



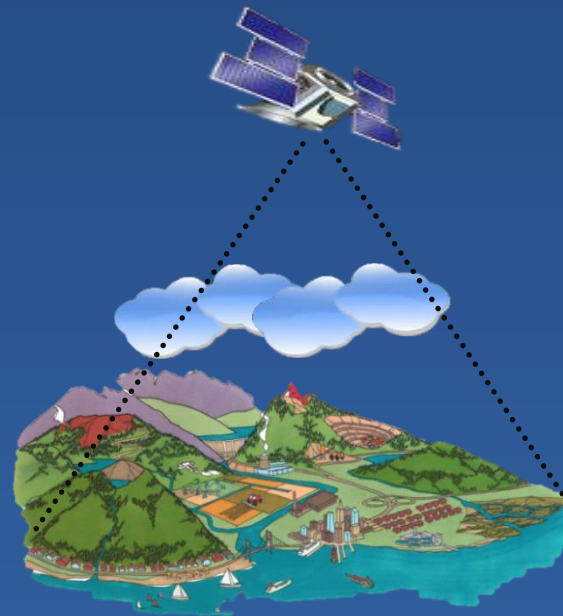
Islamic Republic Of Iran
Ministry Of Energy



Water Research Institute

Iranian Studies and Experiences Related to Water Resource Management Using Remote Sensing Data

«EvapoTranspiration (ET)»



27 February 2018
Neamat Karimi

Outline

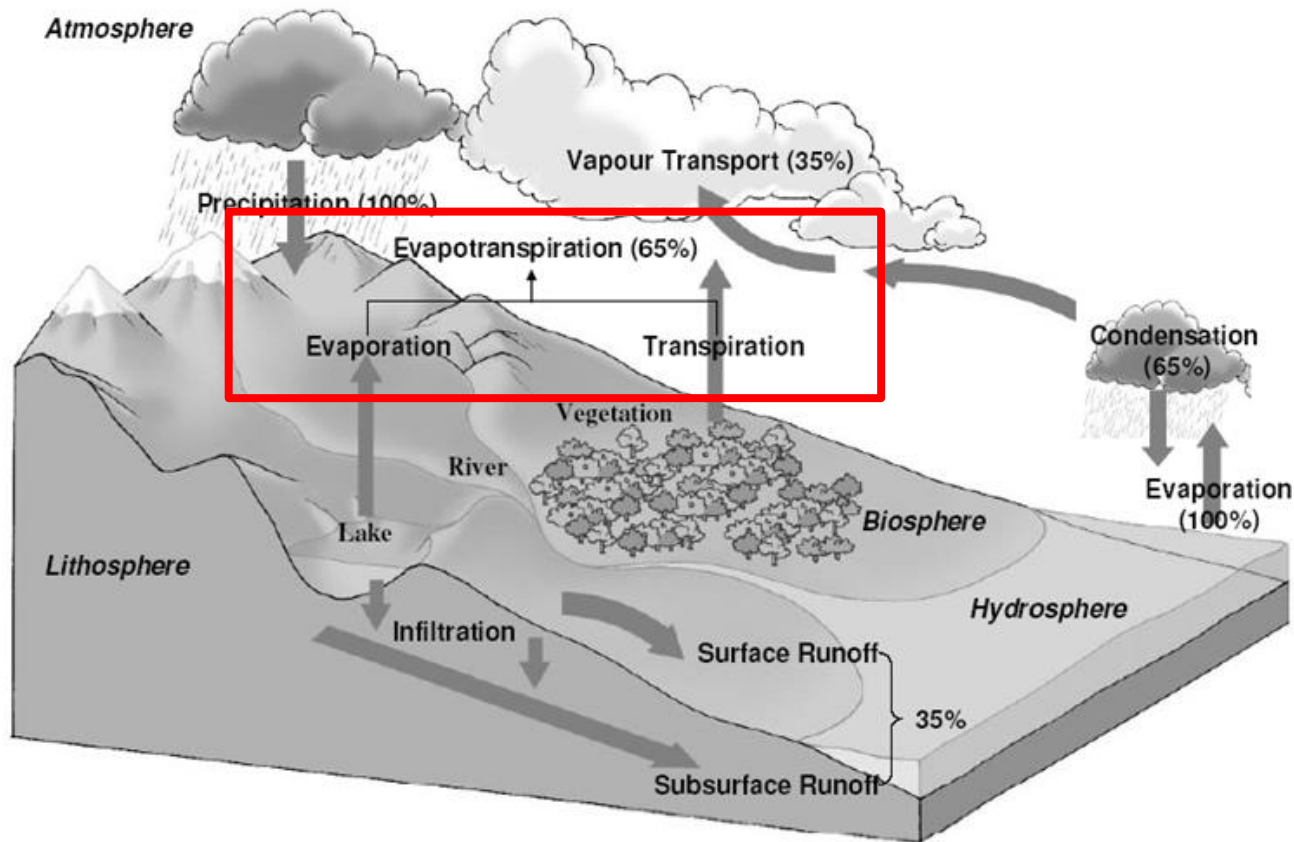


1	Introduction
2	ET Estimation Algorithms
3	Data Used
4	Accuracy Assessment and Results



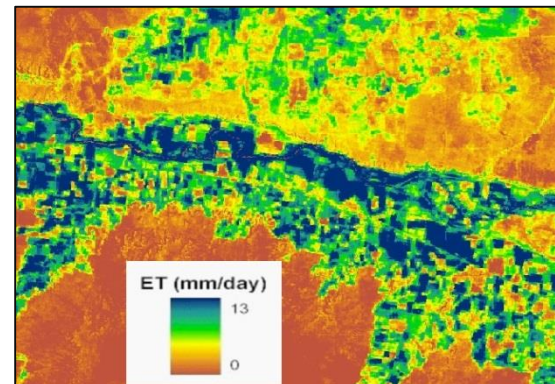
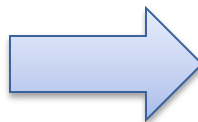
Introduction

- Evapotranspiration (ET) is the sum of evaporation and plant transpiration from the Earth's land and ocean surface to the atmosphere. ET is a main component of the water cycle because about 65% of precipitation is globally evacuated through ET.



