

# Application of SWAT to Quantify Internal Renewable Water Resources in Iran

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### General overview of the Project

- The proposed research project aims to assess the feasibility of applying the ‘virtual water strategy’ to alleviate water stress in Iran.

**Regional crop  
structure  
adjustment**

**Inter-provincial  
food trade**

**Socio-economic  
factors**

**improving regional/provincial  
and national  
water productivity and  
Water use efficiency**

Background

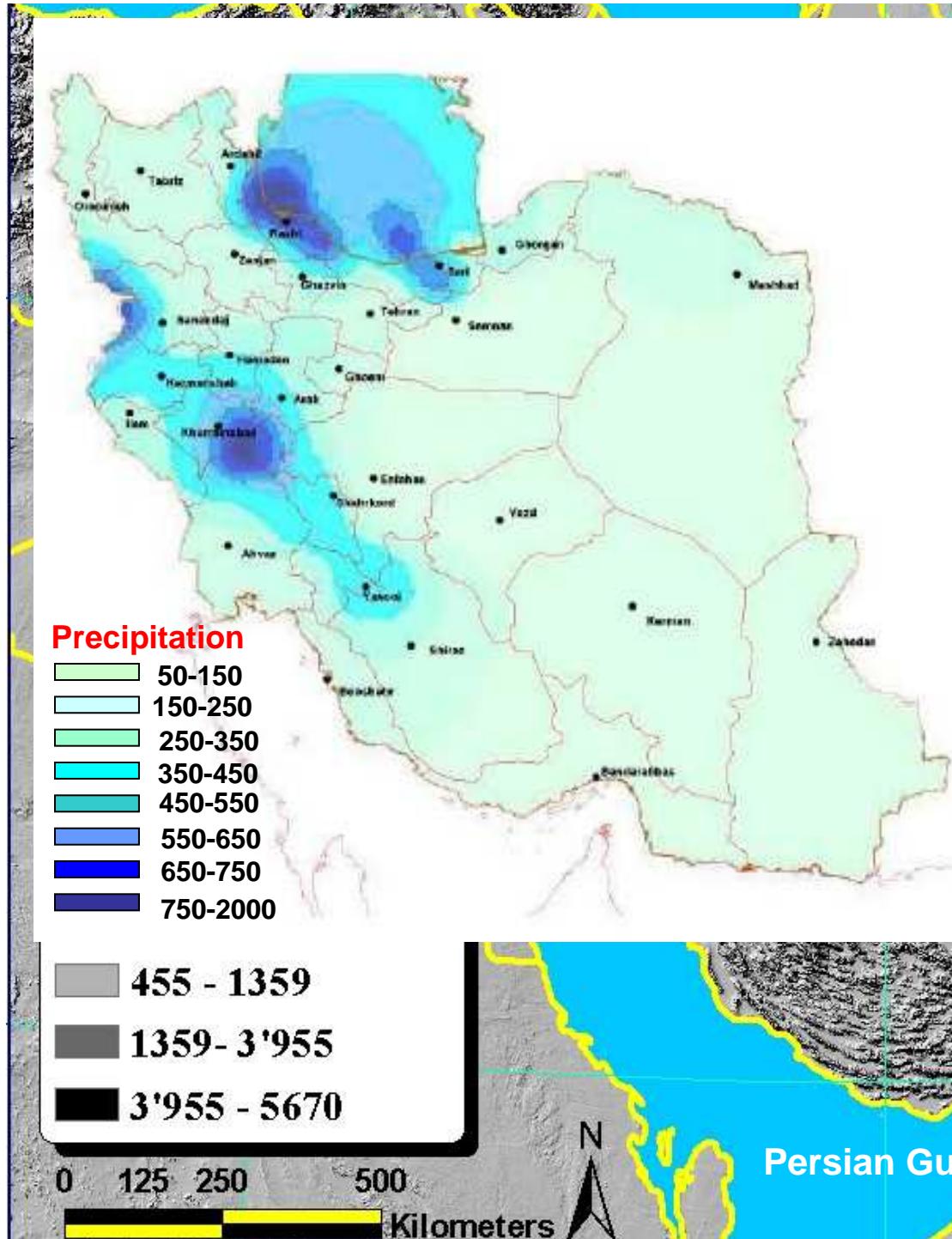
## Objectives

Methodology

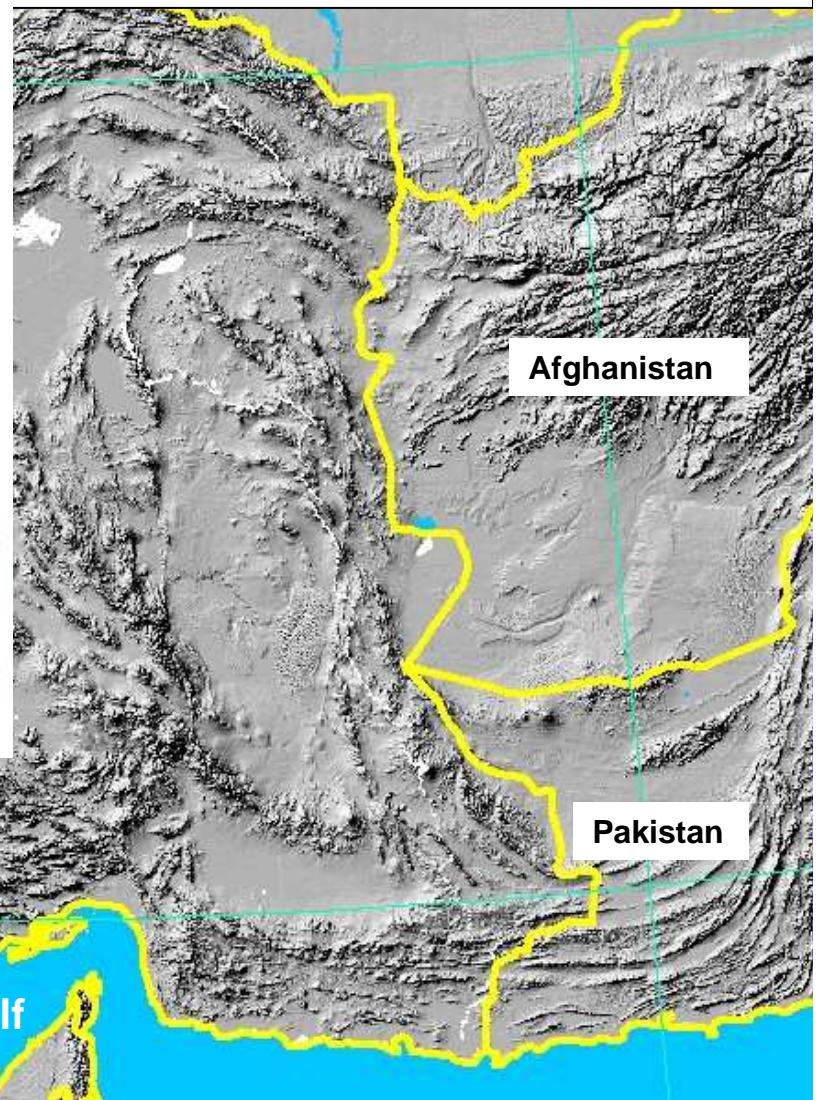
Results and outlook

### Start with SWAT:

- *Quantification of regional water resources*
- *Quantification of provincial water resources*



Area: 1,648,000 km<sup>2</sup> (165 million hectare)  
Altitudes: -80 m to 5670 m  
Average annual precipitation: 252 mm  
Precipitation range: 20-2000 mm  
Temperature: -44 to 56 degree C.



