Relativism in Geomorphology

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Extanded Abstract

Introduction

One of the most important issues in development of any scientific discipline including geomorphology is introduction of new viewpoints and special conceptualization. Introduction of relativism in philosophy, language and sociology has brought about deep evolutions in the epistemology of the research methodology in these sciences. Although this viewpoint was already introduced in geomorphology by the American scientist G.K. Gilbert one hundred and thirty years ago, temporal conditions did not let the development and understanding of the conceptions for others. Recognition of Gilbert's views and its comparison with relativism concepts in this age can familiarize us with Gilbert's thought and the evolutions it made in relativism concept. Besides, it can prevent us from considering Gilbert's relativism to be in parallel with many concepts introduced by others.

The purpose of this article is to understand the depth of Gilbert's transcendental meditation and the difference of his opinion with the dominant scientific thinking in the era of Davis. Obviously, to know the angles such insights can enrich new ways in the epistemological and theoretical literature of the geomorphology.

Materials and Methods

To recognize the concept of Relativism and compare it with Gilbert's opinion, it is necessary to check the works of prominent persons in different fields of knowledge on this subject. After

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theoretical basic review of the relativism, four characters in this field were selected with quite clear and obvious ideas. They were Hans Gadamer (Hermeneutics), Albert Einstein (Physics), Ludwig Bertalanffy (Systems), and Mulla Sadra (Mysticism and illumination). Then, their original texts about the concept of the relativism were separated and their views were analyzed. Finally, we compared them with Gilbert's opinion and explained their differences and similarities.

Results and Discussion

The relativism has not been expressed in the fields of knowledge and methodology nor even as a skill in a common concept. In general, it can be mentioned in ten whole meanings. Some try to limit it to philosophical issues and others treat it as a method.

A. Relativism in the view of Sophists

In this view of the relativism, the principle of non-contradiction, diverse readings and multi-voice are recognized and it is based on denying the existence of truth and fact.

B. Hermeneutics

Every commentator understands the effect of his/her experiences different from those of the others. In other words, understanding and interpretation is a function of semantic horizon of the commentator, and this is nothing except "Relativism" in understanding.

C. Sapir-Whorf's Relativism

This theory explains another aspect of the relativism. Hence, people do not take an equal understanding from a single external mental phenomenon, unless they have similar Language background.

C. Scientific Relativism (Einstein)

Concepts such as time, place and gravity are considered different based on the physical condition they were considered. They are regarded to have a variant nature. In other words, based on this theory, there is no absolute time, and consequently, nor any absolute temporal coincidence. Moreover, time is not the same in the two systems that are not connected to each other.

D. Relativism systemic in epistemology

The external existence of phenomena and their objectivity are authenticated. Frist special totality is supposed as the system. Then, each of the elements is evaluated with the other elements or with the whole system.

Q. Allometric

In this view, efforts of the researcher are focused on the understanding of the relations of these phenomena with each other.

E. Divine Relativism

This Relativism expresses how a phenomenon and its emanation are effective on the observer's understanding.

F. **Genette relativism**

This Relativism expresses that a researcher is not affected by the recognition phenomenon.

G. Relativism in scale

This technique considers the view point of cognition within the framework of special relativity and uses it to describe the reality of object.

J. Gilbert's **of Relativism in Geomorphology**

The understanding of a phenomenon depends on the observer and his/her thought, and the cognition cannot be treated as rigid and absolute matter. According to the researcher's previous take of science, his/her conclusion about a phenomenon is different.

Comparison between the 9 relativism trends and Gilbert's relativism has resulted in the following findings (similarities and differences between each trend and Gilbert's relativism):

Comparison between Sophistēs' relativism and Gilbert's relativism

- Human's thought background is the criterion for knowledge.
- They acknowledge objective and experimental realities.

Comparison between hermeneutists' relativism and Gilbert's relativism

- Introduction of "mental background" and researcher "outcome" in the knowledge of phenomena is emphasized.

Comparison between Sapir–Whorf's relativism and Gilbert's relativism

- Researcher "outcome" is influential on the knowledge of phenomena.

Comparison between scientific relativism and Gilbert's relativism

- Different objective data derived from a single phenomenon result in the relativism in knowledge.

Comparison between relativism in systemic epistemology and Gilbert's relativism

- Relationship between the phenomena is by its own an expression of relativism.
- They also believe in the denial of the necessity of structure in the phenomena.

Comparison between relativism in Allometry and Gilbert's relativism

- Relationship between phenomena is apart from the supervisor's mind.