Introduction

- Many water resources and agricultural management applications require the knowledge of surface evapotranspiration (ET) over a range of spatial and temporal scales.
- However, it is impractical to obtain ET using ground-based observations over large area.
- Satellite remote sensing is a promising tool to estimate the spatial distribution of ET with minimal use of in situ observational data.
- The objective of this project is **to map ET spatial distribution over large areas using primarily remote sensing data.**



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EvapoTranspiration Estimation Algorithms



- 1) **One-source energy balance** models which are based on defining the maximum and minimum ET over the study areas and estimating the ET of other pixels by interpolating the surface properties and conditions: SEBAL, SEBS, SEBI and METRIC
- 2) **Two-source energy balance** models which distinguish the contribution of soil and vegetation covers on surface energy balance and total amount of ET: ALEXI
- 3) Models based on distributions in **surface temperature–vegetation index** triangle/trapezoid space.

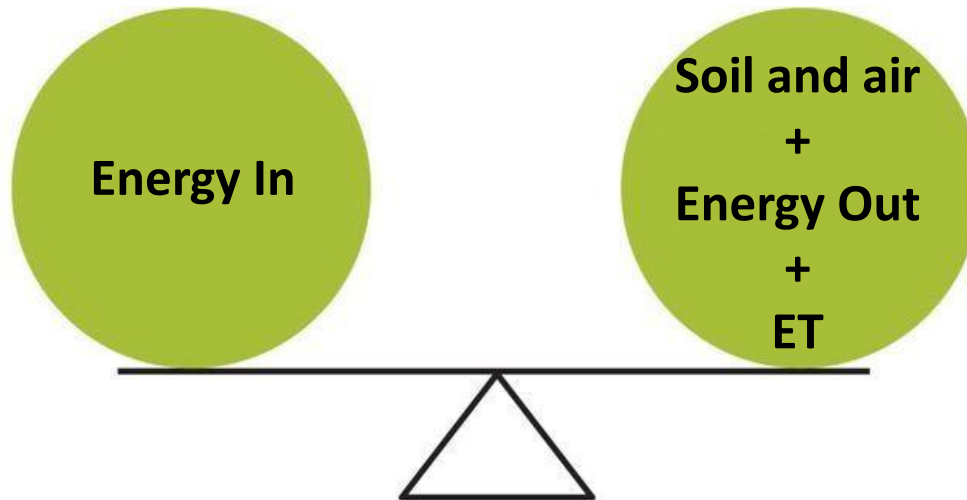


What is the Energy Balance Algorithms?

The basis of all energy balance models:

The energy driving the hydrological cycle (ET) is equal to the incoming energy minus:

- ❑ the energy going to heating of the soil and air
- ❑ the energy reflected back to space.



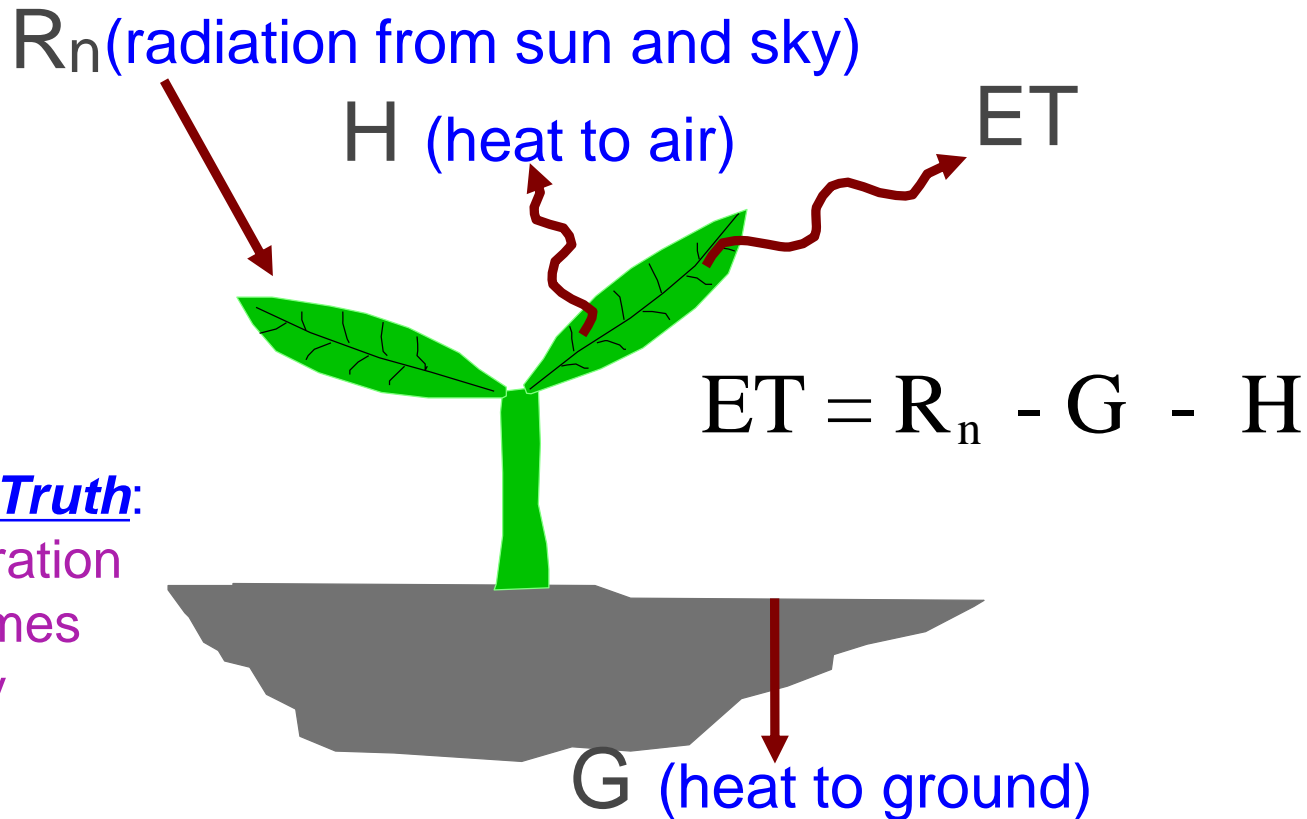
$$ET = \text{Energy In} - (\text{Energy for Soil} + \text{Air} + \text{Energy Out})$$