**Karkheh Dam**

**Max. Volume: 8437.0 MCM**

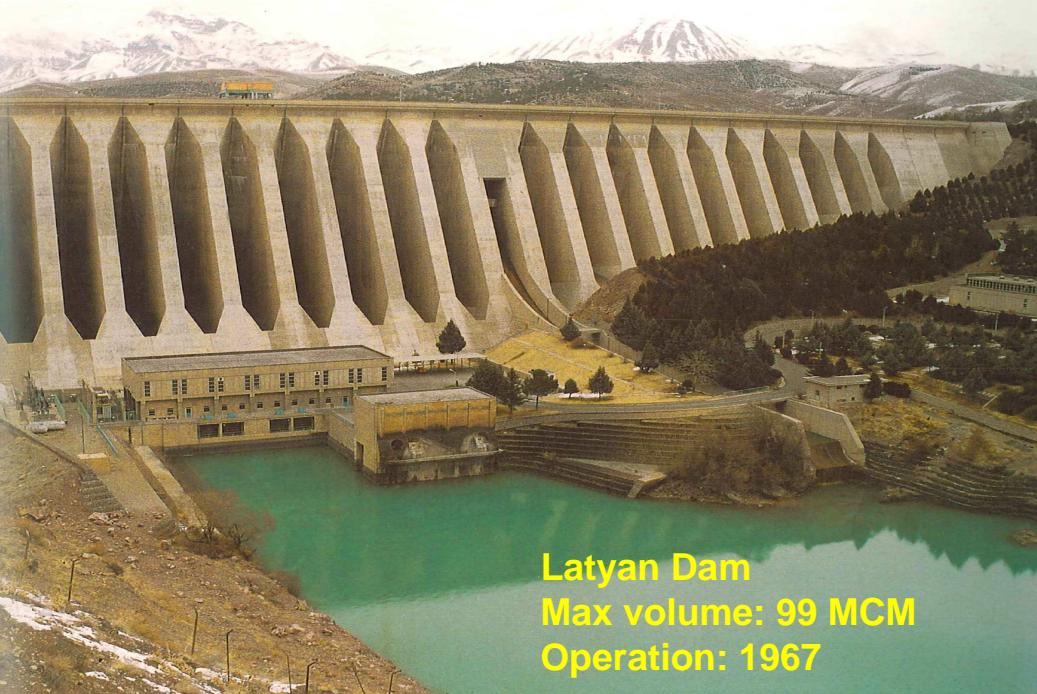
**Operation: 2000**



**Karaj Dam**

**Max volume: 206.35 MCM**

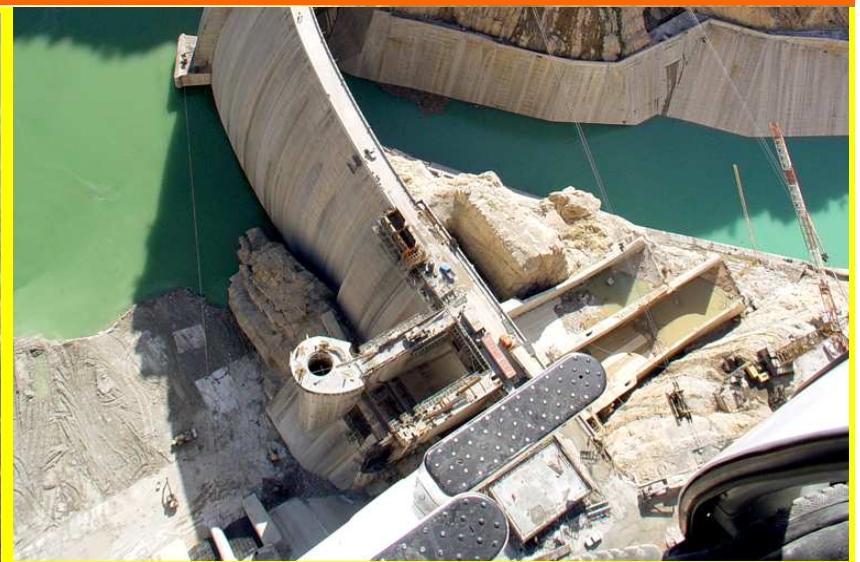
**Operation: 1961**



**Latyan Dam**

**Max volume: 99 MCM**

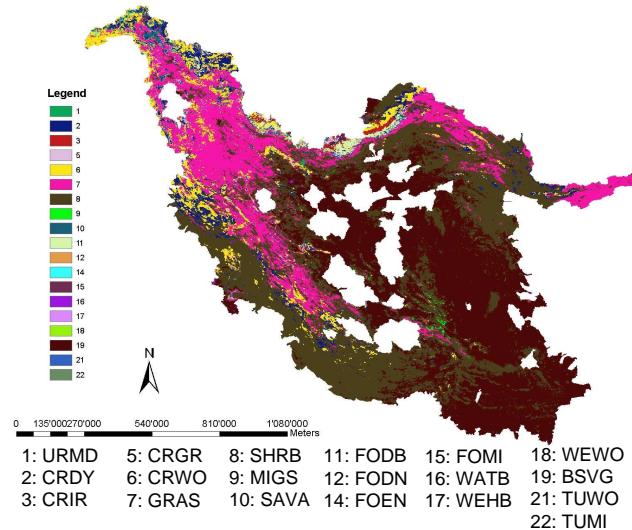
