Bridging the Gap between Potential and Actual Use of Satellite Data

Remote Sensing and GIS is a tool which is now an integrated part of countless professions and scientific studies. Millions of decisions are now powered by the use of RS&GIS techniques. RS&GIS is a dynamic field which is evolving very fast. It is as complex as its application. **With its speed of evolution and complexity involved, we cannot expect every professional working in different fields to be up to date with the knowledge related to the field RS&GIS.**

Satellites observe the earth surface, below it, also the atmosphere every second of the day. Sensors fixed on board on satellites captures the radiations reflected or emitted in different wavelengths. But the signals received by the sensors on board are not only the function of surface properties of the surface reflecting or emitting the radiations but also are affected by atmosphere through which they travel and sensor characteristics of the sensors which capture this signals. Sensor characteristics being well known can be dealt with systematically. But atmospheric effect varies constantly. Most of the satellites capture data using passive remote sensing i.e. sun's radiations are used as the source of energy. But the distance between the earth and the sun varied with the day and also the sun's illumination angle varies with the part of the day. This all involves much more variability in the signals received by the sensors. This all effects are required to be considered before using the satellite data for any of its application. Therefore, **before the application of the satellite data digital number values, it is always recommended to convert this digital numbers (DNs) into absolute radiance and/or reflectance unit to have uniformity in the data used which eliminates the variability due to sensor characteristics as well as atmospheric effects.**

It is unlike that the satellite data in a single wavelength band is used explicitly, almost every time multiple bands are used in combination to produce some useful outputs. Some of the standard and mostly used band combination outputs are True Color Composite (TCC) image, different indices like Normalized Difference Vegetation Index (NDVI) etc.

Air temperature is a continuous phenomenon which varies with space and time. Air temperature is measured at meteorological stations every day and a maximum and a minimum temperature of the day is the output. This discreet point observation of the air temperature does not produce the representative air temperature variation along the space and time. Many of the scientific studies have linked Air temperature with the Land Surface Temperature (LST). Land Surface Temperature (LST) is the temperature of the earth's surface. Although LST has a direct impact on air temperature they both are different. But **the advantage of retrieving the LST values form satellite data and then linking it with air temperature is the easy availability of satellite data in good temporal and spatial resolution which produces results in continuous nature over large spatial extent.** There are various algorithms to retrieve LST values from satellite Thermal bands. Some of the algorithms are the radiative transfer equation, the mono-window algorithm etc. **but to use these algorithms it needs the input of ground truth data and other land use related inputs.**

Because of the above-discussed facts, there exists a gap between potential applicability and effectiveness of the use of the satellite data and the actual use. This gap is bridged with this study. In this study, **a QGIS plugin ('RS&GIS') and a standalone application (for windows users) are developed which is being used by a variety of the professional from various backgrounds and has become a regularly used tool of most of the researchers. The only prerequisite to using this tool is the raw satellite data but no other knowledge.** The tool operates on Landsat (1to8) level 1 data (free available), LISS III (free available) and LISS IV data to **produce absolute radiance and reflectance band values** which can then be directly used for any further application**.** After conversion of the DN into absolute radiance and reflectance unit, the tool gives functionality for standard band combination outputs like True Color Composite (TCC), False Color Composite (FCC), Normalized Difference Vegetation Index (NDVI), Normalized Difference Water Index (NDWI), At-Satellite Brightness Temperature and Land Surface Temperature (LST). **The tool covers almost any band combination by use of its Custom Band Expression/s function** where the user is given functionality to input desired band combination expression. The presence of clouds and cirrus in the data not only affect the outputs visually but it induces ambiguity in the results. **For Landsat 8 data users, the tool provides functionality to remove features like clouds and cirrus from the data. The option is given to the user to clip the data to the area of interest shape file.** Most of the times when work is carried out on areas of large spatial extent, where perhaps tens of satellite image tiles have to be processed and analyzed, **this tool provides functionality for batch processing** which saves a considerable amount of time.

The tool can be significant since it is opening an opportunity to many researchers to get various outputs also the LST map easily and they can apply them in a variety of research. Results obtained are reliable. The use of the tool will result in increased efficiency and effectiveness in performing preprocessing operations and deriving useful outputs from Landsat and LISS data products. It also will result in reduced computational time and efforts and minimized possibilities of human error. **This study shows that successful implementation of this study and regular use of this tool will result in bridging the gap between the potential and actual use of the satellite data.**