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Radiometry

Symbol	Quantity	Equation	Units
Q	energy		joules
Φ	flux	$\Phi = dQ/dt$	watt (j / s)
E	irradiance	$E = d\Phi/dA$	watt / m^2
M	emittance (exitance)	$M = d\Phi/dA$	watt / m^2
I	intensity	$I = d\Phi/d\Omega$	watt / sr
L	radiance	$L = dI/dA \cos\Theta$	watt / m^2 sr

Black-body at any temperature radiates over a range of wavelengths. Radiance varies with wavelength. Define *spectral radiance*, L_λ, such that,

$$\Delta L = L_\lambda \Delta L \quad \text{or} \quad L_\lambda = \left| dL/d\lambda \right|$$

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From Planck we have, expression for spectral radiance

$$L_\lambda = \frac{2hc^2}{\lambda^5\left(e^{hc/\lambda kT} - 1\right)}$$

In which,

$h = 6.6261 \times 10^{-34}\ Js,$ planck

$k = 1.3807 \times 10^{-23}\ JK^{-1}$, boltzmann

$c = 2.9979 \times 10^{8}\ ms^{-1}$, speed of light

T = temperature in degrees kelvin

λ = wavelength in meters

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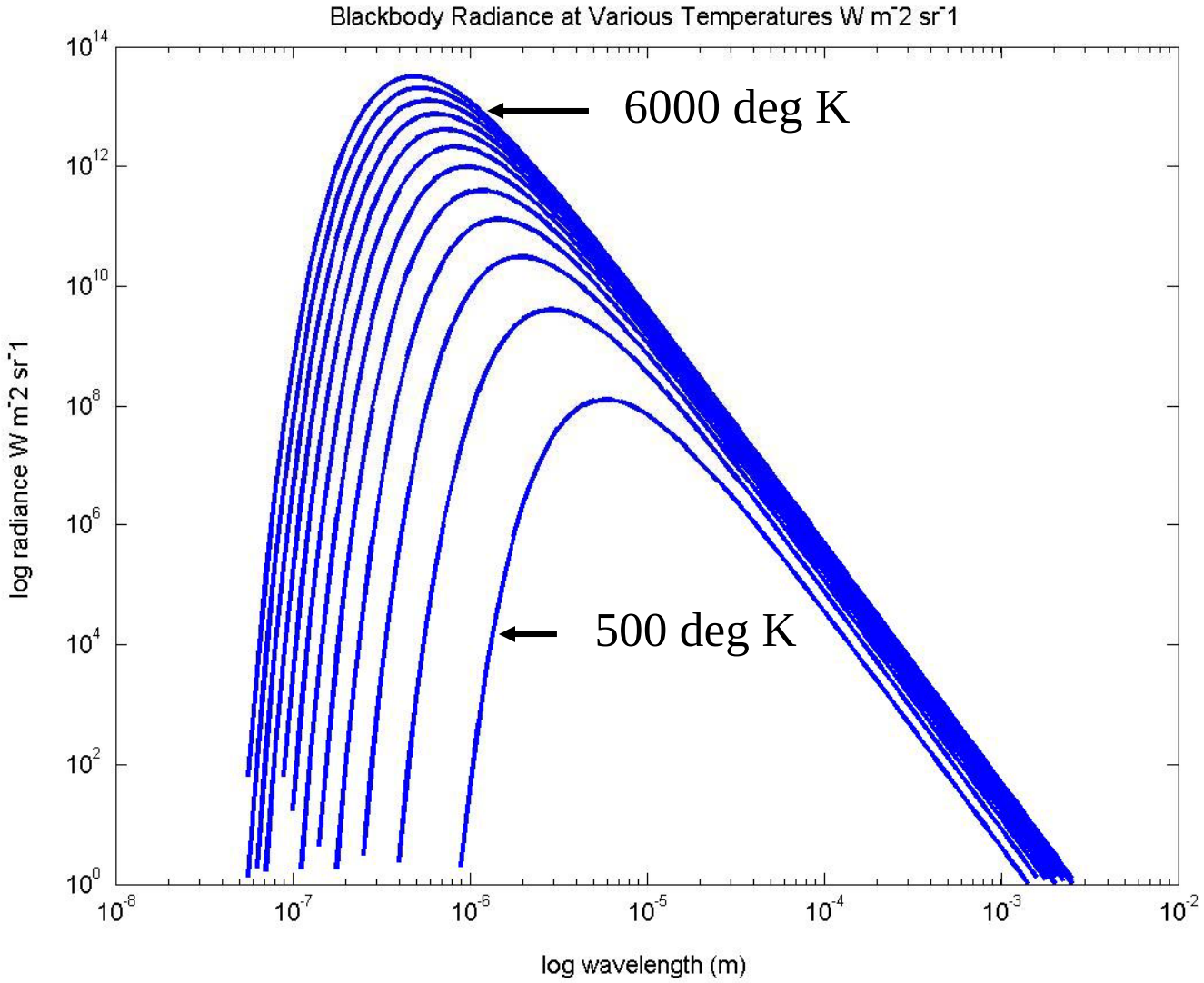
This is actually a log-log plot of L_λ vs. wavelength for black-bodies at various temps.