What is the Energy Balance Algorithms?



- ET is calculated as a “residual” of the energy balance



Basic Truth:

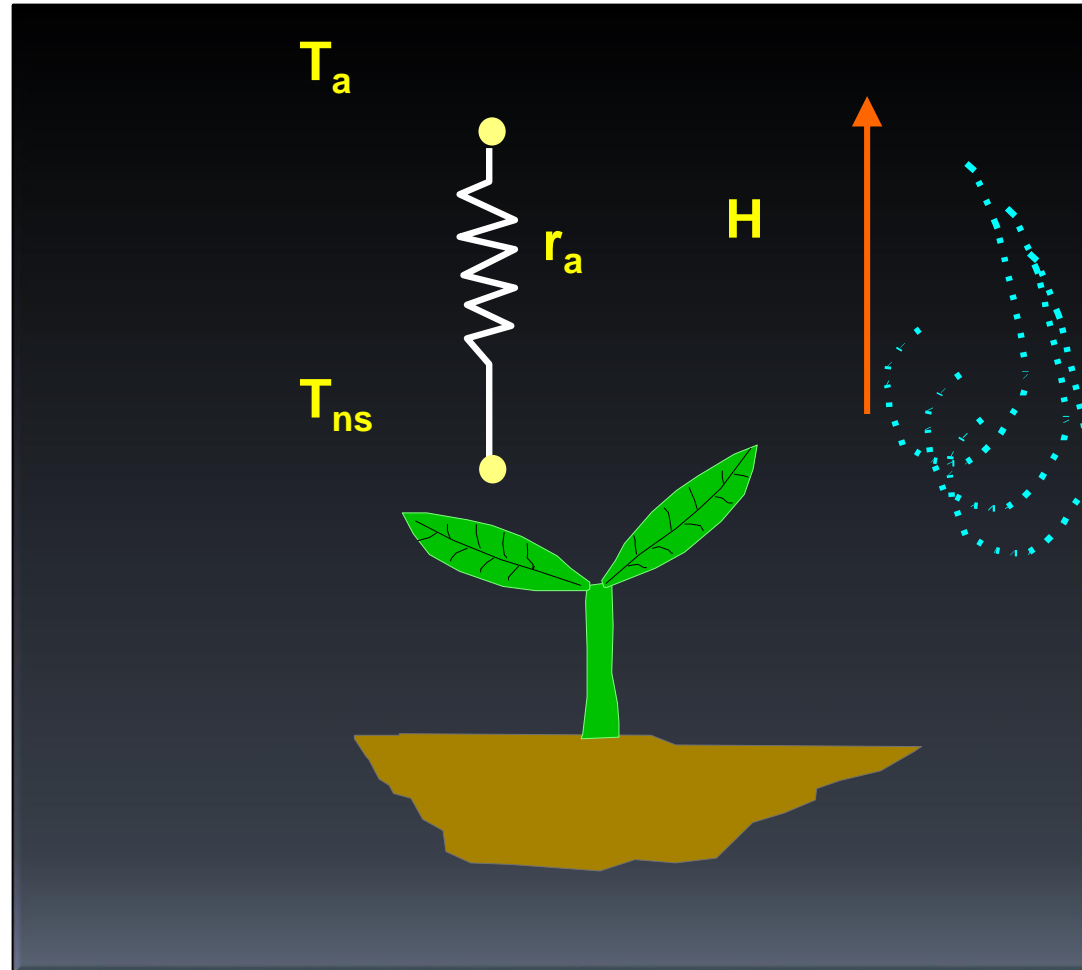
Evaporation
consumes
Energy



$$ET = R_n - G - H$$

Sensible heat flux is the rate of heat loss to the air by convection and conduction, due to a temperature difference.

$$H = \frac{\rho \cdot C_p \cdot dT}{r_{ah}}$$



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Satellite Images and Algorithms Used

- ◎ Energy Balance algorithms needs both short wave and thermal bands

- ◎ Several images can use images from:

- NASA-Landsat (30 m, 16 days) - since 1982
- NOAA-AVHRR (1 km, daily) - since 1980's
- NASA-MODIS (500 m, daily) - since 1999

- ◎ Algorithms:

- 'SSEBop'
- 'SEBAL'
- 'ETLook'
- 'Modified EB'



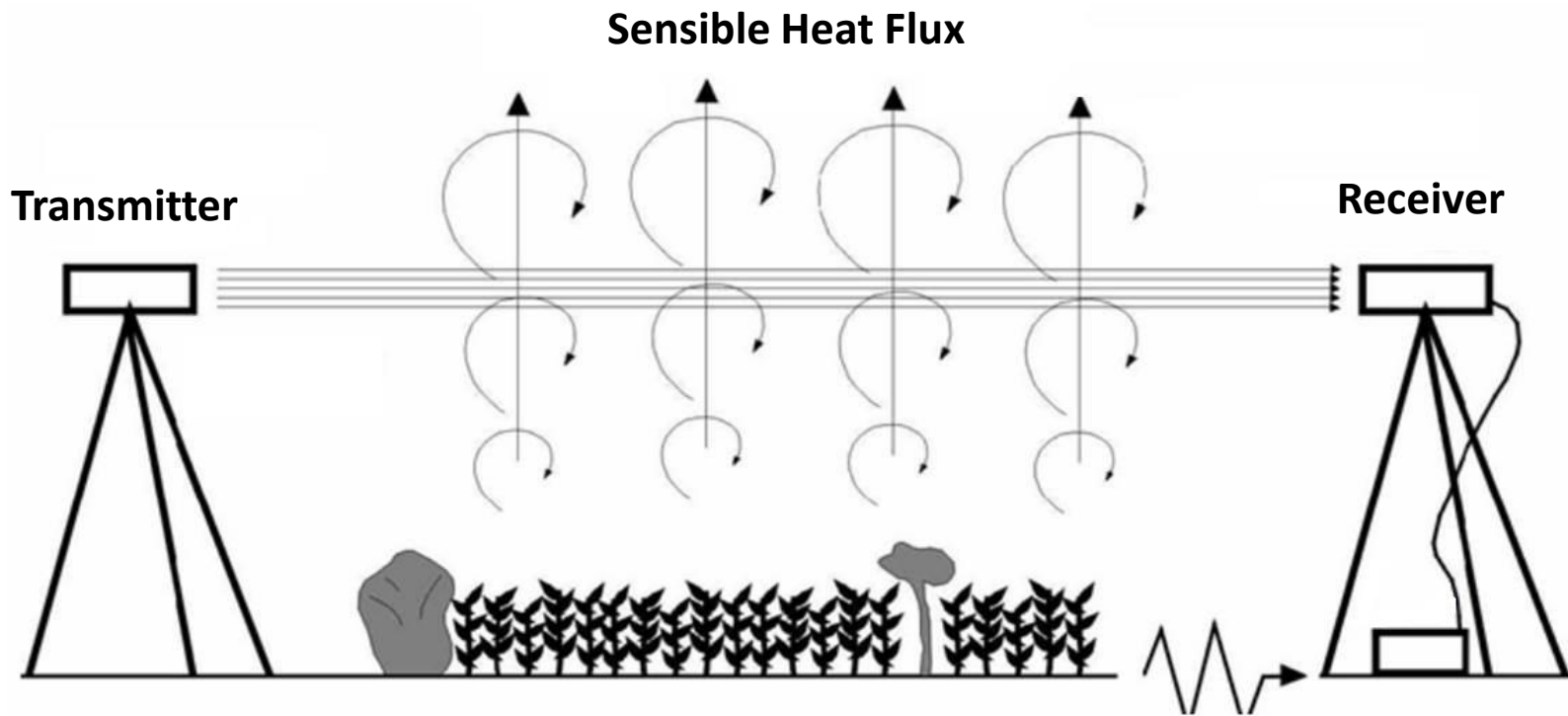
Outline



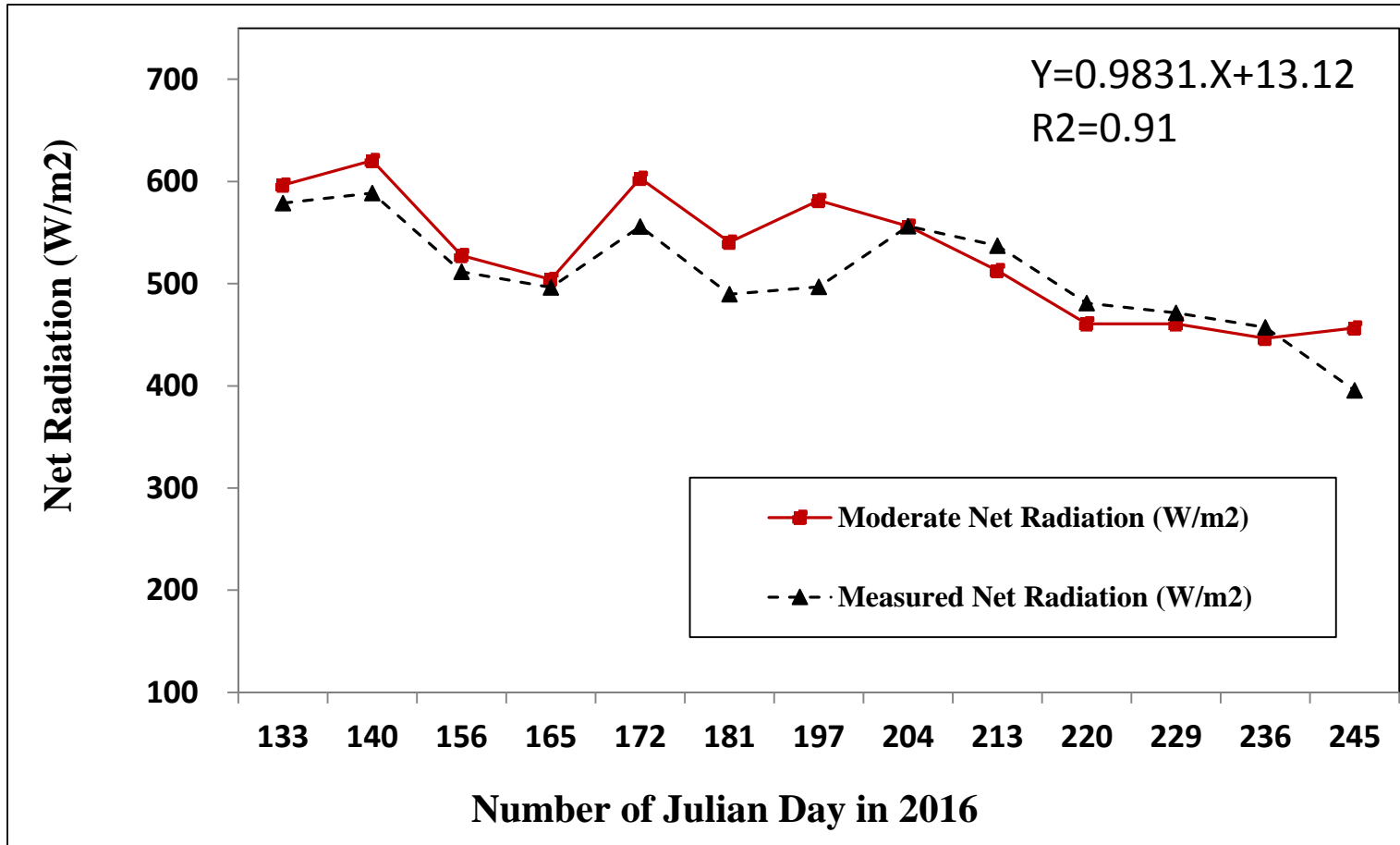
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②	ET Estimation Algorithm
③	Data Used
➤ ④	Accuracy Assessment and Results