**Operation: 1967**



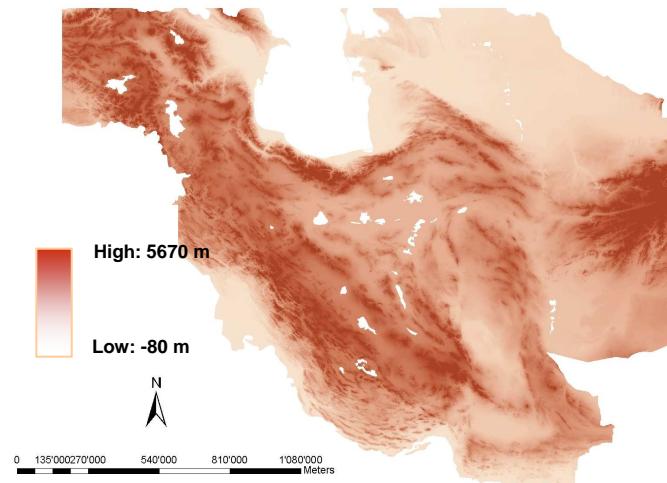
# Model input

## (Global data)

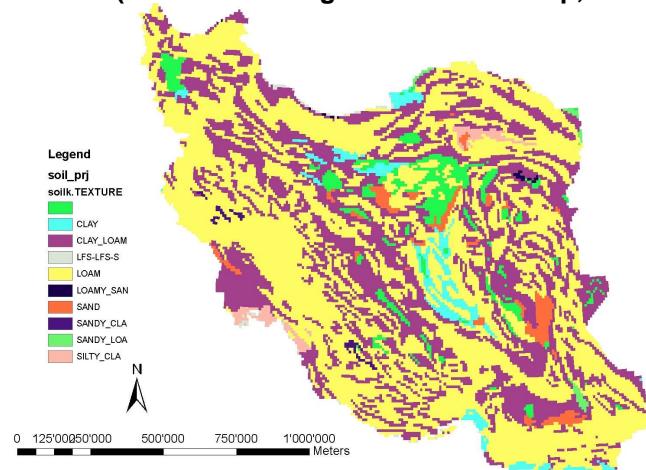
Landuse (Extracted from global USGS landuse/land cover)



DEM (Extracted from global USGS DEM map)



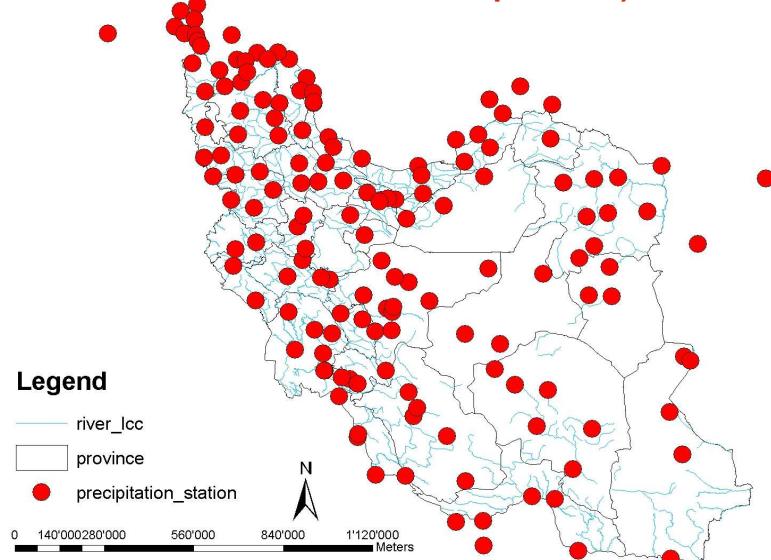
Soil (Extracted from global FAO soil map, 1995)



