Calculation Actual and Potential Evapotranspiration by developing a Tool for MODIS Product - MOD16A2

Nasrin Salehnia, Sohrab Kolsoumi, Muhammad Habib Ur Rahman, Asmat Ullah, Atena Pezeshki, Bita Banezhad, Jafar Mirzadeh

8th Oct. 2018

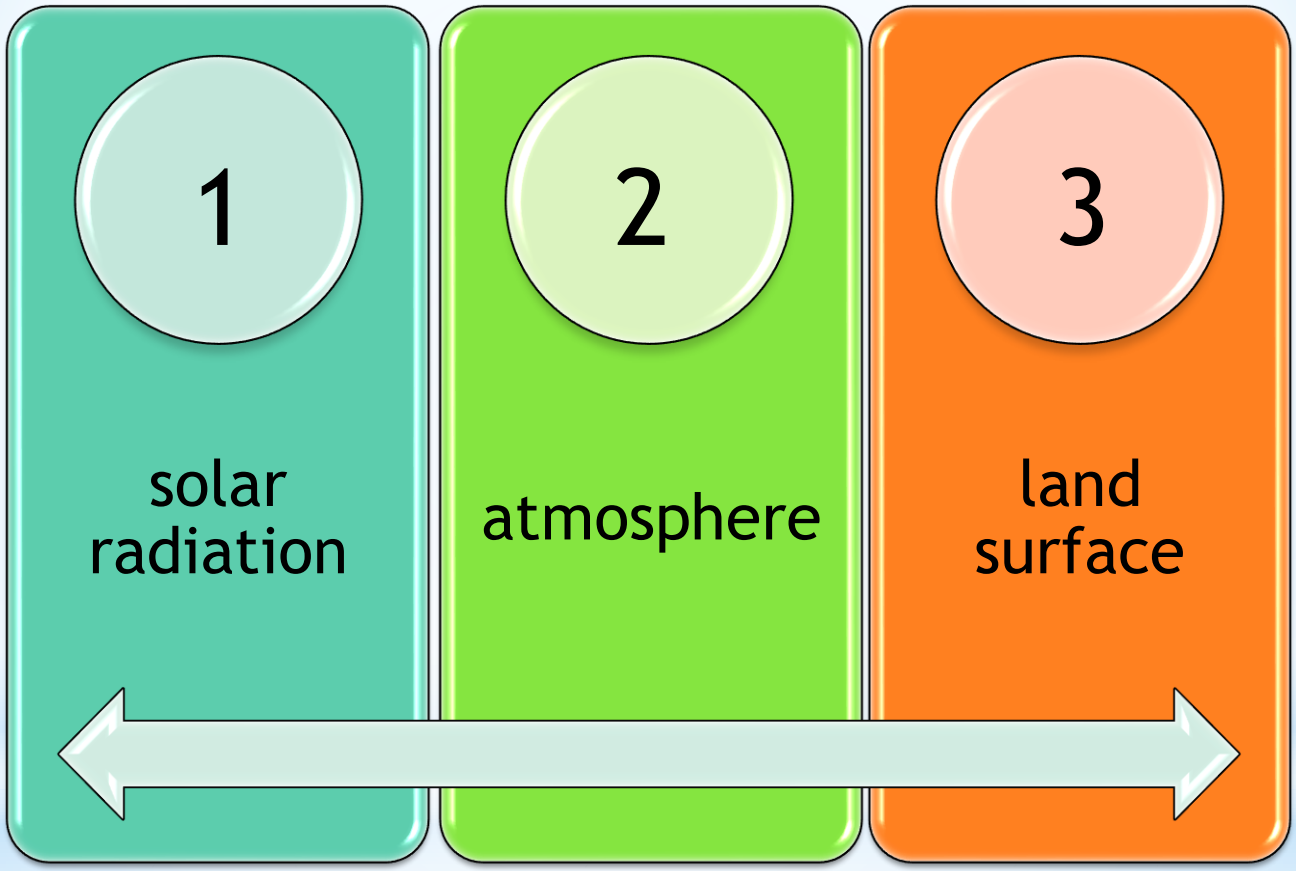
International Conference, Climate Smart Agriculture: the Way of Farming for 21st Century

Introduction

- Monitoring and estimating of daily evapotranspiration (ET) is vital and necessary for allocating and managing water resources in agricultural areas.

- Actual evapotranspiration (AET) is the quantity of water that is actually removed from a surface due to the processes of evaporation and transpiration.

AET



Estimating and calculating the value of AET is complex and not an easy process.

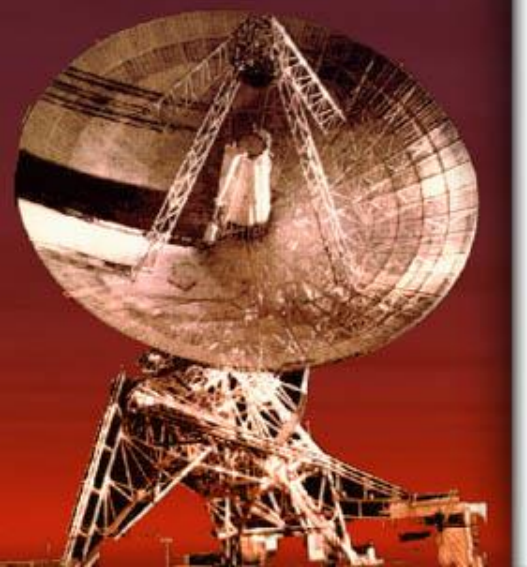
Our objective

- To develop a complete tool for extracting different data from MOD16A2 products and analyzing the data

- Test the tool on a specific sugarcane field in the southwest of Iran.

