n1_91_86_jan_10_2001

STEP 1:
Converting DNs
(for each band)
to Radiance
values

Radiance = (LMAX − LMIN)/255 * DN + LMIN

Radiation leaving the Earth

Radiance = [((LMAX − LMIN)/255) * DN] + LMIN

Radiance = $[((LMAX-LMIN)/255)*DN]+LMIN$

- YOU FIND THESE VALUES IN TABLE 1 FROM THE LAB EXERCISE
- BUT YOU WILL NEED TO KNOW WHETHER TO USE HIGH OR LOW GAIN
- YOU CAN FIND THIS INFORMATION IN THE METADATA FILE FOR THE LANDSAT IMAGE
- CHECK EACH BAND FOR H OR L GAIN
- PAY ATTENTION TO THE SIGNS (+/-)

Radiance = $[((LMAX - LMIN)/255) * DN] + LMIN$

- THIS VALUE REPRESENTS THE DIGITAL NUMBERS FOR EACH BAND
- YOU WILL HAVE A DIFFERENT RADIANCE EQUATION FOR EACH BAND

STEP 1: DN TO RADIANCE

Temporary
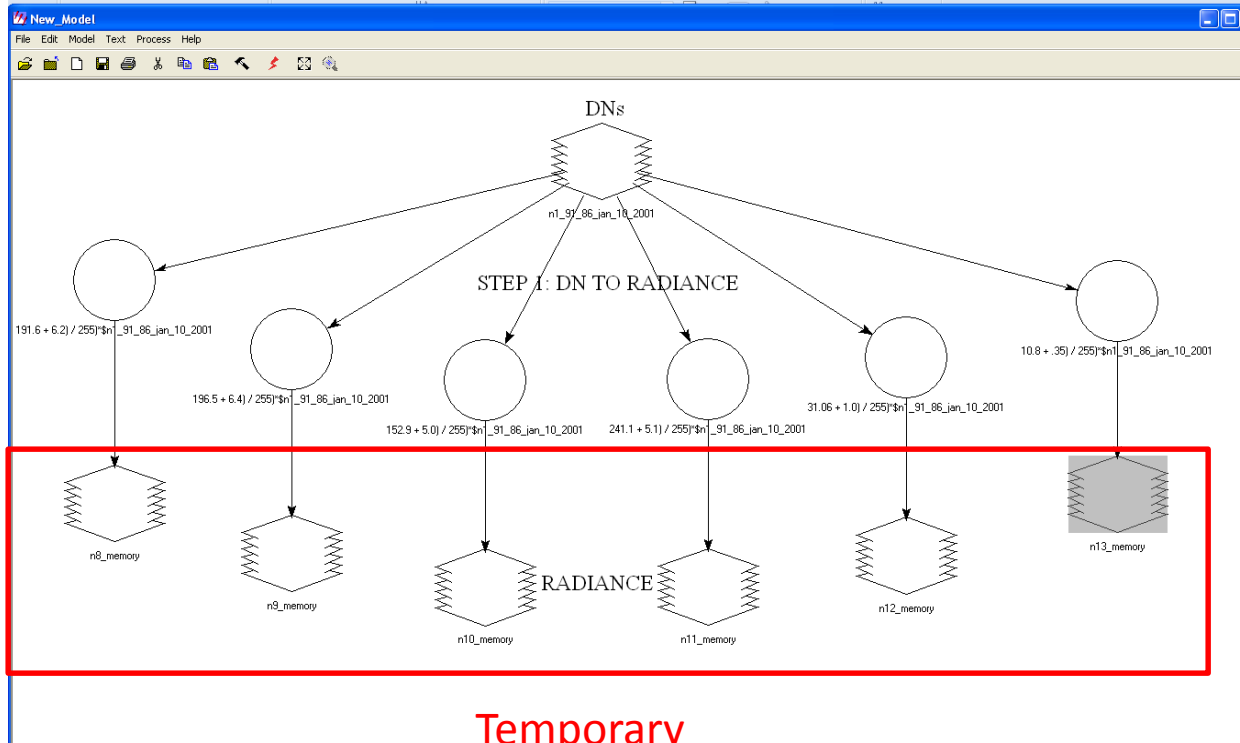
STEP 2: Converting RADIANCE to TOA REFLECTANCE