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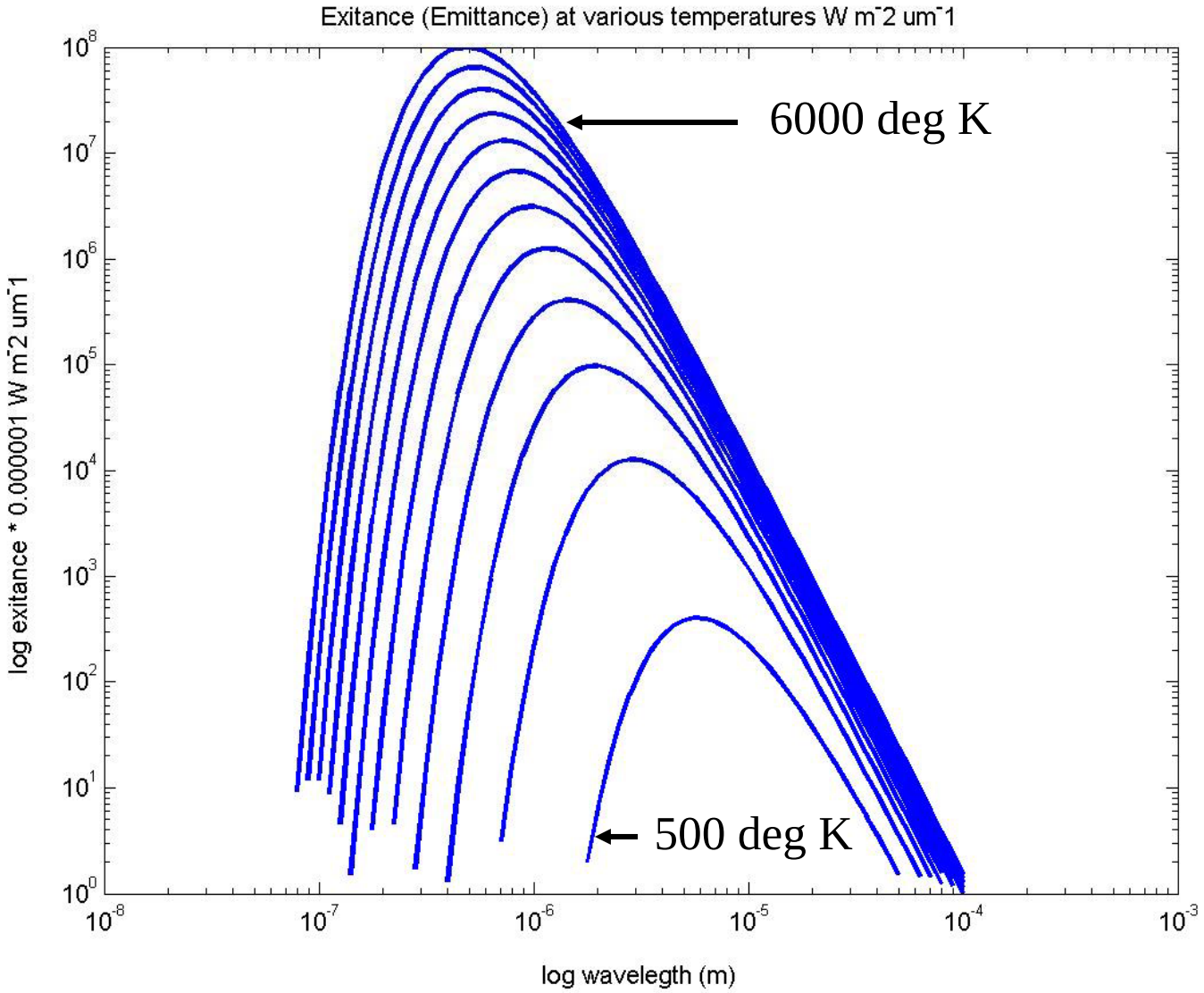
Convert units of L_λ by multiplying by 1E-06, convert to spectral exitance, M_λ by multiplying by pi.



