

# Discovering New Water Resources; Increasing Relative Humidity by Increasing the Temperature

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## Abstract

Relative humidity as one of the climatic parameters has major influence on the amount of water resources, human health and agriculture section. Relative humidity is the ratio of moisture in the air now to the maximum possible moisture air can hold at the current temperature. It depends on the temperature and the pressure of the system of interest. In this study the relative humidity of air and its' trend of change with temperature was assessed in stations of southern coast of Iran (Specifically Chabahar) in a 40-year (1971-2010) period. The data show that relative humidity is high on the southern coast stations of Iran throughout the year.

Contrary to the expectations which the relative humidity has a reverse relationship with temperature, in Chabahar the maximum relative humidity is in the warm seasons (August, June, July). Nature violates our theories and assumptions very often, as we see one of its' actual samples in this research. It can be really an important finding in hydrology of that region because in such situation this high moisture content can be as a pure water resource for residents of southern coast of Iran.

**Key words:** southern coast of Iran, Chabahar, Relation, Relative humidity, Temperature, Water resources.

## Highlights

- develop new water sources.
- direct relation between temperature and relative humidity.
- The rules established in dynamic nature creates another potential abilities.

## 1. Introduction

One of the important climatic parameters is humidity and many researches have been done to study it and its' effect on different context (biology, medicine, water resources, energy &...) (Michael & *etal* 2015, Leclercq-Perlat & *etal* 2015, Nguyen & *etal* 2014). Although relative humidity is one of the valuable humidity criteria, very few researches have been done in this regard.

Relative humidity appears as an important and effective parameter in human comfort and in the agriculture (Evapotranspiration and Frostbite) spatially when drought phenomenon occurs. Relative humidity is the ratio of the absolute humidity in the air with a certain temperature to the maximum absolute humidity of the same volume of the air at the same temperature. In fact, it states that at a certain temperature, how much air is near saturation. Changes in relative humidity will have a major impact on the rate of evapotranspiration. In warm weather and when the relative humidity is low, evapotranspiration will increase and many plants will be in water stress. The growth of most plants increases by increasing the relative humidity and the need for uptake of the water by root will be too low. However, the relative humidity is reduced with increased regional evapotranspiration. Also relative humidity affects the comfort level and

human health and its' excessive increasing can have a negative effect on human comfort. So far, some research has been done on the investigation of relative humidity. The effect of relative humidity on the atmospheric dust concentration in the semi-arid climate was studied by Csavina & et al (2014). Sherwood & et al (2010) investigated that how relative humidity changes in a warmer climate. Hardwick Jones & et al (2010) studied observed relationships between extreme sub-daily precipitation, surface temperature, and relative humidity. Their consideration of relative humidity data shows a pronounced decrease in the maximum relative humidity for land surface temperatures greater than 26°C, indicating that moisture availability becomes the dominant driver of how extreme precipitation scales at higher temperatures. Shi & et al (2013) studied the effect of relative humidity on the human comfort in the warm and wet region.

Water is one of the basic elements of life on the earth and as we know nowadays water crisis is one of the most important hydrologic discussions in the world. The country of Iran is not exceptional from this fact. This country has been located in arid and semi-arid area of the world most of whose precipitations occur in cold seasons. It is while agriculture and plant growth occurring in warm season need more water in summer than in other seasons. According to water crisis and shortage of water resources in Iran, better Understanding of available water resources can ease the life of the residents.

In this study we investigated the relationship between this high temperature and relative humidity in southern coast of Iran (Specifically Chabahar, Eastern most station in Oman). Chabahar as the only oceanic port of Iran is located outside the Strait of Hormuz and Persian Gulf. The region as a corridor connecting Central Asian Countries is important in terms of trade and transit. Since the cognition of every region's potential and correct use of them can ease the life Its residents and due to the very high air temperature of Chabahar,

