

Practical Problems in Remote Sensing

George M. Brillis
QA Scientist
EPA/ORD/NERL/ESD

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The Questions

- “What are some of the everyday issues encountered when collecting Remotely Sensed images
- “What are some of the causes?”
- “Can anything be done about them?”

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Orthoimagery

- What's that?
 - An **orthophoto** or **orthophotograph** is an aerial photograph that has been geometrically corrected ("orthorectified") such that the scale of the photograph is uniform, meaning that the photo can be considered equivalent to a map. Unlike an uncorrected aerial photograph, an orthophotograph can be used to measure true distances, because it is an accurate representation of the earth's surface, having been adjusted for topographic relief, lens distortion, and camera tilt. - Wikipedia

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Manifestations

- How do we know when a problem has occurred?
- What does it look like?

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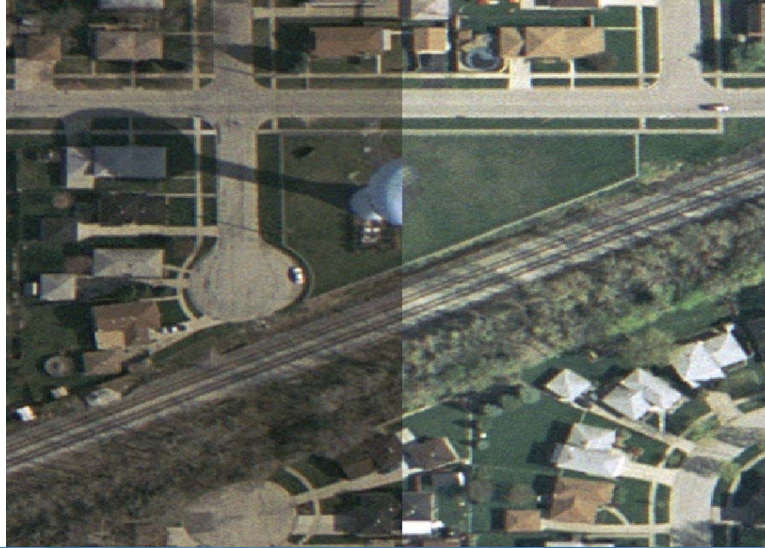
Cloud



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Clipped Feature



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Void



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Elevation Error



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Edge Mismatch



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Smear



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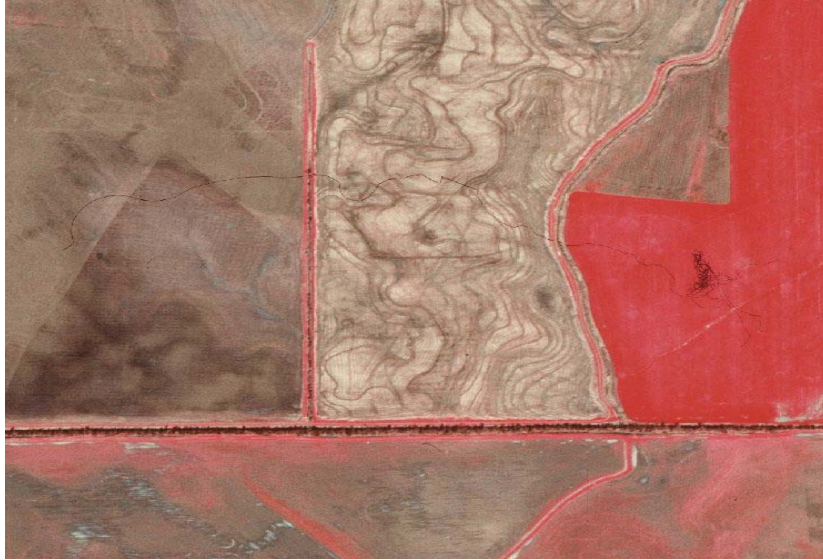
Data Corruption



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Scanned Artifact - Hair



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Tonal Balance



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Shadow Distortion



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Scanning Artifact - Insect



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Shadow



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Causes of Poor Quality Images

- “Contamination” such as bugs, thread, and moisture.
- Causes and Corrections may be different for:
 - Aerial Photos:
 - Camera tilt
 - Satellite Images:
 - Orbital issues
 - Nadir concerns

