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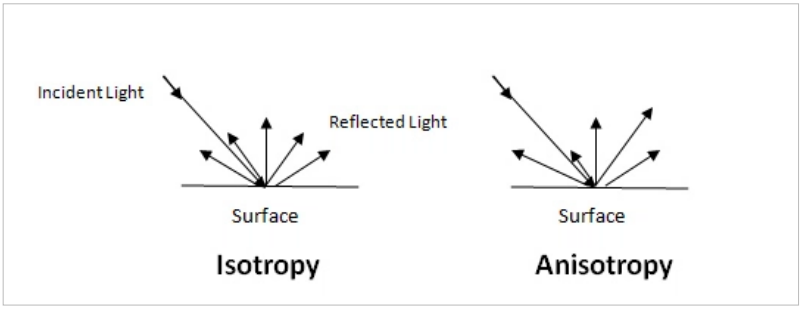
Anisotropy and BRDF

By GOPAL KRISHNA **August 28, 2013**

Our most of the Remote sensing is being sensed from Nadir position which is a position directly beneath the sensor, by forming a right angle from surface but various experiments putting sensors in different zenith positions showed that most of the time maximum information (i.e. reflectance) was gathered from off-nadir position. This vividly indicated that nadir position cannot be always a best position for remote sensing. Keeping this fact in mind, now scientists and researchers are putting their efforts on off nadir positions also.

If light is getting reflected by an object evenly in all directions, then that object is called isotropic object and this equal distribution of reflected light is termed as 'Isotropy'. Contrary to this, if reflected light is not evenly distributed in all directions, this incident is termed as 'Anisotropy'. Almost all of the surfaces on earth are anisotropic in nature, so this will not be wise to sense them in only one direction. That's why scientists felt need of BRDF measurements.



The BRDF stands for "**B**idirectional **R**eflectance **D**istribution **F**unction". Vegetation canopies and atmospheric constituents are not isotropic scatterers of photons as large dependence of reflectance on source incident angle and wavelength was found (Breece and Holmes, 1971). Earth surface features reflect radiation anisotropicaly that's why sensor measurements strongly depend on both position of the sun and position of the sensor relative to the sun. Therefore this reflectance is called 'bidirectional reflectance' which is characterized mathematically by Bidirectional Reflectance Distribution function (BRDF).

BRDF data can be recorded using Spectroradiometer and Goniometer, by movement of spectroradiometer's sensor on different angles of zenith and azimuth accordingly. After processing of this recorded data one can create polar graphs in order to determine maximum reflectance position which is scientifically termed as reflectance hotspot position.

As far as space remote sensing is concerned, there are two satellites in remote sensing arena, having capability of providing BRDF data- MODIS and PROBA-1 (CHRIS sensor on board).

MODIS (Moderate Resolution Imaging Spectroradiometer) is providing BRDF Model Parameters (MOD43B1), and Nadir-BRDF Adjusted Reflectance (NBAR) Products (MOD43B4) form year 2000 with launch of Terra. This BRDF data comes in 3 broad bands 0.3-0.7µm, 0.7-5.0µm, and 0.3-5.0µm with sinusoidal projection and 1km spatial resolution at every 16 days interval.

CHRIS (Compact High Resolution Imaging Spectroradiometer) sensor on board PROBA (Project On Board Autonomy) launched by ISRO (for European Space Agency) using PSLV in 2001 provides BRDF data (spectral range: 415-1050nm) in 5 scenes of one area with 63 spectral bands at a spatial resolution of about 34 m and the spectral band sets are 19 bands read out at 17m GSD.

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