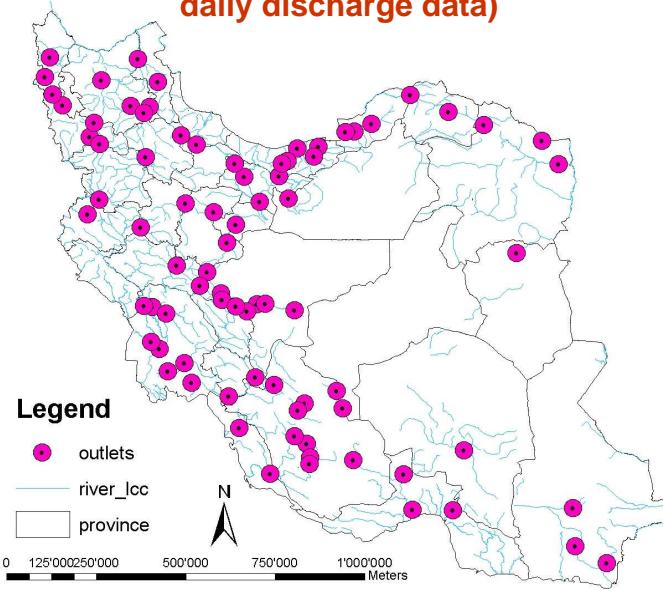
# Model input

## (Local data)

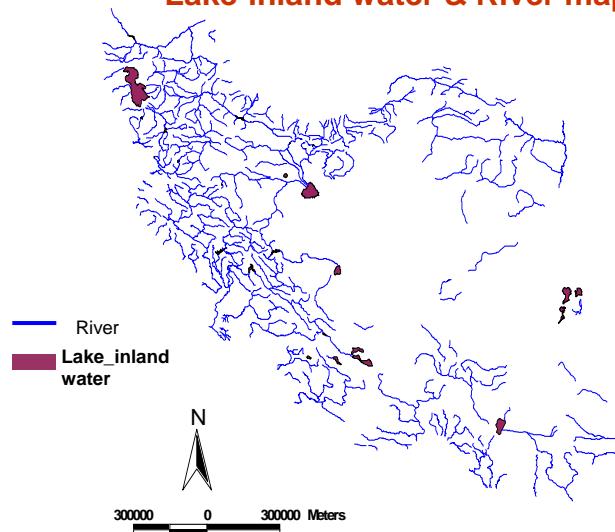
**Synoptic stations (providing daily precipitation, max. and min. temperature)**



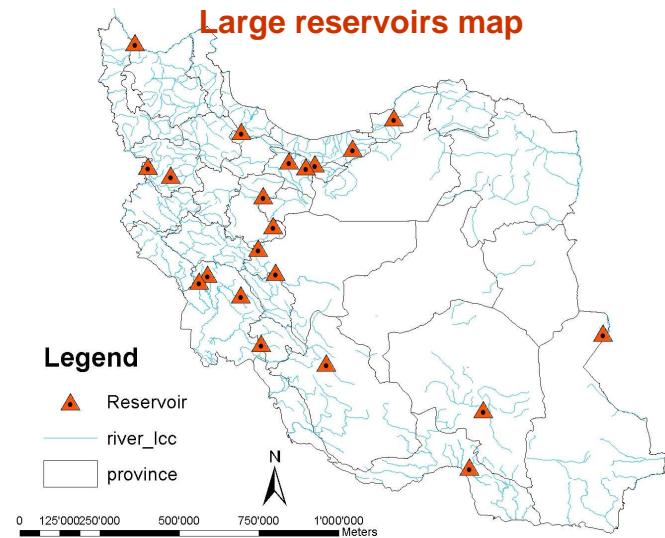
**Hydrometric stations (providing river daily discharge data)**



**Lake-inland water & River map**



**Large reservoirs map**



## **Model setup**

- 1. Arc-GIS (Olivera et al., 2006) interface was used to parameterize whole the area**
- 2. Based on DEM and stream network whole the area was divided into 506 sub-basins (threshold drainage area was set to 600 km<sup>2</sup>)**
- 3. Dominant soil and land use was selected to provide soil and land use data in the model**
- 4. 20 large reservoirs/dams were contributed to the model**
- 5. Considered simulation period for calibration was 16 years from 1987-2003 considering 3 years warm up period**