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Causes of Poor Quality Images Include

- Bugs, thread, hair, etc
- Atmospheric
- Geometric - not covered in this presentation due to time constraints
- Topographic – not covered in this presentation due to time constraints

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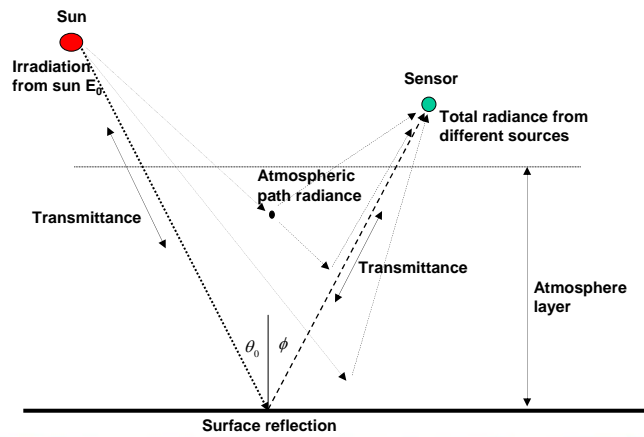
Atmospheric Causes & Correction

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Atmospheric causes

- A diagram showing the effect of the atmosphere on RS data

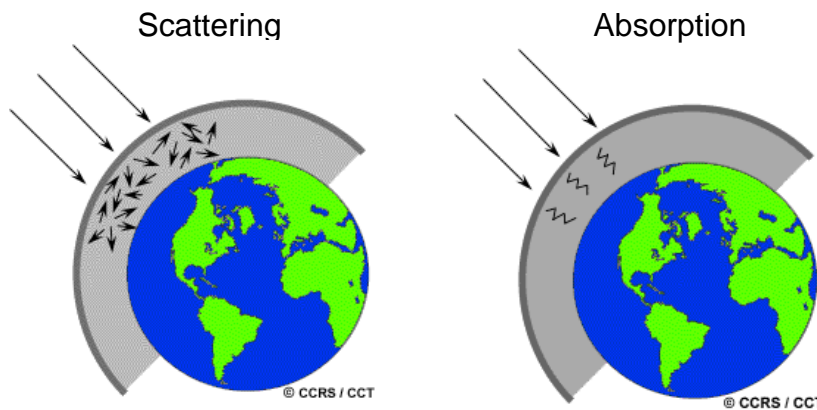


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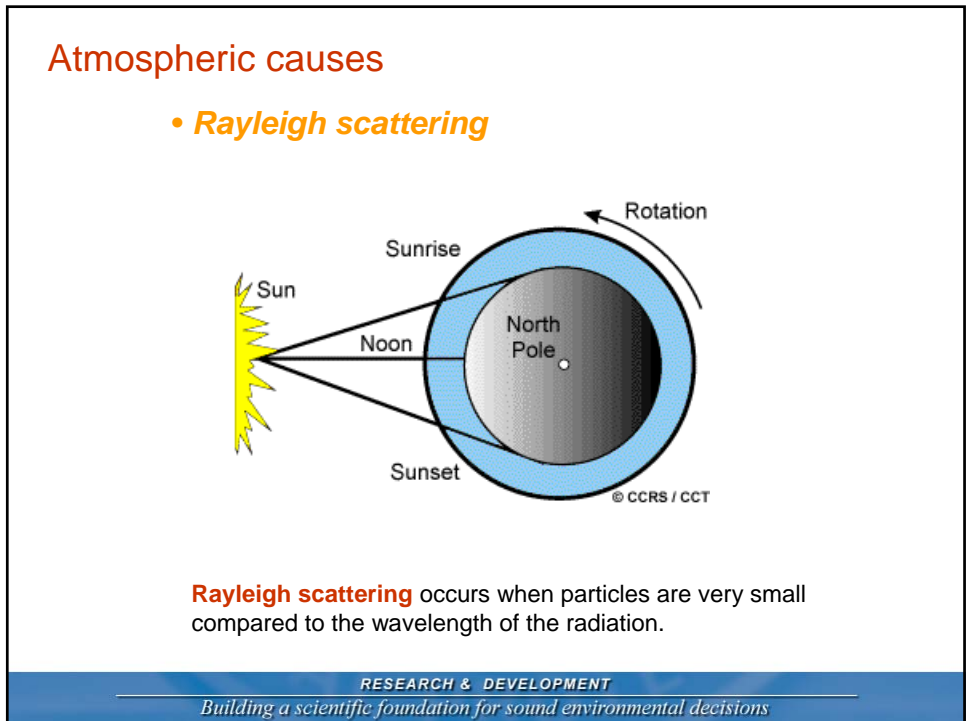
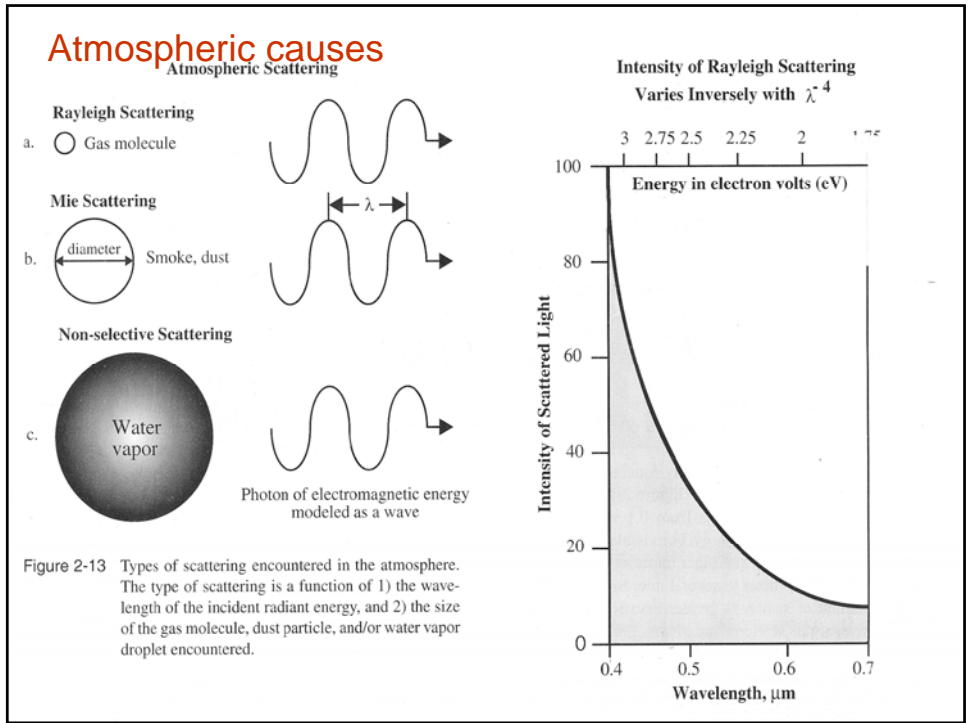
Atmospheric causes

- **Interaction with the Atmosphere**