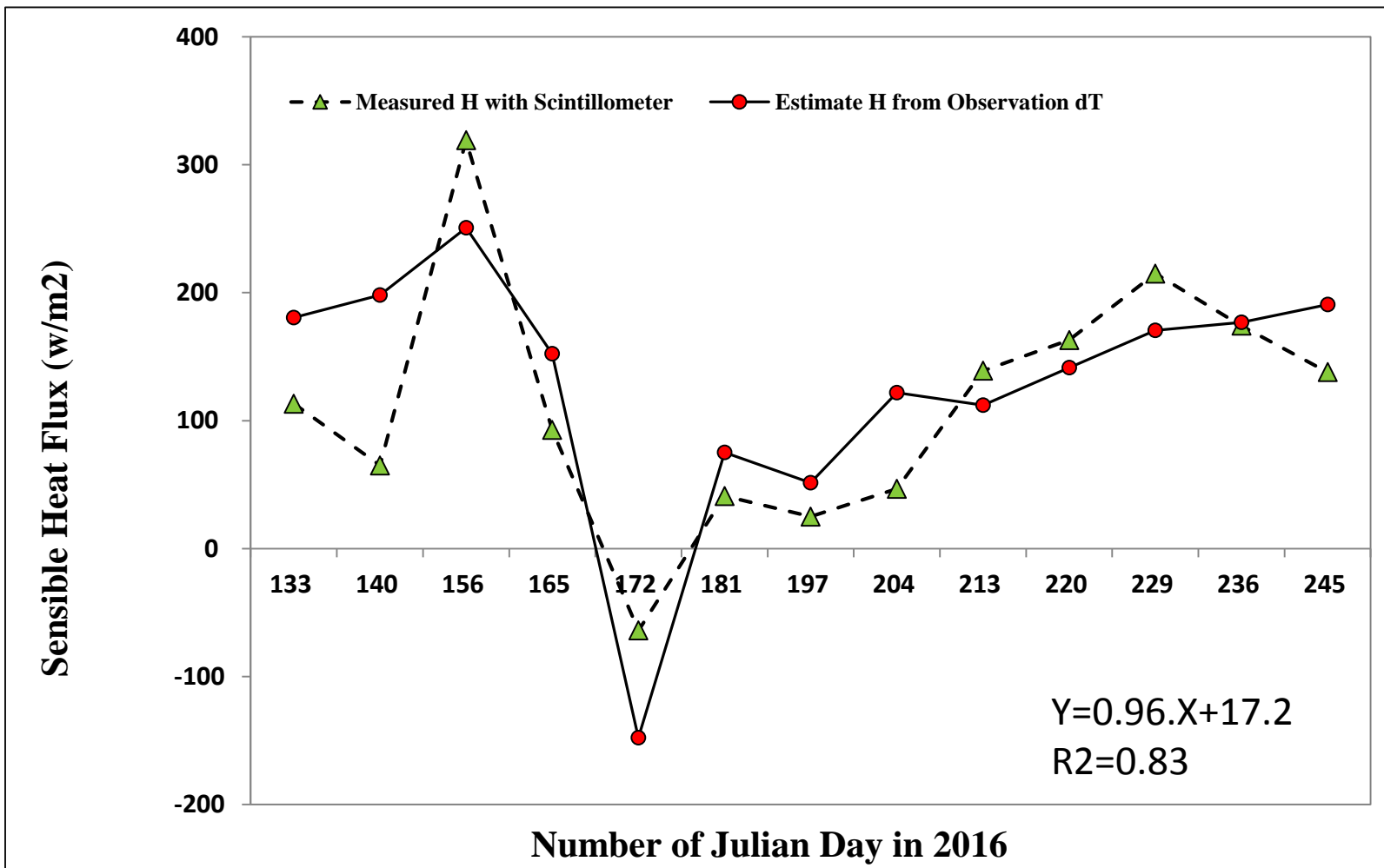
Validation with Scintillometer



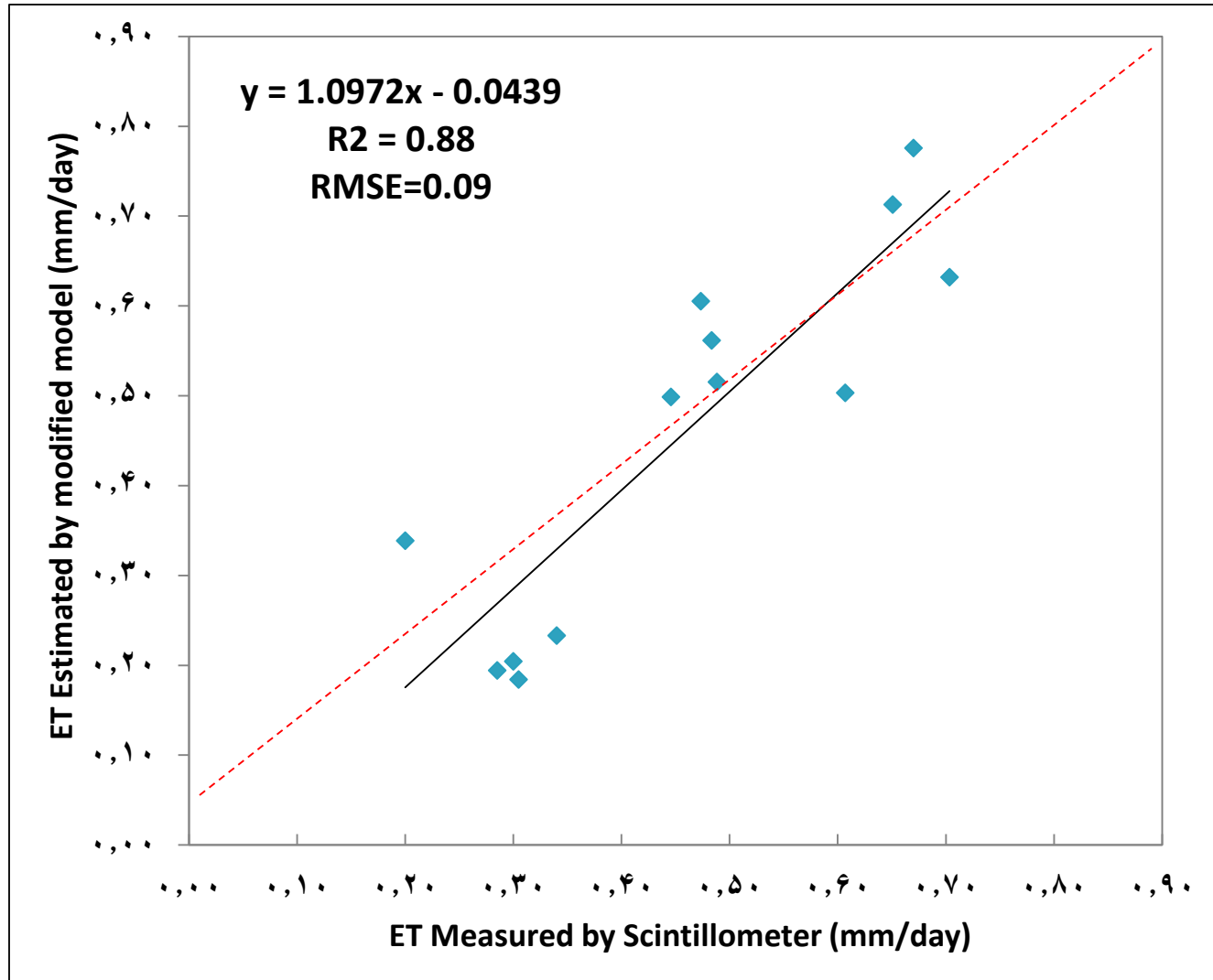
Validation of Net Radiation (Rn)