ET measurement techniques

Material and Methods



- The MOD16A2 product includes actual evapotranspiration (AET), latent heat flux (LE), potential evapotranspiration (PET) and potential latent heat flux (PLE) datasets at 1 km spatial resolution, for 8-day, monthly and annual intervals.

- The 8-day ET is the sum of ET during these 8-day time periods. We used the year of 2015 on a daily scale and 8-day intervals.

- There are two fundamental concepts in calculation evapotranspiration's concepts in MOD16:

Energy Partitioning Logic

Penman-Monteith Logic.

Equations

$$H = \rho\, C_p \frac{T_s - T_a}{r_a}$$

$$\lambda E = \frac{\rho\, C_p\, (e_{sat} - e)}{\lambda\, (r_a + r_s)}$$

$$A' = R_{net} - \Delta S - G = H + \lambda E$$

The second equation is the Penman-Monteith that

$$\lambda E = \frac{sA' + \rho C_p \frac{VPD}{r_a}}{s + \gamma\, (1 + {}^{r_s}/_{r_a})}$$

Case Study

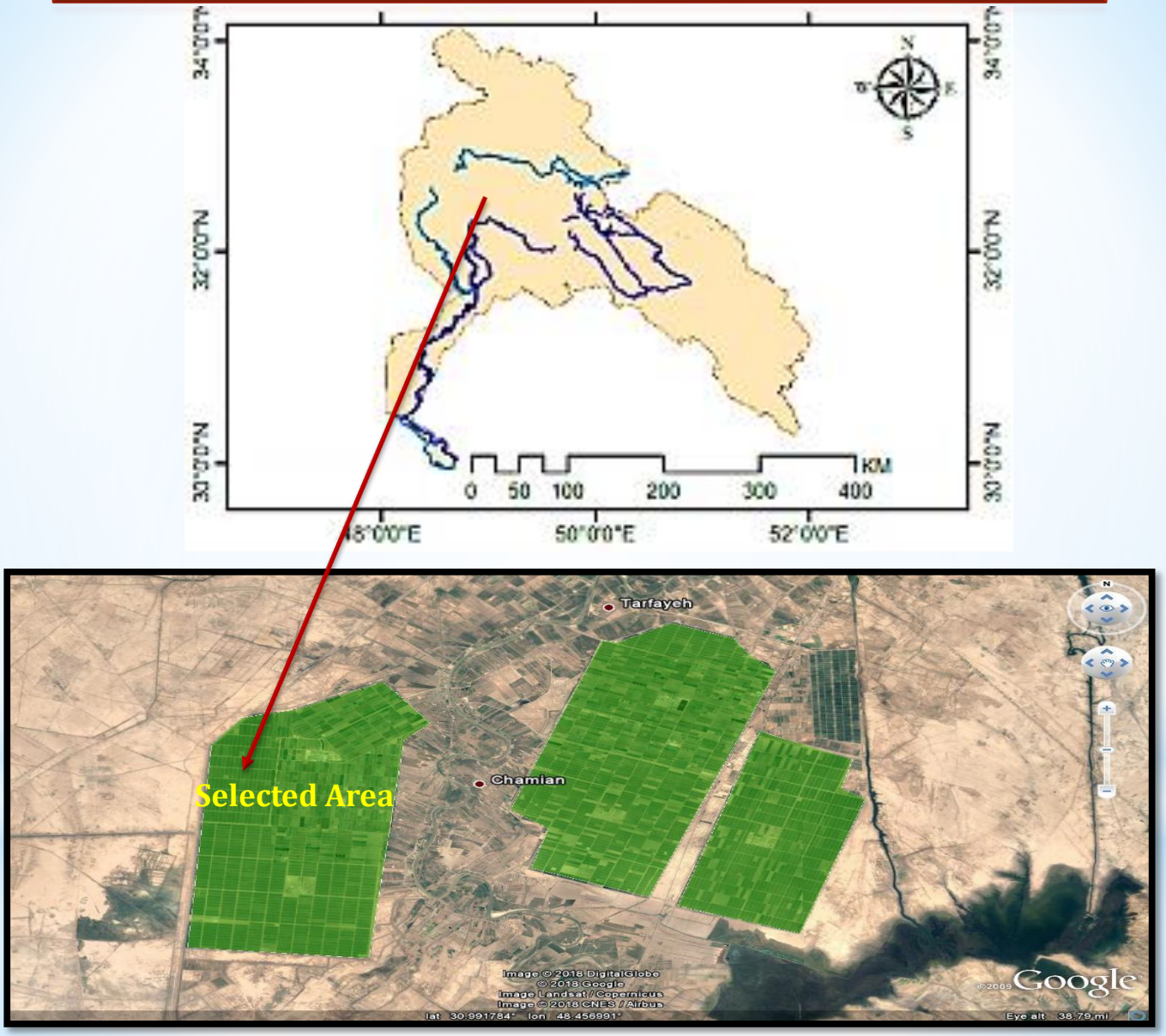


Fig. 1 The selectd area in the Khuzestan province which is planted by sugarcane

Agrimetsoft.com

Applicable and Useful Software Tool

MOD16A2 tool

By: Dr. Nasrin Salehnia

MOD16A2 Tool

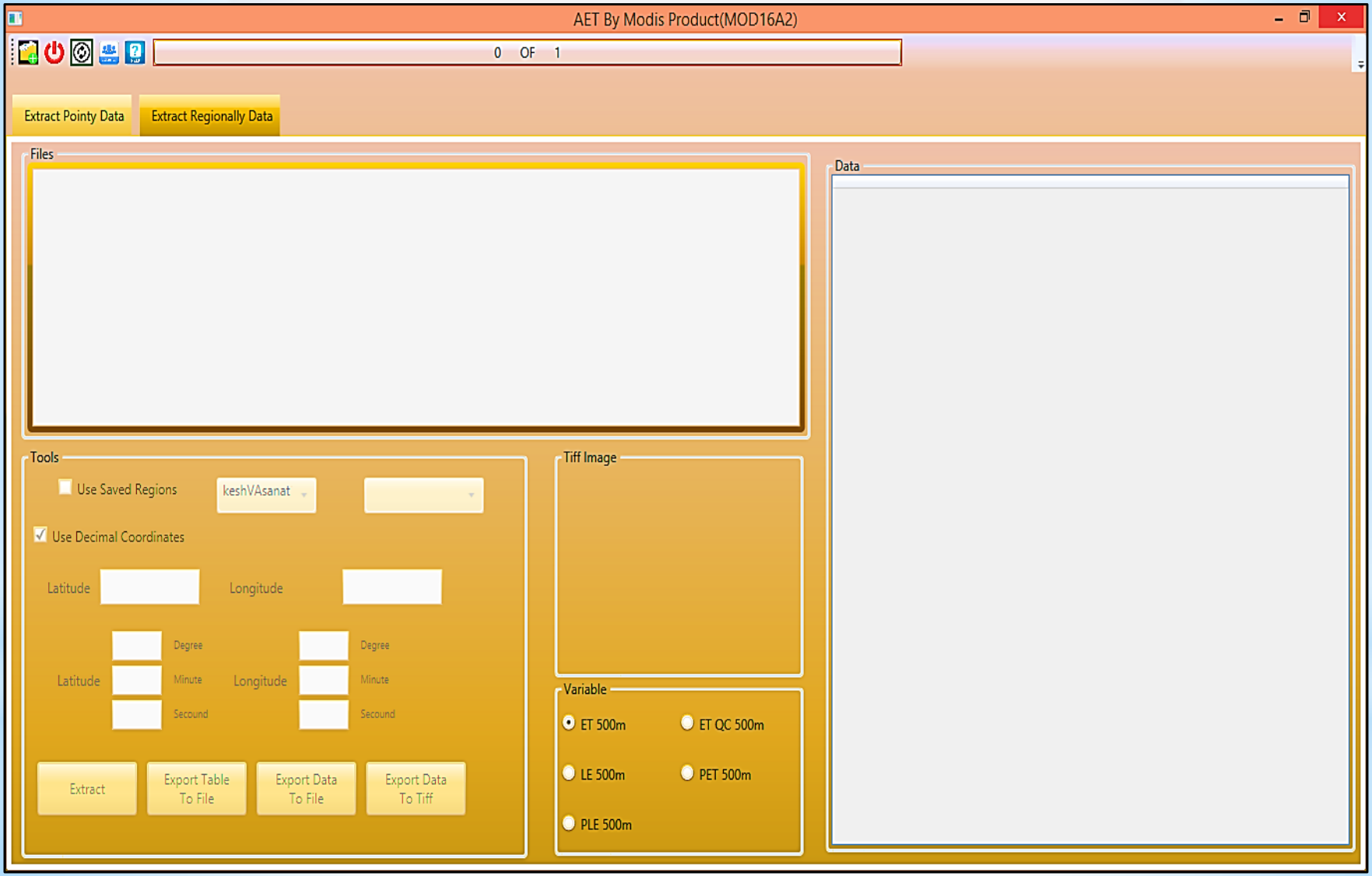


Fig. 2 The Main screen of the MOD16A2 tool

MOD16A2 Tool

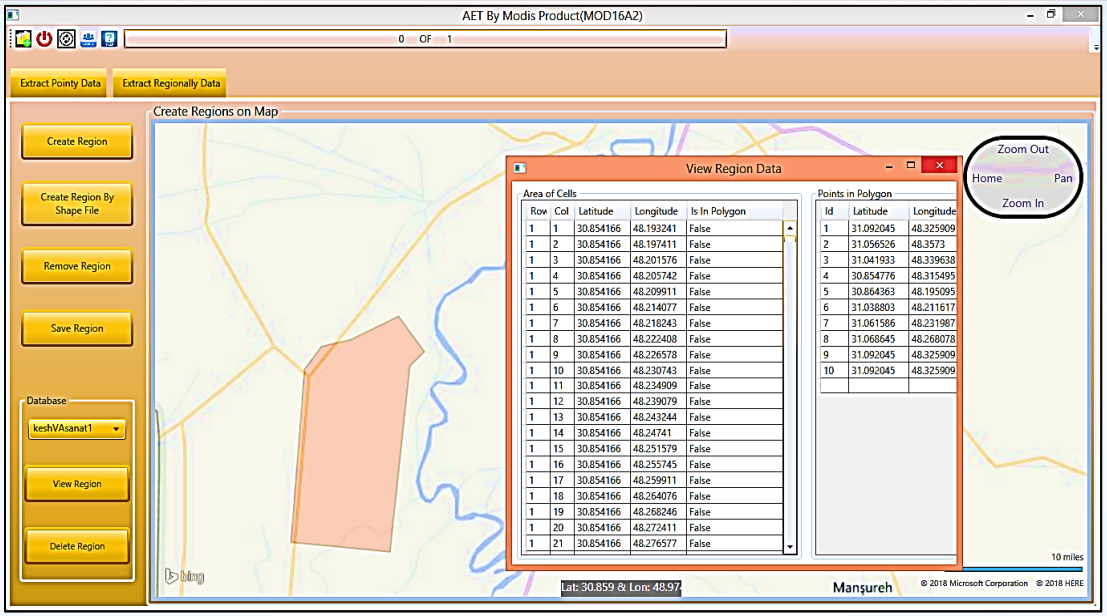


Fig. 3 Create a region on the map for extracting MOD16A2 data.

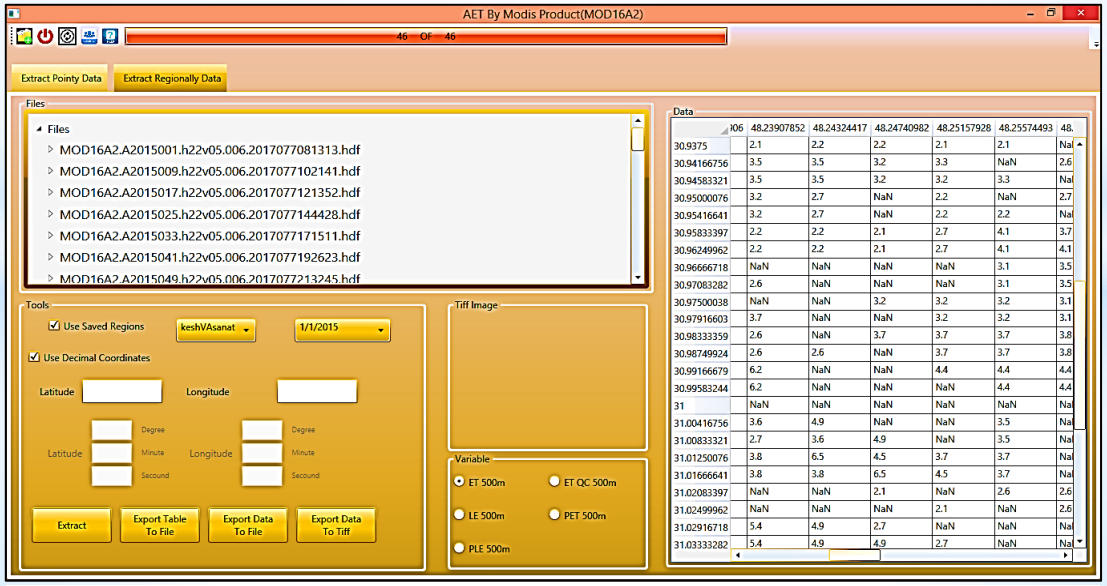


Fig. 4 Load the hdf files of the selected region from MOD16A2 data.

