Estimation of Evapotranspiration based on METRIC and SEBAL model using Remote sensing, near Al-Jouf, Saudi Arabia

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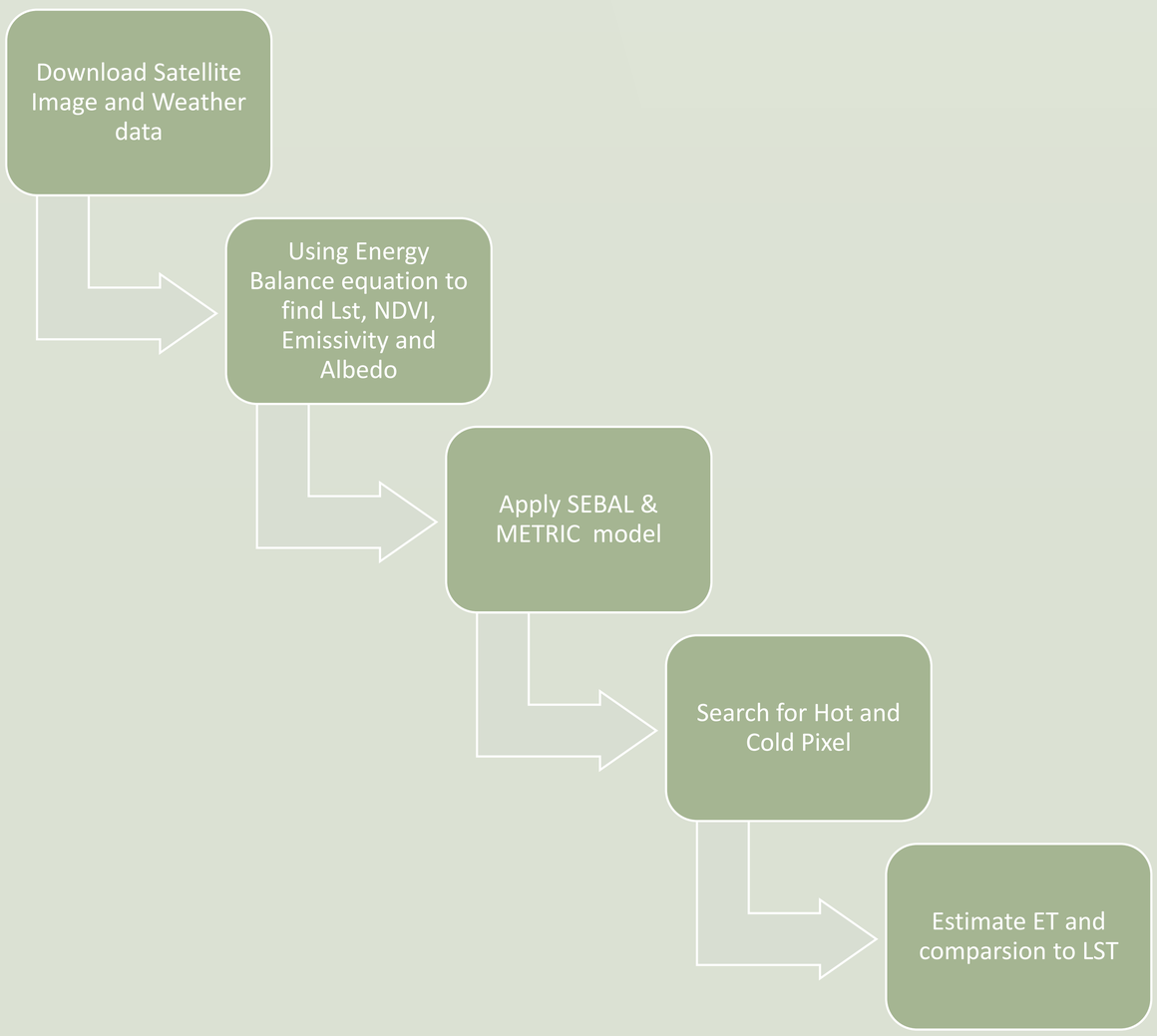
Abstract

The current study focuses on estimating evapotranspiration in arid and semi-arid environment in Norther part of Saudi Arabia near to Al Jouf. The objective of the research is to study, analysis and estimate Evapotranspiration (ETr) using SEBAL (Surface Energy Balance Algorithm for Land) and METRIC (Mapping of Evapotranspiration at high Resolution using Internalized Calibration) model and comparing with LST (Land Surface Temperature). The image was processed in ArcGIS and Matlab software with toolbox LandMOD ET mapper. The area average Evapotranspiration is about 2.21mm/day for METRIC model, 2.6mm/day for SEBAL and the average Land surface Temperature is 333 Kalvin. There is highly inversely correlated between ET and Land surface temperature which is about〖 R〗^2=0.8. The value of ET ranges from 0.05 to 8 mm for both SEBAL and METRIC model during 2019/07/07. Both highly elevated and agricultural area shows high value of ET ranges from 5 to 8 mm/day. In addition, The Normalized Differential Vegetation Index (NDVI), LAI (Leaf Area Index) and Emissivity also calculated from Surface energy balance equation. The estimation of ETr from SEBAL model is better than METRIC model based on R^2 of different vegetation indices. The importance of the work is estimate ET and explain the impact in Environmental effect for better planning in Water resource development.