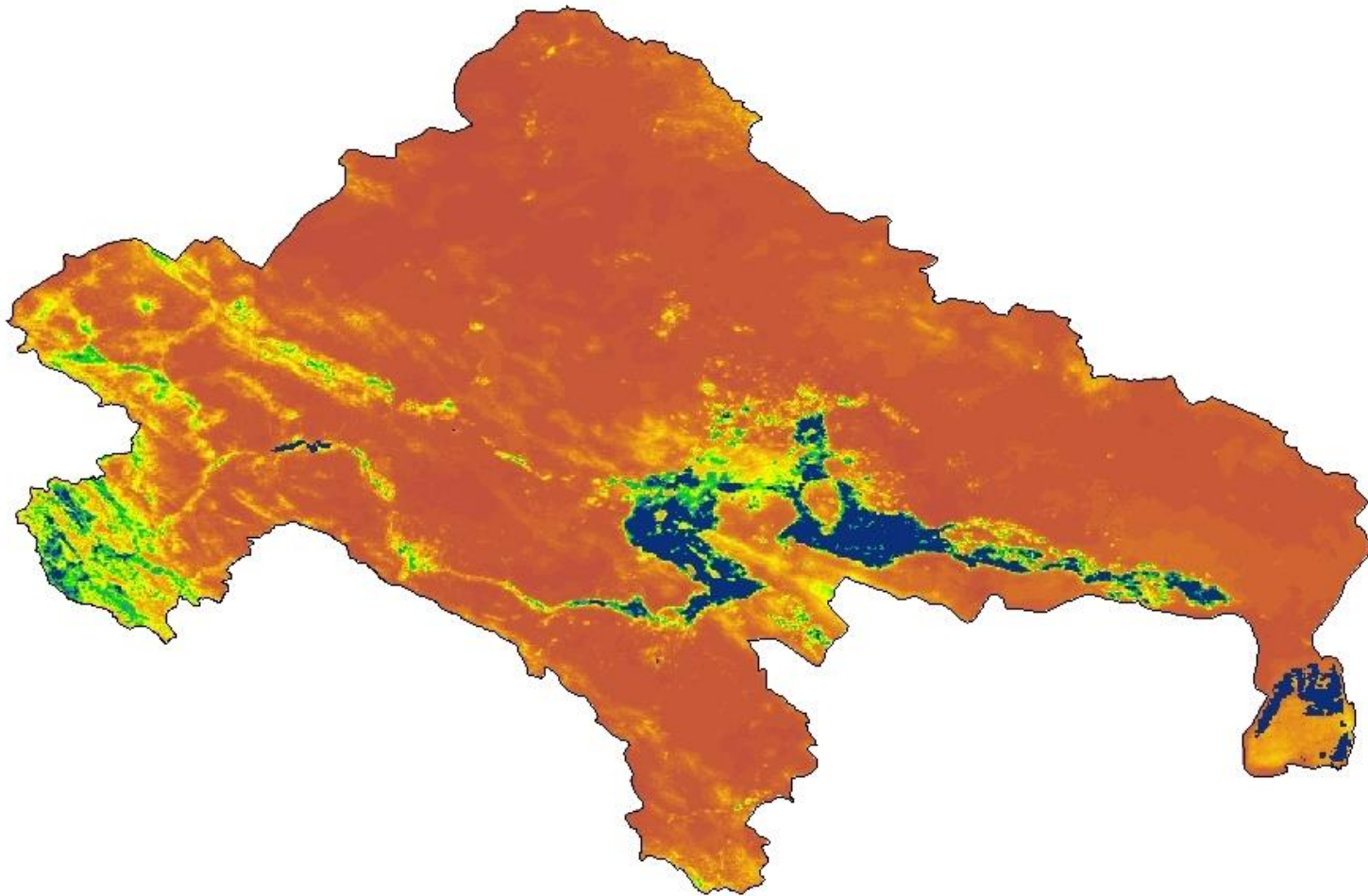
Validation of Sensible Heat Flux (H)



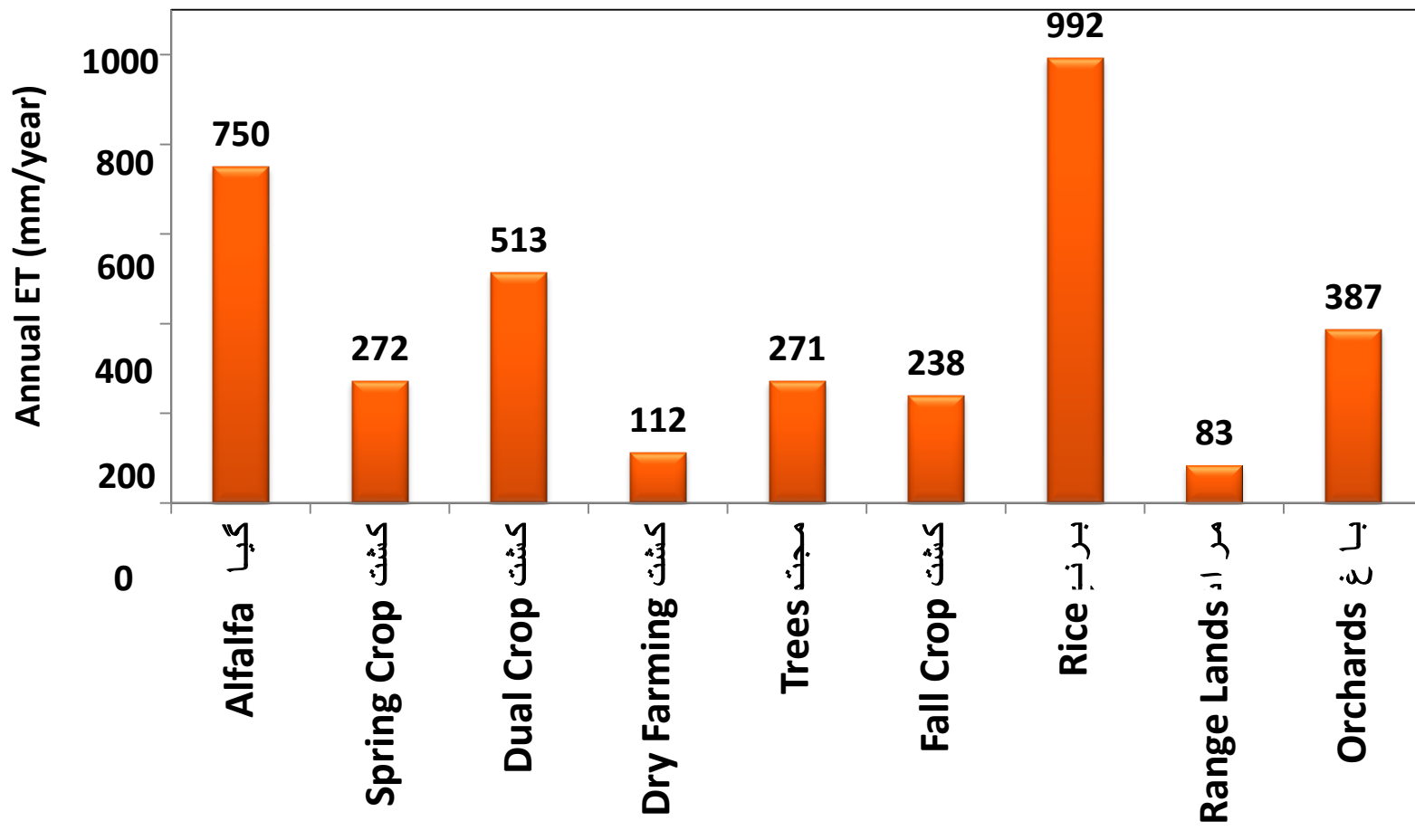
Validation of Final Evapotranspiration (ET)