$$\rho_p = \frac{\pi \cdot L_\lambda \cdot d^2}{Esun_\lambda \cdot \cos\theta_s}$$

$$\frac{\text{Radiance}}{\text{Irradiance}}$$

Radiation leaving the Earth

Radiation reaching the Earth from the sun

STEP 2: Converting RADIANCE to TOA REFLECTANCE

$$\rho_p = \frac{\pi \cdot L_\lambda \cdot d^2}{Esun_\lambda \cdot \cos\theta_s}$$

Unitless planetary reflectance

REFLECTANCE VALUES: 0 – 1 (0% - 100%)

STEP 2: Converting RADIANCE to TOA REFLECTANCE

$$\rho_p = \frac{\pi \cdot L_\lambda \cdot d^2}{Esun_\lambda \cdot \cos\theta_s}$$

Spectral Radiance at sensor's aperture: ***what you calculated in STEP 1***

STEP 2: Converting RADIANCE to TOA REFLECTANCE

$$\rho_p = \frac{\pi \cdot L_\lambda \cdot d^2}{Esun_\lambda \cdot \cos\theta_s}$$

Earth-sun distance in astronomical units:
- can calculate using equation in lab exercise
- can estimate using table in lab exercise
- can use this website:

http://www.fourmilab.ch/cgi-bin/uncgi/Solar/action?sys=-Si

STEP 2: Converting RADIANCE to TOA REFLECTANCE

$$\rho_p = \frac{\pi \cdot L_\lambda \cdot d^2}{Esun_\lambda \cdot \cos\theta_s}$$

Mean solar exoatmospheric irradiances provided in *ETM+ Solar Spectral Irradiances* table in lab exercise