Comparison between Sacred relativism and Gilbert's relativism

- Part of the knowledge in the person who knows is related to what is known.

Comparison between Genetic relativism and Gilbert's relativism

- In Gilbert's viewpoint, knowledge depends on the researcher.

Comparison between Relativism in scale and Gilbert's relativism

- In Gilbert's view, relativism is not digital and numerical.

Conclusion:

The results indicated that:

- Gilbert is the first geomorphologist who has applied the concept of relativism transcendentally and deeply in his methodology 130 years ago (1886).
- Ten independent concepts of epistemic relativism have been used in various systems.

Keywords: geomorphology, Gilbert, relativism, relativity, systems.

Analysis of Daily Precipitation Extreme Indices Trend in Iran

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Extended Abstract

Introduction

Climate change caused some changes in the global environmental conditions in the recent decades. One of the climate change impacts is the disturbance of the hydro- climatic cycle in the world. The effects of climate change on the hydrological cycle are including changes in groundwater levels, lakes, as well as changes in the distribution of rainfall timing and intensity and river flows. Intensity and frequency of extreme precipitation events and the risk of floods and droughts are increasing due to the climate change in the large parts of the world.

The impact of climate change on spatial and temporal characteristics of precipitation and extreme events affected people life. Hence, study on trend and changes of precipitation extreme can reveal the occurrence of every related hazard. The studies around the world have shown that global warming and climate change impacts and the precipitation condition have been altered in different regions. The main objective of this study is to evaluate daily precipitation indices trend in Iran.

Methodology

In order to analyze daily precipitation indices trend, 47 synoptic stations were used to investigate the precipitation extreme events over Iran during the 1982- 2012 (11323 consecutive days). The RClimDex software was applied to extract daily precipitation trend.

The list of precipitation indices are:

- RX1day: Monthly maximum 1-day precipitation
- Rx5day: Monthly maximum consecutive 5-day precipitation

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- R10: Annual count of days when PRCP>=10mm
- R20: Annual count of days when PRCP>=20mm
- CDD: Maximum number of consecutive days with RR<1mm
- CWD: Maximum number of consecutive days with RR>=1mm
- R95p: Annual total PRCP when RR>95th percentile
- R99p: Annual total PRCP when RR>99th percentile
- PRCPTOT: Annual total PRCP in wet days (RR>=1mm)

Results and discussion

On average, the amount of precipitation in climatic stations such as Bam, Zabul, Yazd, Tabas, Jask and Zahedan was less than 80 mm whereas Bandar Anzali, Rasht, Ramsar and Noshahr stations have experienced above 1000 mm of precipitation during the period, 1982- 2012. Among all studied stations, Anzali and Zabol stations have had about 1763 and 52 mm of precipitation during the studied statistical period, respectively. Investigation of total index of annual precipitation in Iran represents that the slope of precipitation in most of the stations is negative during the 1982- 2012. Averagely, the annual precipitation of Iran has decreased about 2.5 mm during the 1982- 2012.

Generally, the results indicated that the trend of CWD index in some regions was negative, in some regions was positive and in some other regions there wasn't any trend in the index during the 1982- 2012. Among all the studied stations, the CWD index had positive trend for 11 stations including Kashan, Semnan, Ramsar, Mehr Abad, Dooshan Tapeh, Zahedan, Khorram Abad, eastern Isfahan, Anzali and Abadeh. There was no trend in Arak, Bandar Lengeh and Shahrood stations and negative trend was observed in other stations. According to the results, the CDD index was increasing in most of the studied stations during the period 1982- 2012. Approximately, in 72.5% of the stations the index was raising and in 27.5% of stations it showed decreasing trend. The trends showed that the number of days without precipitation is increasing. The greatest changes have been observed on the coast of the Caspian Sea and the Persian Gulf. The results showed that the indices of R 10 mm, R 20mm, and R 25 mm, at most of the stations have been decreased and R 10 mm index had more negative trend.

The trends indicated that the number of days without precipitation is increasing. Among the studied stations, Ramsar station has experienced the highest downward slope of R95p index with 6.4 mm, annually. From this point of view, Saghez, Rasht, Sanandaj and Bandar Abas stations had the highest downward slope in very wet days. Moreover, Gorgan station with 2.7 mm has experienced the most increasing trend among all stations annually and Shiraz, Esfahan and Chabahar with higher than one mm are in the next rank.