MOD16A2 Tool

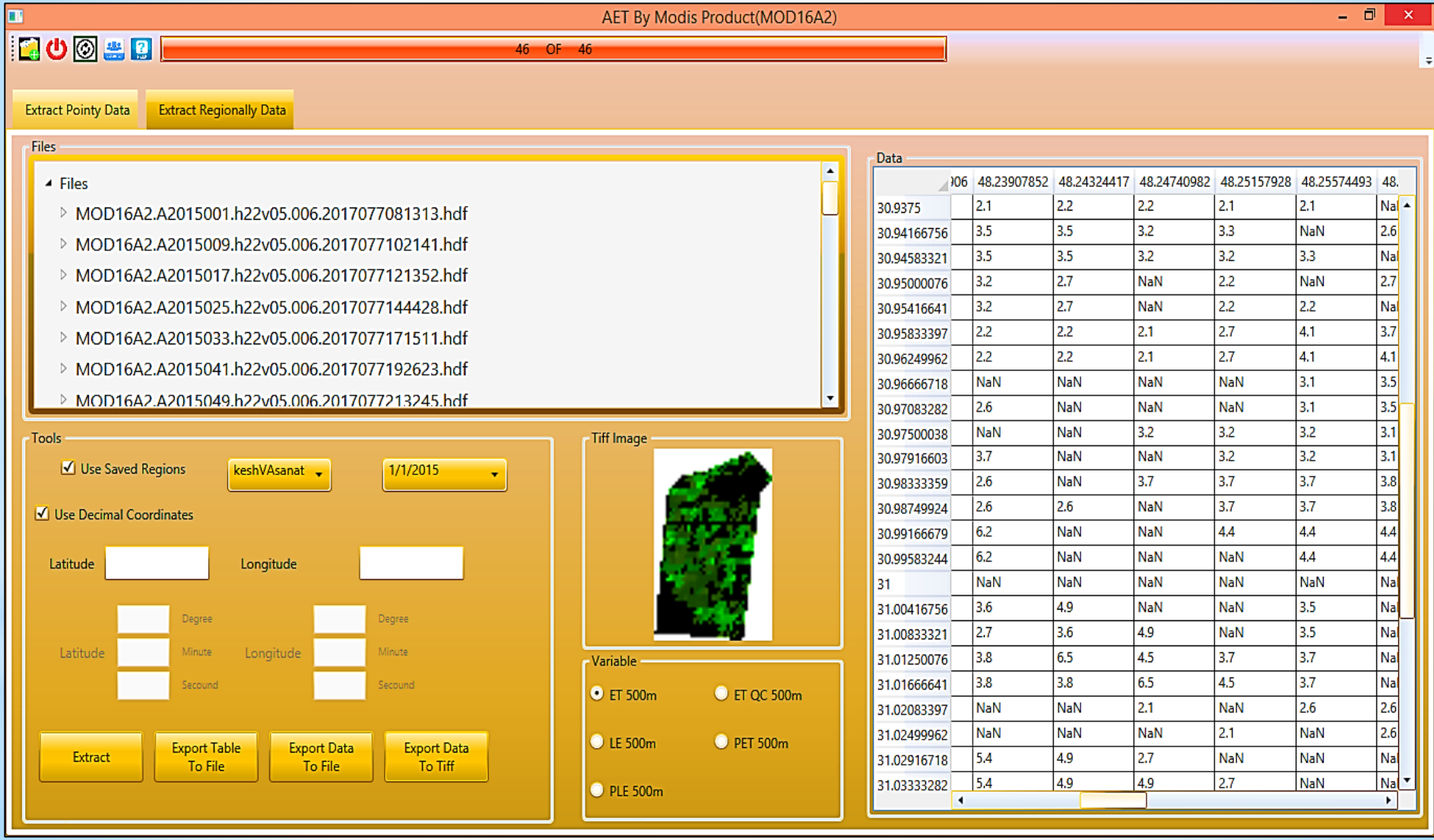