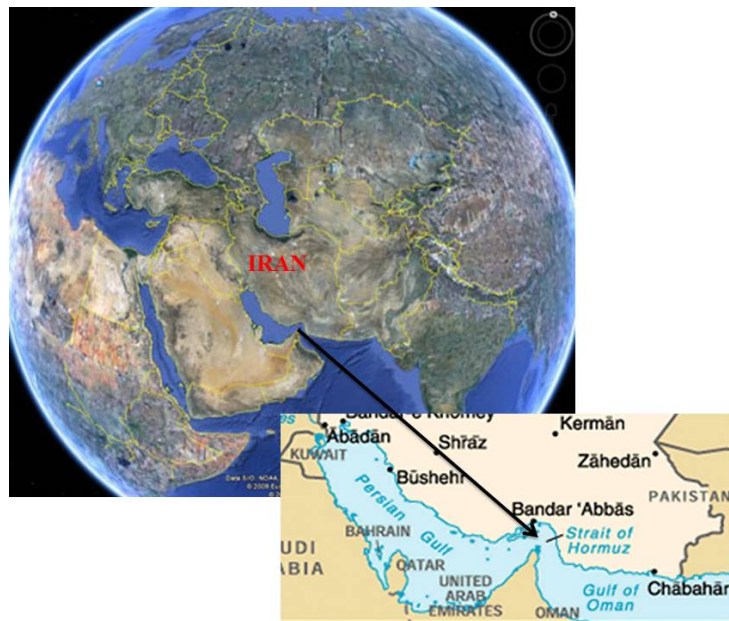
## 2. Material and method

### 2-1. Case study

The data which is used in this study obtained from Bandar abass, Bandar lengeh, Jask, Kenarak, Chabahar stations.

Chabahar city is in the south east of Iran near the warm water of Oman and Indian Ocean. This city is bounded to the north by Iranshahr and Nikshahr, to the south by the Oman, to the east by the Pakistan and to the west by the Kerman and Hormozgan. Chabahr climatic station is in the east of Oman and is located in  $25^{\circ} 17'$  north and  $60^{\circ}37'$  east in the 8 meter height from the sea level.

In this study mean temperature and relative humidity were collected in the 40-year period in from Bandar abass, Bandar lengeh, Jask, Kenarak, Chabahar stations (table1). Then the analyses were done.



**Fig1: The position of southern coast of Iran in the world**

The relative humidity ( $\phi$ ) of an air-water mixture is defined as the ratio of the partial pressure of water vapor ( $H_2O$ ) ( $e_\omega$ ) in the mixture to the saturated vapor pressure of water ( $e^*_\omega$ ) at a given temperature.

Relative humidity is normally expressed as a percentage and is calculated by using the following equation [6]:

$$\phi = \frac{e_\omega}{e^*_\omega} \times 100\% \tag{1}$$

**3. Discussion and results**

data from all stations show High relative humidity high on the southern coast of Iran throughout the year.

**Table 1: Monthly mean temperature and relative humidity in 40 year (1971-2010) in South coast stations of Iran**

Station	lat	R%	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	lon	T												
BANDAR ABASS	27 13 N	R%	63	61	65	67	69	68	63	60	64	67	68	65
	56 22 E	T	20	24	29	32	34	34	33	31	27	23	19	18
BANDAR LENGEH	26 32 N	R%	61	59	63	67	67	67	66	61	61	64	64	62
	54 50 E	T	20	24	29	32	34	34	32	30	26	22	19	18
JASK	25 38 N	R%	62	63	69	76	78	77	71	67	66	66	64	61
	57 46 E	T	22	25	29	30	31	32	32	30	27	24	21	20
KENARAK	25 26 N	R%	63	62	65	71	73	72	67	62	59	62	62	62
	60 22 E	T	21	24	28	30	31	32	33	31	28	24	20	19

CHAHBAHAR	25 17 N	R%	62	68	72	73	75	78	79	80	78	75	68	63
	60 37 E	T	20	21	24	27	30	31	31	30	29	28	25	22

The diagram below (Fig 2) illustrates how the relative humidity changes with temperature. Generally, a volume of air contains a specific, (fixed) amount of moisture. As the volume of air is heated, the relative humidity decreases. As the volume of air is cooled, the relative humidity increases.