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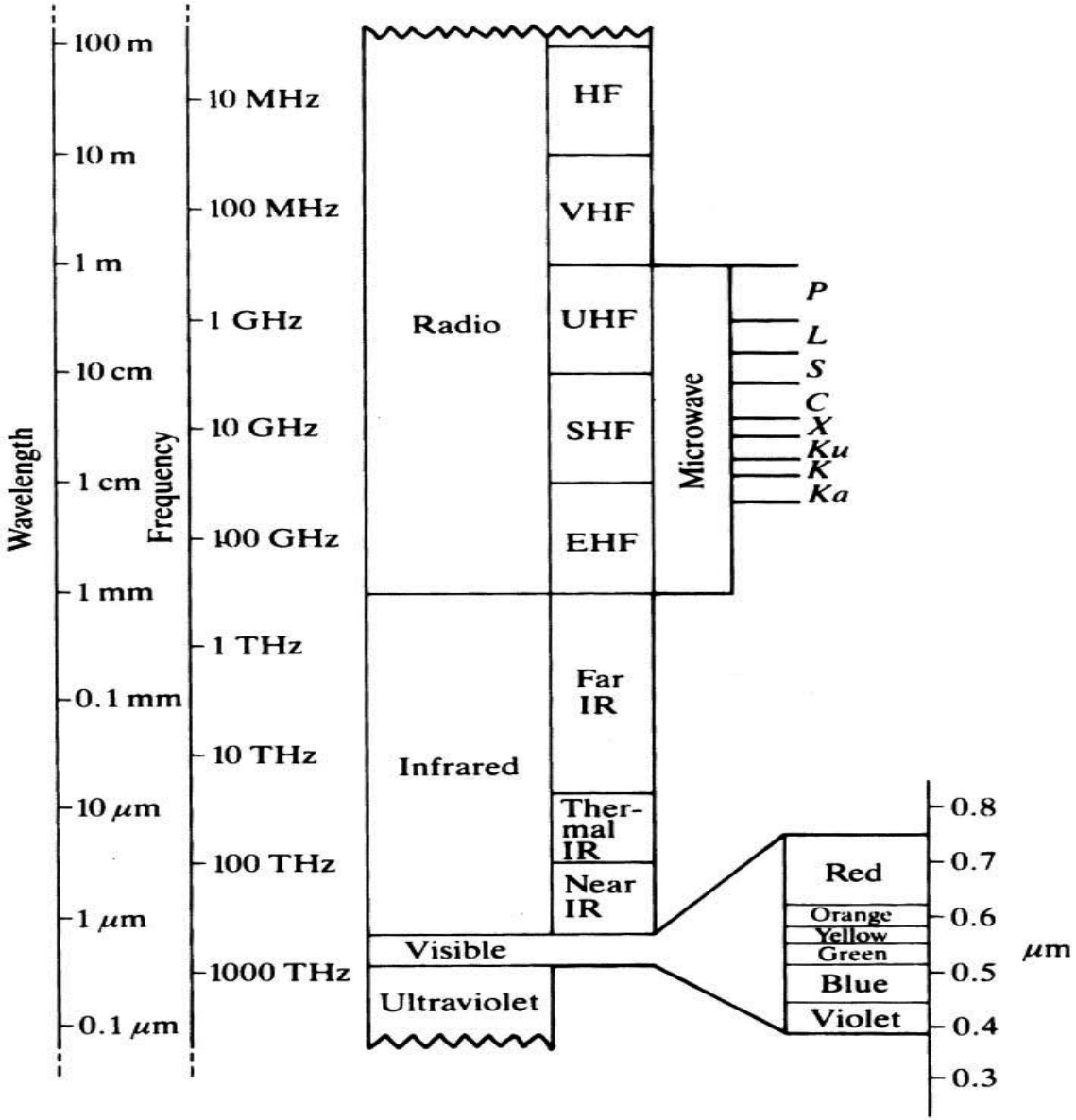

From Rees, 2001

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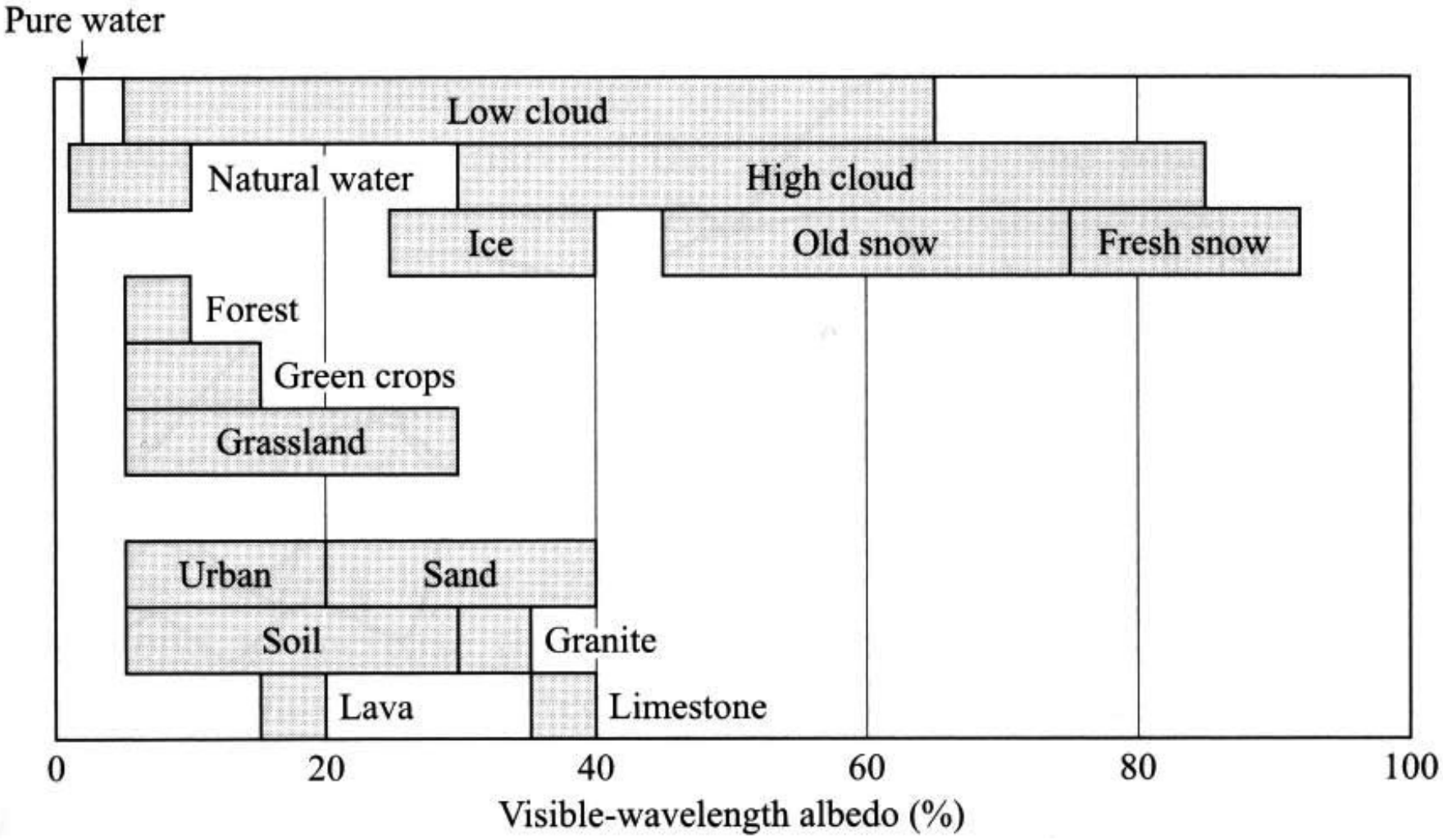