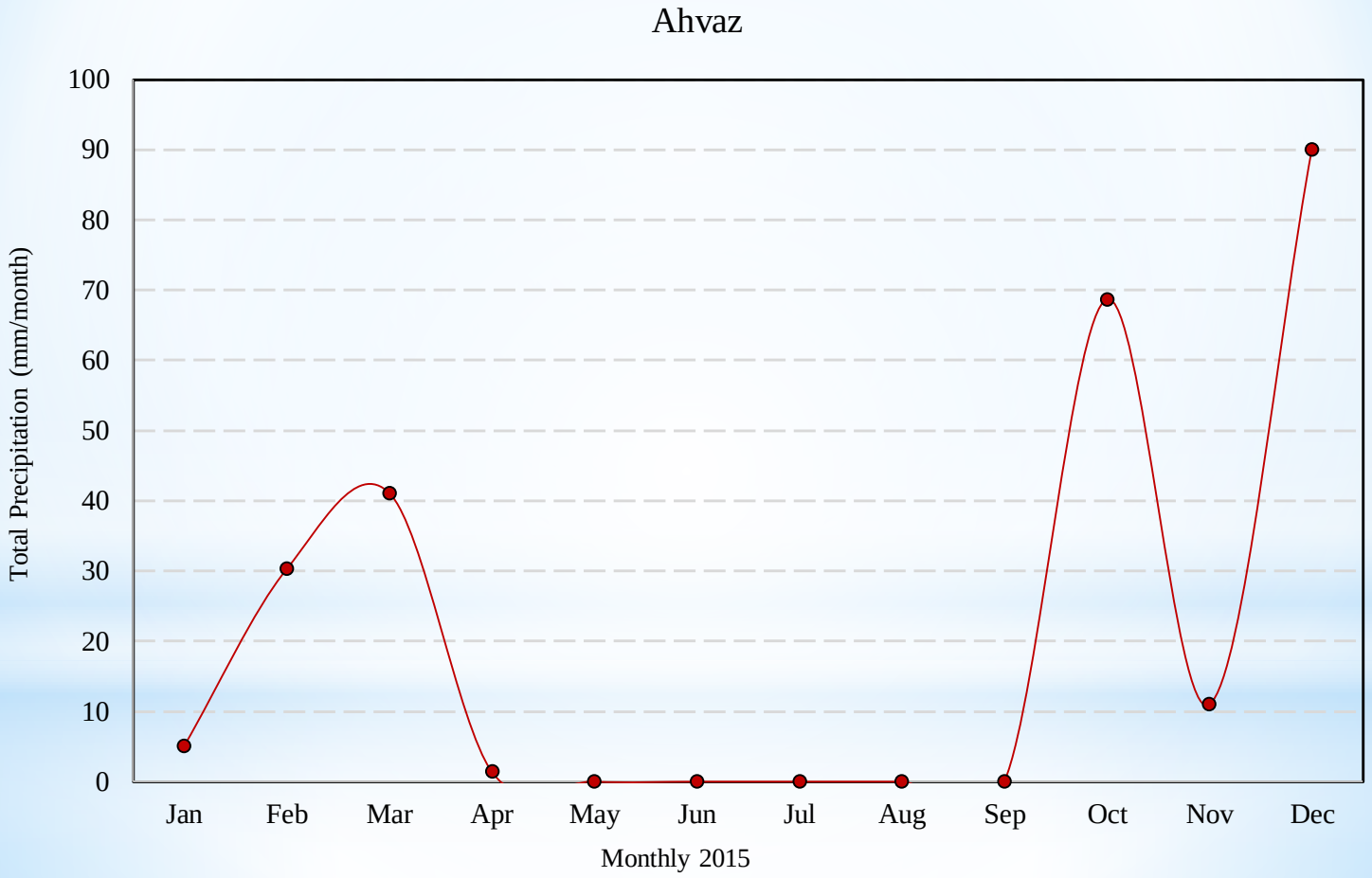
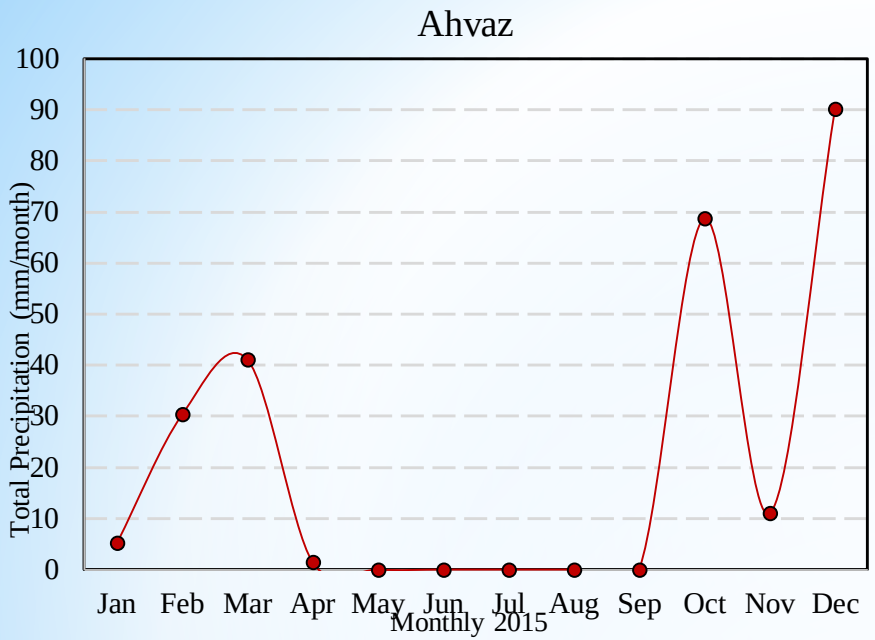