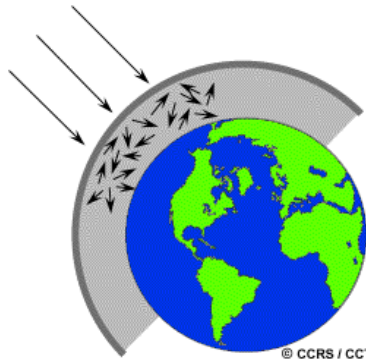
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Atmospheric causes

- **Mie scattering**



Mie scattering occurs when the particles are just about the same size as the wavelength of the radiation

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Atmospheric causes

- **Nonselective scattering**



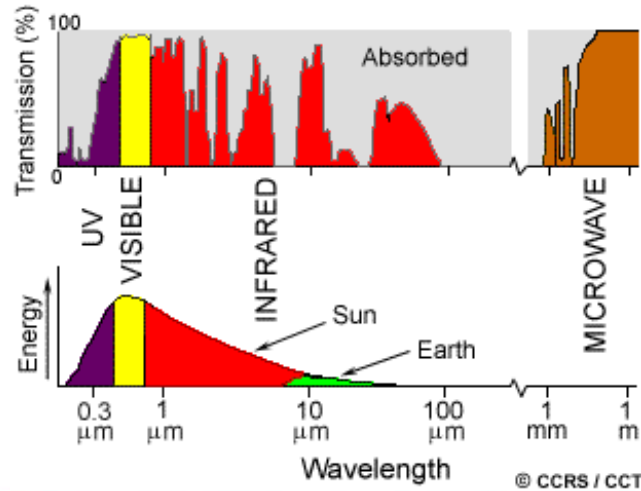
Nonselective scattering. This occurs when the particles are much larger than the wavelength of the radiation

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Atmospheric correction

- **Atmospheric window:** It refers to the relatively transparent wavelength regions of the atmosphere - areas of the spectrum which are not severely influenced by atmospheric absorption and thus, are useful to remote sensors.