From Rees, 2001

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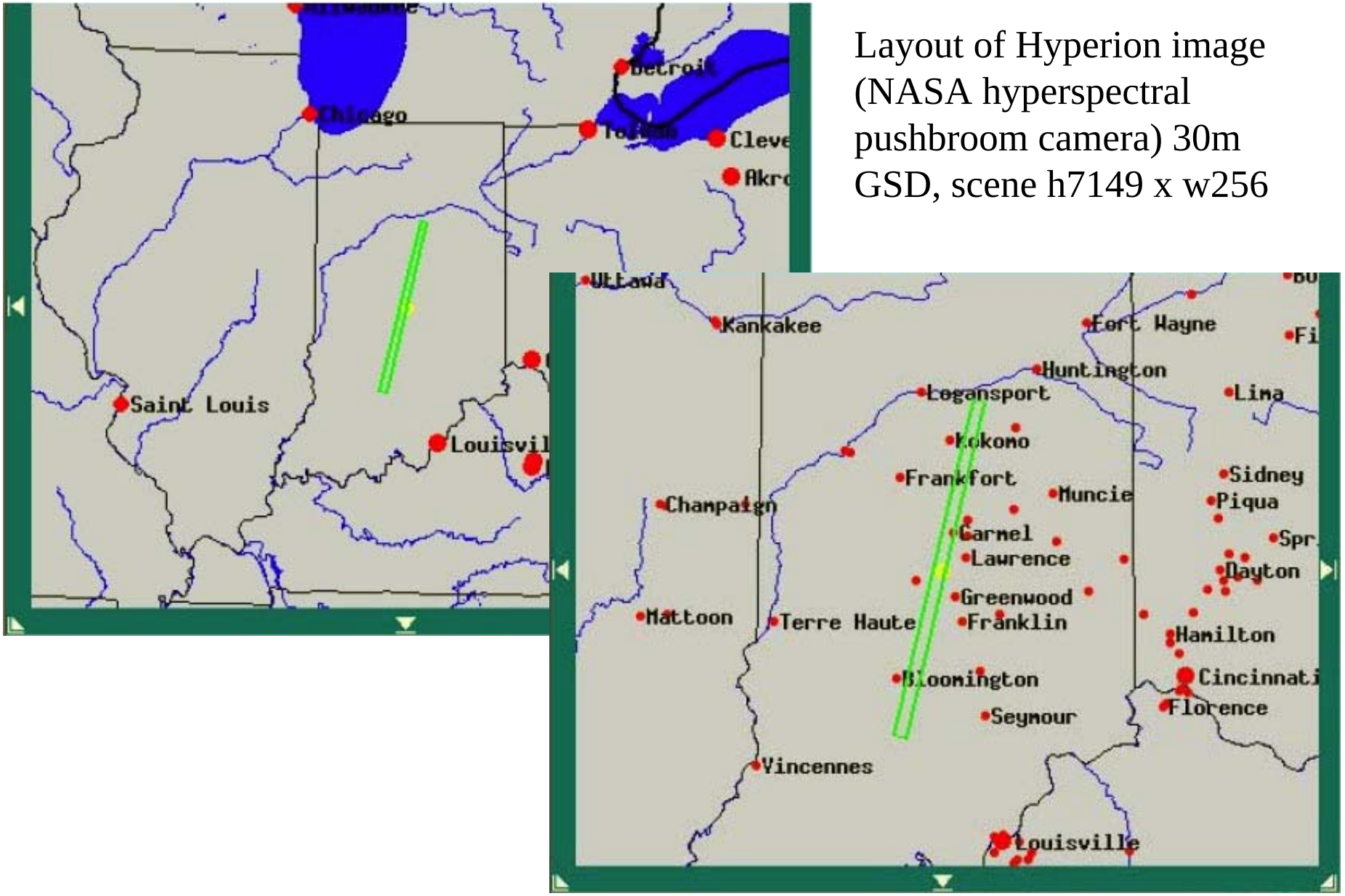