Conclusion

The results indicated that all Precipitation Extreme Indices has been changed over Iran during the 1982-2012. There were negative trends in more stations. In most of the studied stations, annual rainfall has decreased and the number of dry days (CDD) has increased. Only a few stations in the central regions and the foothills of the Zagros have had positive trend.

Keywords: climate change, extreme indices, Iran, precipitation, trend.

Determination and Investigation about Beginning and End Dates of Early and Late Freezes and Possibility of its Continuity, Intensity and Succession in Ardabil Province

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Extended Abstract

Introduction

Freeze is one of the serious climatic phenomena that influence different aspects of human life including agriculture, transportation and energy. The effects of freeze in agriculture are more than other activities. The effects in agriculture section appear more than its earliness or lateness aspects. In Ardabil Province, in most years, early and late freezes have caused serious damages to agricultural products. For example, in April 2014, the gardens in Ardabil Province experienced a loss of more than 4 billion Rials due to late spring cold. Due to this cold, 21000 Hectares of the gardens were damaged.

One of the the causes of enormous losses resulted from climatic phenomena like freezes is unknown remaining of dimensions and nature of this phenomenon. In occasions of occurrence of early and late freezes, to decrease the losses, it is needed to have a coherent management program. To prepare this program, it is required to know different aspects of this phenomenon. In this research, it is tried to determine beginning and end dates of early and late freezes and to investigate several cases of properties of these freezes along with its possibility.

Materials and methods

Data used in this study is minimum daily temperature in a 15-year statistical period (from 1996 to 2010) in the stations of Ardabil Province. After collecting the data, a series of data were planned so that the first day-counting of data was considered October to analyze the beginning and end dates of the freezes (lack of temperature to zero and under zero Centigrade). In this research, we used knowledge of possibilities and also an approach called Markov's Chains.

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Accordingly, continuity and possibility of occurrence of early and late freezes are considered in different continuities. We investigated various intensities of early and late freezes and possibility of its occurrence and succession of different states.

Results and discussion

Analysis of the beginning and end dates of occurrence of the freezes shows that general trend of day-counting of beginning date of freezes in Parsabad Station is decreasing and moves toward hot season. In stations of Ardabil and Khalkhal, this trend is increasing. In Khalkhal Station, the beginning dates of freeze moves toward cold season with intensity of 1.07 day per year.

Investigation about the end dates of freezes according to regression analysis shows that general trend of day-counting was decreasing by 0.517 day per year in Parsabad Station and was increasing by about 0.29 and 0.14 day per year in stations of Ardabil and Khalkhal, respectively.

Early freezes start in November in Parsabad Station and in October in the stations of Ardabil and Khalkhal. The continuity of early freezes in Parsabad Station is less than other stations so that in this station freezes are not lasted more than 2 days. In Khalkhal Station, continuity of freezes is more than other stations.

In Parsabad Starion, due to lower elevation, temperature was higher than other stations and intensive freezes are not observed. In Khalkhal Station, number of freezes is more than other stations. In this station, 11 intensive freezes lower than -3 centigrade has occurred that there is 2.37 per cent of possibility of its occurrence in October.

Conclusion

The most important conclusions can be made of the discussion are as follow:

- Day-counting trend of beginning of early freezes is decreasing in Parsabad Station and is increasing in Ardabil and Khalkhal. Day-counting trend of late freezes is decreasing.

- Early freezes begin in November in Parsabad Station and in October in Ardabil and Khalkhal. Late freezes are in April in Parsabad Station and in May in Ardabil and Khalkhal.

- Continuity of early freezes in Parsabad Station is less than other stations; and in Khalkhal Station the continuity of freezes is more than other stations. In late freezes in Khalkhal Station, continuity of freezes has been less than other stations.

- In terms of intensity of freezes, early intensive freeze has not happened in Parsabad Station. In this area, due to low elevation, temperature is also more than other stations and intense freezes are not observed. In Khalkhal Station, number of intensive freezes with possibility of occurrence of 2.37 percent in October is more than other stations.

- In terms of succession of different states of freeze, in early dates there is the highest possibility of occurrence of freeze after freeze in Khalkhal Station with 63.31 percent. In late dates in Ardabil Station, the occurrence of freeze is with 61.54 percent after the state of without freeze.

Keywords: Ardabil Province, continuity, early and late, intensity, possibility, succession.