## Definition of three approaches used in calibration processes using SUFI-2:

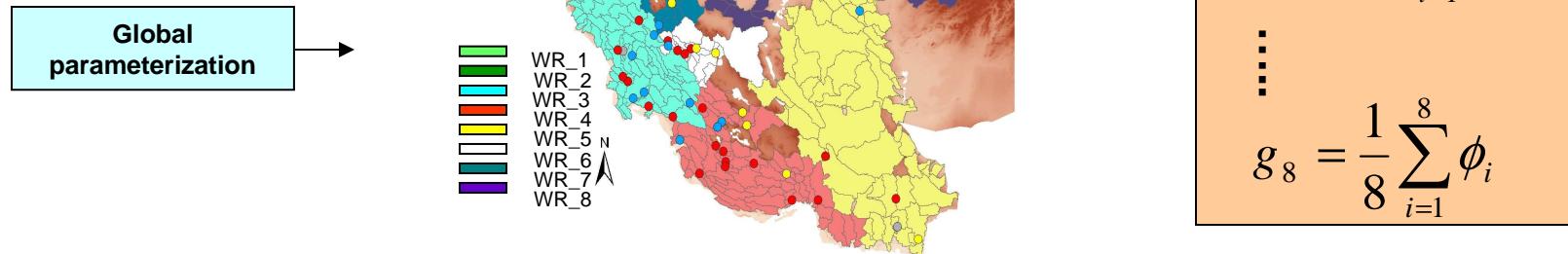
### 1. Global approach



### 2. Scaling approach

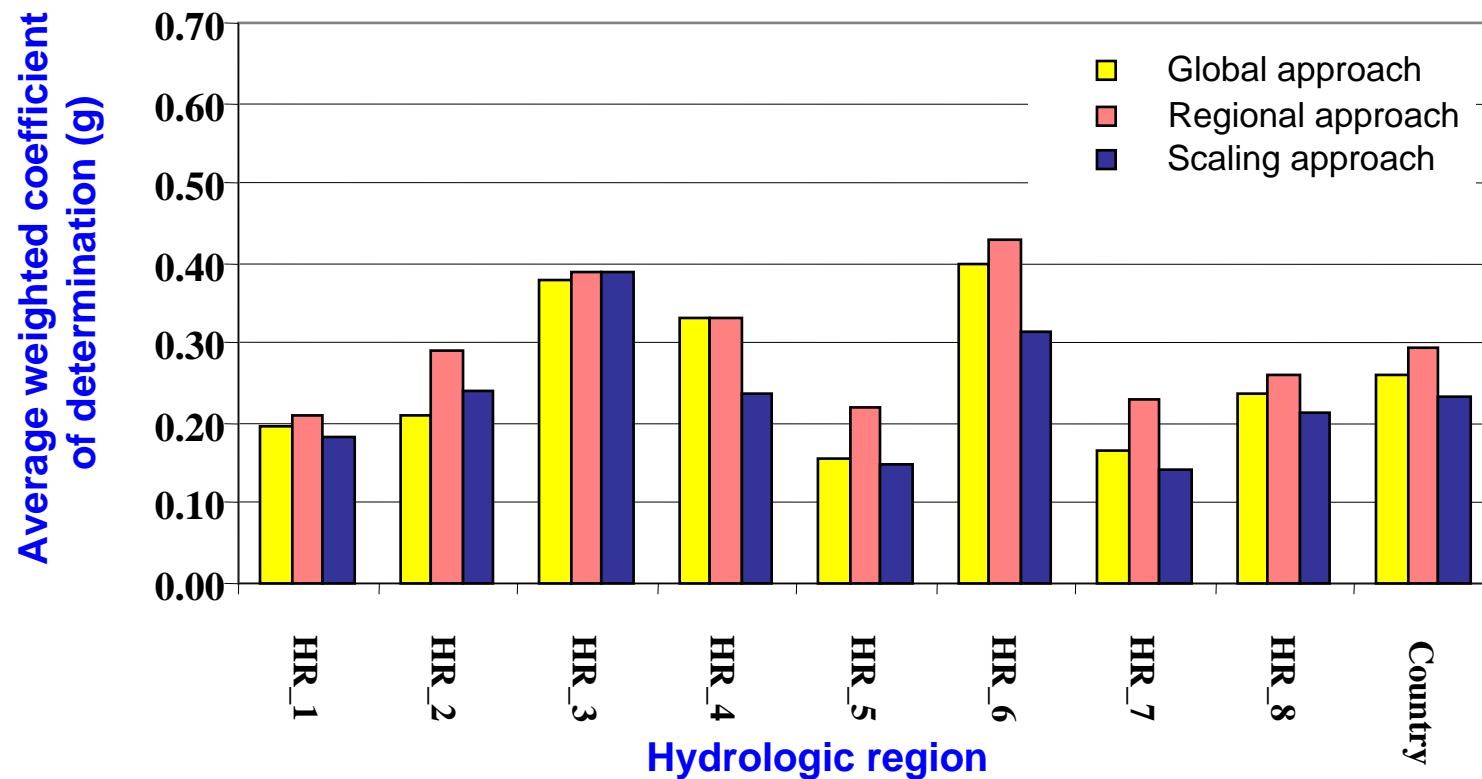


### 3. Regional approach



(Krause et al., 2005):

$$\varphi = \begin{cases} bR^2 & \text{for } 0 < b \leq 1 \\ \frac{b-1}{b} R^2 & \text{for } b > 1 \end{cases}$$



Average weighted coefficient of determination for the eight hydrologic regions and the whole country

