

**Title:** Improving Evapotranspiration Estimation Using Remote Sensing Technology

**Priority Problem Area:** (1)-Integrated Statewide Water Budget

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**Objectives:**

The specific objectives of this project are:

1. To modify the SSEBop model for better estimation of ET in agricultural and riparian vegetation.
2. To validate the accuracy of the modified SSEBop model by using results from ground ET and micrometeorological measurements, and REEM generated ET values in New Mexico LRG and MRG.
3. Organize a workshop to demonstrate the application of the SSEBop model for regional estimation of ET based on Landsat as well as MODIS images

**Progress Report**

We have been working in collaboration with Dr. Gilbert Senay of USGS to develop a modified version of the SSEB Model for remote sensing of ET in New Mexico. Previous research project funded by WRI during 2015 showed that the SSEB model as is, does not provide accurate estimate of ET in agricultural areas in New Mexico. After reviewing the theoretical principles of the SSEB model, we decided to make several modification in the original model which is described below.

**Energy Balance:**

One of the short-coming of the SSEB model is the lack of energy balance in the model. The SSEB model uses a scaling process to estimate the ET in various pixels instead of a true energy balance approach. We modified the model to use energy balance in calculation of ET as follows;

$$E_f = \frac{R_{ni} - G_i - H_i}{R_{ni} - G_i} = 1 - \frac{H_i}{R_{ni} - G_i} \quad (1)$$

In which;

- E<sub>f</sub>= Evaporative fraction
- R<sub>ni</sub>= instantaneous net radiation
- G<sub>i</sub>= Instantaneous ground flux

$H_i$  = Instantaneous sensible heat

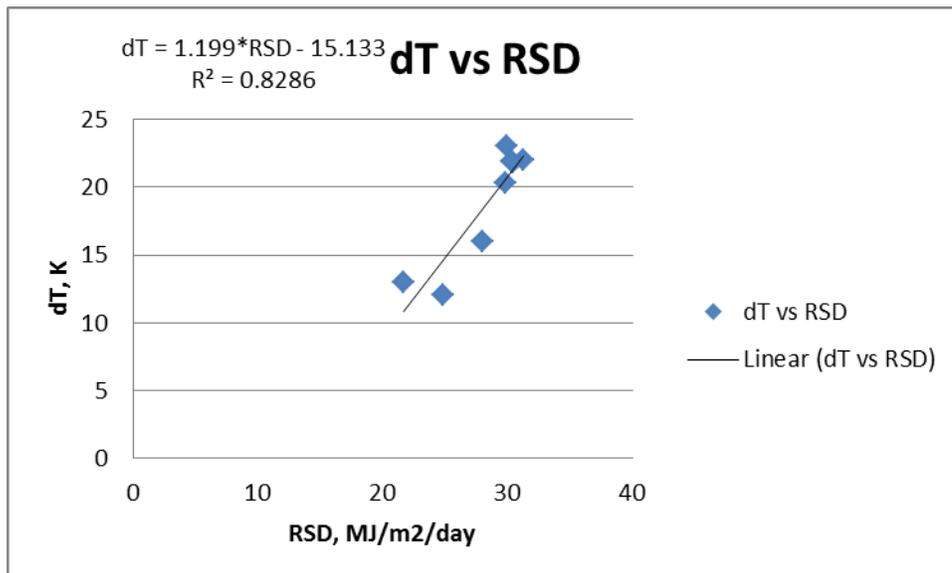
$R_{ni}$  and  $G_i$  is calculated using procedure outlined by Samani et al (Samani et al, 2007). The sensible heat ( $H_i$ ) is calculated using the temperature gradient as described by Samani et al (2007)

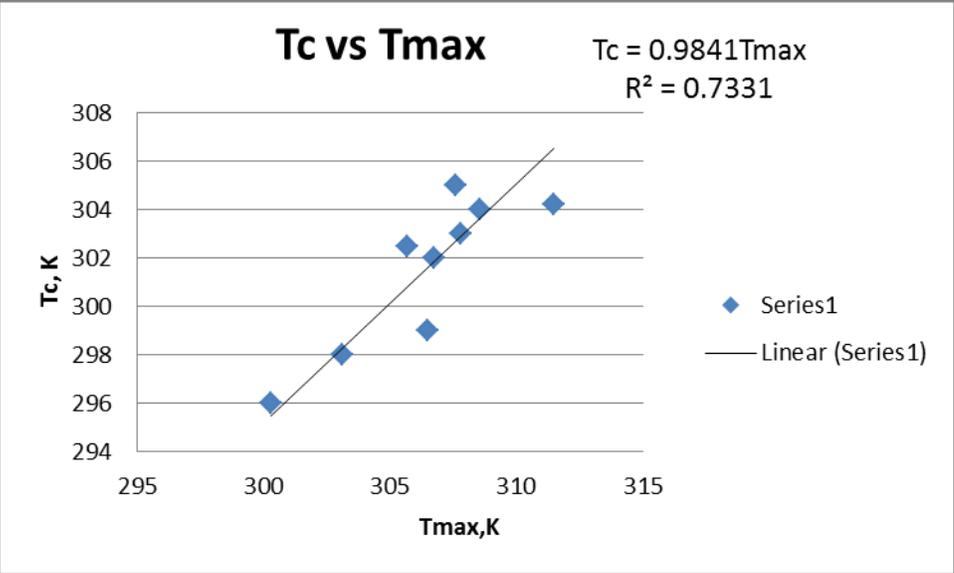
The ET is then calculated by multiplying evaporative fraction by daily net radiation (RND) as:

$$ET = E_f * (RND) \quad (2)$$

### Estimating Hot and Cold Temperature ( $T_h$ , $T_c$ )

In estimating surface temperature of hot and cold pixel, we have used our previous field data to develop calibration parameters for New Mexico. The attached calibration curves (figures 1,2) were developed for Lower Rio Grande Basin. These calibration curves in conjunction with the satellite images will be used to calculate the ET values. The calculated ET values will be compared with measured ET data for validation,.





Reference:

| Samani, Z., A.S. Bawazir, R. Skaggs, M. Bleiweiss, A. Piñon, and V. Tran (2007<sup>a</sup>). Water use  
| by agricultural crops and riparian vegetation: An application of remote sensing technology. J. of  
Contemporary Water Research & Education 137: 8-13.