Simulation Effects of Improvement and Restoration Operations of Rangeland on Soil Loss using RUSLE Model

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Extended Abstract

Introduction

Rangelands are natural ecosystems with native plant species. Water, soil and vegetation have fundamental role in management of natural ecosystems such as rangelands. Thus, it is essential to perform researches for preservation of the natural and human environment. Proper and allowable utilization of the rangelands in range management projects is the important scientific and technical measure of the range management in Iran. Range management projects as improvement - restoration and reclamation guidelines have particular importance in the Natural Resources Organization of Iran. On the other hand, erosion and soil loss and sediment production has become today one of the main problems in the human environment. Restoration of vegetation and its effects on reduction of erosion have been studied by Li, 2006, Zhou, et al. 2008, Zhanga et al. 2004, Abdelkrima, et al. 2013. The Goal of the improvement - restoration operations in natural ecosystems is recovery plant composition for more protection of water and soil and decrease in soil erosion. Therefore, soil management for optimal utilization is essential to reduce its degradation. Mapping the rate of erosion and sediment yield and regional prioritization are effective steps for management, protection and utilization of the soil. The purpose of this study is to estimate the amount of soil erosion and to simulate the effects of improvement and restoration of soil loss in the Lar area, Mazandaran.

Material and methods

In the present research, Revised Universal Soil Loss Equation (RUSLE) was applied using GIS. The parameters of this model are consisted of R, K, LS, C and P. These are calculated with

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rainfall data, soil maps, digital elevation models and remote sensing techniques. Suitable location of improvement - restoration projects was determined based on maps of slope, elevation, vegetation, pedology and rangeland condition. Then, by combining these maps and applying basic principles of range management, we offered rangeland management model for improving or maintaining the optimal status. Then, erosion risk map was prepared using revised universal soil loss equation. Finally, changes in erosion after restoration and reclamation operations were predicted using this model in GIS.

Results and discussion

The results showed that the mean values of the parameters R, K, LS, C and P for study area was 67.143, 18.0, 52.5, 37.0 and 1, respectively. Average of yearly sediment load was estimated about 51 tons ha^{-1} $year^{-1}$. Allocation of the areas to restoration and reclamation operations is including 378 ha for seeding, 246 ha for inter seeding and 176 ha for planting pile. Also cultivation on contour lines with seeding and strip cultivation with inter seeding was suggested and simulated. Simulation results after the suggested operations showed that the P and C factors will be 0.8 and 0.31, respectively. Therefore, erosion value will be reduced to 34 tons ha^{-1} $year^{-1}$ and following that it is equivalent to 34% reduction. RUSLE model was used by many researchers and its performance was confirmed according to the results of this research. The results showed that the areas with low slope had more sediment rate than other areas. Average of yearly sediment load was ranged from zero to 595 tons ha^{-1} $year^{-1}$in study area. Soil erosion was more in eastern south parts of the watershed. This is similar to the results of Asadi, et al. 2010. Restoration and reclamation operations have changed C factor that can cause reduction of erosion. After simulation, these operations had reduced erosion from zero to 464 tons ha^{-1} $year^{-1}$. This is also similar to the results of Ligdi and Morgan, 1995, Terranva, et al. 2009, and Stevens, et al. 2009.

Conclusion

The reduction in P and C factors and consequently decrease in erosion have indicated the importance of improvement - restoration projects within rangelands. . It has been revealed that combination of GIS with sediment and erosion models can be an effective method to determine spatial distribution of sediment and erosion. The suggested improvement – restoration operations in addition to protection of water and soil have caused an increase in forage production and as a result increased livestock products and household income.

Keywords: rangeland reclamation, RUSLE Model, soil erosion, vegetation cover.

Analysis of Sea-air Temperature Difference on Regional Heavy Precipitation in the Southern Coasts of Caspian Sea during Fall

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Extended Abstract

Introduction

With the onset of fall season, the air temperature on the Caspian Sea is diminished, but due to the difference in the specific heat capacity of air and water, the reduction rate of temperature is far greater than that of the sea. Therefore, the surface of Caspian Sea remains warmer than air. Establishment of dynamic high-pressure centers or diffusion of Siberian high pressure system over Caspian Sea especially during fall results in development of southward air stream over the sea. Caspian Sea as the first supplier of moisture resources for heavy precipitation and especially ultra-heavy precipitation of its southern coasts plays a principal role in explanation of the occurrence of precipitations in these coasts. The changes in Caspian Sea water temperature can result in variations in the precipitation in southern coasts of Caspian Sea. However, the seawater temperature is not sufficient for the precipitations of the southern coasts of Caspian Sea and the air temperature over the sea should also be taken into consideration. The sea-air temperature difference (ΔT), as humidity intake index, has attracted the attention of researchers to such an extent that it has become the most important thermodynamic factor in development of abundant and heavy precipitations in the southern coasts of Caspian Sea. Gradual increase of the sea surface temperature in its proper arrangement from the north to the south and intake of humidity from the sea (ΔT index) have been considered necessary for development of heavy and ultra-heavy precipitations in the southern coasts of Caspian Sea.