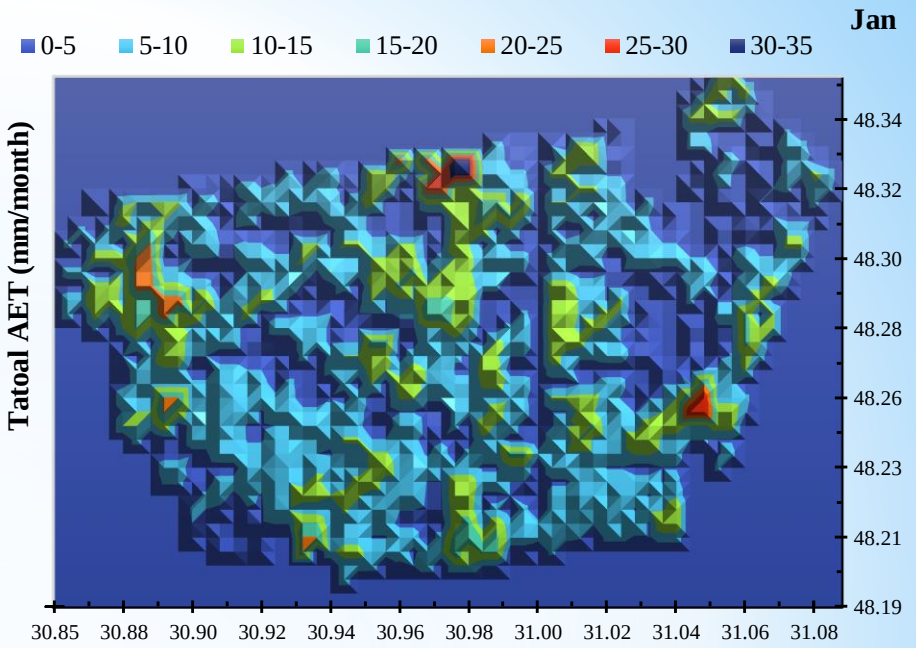
Fig. 5 All the AET data of the selected region is presented in the right table.