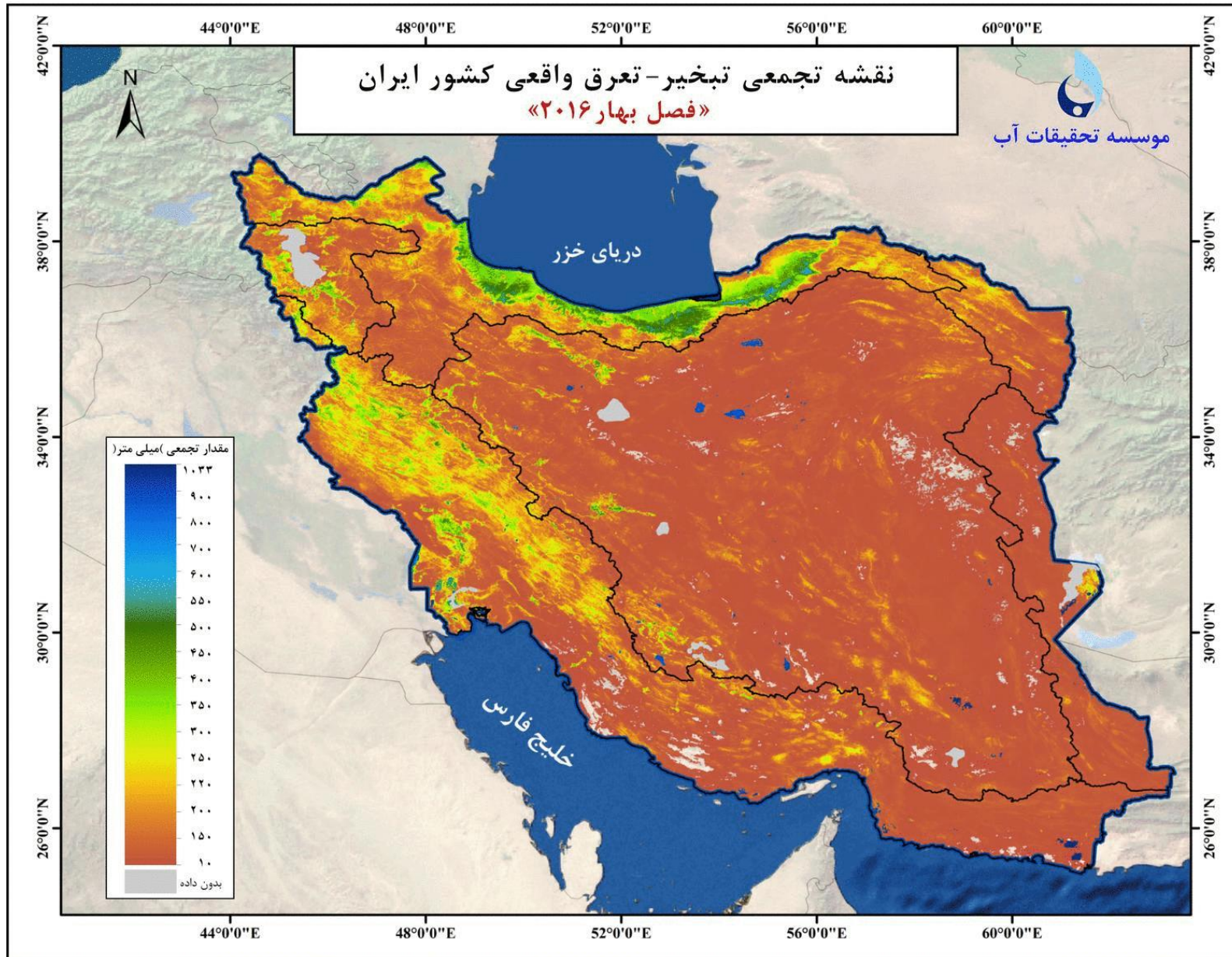
Monthly Changes of ET Over Esfahan Basin



Annual ET of Different Land Use/ Land Cover (2016)



Seasonal ET of Iran





Thank you For Your Attention

Alamkouh Glacier, Iran

<http://wrr-wri.ir/>