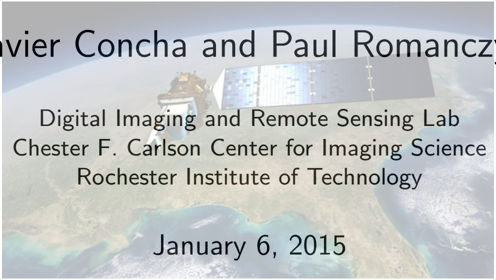
Intro to Instrumentation and Field Measurements in Remote Sensing



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Outline

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Course Goals

- Learn the importance of field measurements
- Learn how to take field measurements
- Learn about DIRS instruments

Course Description

- Friday: Introduction
- Monday: Introduction (con't) and DIRS instruments exhibition
- Tuesday: Lab: Reflectance measurements
- Wednesday: Lab: LIDAR measurements

Definitions

Field Measurements or Groundtruth:

"Observations or measurements made at or near the surface of the earth in support of remote sensing."

Remote Sensing:

"Remote sensing is the science of obtaining information about objects or areas from a distance, typically from aircraft or satellites."

Motivation

Why is it important?

- Validation
- Calibration
- Correction

Motivation
Examples

Include:
Javier's example (over water mea.)
Paul's example (LIDAR and trees?)

Kind of Measurements

- reflectance
- concentration
- location

Radiometric Quantities

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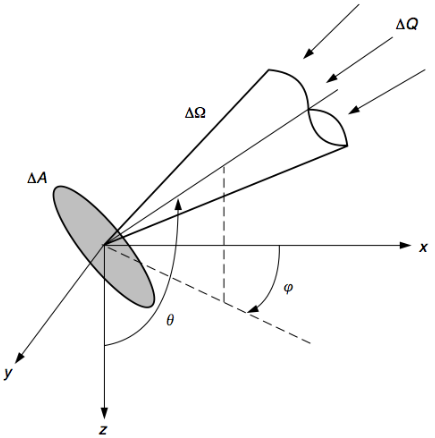
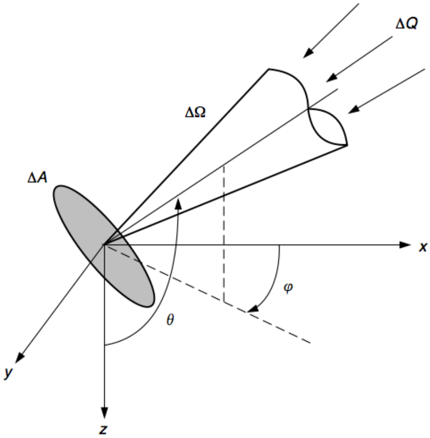


ΔQ: radian energy incident
Δt: time interval
ΔA: surface area at location (x,y,z)
$\Delta \Omega$: solid angle in direction (θ,φ)
$\Delta \lambda$: photons wavelength interval

$$L(x,y,z,t,\theta,\varphi,\lambda) \equiv \frac{\Delta Q}{\Delta t \Delta A \Delta \Omega \Delta \lambda} \quad \left[Js^{-1}m^{-2}sr^{-1}nm^{-1}\right] \qquad (1)$$

Radiometric Quantities



ΔQ: radian energy incident
Δt: time interval
ΔA: surface area at location (x,y,z)
$\Delta\Omega$: solid angle in direction (θ,φ)
$\Delta\lambda$: photons wavelength interval

$$L(x, y, z, t, \theta, \varphi, \lambda) \equiv \frac{\partial^4 Q}{\partial t \partial A \partial \Omega \partial \lambda} \quad \left[Js^{-1}m^{-2}sr^{-1}nm^{-1}\right] \qquad (1)$$

Radiometric Quantities

Spectral downwelling scalar irradiance at depth z:

$$E_{od}(z,\lambda) = \int_{2\pi_d} L(z,\theta,\varphi,\lambda)d\Omega \quad \left[Wm^{-2}nm^{-1}\right] \tag{2}$$

Spectral upwelling scalar irradiance at depth z:

$$E_{ou}(z,\lambda) = \int_{2\pi_u} L(z,\theta,\varphi,\lambda)d\Omega \quad \left[Wm^{-2}nm^{-1}\right] \tag{3}$$

Spectral scalar irradiance at depth z:

$$E_o(z,\lambda) \equiv E_{od}(z,\lambda) + E_{ou}(z,\lambda) \tag{4}$$

$$= \int_{4\pi} L(z,\theta,\varphi,\lambda)d\Omega \tag{5}$$

Radiometric Quantities

Spectral downwelling plane irradiance at depth z:

$$E_d(z,\lambda) = \int_{2\pi_d} L(z,\theta,\varphi,\lambda)|cos\theta|d\Omega \quad \left[Wm^{-2}nm^{-1}\right] \tag{6}$$

Photosynthetic available radiation, **PAR**:

$$PAR(z) \equiv \int_{350nm}^{700nm} \frac{\lambda}{hc} E_o(z,\lambda)d\lambda \quad \left[photons\ s^{-1}m^{-2}\right] \tag{7}$$

Objectives

- Develop over-water atmospheric correction
- Design water constituent retrieval algorithm
- Apply glint correction
- Validate results
- Demo process to a different study site

Outline

Conclusions

- Current retrieval algorithm depends on IOPs from the field. Not always available!
- LUT from Hydrolight: Highly dependent in phase function
- Obtain field data for Landsat-8 is difficult, mainly for weather conditions

Thanks for your attention!

QUESTIONS?

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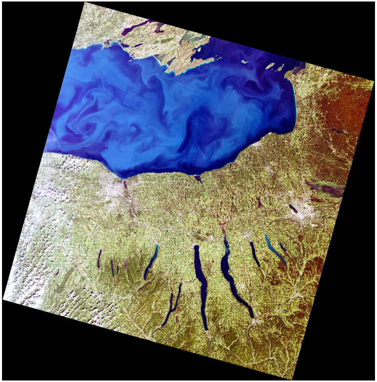

(09/19/2013)

Thanks for your attention!
QUESTIONS?

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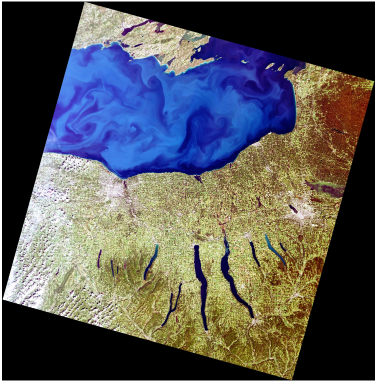

(09/19/2013)

References

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[[Muller-Karger et al., 2013]]Muller-Karger, F., Roffer, M., Walker, N., Oliver, M., Schofield, O., Abbott, M., Graber, H., Leben, R., and Goni, G. (2013).
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