Layout of Hyperion image (NASA hyperspectral pushbroom camera) 30m GSD, scene h7149 x w256

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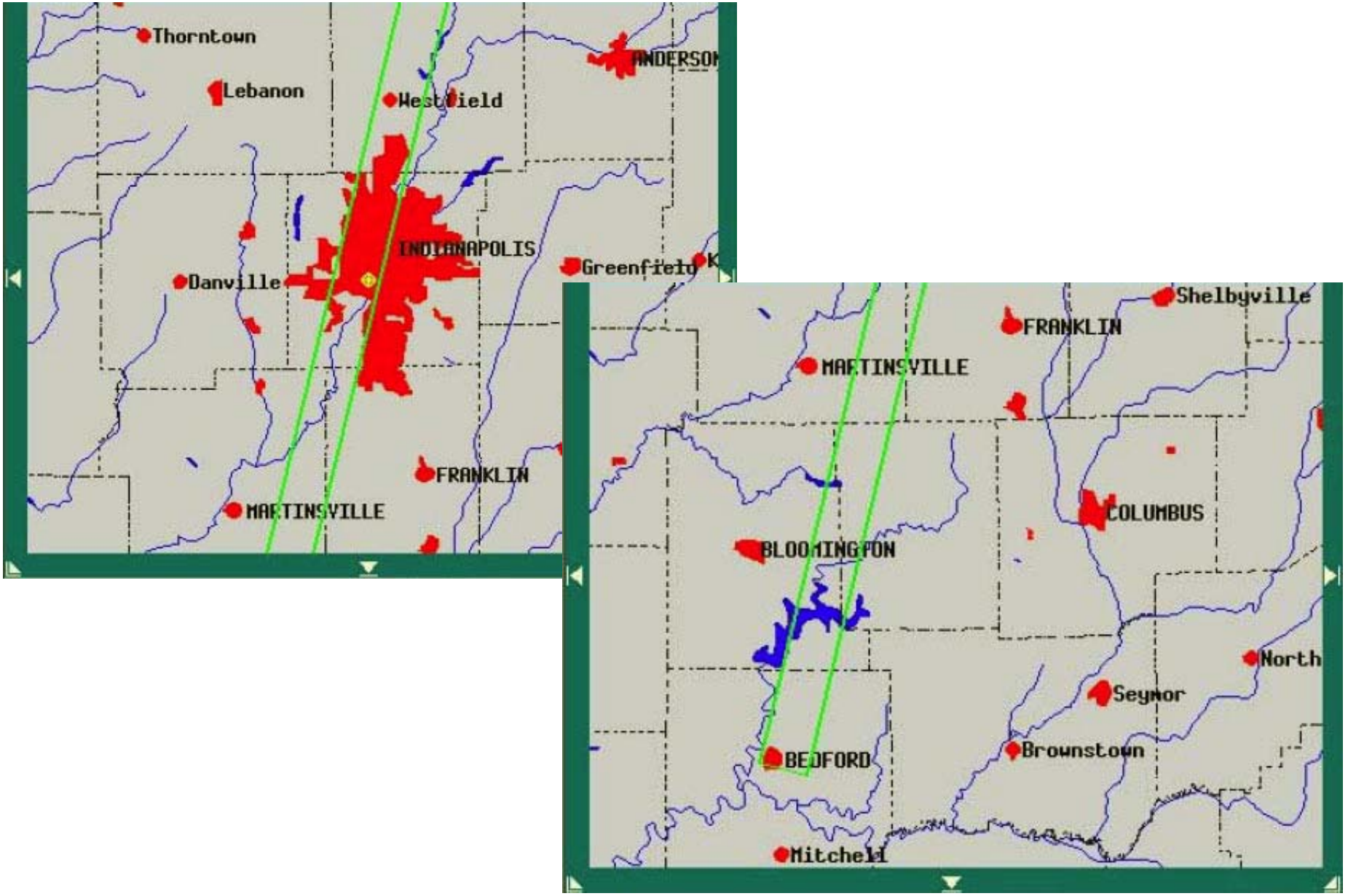

