COMPRISION STUDY ON MAPPING OF ET IN THE CIA OF MURRUMBIDGEE CATCHMENT WITH REMOTE SENSED SATELLITE DATA: EXAMPLES FROM NATIONAL AIRBORNE FIELD EXPERIMENTATION

Kaishan Song[1,2], Mohsin Hafeez[3,2], Jia Du[1], Lihong Zeng[1], and Umair Rabbani[2]

[1]Northeast Institute of Geography and Agricultural Ecology, CAS, Changchun, Jilin Province, China
[2] CSIRO Land and Water Division, Locked Bag 588, Wagga Wagga, NSW 2678, Australia
[3] International Centre of Water for Food Security, Charles Sturt University, Locked Bag 588, Wagga Wagga, NSW 2678, Australia
Email:songks@neigae.ac.cn; Tel: 86-431-85542364; Fax: 86-431-85542298

Abstract: Spatial knowledge of land surface evapotranspiration is of prime interest for environmental applications, such as optimizing irrigation water use, irrigation system performance, crop water deficit, drought mitigation strategies and accurate initialisation of climate prediction models especially in arid and semiarid catchments where water shortage is a critical problem. The recent drought in Australia and concerns about climate change has highlighted the need to manage water resources more sustainable especially in the Murrumbidgee catchment which utilizes bulk water for food production. This study focused on estimation of daily actual evapotranspiration in Coleambally Irrigation Area (CIA) area, using the SEBAL model applied to a remote sensing TERRA/MODIS, NOAA AVHRR 18 and Landsat 5 TM sensor during different satellite over pass days in National Airborne Field Experimentation (NAFE) campaign, lasted over 3 weeks (October 30 to November 21, 2006). All ground truth data for calibration of model was collected during the field campaign, such as soil moisture, surface roughness, skin and soil temperature, and vegetation water content.

Results showed that actual ET estimated from NOAA AVHRR 18 was always overestimating (range from 11.5% to 59.3%) as comparison to Eddy system (on average 37%) during the image acquisition dates. However, for the same image acquisition dates, TERRA/MODIS ET ranges from 9.8% lower to 14.3% higher than the Eddy system. Landsat 5 TM modeled ET results were comparable to the Eddy Covariance system having a minor error of -1.21%. It was proven possible to simultaneously use SEBAL for different sensors with the combination of high spatial and temporal resolution to estimate ET spatial distribution characteristics; though the accuracy of NOAA-AVHRR derived result is not ideal. The Landsat ET results in this study match very well with the Eddy system. Considering the lack of high spatial resolution thermal satellite and need of time-series ET dynamics, the MODIS data could be used to provide seasonal actual ET for regional studies. The combination of MODIS and Landsat can be a better choice for future ET study at regional or catchment scale, but further study need to be conducted to integrate to provide both high spatial and temporal ET. Estimation of actual ET from TERRA MODIS in combination with Landsat imagery indicated relatively good accuracy and potential for use in the water balance and water productivity analysis at the catchment level. In future, the ET will be modeled from high resolution thermal data and the results will be compared with the optical satellite imagery results to find out uncertainty in up-down scaling modeling for ET estimation.

Keywords: Airborne, Collyambally Irrigation Area, Murrumbidgee catchment, NAFE, optical satellite