AUTOMATION OF DISAGGREGATION OF LAND SURFACE TEMPERATURE BY DEVELOPMENT OF AN IDL WIDGET APPLICATION

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Satellite-derived fine resolution Land Surface Temperature (LST) is an important input variable for many hydrological applications.

Non-linear Radiant Temperature Disaggregation (NL-DisTrad) algorithm is used to disaggregate coarse resolution LST to finer resolution.

It is automated by developing an IDL widget.

It allows an end-user to input the mandatory GeoTIFF bands, processes them automatically, and downscales MODIS LST (spatial resolution 960m) to that of Landsat ETM+ at 60m.
Objective

To automate the disaggregation of LST using NL-DisTrad algorithm, in IDL programming language by synergistic use of Landsat-7 and MODIS thermal data products
Methodology

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NL-disTrad Model

\[ \text{Observed LST}_{960} \quad \text{Observed NDVI}_{960} \]

\[ \text{Hot Edge Model} \quad a, b, c \]

\[ \text{ModelledLST}_{960} = (a \times \text{NDVI}_{960}^2) + (b \times \text{NDVI}_{960}) + c \]

\[ a, b, c \quad \text{ModelledLST}_{960} \]

\[ \text{ResidualsLST}_{960} = \text{ObservedLST}_{960} - \text{ModelledLST}_{960} \]

\[ \text{ANN Model} \]

\[ \text{ResidualsLST}_{960} \]

\[ \text{LST}_{60} = (a \times \text{NDVI}_{60}^2) + (b \times \text{NDVI}_{60}) + c + \text{ResidualsLST}_{60} \]
Training the ANN

Observed LST\textsubscript{960} \quad \text{Modelled LST}\textsubscript{960} \quad \text{Residual LST}\textsubscript{960}

Observed NDVI\textsubscript{960} \quad \text{Residual LST}\textsubscript{960} \quad \text{Training Data For ANN Model}

Observed NDVI\textsubscript{60} \quad \text{Training Data For ANN Model} \quad \text{Residual LST}\textsubscript{60}
Results & Discussion

Developed IDL Widget

Automated LST Disaggregation

MODIS Data Input:
- Thermal Band (960m):
- Red Band (240m):
- NIR Band (240m):

Landsat-7 Data Input:
- Red Band (60m):
- NIR Band (60m):

Output Location:

OK
The NL-DisTrad algorithm uses the relationship between NDVI and LST at a coarse resolution, for hot edge pixels.

Using an ANN model, the residuals obtained at the coarse resolution are modelled and the resulting residuals are added to the disaggregated LST at a fine resolution.

The ANN model uses NDVI of neighbourhood pixels, as it is assumed that the LST of a pixel will be influenced by the vegetation in surrounding pixels.

This hybrid model (Hot edge model + ANN model) is validated by comparing the automatically disaggregated LST to the observed ETM+ LST.
Some satellites do not carry thermal sensors, but can provide fine resolution NDVI.

As this widget requires only LST and NDVI datasets at coarse resolution, it may be used to disaggregate the MODIS temperature data to a resolution comparable to that of other bands' reflectance datasets.