Materials and methods

In this research, the daily precipitation data of seven synoptic stations of Northern provinces of

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Iran have been collected from 1968 to 2013. The threshold of heavy precipitations was defined as the day in which its precipitation level is greater than the percentile 95 of that year. Then, all of the days in which at least five stations have recorded heavy precipitation were simultaneously extracted and considered as regional heavy precipitation days. By extracting the air temperature at 2 meter above the sea level (Air2m) and the sea surface temperature (SST), the ΔT value was calculated as follows:

$$\Delta T = SST - Air2m$$

Using Ward linkage method and correlation between the data, ΔT values were clustered in the days in which regional heavy precipitation had occurred in the northern stations of Iran. In each of the clusters, the day that had the greatest correlation with other days was selected as the sample. For the sample days, SLP, VWnd, Uwnd, and HGT data in 1000 HPa for analysis of synoptic conditions leading to regional heavy precipitation were extracted from http://www.esrl.noaa.gov. The relationship between regional heavy precipitation in the stations and ΔT was analyzed to interpret the extracted clusters.

Results and discussion

With the onset of fall season, the air temperature experiences more rapid decline than seawater temperature. Therefore, in this season, the sea will be warmer than air. The long-term mean (1986-2013) of SST and Air2m and ΔT during fall has been shown in Fig. 1.

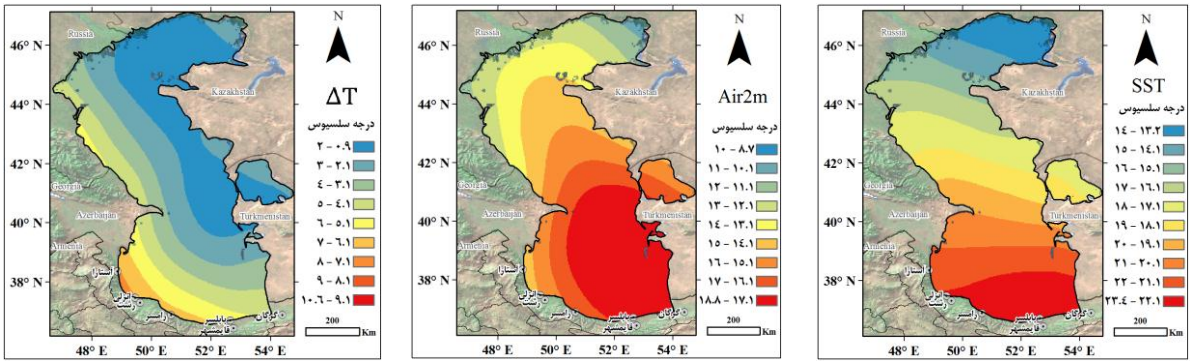

Fig.1: Long-term mean (1986-2013) of SST and Air2m and ΔT during fall.

The relationship between regional heavy precipitation and ΔT was investigated in the studied stations. Unexpectedly, direct relationship between ΔT in the south Caspian Sea and regional heavy precipitation does not exist in all of the stations. This relationship only applies to the stations located in the East, whereas in the stations situated in the West, this was inverse relation.

Using Ward linkage method and calculation of the correlation between the data, three clusters were recognized. In each of the clusters, the day that had the greatest correlation with other days was selected as the representative of the cluster (Fig. 2). The first cluster is representative of the days with regional heavy precipitation in conditions where ΔT gradient reaches its maximum from Northwest to the southeast. The second cluster represents incidence of regional heavy precipitation in conditions where the maximum ΔT gradient is from the north

to the south. Eventually, the third cluster can be considered as the greatest ΔT gradient observed from the West to the East (also Southwest to Northeast) .