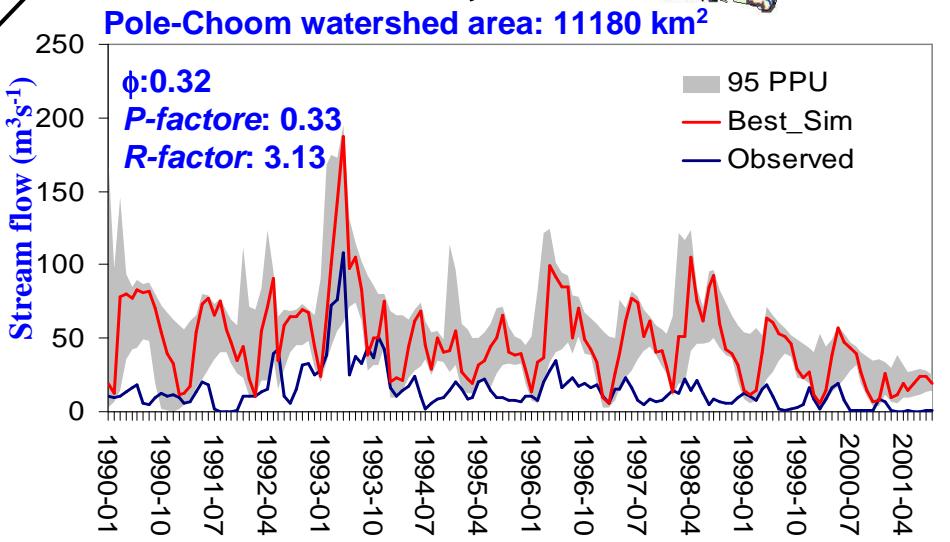
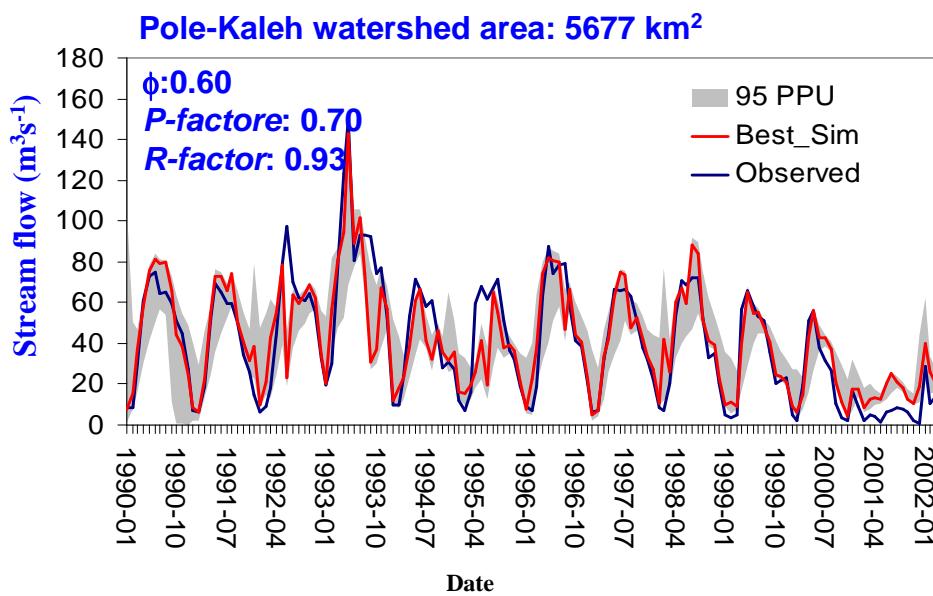
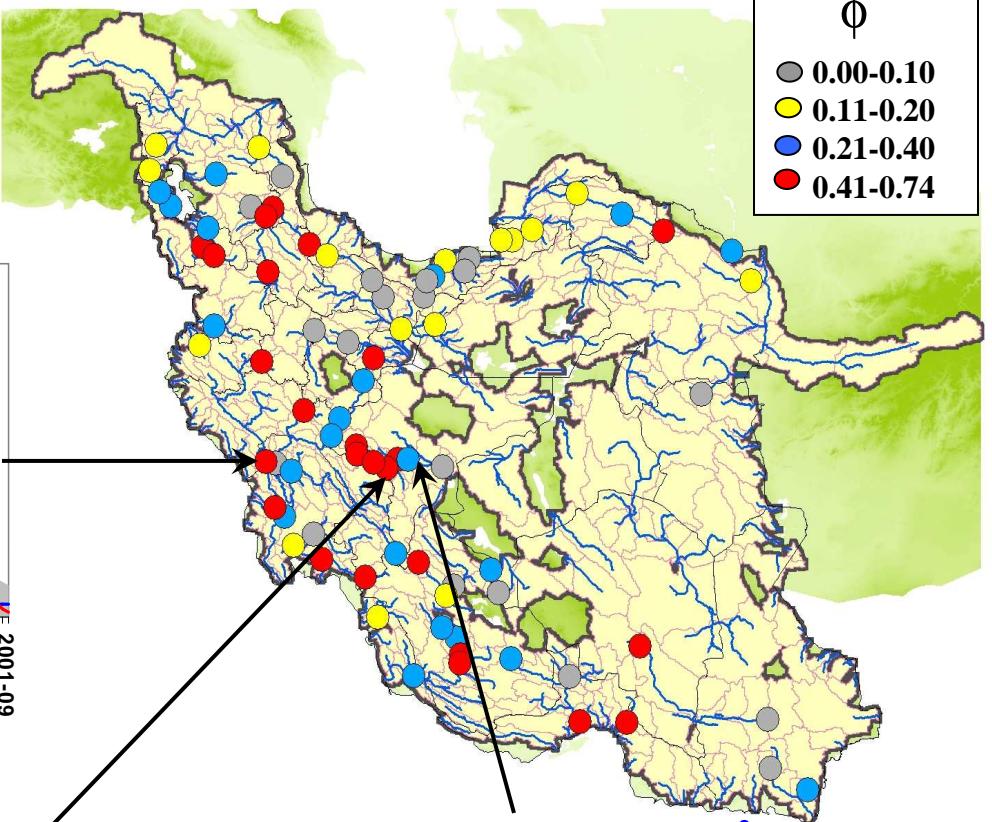
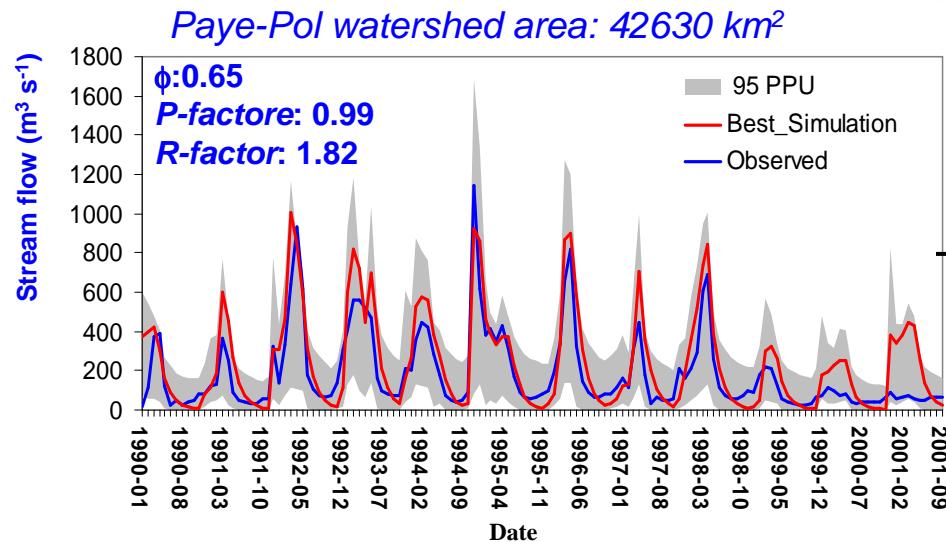
## Background

