

Western Water Use Model METRIC Presentation Review

MEMORANDUM

TO: Thad Kuntz
FROM: Marc Groff
RE: 28 March 2011 METRIC Presentation Review
DATE: 7 April 2011

Introduction

On 28-29 March 2011, Dr. Ayse Irmak and Mr. Ian Ratcliffe presented results from the METRIC™ evapotranspiration (ET) mapping project conducted by the University of Nebraska-Lincoln for the North and South Platte Natural Resource Districts (NRDs). The presentation on the 28th was directed to the North and South Platte board of directors at a joint NRD board meeting held in Bridgeport, NE. The presentation on the 29th was held at the offices of the North Platte NRD and was directed to the technical staffs and consultants currently providing technical support to the NRDs. During these presentations, Dr. Irmak and Mr. Ratcliffe provided a summary of the final project report, dated March 2011 and delivered to the NRDs via email on 25 March 2011, and responded to questions posed during the presentations. At the conclusion of the meeting on the 29th, three hard drives containing project data were also provided to the project sponsors.

Following the presentations, TFG was asked to provide a brief memo discussing ways results from the UNL mapping project might be incorporated into the Western Water Use Model currently under development. TFG has not reviewed the contents of the hard drives containing project data and has developed this memo based on understandings of the project gained from attending the two project presentations discussed above and a cursory review of the provided final report.

Discussion

As discussed in the project final report and during the presentations, the goal of the METRIC™ project was to produce spatial ET maps for agriculturally cropped and rangeland areas in the North and South Platte NRDs for the purposes of evaluating spatial and temporal variations in ET across the NRDs. To compute ET, information on landuse and climate data from selected weather stations was combined with information processed from Landsat satellite images covering the area of interest. Crop specific ET estimates from the METRIC™ process as described would be impacted by both the

accuracy of the land use information and the accuracy and representativeness of the climate data used in the computations.

TFG's understanding is that the project used a composite land use coverage developed from three sources of information:

- The 1991 – 1993 Nebraska Gap Analysis Program (GAP) coverage
- The 1997, 2001, and 2005 Nebraska Cooperative Hydrology Study (COHYST) coverages
- The 2001 National Land Cover Dataset (NLCD) coverage

As was discussed after the presentations, landuse coverages developed for the METRIC™ project could be used as another check against the irrigated and dryland acreage dataset currently being determined for the Western Water Use Model (WWUM). It was noted during the presentations that the COHYST coverages underwent additional QC work during the METRIC™ project to address accuracy issues which have been previously raised in regards to the mix of crop types identified in the coverages. The extent of the METRIC™ project QC effort should be explored further prior to placing a high level of dependence upon the acreage values from the METRIC™ project for any potential use in the WWUM project.

The presentations also made reference to the climate station data used in the METRIC™ project study. Within the boundaries of the North and South Platte NRDs, two stations from the High Plains Climate Center (HPCC) Automated Weather Data Network (AWDN) were used: the station near Scottsbluff and the station near Sidney. Information from these two stations was combined with information from 23 other stations outside the boundaries of the North and South Platte NRDs to establish reference crop ET values. The report describes the QC process conducted on the data from these stations. However, the representativeness of the data collected at certain stations (e.g. Sidney) to the conditions occurring within the North Platte Valley, which is the initial target area of the WWUM project, may be an issue. Any steps taken to address this issue did not appear to be described in the report or discussed during the presentations.

With regards to processing of the Landsat images, the presentations and report discussed several techniques used to refine image content and to distribute the values computed from a short period of time each month to the time between each image. Cloud cover was the main issue requiring image refinement. Techniques used to fill areas hidden by cloud cover based on surrounding land areas were discussed. These techniques obviously have limits, as the images taken along Landsat path 33 in 2005 were so cloud filled that they could not be processed according to the report. For each month, there are generally two images taken, one towards the beginning of the month and one towards the middle of the month, which show conditions as of approximately 11:00 a.m. on each of the two days. The report discusses cubic splining techniques used to fill in estimates of ET between these two hourly time periods each month when energy balance computations were made.

Summary of Suggested Uses within the WWUM Project

The METRIC™ project report lists several potential uses for the developed ET estimates. Generally, as stated in the report, these uses center on providing the ability to contrast variances in ET spatially and temporally. These types of analyses would be limited to the years 1997 (from the work done by the University of Idaho, assuming this information has been communicated to the NRDs), 2002, and 2005. The 2005 analysis would also be spatially limited to approximately the western half of the North and South Platte NRDs due to cloudy conditions preventing the analysis of required images.

Another specific use which was discussed during the presentation was the development of site specific crop coefficients. The information provided on the hard drives could be examined to determine if sufficient information has been provided to allow for this; however, TFG believes it would be a priority to ensure accurate landuse information prior to beginning such a program.

Estimates of ET will be used in the WWUM for developing a water budget concerning the fate of applied water (both irrigation and precipitation). The water budget will make an accounting on a monthly basis from 1950 through 2010. Results from the METRIC™ project provide a reference set of ET information for the years 1997, 2002, and 2005 which could be used; however, given the issues discussed in this memo, it is TFG's general recommendation at this point to make use of the results in relative terms rather than absolute terms. For instance, ET values used in the WWUM project during the years 2002 and 2005 should be expected to show a similar relative difference as that shown in the METRIC™ project. This is in line with the initial goals of the METRIC™ project and provides the NRDs with an encompassing dataset for comparative purposes.

Using the results in a relative format may also allow for identification of areas showing water stress where irrigation was not able to fully meet crop water demands. For instance, fields within close proximity of one another growing the same irrigated crop type would be expected to show similar levels of ET. Should they show a significant difference, one potential cause could be the inability of irrigation to supply enough water to allow a crop to transpire at a maximum rate. This inability could be related to localized irrigation management decisions, or a physical inability to provide the water. This could provide a rationale for setting water production function values used within the WWUM project to targets below maximum levels for selected areas.

Every method for computing ET has advantages and disadvantages and is subject to the accuracy and applicability of the input data provided to the method being used. The North and South Platte NRDs have an advantage over many in that records of actual, site specific water application collected as part of the NRD's acreage certification and metering programs are available. It is TFG's opinion that regardless of the method chosen to estimate crop ET, those values need to be reasonable with consideration of the information collected in the field.