LST (Land Surface Temperature) Calculation

Required:

- Thermal Infrared Band (Band 10 or Band 11)
- NDVI (Normalized Differentiation Vegetation Index)

$$NDVI = \frac{Near\ Infrared\ Band\ (Band\ 5) - Red\ Band\ (Band\ 4)}{Near\ Infrared\ Band\ (Band\ 5) + Red\ Band\ (Band\ 4)}$$

- MLT.txt file

Parameters:

Label	Name	Data Type	Type	Direction
Input Raster	Input_Raster	Mosaic Dataset,Mosaic Layer,Raster Dataset,Raster Layer	Required	Input
RADIANCE_MULT_BAND	RADIANCE_MULT_BAND	Double	Required	Input
RADIANCE_ADD_BAND	RADIANCE_ADD_BAND	Double	Required	Input
K1_CONSTANT_BAND	K1_CONSTANT_BAND	Double	Required	Input
K2_CONSTANT_BAND	K2_CONSTANT_BAND	Double	Required	Input
NDVI	NDVI	Raster Dataset,Raster Layer,Mosaic Dataset,Mosaic Layer	Required	Input
NDVI- Minimum Value	NDVI_Minimum_Value	Double	Required	Input
NDVI - Maximum Value	NDVI_Maximum_Value	Double	Required	Input
Wavelength of emitted radiation	Wavelength_of_emitted_radiation	Double	Required	Input
Output Raster	Output_Raster	Raster Layer,Raster Dataset,Mosaic Dataset,Mosaic Layer	Required	Output

Processing:

Step 1: Conversion to Top of the Atmosphere (TOA) Radiance:

$$TAO = RADIANCE\_MULT\_BAND \times Thermal\ Infrared\ Band\ (Band\ 10/Band\ 11) + \text{RADIANCE\_ADD\_BAND} - 0.29$$

Step 2: Conversion to Brightness Temperature (BT) from TAO:

$$BT = \frac{\text{K2\_CONSTANT\_BAND}}{\ln(\frac{\text{K1\_CONSTANT\_BAND}}{TAO} + 1)} - 273.15$$

Step 3: Convert to Proportion of Vegetation from NDVI:

$$PV = \frac{NDVI - \text{ NDVI\_Minimum Value}}{\text{NDVI\_Maximum Value } - \text{ NDVI\_Minimum Value}}$$

Step 3: Convert to Land Surface Emissivity (E):

$$E = 0.004 \times PV + 0.986$$

Step 4: LST Calculation:

$$LST = \frac{BT}{1 + (\text{Wavelength\_of\_emitted\_radiation} \times \frac{BT}{14388}) \times \ln(E)}$$

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