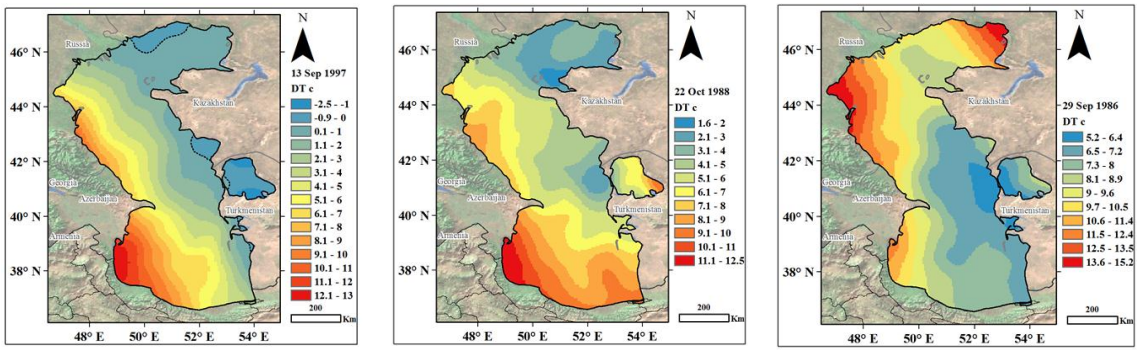

Fig.2: ΔT in 13 Sep 1977 (lesf cluster), 22 Oct 1988 (middle cluster) and 29 Sep 1986 (right cluster)

Investigation of synopsis maps of regional heavy precipitation in the selected days suggests their similar synoptic conditions such that establishment of high-pressure center in the northwest Caspian Sea leads to influx of cold-air from more northern latitudes and over Caspian Sea towards southern latitudes. The stations located in the east part of the study area will receive greater precipitation when ΔT reaches its maximum level in the southern coasts of Caspian Sea (the second cluster). In contrast, the stations located in the West will receive greater precipitation when ΔT gradient increases from the east to the west (the third cluster).

Conclusion

With the increase in ΔT in the southern parts of Caspian Sea, regional heavy precipitation grows significantly only in the eastern part of the study area. The results obtained from ΔT clustering unveiled three clusters, where the first, second, and third clusters represented the maximum ΔT gradient from the Northwest to the southeast, north to the south, and west to the east, respectively. The stations located in the east part of the studied region will have greater precipitation when ΔT reaches its maximum in the southern coasts of Caspian Sea (the second cluster). In contrast, the stations located in the West will receive the maximum precipitation when ΔT gradient increases from the east to the west (the third cluster). These results were in line with those obtained from investigation of the correlation between ΔT and regional heavy precipitation. The analysis of synoptic maps indicated that in all of the three clusters, establishment of high-pressure center in the northwest part of Caspian Sea results in infusion of cold air from more northern latitudes over Caspian Sea and towards southern latitudes.

Keywords：autumn, regional heavy precipitation, sea-air temperature difference, southern coasts of Caspian Sea.

Spatial Analysis of the Frequency of Jet Streams Influencing the Extreme Precipitation in Western Iran

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Extended Abstract

Introduction

There are wind belts or bands extending long distances over a region. According to the definition of World Meteorological Organization, if the speed of wind bands exceeds 30 m/s, jet streams emerge. However, based on the definition of Climate and Air Dictionary, jet streams are the highly intense horizontal winds with a speed more than 50 nodes or about 25 m/s blowing above planetary winds. In fact, jet streams are speed cores moving below short and high waves and, like them, have convergence and divergence areas. Windward core speed is also reduced from core center to the arounds; this reduction toward the pole is cyclicity or positive and toward the equator is anti-cyclicity or negative.

Materials and methods

This is an empirical research with a deductive approach. The geographical areas under study are the regions in western Iran. The research database, with an environmental approach to the circulation, includes two variable groups. First, daily precipitation data of 69 synoptic and climatological stations of western Iran (Hamedan, Kordestan, Kermanshah, Ilam, And Kurdistan provinces) in 1961-2010 were extracted from State Meteorological Organization. The second variable group involved orbit wind and meridian wind indices to define jet streams in 250, 300, 400, and 500 HPa. These were extracted from NOAA website. Moreover, the data were extracted using GrADS software. Given environmental incidence database, daily precipitation of the western Iran was interpolated using Kriging method. To do this, when interpolating daily precipitation, the area under study was converted to 1367 pixels with 2.5*2.5 dimensions. The result was the formation of an array of western Iran daily precipitation database with 18624*1367 dimensions. Performing calculations on these data was conducted by MATLAB

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software and the result has been illustrated as a map. ArcMap was used to draw the maps. There were 119 extreme precipitation days, which covers 30 percent of the stations under study. In spatial analysis, one of the most common parameters to assess the dispersion of the points around the average center is Standard Deviation Ellipse, because the point positions may have direct deviance regarding the incidences and Standard Deviational Ellipse. This can well show directed deviance of probability distribution; Moreover, the Standard Deviational Ellipse is used to indicate the deviance direction of probability distribution. It was also applied to windward incidence in each pixel.