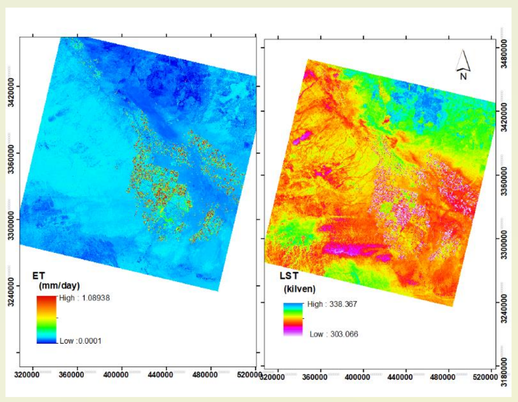
Objectives

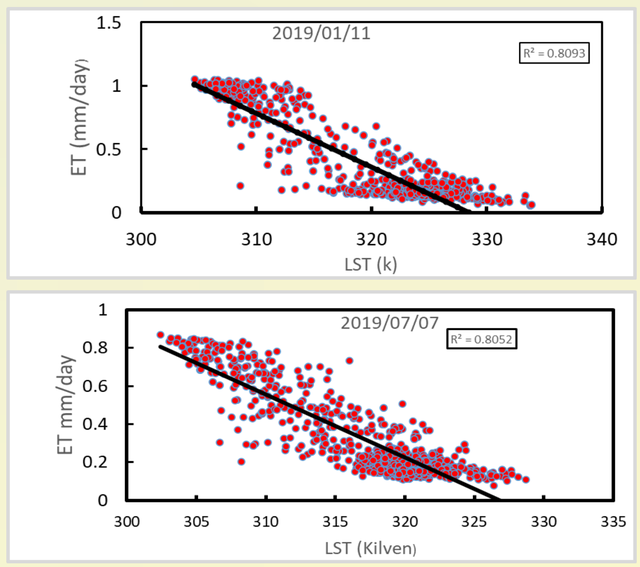
The objective of the analysis is to collect remote sensing Landsat 8 images to yield daily ETr from METRIC and SEBAL model and compare with different vegetation indices and LST. This done in the Northern part of Saudi Ariba considered to be agricultural region.

Methodology

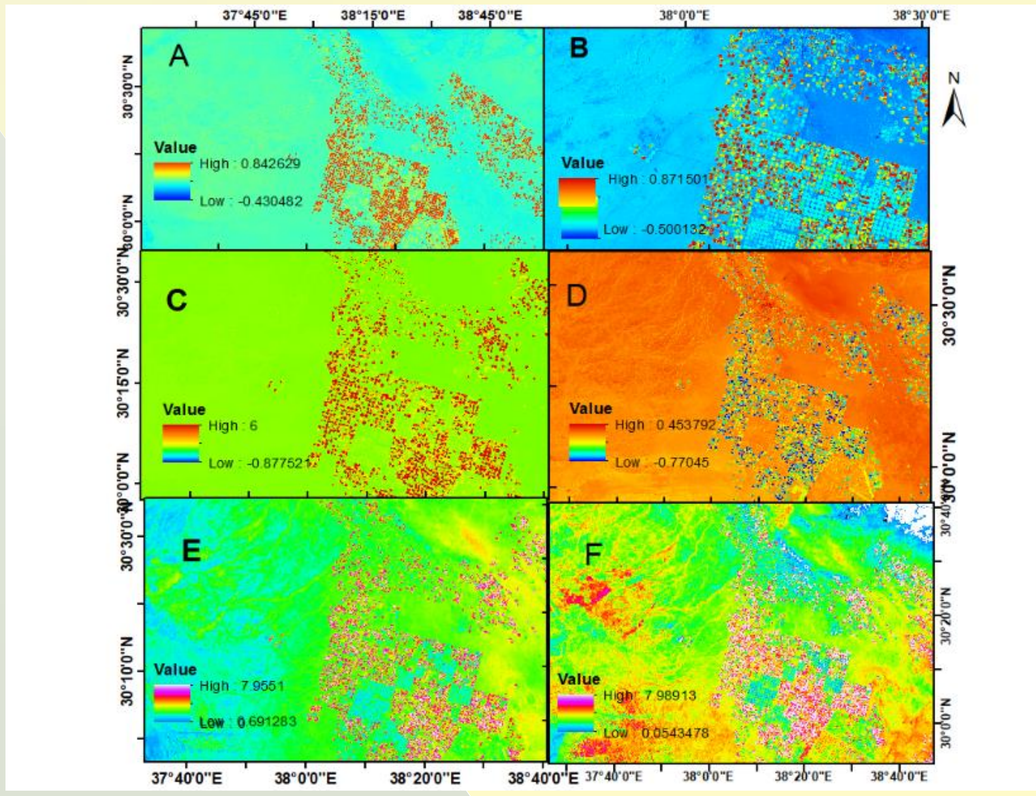


Results





Relation between fractional ET and LST



(A) (SAVI), (B) (NDVI), (C) (LAI), (D) (NDWI), (E) ET from METRIC model, (F) ET from SEBAL model

Conclusions

This study presents a computational grid to evaluate and estimate daily ET amount in and near Al-Jouf region, Saudi Arabia using Landsat 8 remote sensing imagery. The result shows there is highly inversely relation between fractional Et values and Land Surface Temperature. The advantage of satellite remote sensing in the study and characteristic of Evapotranspiration typically important to irrigation, Hydrology and Water resource management. The image is processed by LandMODETmapper, which is a Matlab based GUI for application of METRIC and SEBAL models on Landsat and MODIS (Bhattarai, N., & Liu, Tao 2017). The hourly and daily actual ETr was estimated for SEBAL and METRIC model. The area average Evapotranspiration is about 2.21mm/day for METRIC model, 2.6mm/day for SEBAL (Figure 4), According to (Elhag et al., 2017) high value of ET is considered for arid environment. The average Land surface Temperature is 333 Kalvin. The range of ET estimated using SEBAL model is 0.05 to 8 mm. Higher Et value is shown in high mountains and agricultural area this is due to environment condition being arid and semiarid.

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