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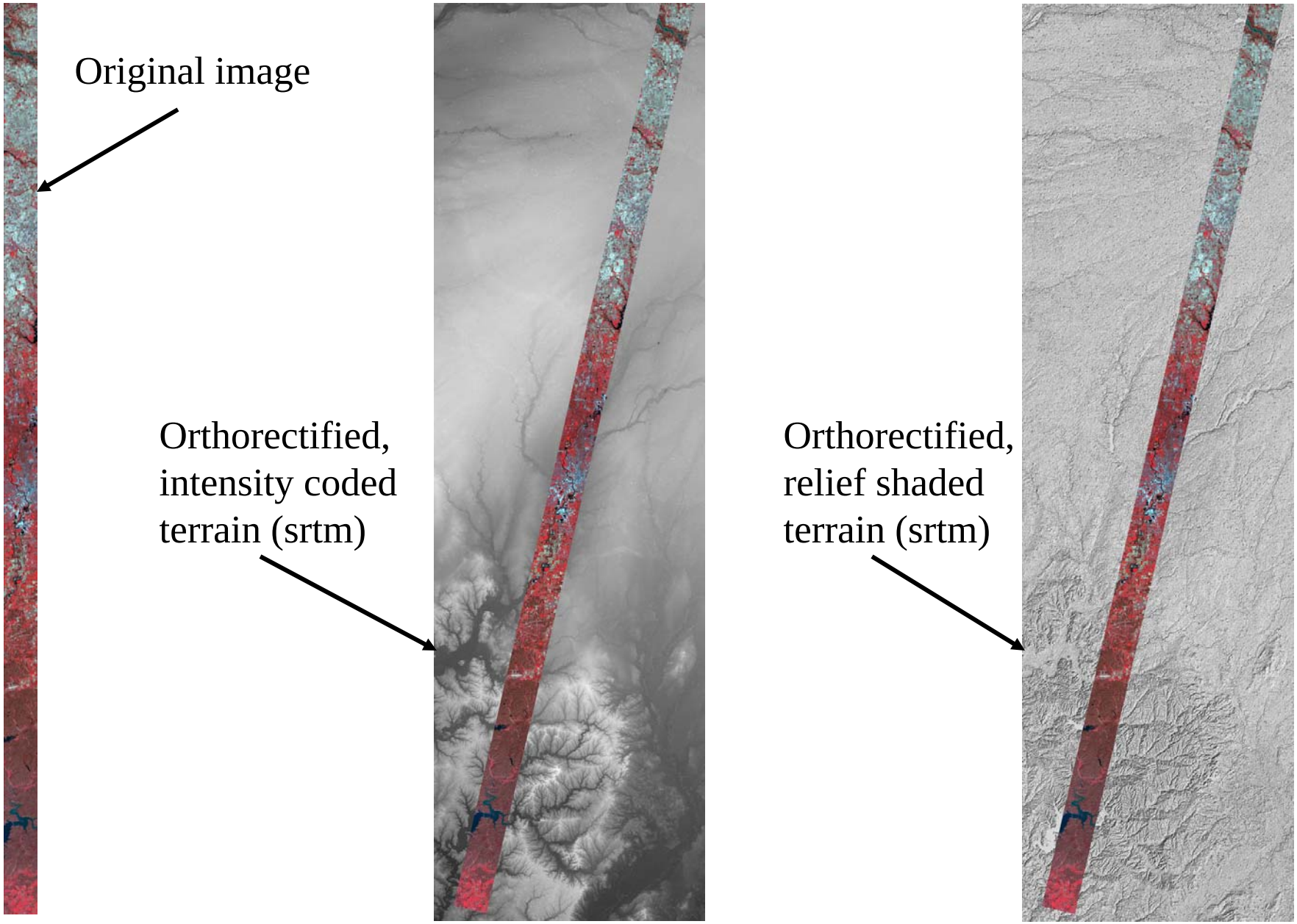