## Objectives

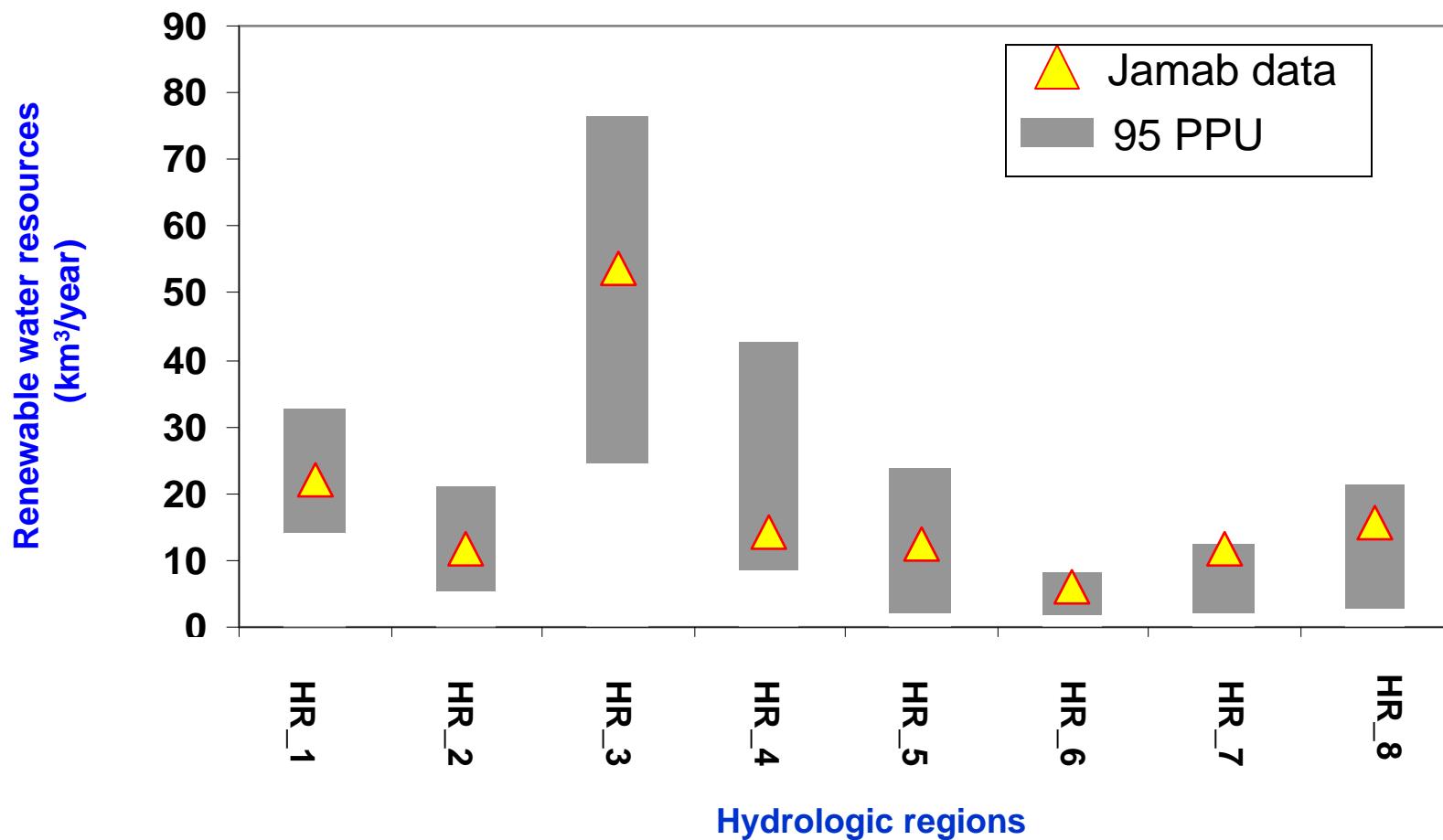
## Methodology

## Results

**Weighted coefficient of determination ( $\phi$ ) at 81 stations across the Country**

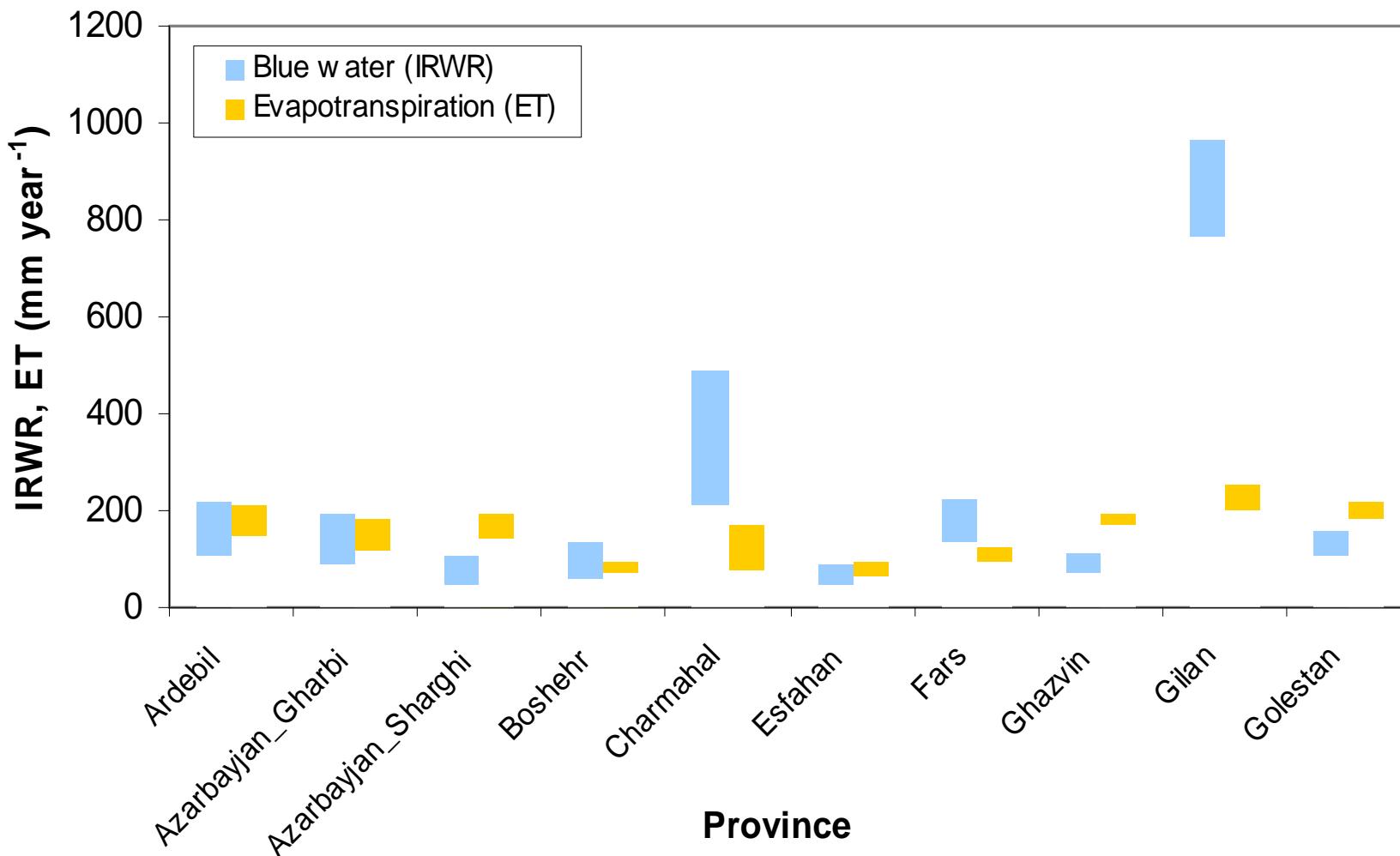


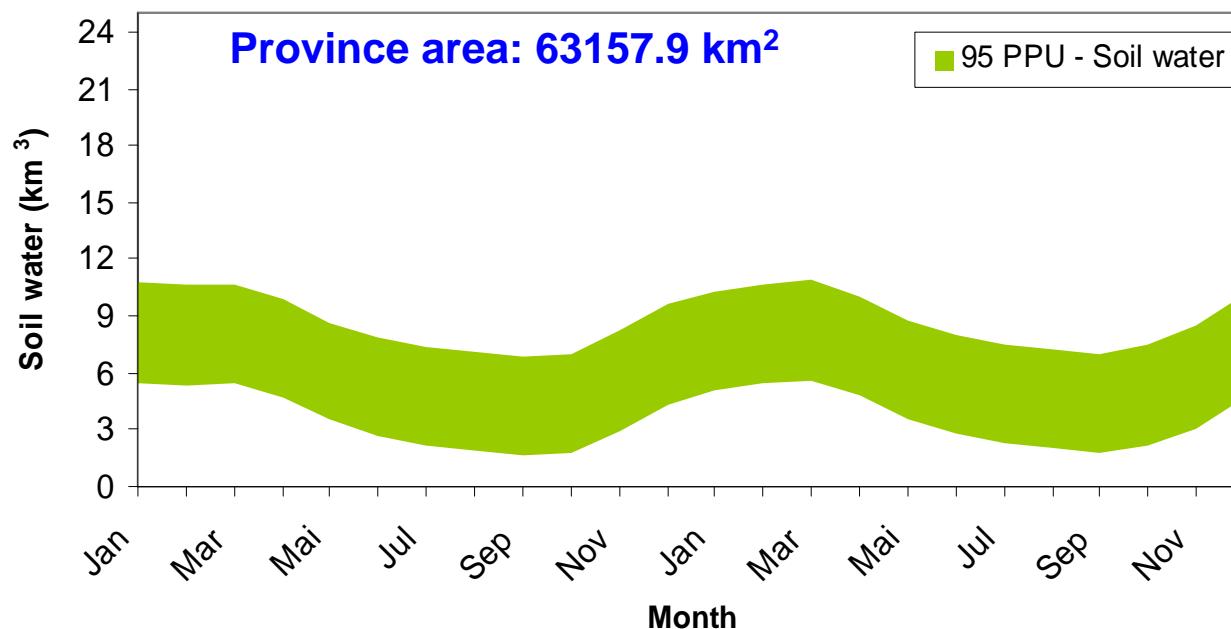
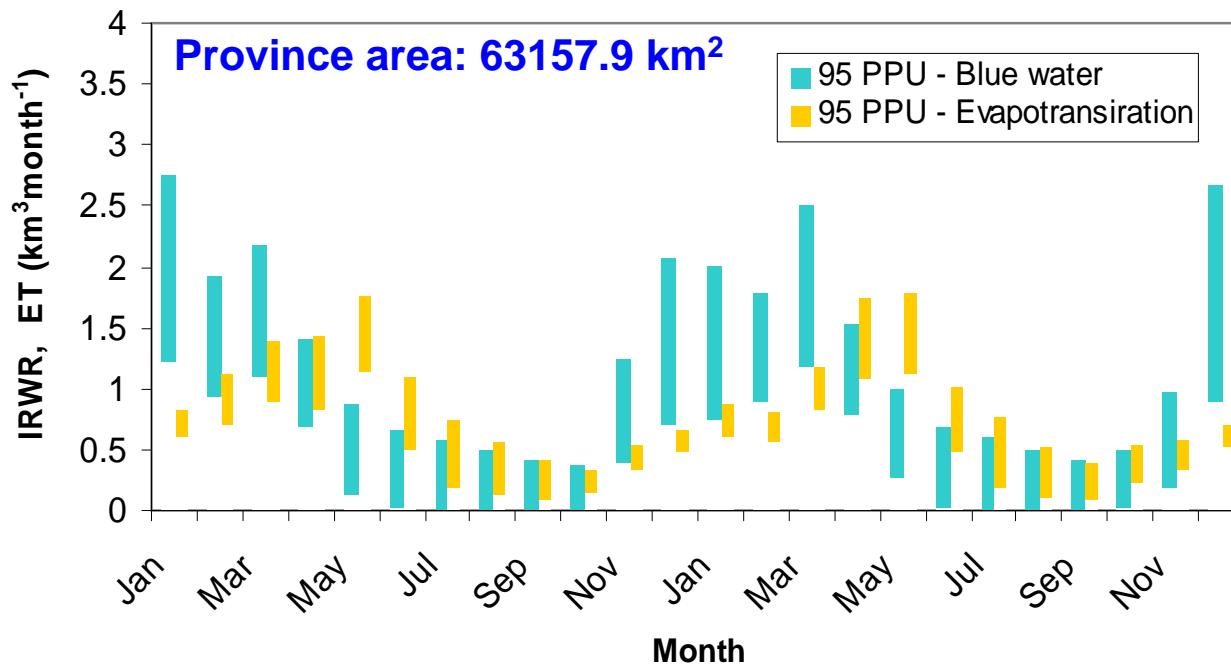
## 95 PPU of regional renewable water resources (First round of calibration)



**Final results from the final parameter set (Regional approach):**

**1. Internal renewable blue water resources and actual evapotranspiration at provinces**





**3. Average (1990-2002) monthly internal renewable blue water (IRWR), Actual evapotranspiration (ET) and Soil water for Khozestan province**

## 2. Blue water resources at sub-province level

(was constructed based on final parameter set resulted from “Regional approach”)