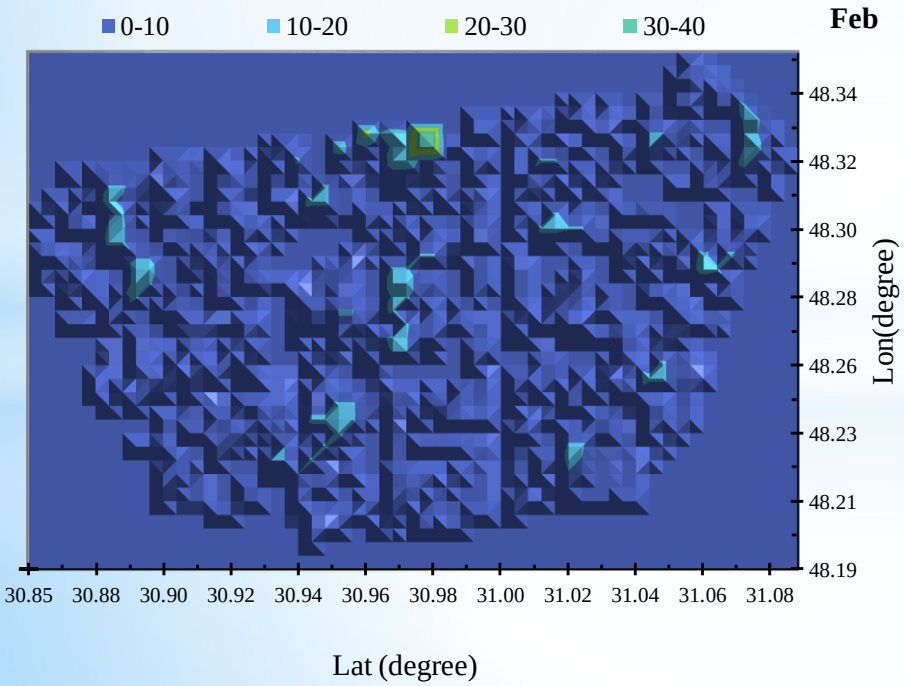
Results and Discussion

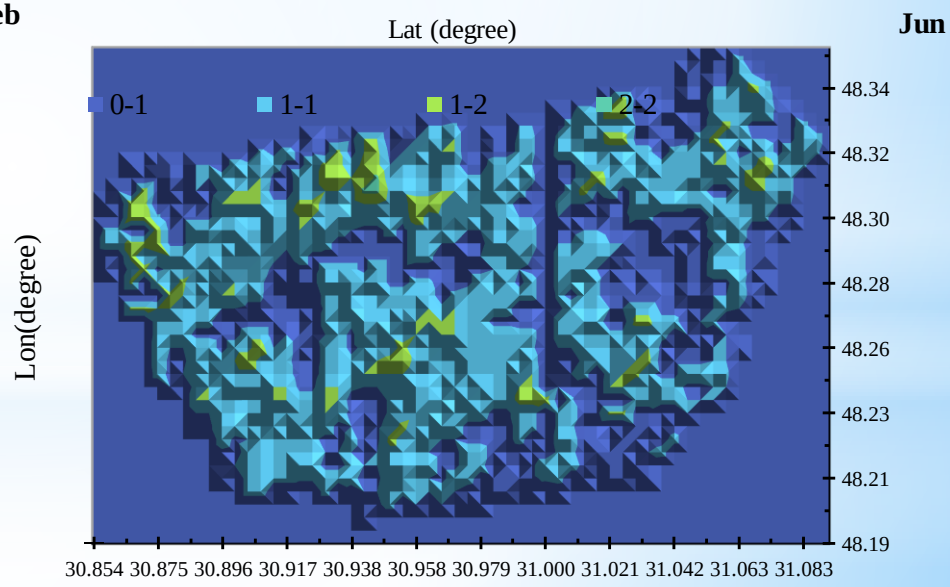
The nearest station to the selected field is the Ahvaz synoptic station.