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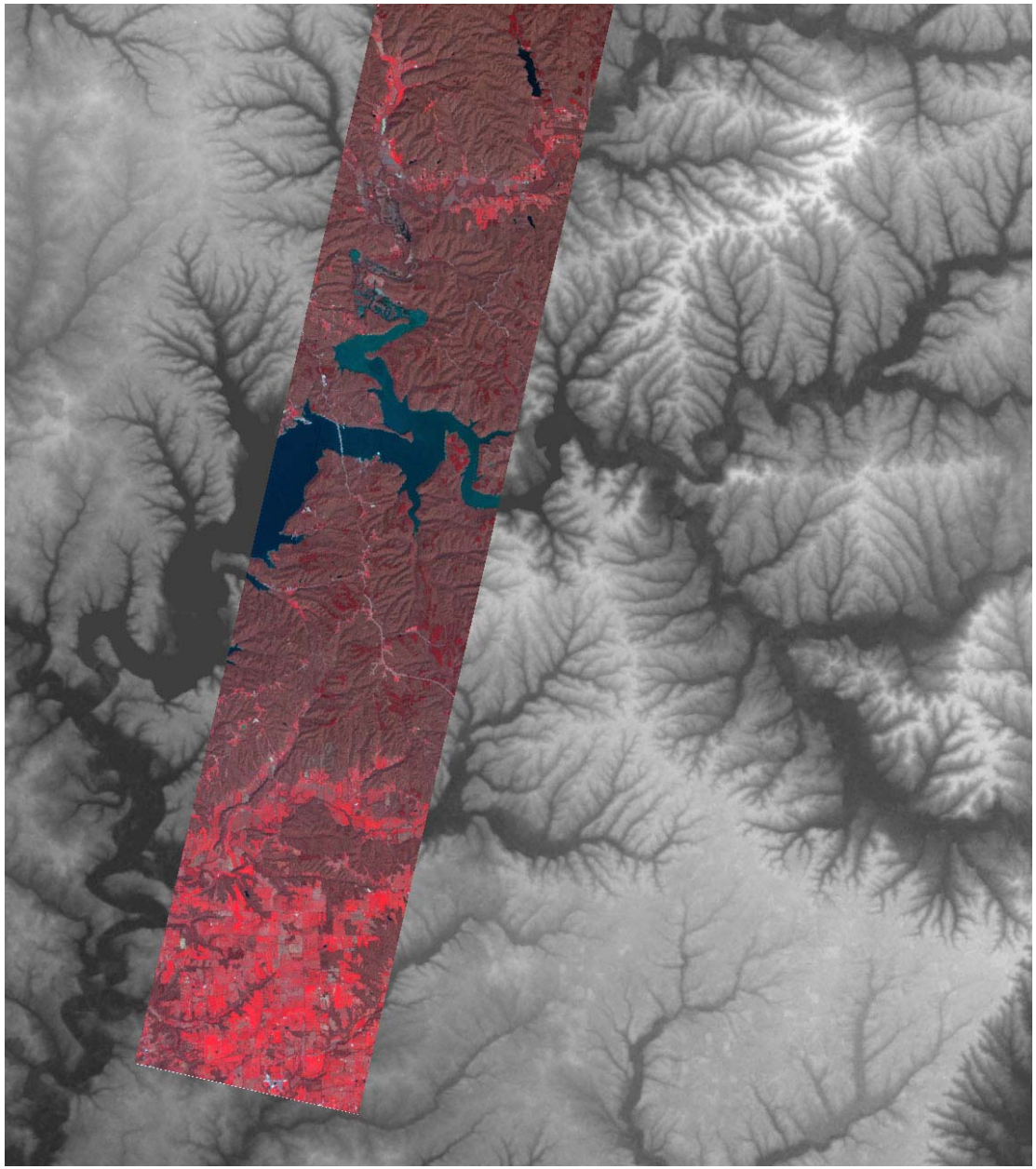

Zoom in at southern portion of scene

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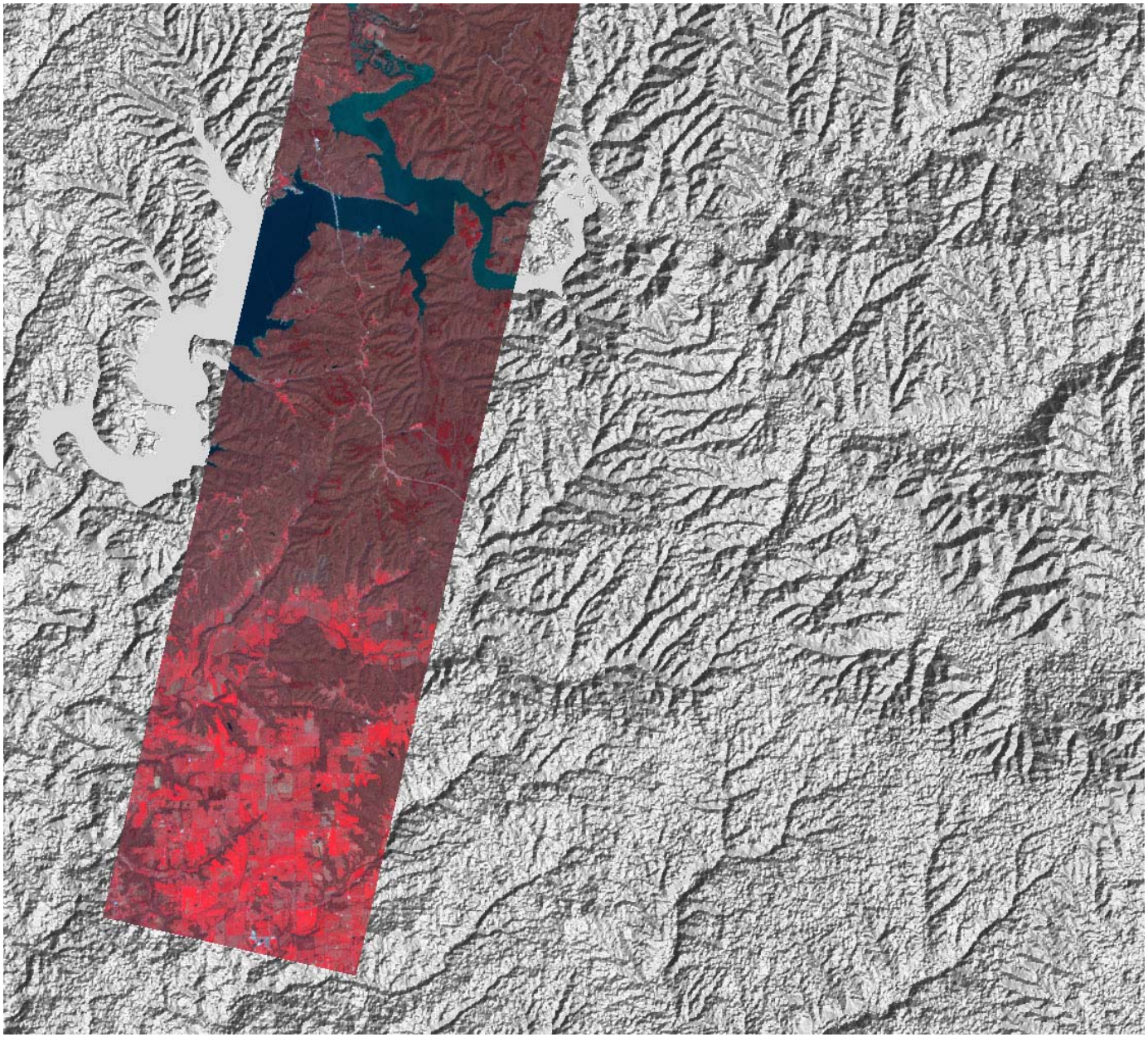