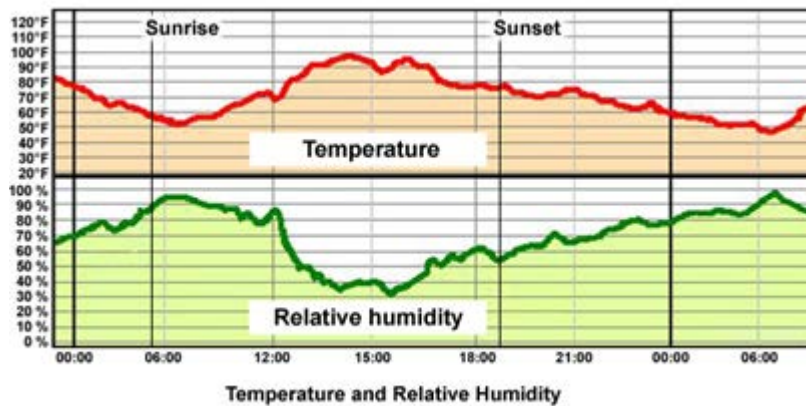


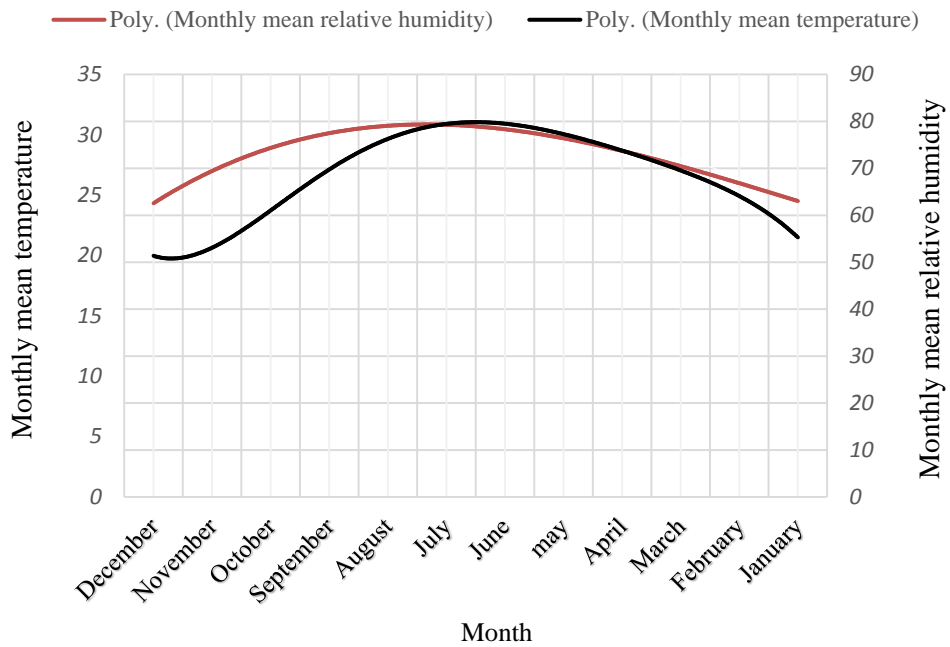
Fig2: the relationship between temperature and relative humidity in general ([www.meted.ucar.edu](http://www.meted.ucar.edu))

Table 2: Monthly mean temperature and relative humidity in 40 year (1971-2010) in Chabahar station