Results and discussion

Windward frequency in 250 HPa level showed that the highest frequency of jet stream is from southern Red Sea to the southern Mediterranean; in other words, in more than 70% of the cases the establishment and passing of jet stream affecting extreme precipitation of the western Iran are extended in this range. The same things cause the infusion of humidity from the Red Sea to western Iran precipitation systems. The frequency of jet stream in 300 HPa level indicated that during the research period, the highest frequency of jet stream extends from northern Red Sea to western and central Iran. In other words, the areas of this range have been present in 50% of the formation and establishment sites of the jet stream. It is evident that windward development and its influence are reduced by height reduction. Windward frequency in 500 Hpa level showed that during the research period, the highest frequency extends from northeastern Red Sea to western Iran regions. The areas of this range have been in 50% of formation and establishment sites of windward. This corresponds to the highest frequency of windward incidence. The windward frequency reduces when we go eastward. Jet stream frequency in 500 HPa level is not surprising because windward incidence in this atmosphere level is not basically so high.

Conclusion

The results indicated that jet stream in 250 HPa have a high frequency. The jet stream average velocity maps are corresponding to the incidence of jet stream maximum frequency in one hand, and in the other hand against the incidence of jet stream maximum speed in the area under study. This implies the situation of second quarter of jet stream core (which accompanies positive Vorticity as well as upper surfaces divergence and lower surfaces convergence) on western Iran.

Keywords: atmospheric instability, extreme precipitation, jet stream, Standard Deviational Ellipse, West of Iran.

Sea-level Changes during 2600 BP and Little Ice Age and its Impacts on Iranian Coast

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Extended Abstract

Introduction

The Caspian Sea (CS) can be subdivided into three parts: North, Middle and south parts. The sea experienced many cycles of Sea-level changes with vast emerged and submerged areas. In the terraces in Dagestan, two major phases have been distinguished. The Early Khvalyn transgression is represented by five successive marine terraces between +50 and 0 m at absolute height. Furthermore, at the boundary of Late Pleistocene and Holocene a -50 and by other researcher a -113 sea level record has been identified. This is why many researchers call it as a capricious level due to great sea level changes. Recent sea-level changes also got attention, experienced around 3 m sea-level changes between 1929 and 1977 and rose back in 1995. Five late Holocene records have been identified at least up to -22 absolute elevation. Present work aims at showing two phases of transgression and its impact on Iranian coast by Arial photograph and radiocarbon dating, a 2600 BP and Littlie Ice age.

Radiocarbon dating

Radiocarbon dating results are available now from all over the CA along the Iranian coast. Further radiocarbon dating is also needed to achieve better understanding of sea level change. The crucial thing is that the samples must not be reworked and then it is important to take samples from marine environment. Otherwise, the results are not accurate and sometimes in a wrong way. The marine environment far away from the wave is the best target to take the samples. The absolute elevation is also important, unreported elevation of the samples might indicate different data and should consider the same coordinate systems for all data. In this work, nearly all sample elevations have been measured by DGPS device based on the mean sea –level of the Persian Gulf. Table 1 indicates the radiocarbon dating data along the three parts of the Sea, East, Middle and West parts.

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The southeastern part of the CS

The south-eastern part of the CS is one of the best targets to reconstruct the sea-level curve and coastal evolution. An overall study of the past and recent sea-level changes has been done in this part as a PhD thesis. The dominated coastal features in this part are characterized by Barrier-Lagoon and delta deposits. This part is very sensitive to sea level changes due to low angle coast and any minor sea-level change will have its own impact on the coast.

Based on Arial photograph and field data, two high stands at -22 and -24 were distinguishable, Old Miankaleh spit and old delta deposits. Linear old shoreline and old Gorgan delta is well observed by aerial photograph and confirmed by field works. They are placed at absolute elevation of around -24.

In the southern part of Gorgan Bay, the Bagho outcrop presents marine deposits similar to present Miankaleh spit characterized by crossbedding, medium to coarse sand and Caspian fauna. Eastward, it has been buried by Qareh Su and Gorgan Rivers and their deposits.