Zoom in at southern portion of scene

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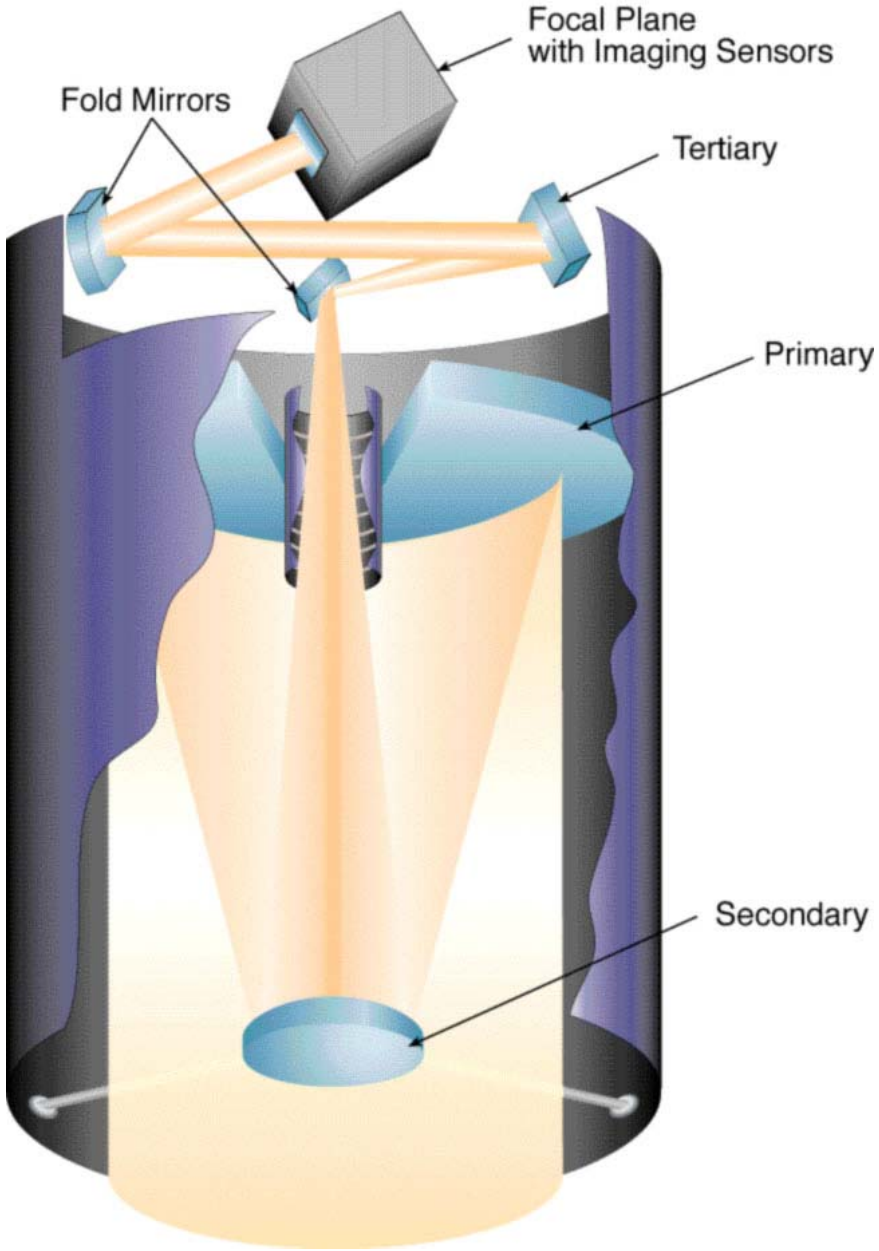

IKONOS optics and focal plane layout

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IKONOS focal plane