



TRAINING ON GOOGLE EARTH ENGINE

MODULE 7 : GEE Application in Water Resources

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MODULE 7 : GEE Application in Water Resources

- **Water Indices (Water Body Detection)**
- **Water Body change (time series)**
- **Water Precipitation**
- **Water Flood Detection**
- **Water Quality Indices**
- **Examples and exercises**

spectral index

A spectral index is a mathematical equation that is applied on the various spectral bands of an image per pixel.

So, each pixel is described by n numbers, where n is the number of spectral bands. A spectral index is calculated using some of these values (depends on the specific index) in a mathematical formula.

The most common mathematical formulas that are used is the normalized difference:

$$(B_x - B_y) / (B_x + B_y)$$

In practical terms, it is the difference between two selected bands normalized by their sum. This type of calculus is very useful to minimize (as much as possible) the effects of illumination (shadows in mountainous regions, cloud shadows, etc) and enhance spectral features that are not visible initially

Normalized Difference Water Index (NDWI)

Normalized Difference Water Index (NDWI) is used for the water bodies analysis. The index uses Green and Near infra-red bands of remote sensing images. The NDWI can enhance water information efficiently in most cases. It is sensitive to build-up land and result in over-estimated water bodies. The NDWI products can be used in conjunction with NDVI change products to assess context of apparent change areas (Bahadur, 2018).

Formula of NDWI = $(\text{Green} - \text{NIR}) / (\text{Green} + \text{NIR})$

- NDWI (Landsat 8) = $(B3 - B5) / (B3 + B5)$
- NDWI (Landsat 4 – 7) = $(B2 - B4) / (B2 + B4)$
- 1. NDWI (Sentinel 2) = $(B3 - B8) / (B8 + B11)$

Normalized Difference Moisture Index (NDMI)

NDMI is used to determine vegetation water content. It is calculated as a ratio between the NIR and SWIR values in traditional fashion (USGS, 2019).

Formula of NDMI = $(\text{NIR} - \text{SWIR}) / (\text{NIR} + \text{SWIR})$

- NDMI (Landsat 8) = $(B5 - B6) / (B5 + B6)$
- NDMI (Landsat 4 – 7) = $(B4 - B5) / (B4 + B5)$
- 1. NDMI (Sentinel 2) = $(B8 - B11) / (B8 + B11)$

Sentinel-2 Water Quality

six relevant indicators of water quality:

- (i) the concentration of Chlorophyll a (Chl_a)**
- (ii) the density of cyanobacteria (Cya)**
- (iii) turbidity (turb)**
- (iv) colored dissolved organic matter (CDOM)**
- (v) dissolved organic carbon (DOC)**
- (vi) water color (Color).**