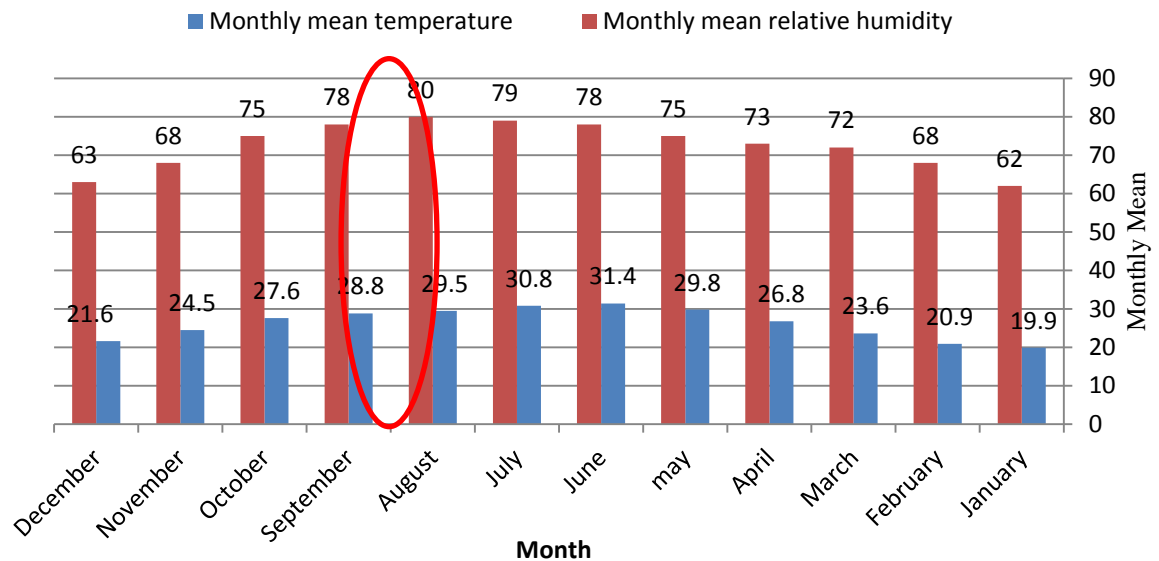
	<i>Decemb</i>	<i>Novamb</i>	<i>October</i>	<i>Septemb</i>	<i>August</i>	<i>July</i>	<i>June</i>	<i>may</i>	<i>April</i>	<i>March</i>	<i>Februar</i>	<i>January</i>	<i>max</i>
<i>Monthly mean</i>	21.6	25	27.6	28.8	29.5	30.8	31.4	29.8	26.8	23.6	20.9	19.9	31.4

Monthly mean relative	63	68	75	78	80	79	78	75	73	72	68	62	80
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In this study this relation is converse. With the increase in temperature the relative humidity will increase and vice versa. It has been shown in the fig 3, 4.



**Fig 3: the relationship between temperature and relative humidity in Chabahar**



**Fig4: Diagram of the relative humidity and temperature in Chabahar**

Relative humidity has a reverse relationship with temperature but according to the diagram (3,4) in 40 -year period ( 1971-2010 ) in Chabahar relative humidity is high throughout the year and the highest relative humidity ( 80% ) is in the warmest month of the year ,August, with average temperature of 29.5 c. Therefore, in this region, relative humidity increases with temperature that reflects the richness of the moisture in the warm air.

The explanation of this phenomenon can be stated as follows: Geographical location of southern coast of Iran is near seas and on the orbit 25 degrees north of the Tropic of Cancer and the Tropic Zone. The air temperature in the area is high .This causes the moisture capacity of the atmosphere increases, in addition, the stability of the atmospheric air because of the subtropical high- pressure scanning in large part than this caused the build- up does not allow the moisture in the layer adjacent to the barrier. In the other words, accepting atmosphere for water increases



with increasing temperature and air humidity is rich. The relative humidity increases with increasing heat knowing this and making items recoverable humidity in this region throughout the year, especially in Chabahar that is near the warm water of Oman and Indian Ocean in the heating season when demand for water exceeds the available water can be purified as a source of pure water and water used in agriculture and household. There is some rules in the nature that some phenomenon of the earth obey them but because it is dynamic, sometimes these rules are incorporated with each other and create Complex phenomena which can be explained with simple Principles. These simple Principles will from the base of Complex phenomena like something that happened in this region.

## Conclusion

As we found contrary to expectations which the relative humidity has reverse relationship with temperature, in this region the maximum relative humidity is in the warm seasons (August, June, July). This phenomenon in addition to reducing water demand in the agricultural sector, can also be pure water sources with the capture of it as the new water source, In order to increase the comfort of living without adverse impact to the environment

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