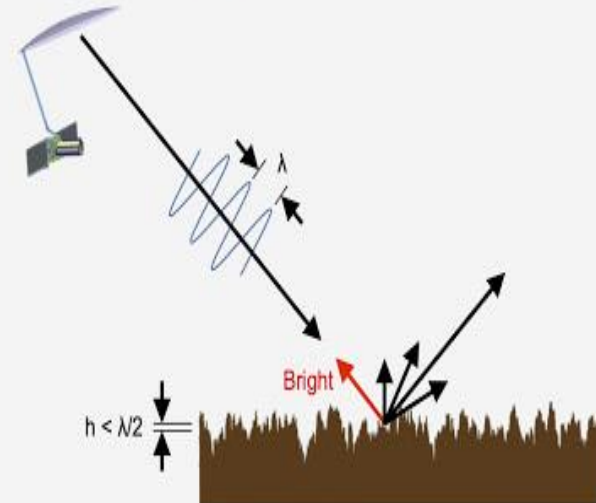


- 4 – The wide range of covering : hundreds of kilometers along the path and tenths wide that can show a very big features .
- 5 – ability to record at any conditions : because of radar make his field of energy ( Active ) so we can record at ant conditions – clouds – Fog – smoke – dust – and at ant time of day .
- 6 – ability to penetrate the earth surface of some meters

## Synthetic Aperture Radar (SAR)



## Microwave Scattering (Rough)



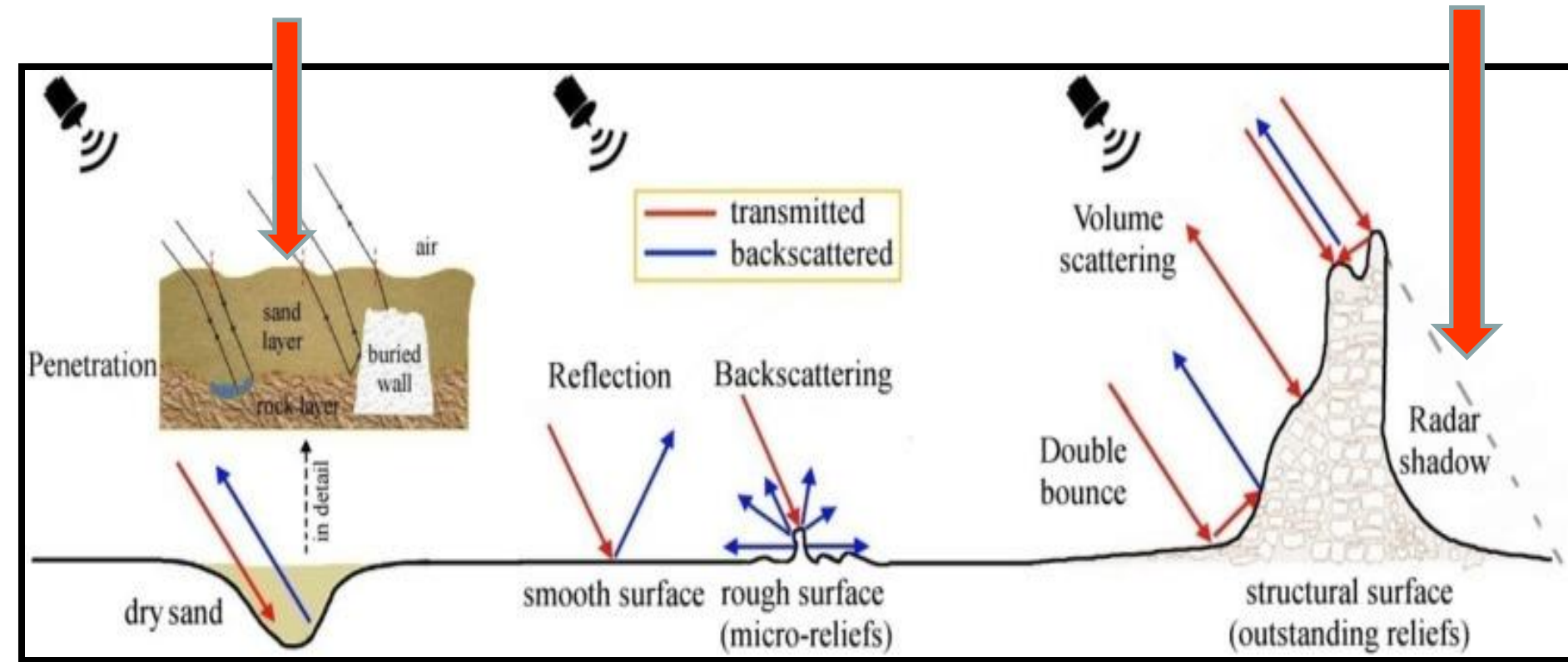


# Negatives of Radar Imagery

- 1- The moving of satellite or plane can make some mistakes
- 2 – The shadows borne by opposite side of features appear as black areas on image

Shadow

Penetration with earth surface



# References

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# Earth Science Satellite Remote Sensing Vol. 1: Science and Instruments , Qu J. J., Gao W. , Kafatos M. , Murphy R. E, Salomonson V. V., Tsinghua University Press, Beijing and Springer-Verlag GmbH Berlin Heidelberg . 2006

# Internet Remote Sensing Lectures sites