VI's

NDVI

Vegetation indices (VI) are empirical measures that quantities vegetation biomass of the vegetation at the land surface. They often are function of the red and near infrared spectral functions. The Normalized Difference Vegetation Index (NDVI) is the most commonly use by the Remote sensing community and it is basically a ratio using the red and NIR band reflectance.

As a ratio, the NDVI has the advantage of minimizing certain types of band-correlated noise (positively-correlated) and influences attributed to variations in direct/diffuse irradiance, clouds and cloud shadows, sun and view angles, topography, and atmospheric attenuation. Ratioing can also reduce, to a certain extent, calibration and instrument-related errors. The extent to which ratioing can reduce noise is dependent upon the correlation of noise between red and NIR responses and the degree to which the surface exhibits Lambertian behavior. The main disadvantage of ratio-based indices tends to be their non-linearities exhibiting asymptotic behaviors, which lead to insensitivities to vegetation variations over certain land cover conditions. Ratios also fail to account for the spectral dependencies of additive atmospheric (path radiance) effects, canopy-background interactions, and canopy bidirectional reflectance anisotropies, particularly those associated with canopy shadowing. The NDVI was developed to standardize the values ranged from -1 to 1.

EVI

EVI (Enhance Vegetation Index) was developed to minimize the atmospheric effect by using the difference in blue and red reflectances as an estimator of the atmosphere influence level [Jiang]. This concept is based on the wavelength dependency of aerosol scattering cross sections. In general the scattering cross section in the blue band is larger than that in the red band. When the aerosol concentration is higher, the difference in the two bands becomes larger. This information is used to stabilize the index value against variations in aerosol concentration levels. The EVI incorporates this atmospheric resistance concept as in the Atmospheric Resistant Index (ARVI), along with the removal of soil-brightness induced variations in VI as in the Soil Adjusted Vegetation Index (SAVI). The EVI additionally decouples the soil and atmospheric influences from the vegetation signal by including a feedback term for simultaneous correction. The EVI formula is written as:

$$EVI = \frac{\rho_{nir} - \rho_{red}}{\rho_{nir} + 6\rho_{red} - 7.5\rho_{blue} + 1}$$

where _x are the full or partially atmospheric-corrected (for Rayleigh scattering and ozone absorption) surface reflectances; L is the canopy background adjustment for correcting nonlinear, differential NIR and red radiant transfer through a canopy; C1 and C2 are the coefficients of the aerosol resistance term (which uses the blue band to correct for aerosol influences in the red band); and G is a gain or scaling factor. The coefficients adopted in the EVI algorithm are, L=1, C1=6, C2=7.5, and G=2.5.

Since AVHRR does not have the blue band, EVI2 was developed by Jiang et all (2008) to address this issue.

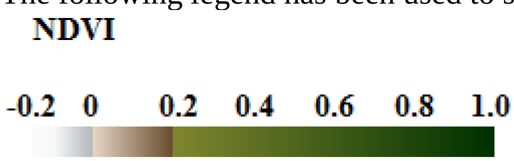
Process

Daily global MODerate resolution Imaging Spectroradiometer (MODIS) (starting at 2000) and Advantage Very High Resolution Spectroradiometer (AVHRR) (from 1981 thought 199) data record are used to calculate vegetation indices (NDVI and EVI2). Both MODIS and AVHRR provides daily data surface reflectance and quality information about clouds, partial clouds, shadow, presence of ice and snow.

NDVI can be calculated with the following expression:

$$NDVI = \frac{\rho_{nir} - \rho_{red}}{\rho_{nir} + \rho_{red}}$$

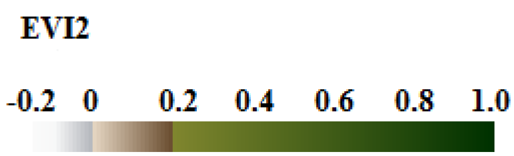
The following legend has been used to show NDVI.



On the other hand, the EVI2 formula is written as:

$$EVI\,2 = 2.5 * \frac{\rho_{nir} - \rho_{red}}{\rho_{nir} + 2.4 * \rho_{red} + 1}$$

The following legend has been used to show EVI2.



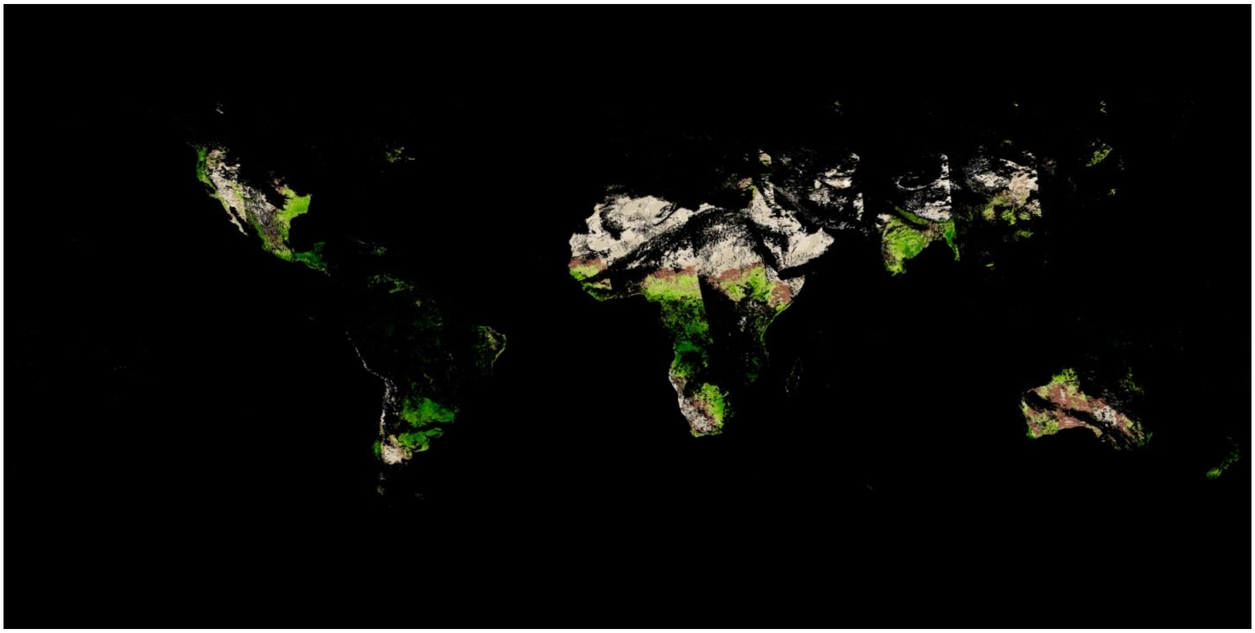


Figure 1: Input (NDVI)

Limitations

These data show gaps because they were filtered. The user can use the non-filtered data.

Reference

Z. Jiang, A R. Huete, K. Didan, T. Miura. “Developed of a two-band enhanced vegetation index without a blue band”. Remote Sensing of Environmental, 112, 2008, 3833-3845.

X. Zhanga, M. A. Friedla, C. B. Schaaf, A. H. Strahlera, J. C.F. Hodgesa, F. Gaoa, B. C. Reedb, A. Huete. “Monitoring vegetation phenology using MODIS”. Remote Sensing of Environmental, 84, 2003, 471-475.