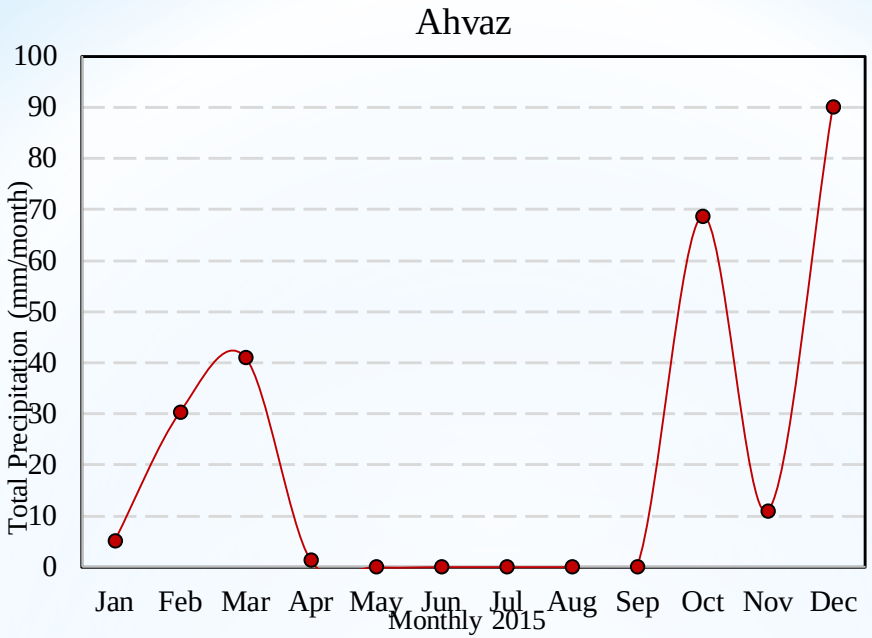


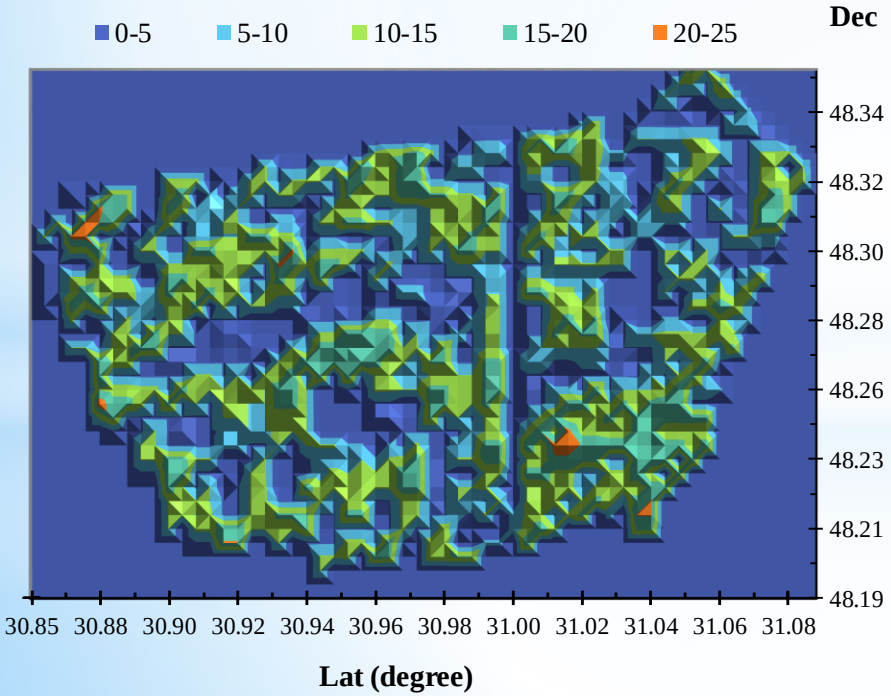

Ahvaz
Total Precipitation (mm/month)
100
90
80
70
60
50
40
30
20
10
0
Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
Monthly 2015

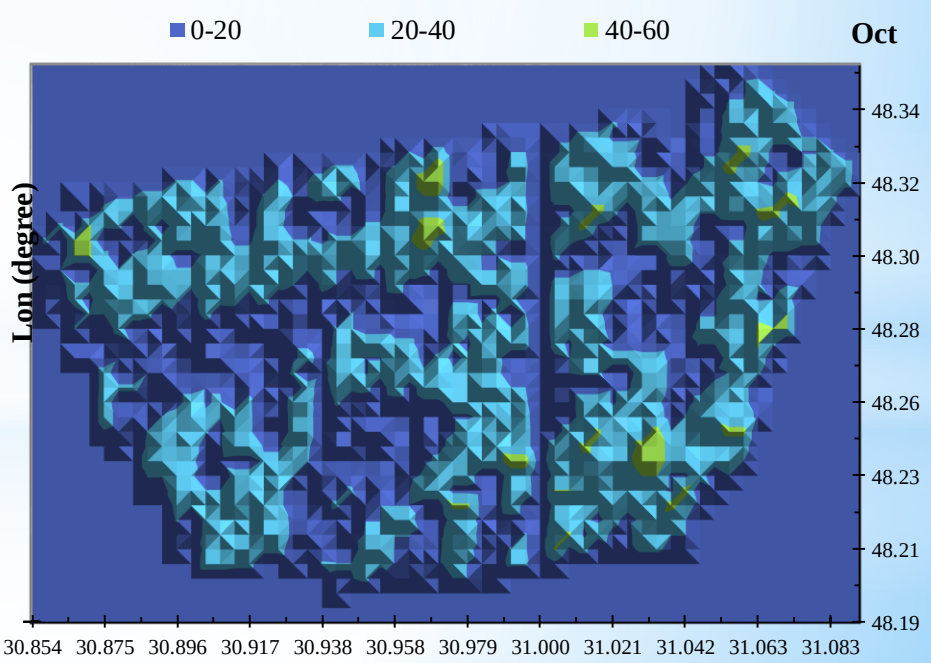

Jan
0-5 5-10 10-15 15-20 20-25 25-30 30-35
Tatoal AET (mm/month)
48.34
48.32
48.30
48.28
48.26
48.23
48.21
48.19
30.85 30.88 30.90 30.92 30.94 30.96 30.98 31.00 31.02 31.04 31.06 31.08


0-10 10-20 20-30 30-40
Feb
48.34
48.32
48.30
48.28
48.26
48.23
48.21
48.19
30.85 30.88 30.90 30.92 30.94 30.96 30.98 31.00 31.02 31.04 31.06 31.08
Lat (degree)


Jun
Lat (degree)
0-1 1-1 1-2 2-2
Lon(degree)
48.34
48.32
48.30
48.28
48.26
48.23
48.21
48.19
30.854 30.875 30.896 30.917 30.938 30.958 30.979 31.000 31.021 31.042 31.063 31.083


Ahvaz
Total Precipitation (mm/month)
100
90
80
70
60
50
40
30
20
10
0
Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
Monthly 2015


Dec
0-5
5-10
10-15
15-20
20-25
48.34
48.32
48.30
48.28
48.26
48.23
48.21
48.19
30.85 30.88 30.90 30.92 30.94 30.96 30.98 31.00 31.02 31.04 31.06 31.08
Lat (degree)


Oct
0-20
20-40
40-60
Lon (degree)
48.34
48.32
48.30
48.28
48.26
48.23
48.21
48.19
30.854 30.875 30.896 30.917 30.938 30.958 30.979 31.000 31.021 31.042 31.063 31.083

Conclusion

- ✓ Estimation of Actual Evapotranspiration (AET) is of vital importance in water resources management and planning in Iran.
- ✓ Calculating AET from direct and indirect methods are not easy and normally costly and time-consuming. So, remote sensing products are preferable.
- ✓ we developed a tool for extracting MOD16A2.
- ✓ The maximum amount of AET is equal to 60 mm/month and was happened in Oct., also the maximum amount of total precipitation was happened in Oct. and Dec. at 2015 with the amount of 91 and 63 mm/month.

Conclusion

- ✓ The archived results showed that we can use the tool for extracting AET and other variables including ET, PET, and LE.

Thanks for your attention