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A model for evaluation of local and regional surface Evapotranspiration by Remote Sensing

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In this paper we present a Remote Sensing method to assess the actual ET (ET_a) based on Priestly-Taylor and Penman-Monteith equations. This method could be applicable to local and regional energy balance appraisal. The method utilizes satellite data from Landsat, MODIS and NOAA-AVHRR. The effectiveness of the methodology is illustrated using visible-NIR and thermal data imaged by Landsat 7, covering the Hula Valley in The Upper Galilee region of Israel.

The model uses three major variables: Net radiation (R_n), ET_a, Saturated and dry bare soil evaporation

R_n was obtained by applying the total broadband shortwave Albedo and the difference between incoming and outgoing longwave radiation. Estimation of R_n requires retrieval of surface reflection and brightness temperature. additional meteorological data includes incoming shortwave and longwave radiation and air temperature. ET_a was evaluated using acquired data from deficit and well watered vegetation. To evaluate ET_a surface vegetation cover density is essential. It was derived directly from vegetation indices. Saturated and dry bare soil evaporation was determined from the Priestly-Taylor and Penman-Monteith equations.

The model was validated in the winter and spring of 2000. Regional average ET varied between 1.3 mm day^{-1} to 7.5 mm day^{-1} on winter and spring respectively. Albedo of bare Alluvium soil, varied between 0.20-0.35, surface temperature varied between 13-37 ^{0}C and R$_{n}$ varied from 325 to 775 (W m^{-2}). With low values determined in the winter and high values in the spring. Consequently, ET varied from 1.7 mm day^{-1} in the winter to 5.5 mm day^{-1} in the spring.

On Peat, albedo of bare soil, surface temperature and net radiation varied between 0.13-0.45, 13-32 ^{0}C and 300-750 (W m^{-2}) while ET varied from 1.5 mm day^{-1} in the winter to 4.5 mm day^{-1} in the spring.

On Rendzina, albedo of bare soil, surface temperature and net radiation varied between 0.22-0.48, 12-42 ^{0}C and 325-740 (W m^{-2}) for winter and spring respectively. ET varied from 1.35 mm day^{-1} in the winter to 4.0 mm day^{-1} in the spring.

These results complied with ground measurements marking the ability of the above model to retrieve spatial and temporal ET.