

## Synopsis 21

# Georectification, Image Analysis for Vegetation and Evapotranspiration from Remote Sensing

Prepared by Ayse Irmak  
GIS in Water Resources  
Fall 2011

---

This section describes how to georeference images to geometric data and how to calculate a common vegetation index, NDVI. We cover how to download a free Landsat image from the USGS EROS data center. The image is converted into other formats using ArcGIS. Landsat images have 30 m resolution.

The NDVI indicates the presence of live green vegetation. NDVI is the normalized difference vegetation index and is based on the RED and near infrared (NIR) regions of the electromagnetic spectrum. NDVI provides a rapid means to show the spatial distribution and amount of vegetation.

We show how evapotranspiration (ET) can be derived from satellite images using either a full surface energy balance process that requires a thermal image and making a rapid, but less accurate ET estimate using the NDVI. The concept of crop coefficient ( $K_c$ ) or fraction of reference ET ( $ET_rF$ ) is reviewed, where  $K_c = ET_rF = ET_{actual}/ET_{reference}$ , where the  $ET_{reference}$  is reference ET, which is computed by the American Society of Civil Engineers standardized Penman-Monteith method as applied to a clipped grass or alfalfa surface. In the rapid method,  $ET_rF \sim 1.25$  NDVI when the alfalfa reference is used and  $ET_rF \sim 1.5$  NDVI when the grass reference ET is used.

The full surface energy balance, using processes named METRIC or SEBAL, are more complicated to apply, but provide relatively high accuracy in ET estimates. Example applications from Nebraska and Idaho are shown, where ET estimates are used for managing ground-water use and to manage water rights and water transfers.

### Computer and Data Requirements

To carry out the exercise, you need to have a computer that runs the ArcInfo version of ArcGIS 10. There is no need for remote sensing software. The data are provided in an accompanying zip file.