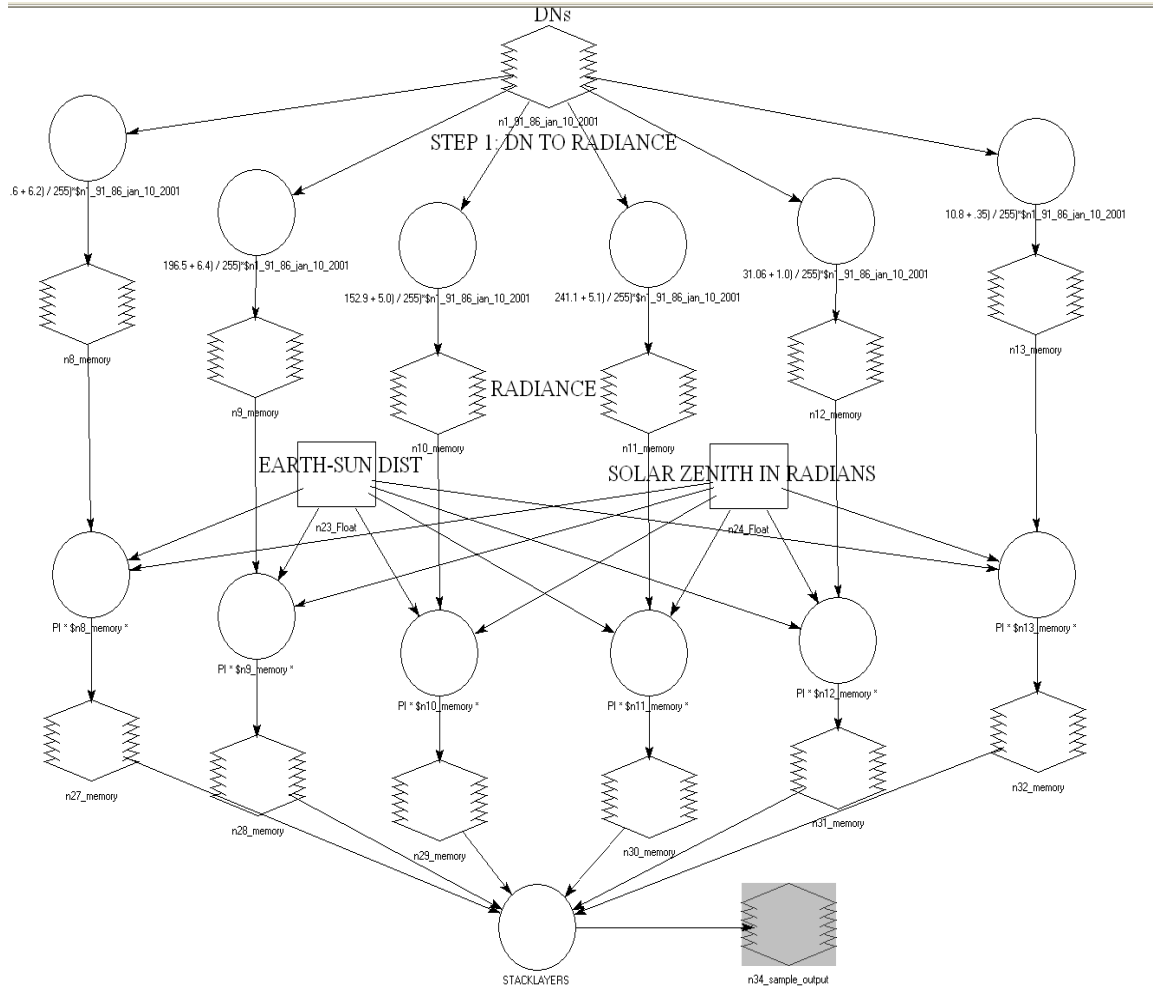# STEP 2: Converting RADIANCE to TOA REFLECTANCE

$$\rho_p = \frac{\pi \cdot L_\lambda \cdot d^2}{Esun_\lambda \cdot \cos\theta_s}$$

Solar zenith angle which is calculated using the equation:
Solar zenith=90-sun elevation

IN ERDAS MODELER ANGLES MUST BE IN RADIANS SO YOU NEED TO MULTIPLY YOUR SOLAR ZENITH ANGLE BY (PI/180)!!!

DNs

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STEP 1: DN TO RADIANCE

.6 + 6.2) / 255)*$n1_91_86_jan_10_2001

10.8 + .35) / 255)*$n1_91_86_jan_10_2001

196.5 + 6.4) / 255)*$n1_91_86_jan_10_2001

152.9 + 5.0) / 255)*$n1_91_86_jan_10_2001

241.1 + 5.1) / 255)*$n1_91_86_jan_10_2001

31.06 + 1.0) / 255)*$n1_91_86_jan_10_2001

n8_memory

n13_memory

n9_memory

RADIANCE

n10_memory

n11_memory

n12_memory

EARTH-SUN DIST

SOLAR ZENITH IN RADIANS

n23_Float

n24_Float

PI * $n8_memory *

PI * $n13_memory *

PI * $n9_memory *

PI * $n10_memory *

PI * $n11_memory *

PI * $n12_memory *

n27_memory

n32_memory

n28_memory

n29_memory

n30_memory

n31_memory

STACKLAYERS

n34_sample_output

NOTES:
- "PI" variable can be found in DATA GENERATION
- X**2 is the same as X^2
- Be very careful of parentheses
- Save your model often
- The red lightning bolt will run the model
- When you stack your layers, make sure you stack them in order (i.e., band 1, band 2, band 3…)
- Watch your output file types!

It is very likely that you will run into errors when trying to run your model for the first time….

BUT try not to get too frustrated! Just double check your equations carefully…we will get them to run!