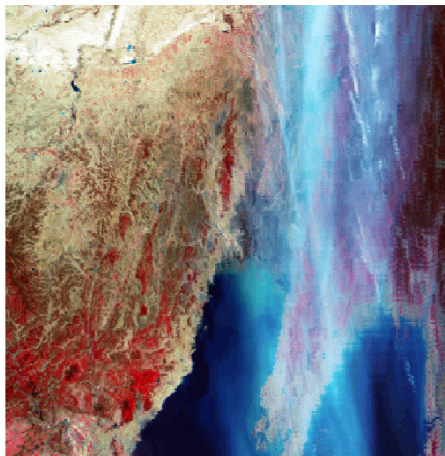


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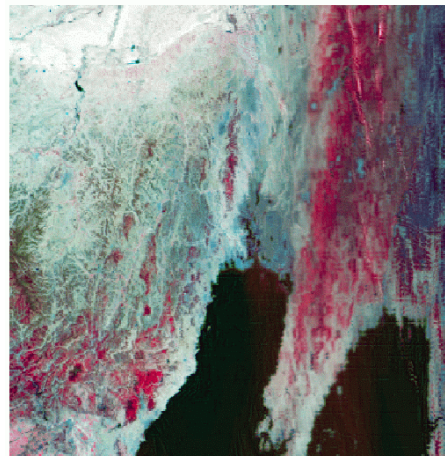
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Atmospheric correction

- MODIS imagery of Chinese northeastern coast, (False color composite, May 7, 2000)



(Before AC)



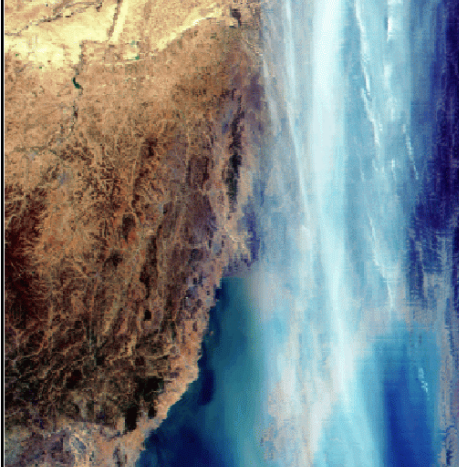
(After AC)

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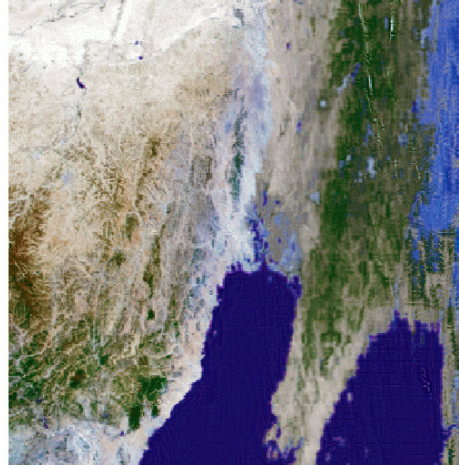
Building a scientific foundation for sound environmental decisions SL Liang, University of Maryland, College Park

Atmospheric correction

- MODIS imagery of Chinese northeastern coast, (Natural color composite, May 7, 2000)



(Before AC)



(After AC)

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How did they do that?

