Project Title: “ESTIMATION OF EVAPOTRANSPIRATION AND ITS MAPPING USING REMOTE SENSING APPROACH”

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Introduction / Background

Evaporation- Process by which energy from the sun causes water on the surface of the earth to change to water vapor, the gas phase of water, the first step in the water cycle.

Transpiration- The process by which moisture is carried through plants from roots to small pores on the underside of leaves, where it changes to vapor and is released to the atmosphere.

Evapotranspiration is the combination of two separate processes whereby water is lost on the one hand from the soil surface by evaporation and on the other hand from the crop by transpiration is referred to as evapotranspiration (ET). Evapotranspiration is one of the main components of the water cycle and the importance of its accurate estimation is obvious, however, this is difficult to achieve in practice because actual evapotranspiration can not be measured directly and it varies considerably in time and space. A large number of empirical methods have been developed worldwide to estimate evapotranspiration from different climatic and meteorological variables. The analysis of the performance of the various algorithms revealed the need for formulating a standard method for the computation of the reference crop evapotranspiration. For this reason the FAO Penman-Monteith method (Allen at al) has been recommended as a standard.
**Objectives of the project:**
The main objective of the project is to estimate evapotranspiration using various methods and check their potential with standard method to map evapotranspiration using remote sensing data. All the metrological parameters may not be available to find spatial evapotranspiration values on regional scale, so most suitable method is to be recommended for the study area with the available metrological parameters and finally values are validated using pan evaporation method. Another objective of this project is to develop most reliable and easy to handle evaporation pan with suitable standard conditions.

**Methodology:**

Fig. 1

Firstly the meteorological data of Belagavi region is collected from Indian Meteorological Department Pune. The $ET_0$ values are calculated by standard method i.e., FAO 56 Penman monteith method using FAO 56 $ET_0$ Calculator. The five empirical methods are selected
which are primarily based on the temperature then the ET₀ is calculated for all the five selected method in MS. Excel and correlated each equation with Penman monteith equation. From the graph correlation coefficient R² is obtained, then the best method is selected based on the higher R² value. Then these results are also validated with Pan Evaporation field experiment. The Landsat 8 satellite images are collected which are free from cloud coverage from USGS earth explorer. By using QGIS these images are processed then by using Raster calculator the land surface temperature is calculated. After getting temperature the Spatial ET is calculated with the best selected empirical method. After this, spatial ET is mapped in QGIS. From this map ET at every point of study area will be obtained.

Results and Conclusions

<table>
<thead>
<tr>
<th>Date</th>
<th>Pan method ET₀ (mm/day)</th>
<th>Penman Monteith Equation ET₀ (mm/day)</th>
<th>Hargreaves Equation ET₀ (mm/day)</th>
<th>Turc Equation ET₀ (mm/day)</th>
<th>Thornthwaite Equation ET₀ (mm/day)</th>
<th>Blaney Criddle Equation ET₀ (mm/day)</th>
<th>Kharrufa equation ET₀ (mm/day)</th>
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The data obtained from Indian Meteorological Department for the recent weeks for study area of Ghataprabha River Basin Belagavi, has been used for the calculation of Evapotranspiration by the five empirical methods. Calculation of Evapotranspiration was performed using empirical methods with the help of Ms – Excel and also value of $R^2$ was determined which were shown in Tables and compared with Penman-Monteith method. A good correlation was found between $ET_o$ values estimated by each of five temperature based methods and Penman-Monteith method, Among the evaluated temperature based methods, the Hargreaves method performed the best followed by turc, Thornthwaite, Blaney Criddle, and kharrufa methods for the semi-humid region of ghataprabha river basin Belgaum.

After validation with pan method Hargreaves method is giving good correlation. Hence Hargreaves is the best method to estimate Evapotranspiration with minimum meteorological data.

Fig 4 indicates Variation of Potential Evapotranspiration over ghataprabha river basin. Potential Evapotranspiration is increasing towards ridge of the river basin as there is barren
land, and decreasing at reservoir site because temperature will be less at reservoir therefore evapotranspiration will be less.

Scope for future work

Evapotranspiration shall be calculated with minimal use of meteorological data. Spatial variation of Evapotranspiration shall be available for entire study area. Project shall motivate use of geospatial technology in water recourse and Agriculture. Project shall help formers to get information about crop water requirement. Project shall help government to prepare irrigation plan. The remote sensing approach to estimate evapotranspiration provides several advantages over traditional methods. Experimentally, the calculation of evapotranspiration can be made quite accurately using weighing lysimeters, eddy correlation techniques, and the Bowen ratio technique. These methods are limited, because they provide point values of ET for a specific location and fail to provide the spatial ET values on a regional scale. This limitation has motivated the development of remotely sensed data from satellites to estimate ET over vast areas. This project can help formers to predict crop water requirement and irrigation planning for their agriculture fields.