- Image processing using software such as
“ENVI” <http://www.itvis.com/envi/>
and/or
“ERDAS” <http://www.erdas.com>

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Image Enhancement

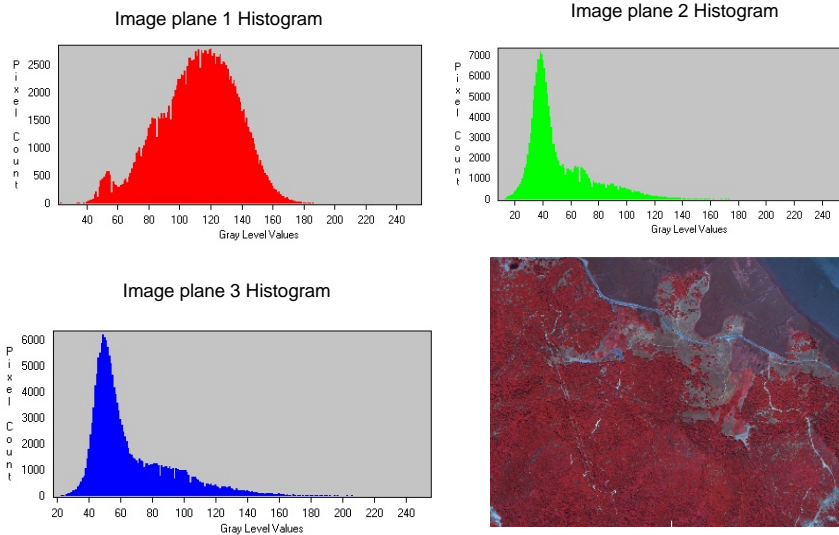
- Some common techniques are
 - stretching,
 - compression to single band image,
 - spatial frequency,
 - filtering
- Each pixel has a “Brightness Value” a.k.a. “Digital Number” (DN)
- [no time to cover all]

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Image enhancement

Histogram

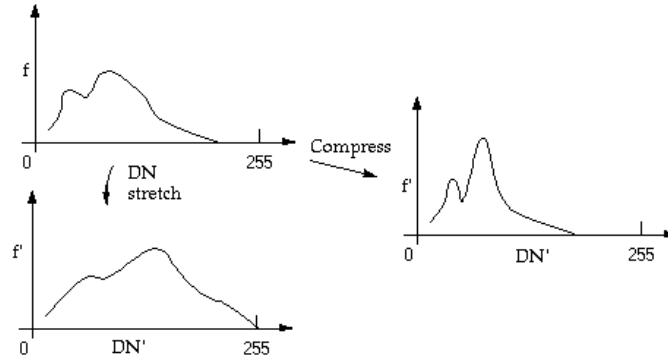


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Image enhancement

- *Image stretch and compression*



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Image enhancement



Original composite (NIR,R,G)



Linear stretch



Histogram equalization

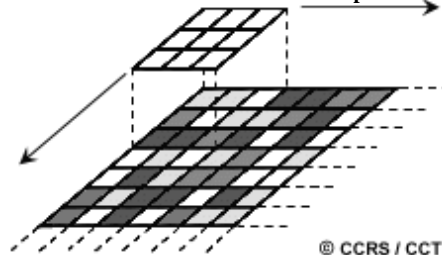
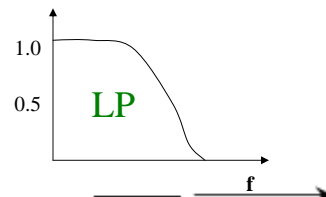
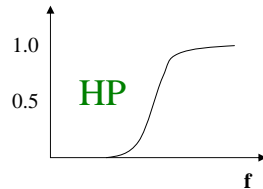
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Image enhancement

- **Spatial filtering**

- Spatial frequency
- Filtering procedure
- Low-pass filter
- High-pass filter



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Spatial filtering encompasses another set of digital processing functions which are used to enhance the appearance of an image.

Spatial frequency refers to the frequency of the variations in tone that appear in an image. **filtering procedure** involves moving a 'window' of a few pixels in dimension over each pixel in the image, applying a mathematical calculation using the pixel values under that window, and replacing the central pixel with the new value

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Summary

- Atmospheric correction, scattering, absorption, atmospheric windows
- Geometric correction, geometric distortion sources, Geometric transform
- Terrain correction, slope-aspect induced radiance distortion, four correction methods
- Image enhancement, histogram, stretch, compression to single band image, spatial frequency, filtering

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For more information...

- EPA Geospatial Quality Council website

<http://www.epa.gov/nerlesd1/ggc/default.htm>

Call or e-mail:

George M Brilis

brilis.george@epa.gov

702-798-3128

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