The middle part of the CS

Because of short distance of the Alborze Mountains and the sea and high energy environment, the coast characterized by gravel and coarse sand is known as erosional coast not sensitive to sea level changes as it was observed at the eastern part. However, there is a small old elongated lagoon indicating a Lagoon- barrier system in this part. Also, results of a core study indicates a lagoonal deposits further south at the foot of Alborz mountains and overlaid now by fluvial and organic rich layer. This organic layer was dated around 500 BP which probably is an evidence of little ice age high stand. The lower part of the mentioned core, also Lagoonal deposits, a sample dated around 2500 BP at the depth of 3.6 m. Two highstands at -24 and 19 absolute elevations were identified in this part.

The Western and East Sefidrud delta

The impact of sea-level change in this part is more studied than the other part of the CS. Sefidrud delta is the biggest river in the southern part of the CS originating from Zagrous Mountains and crossing Alborz mountains to the CS. Due to high sediment supply in this part, the impact of sea-level change is different from the other parts.

Recent study of sea-level rise between 1977 and 1995 indicates that 3 m sea level rise on the coast has not been changed. This is because the coast will be developed in 3 dimensional direction not just a simple linear trend. Therefore, accommodation space resulted from sea level rise is compensated by sediment supply and other process like longshore currents. Many papers have been published recently about the effects and most of them concentrated on Little Ice Age impacts on the coast. Present morphological features include a series of beach-barrier, Lagoons, modern delta and old delta.

Conclusion

Rapid sea level change is unique in the Caspian Sea and therefore coast response against this change get attention of many researchers. A real observation of coastal response to sea-level change instead of using mathematical model enables us to predict coastal behavior. The CS experienced many cycles and in the late Holocene two highstands, a 2600 BP and Little Ice age,

had strong impacts on the coast. These two highstands were synchronized with cooling periods of Northern hemisphere. Now the level of the Caspian is situated around -28 below sea level and considering the elevation -24 and -22 at the periods of two mentioned highstands. Large area of the southern Caspian was submerged at those periods. Any model should consider these highstands.

Keywords: Rapid Sea level change, Sefidrud Delta, The Caspian Sea, Transgression.

Analysis of Monthly Changes in Tropopause Height Layer on Iran

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Extended abstract

Introduction

Tropopause is the transitional layer between the troposphere and stratosphere. This layer determines the upper limit of the troposphere and somehow expresses the spatial and temporal variations in the thickness of the layers and the layer indicated his thermodynamic variability. This is the layer that short-term and long-term atmospheric phenomena occur in. In other words, this layer determines the thickness and upper limit of the troposphere layer. Iran in terms of geographical location is on the northern side of the Hadley cells in the general circulation. That's why when handling the extremely cells, we observe changes in the climate of this country. That's why the country is in the range of atmospheric systems of important effects such as (Arabian subtropical high pressure, Siberian high pressure, Azores high pressure, Mediterranean cyclones and Sudan low). This country is located in vicinity of vast deserts of the Arabian Peninsula and Siberia. Existence of two great ranges of Alborz and Zagros Mountains in north and west of Iran and the Dasht-e Kavir and Dasht-e Lut in Central and South East also remarkably influenced the entry and transit systems and mechanisms of precipitation systems. All of these factors caused changes in troposphere and tropopause of Iran . Hence, the tropopause height chowders is reaction of annual and seasonal variability happened in troposphere. If these changes can be estimated, the annual seasonal trends or changes in the troposphere layer can be changed. For this purpose, the maps of the height of the tropopause layer altitude on the slope of Iran in the period 2015-2003 is examined in each month of the year.

Materials and method

In this study, we have used data from the Atmospheric Infrared depth of (ATMOSPHERIC INFRARED SOUNDER) Moderate-resolution imaging spectro radio meter (MODIS), Aqua,

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Earth Observing System (EOS), and the product (AIRS+AMSU) V006 (AIRX3STD) at GES DISC. This product series of MODIS data in the form of geophysical parameters in the network have been distributed in, 1 × 1 ° arc. The data are available for the area ranged from -180 to 180 in longitude and from -90 to 90 in latitude at http://modaps.nascom.nasa.gov. After obtaining the images from 2003 to 2015, data were compiled in MATLAB software, and using the World Meteorological Organization Tropopause height values they were calculated for the matrix of size 12 × 155 for each year (155 networks were introduced and 12 months of the year are inscribed on the Iranian border). The image processing was conducted by ArcGIS10.2 and the maps of each month were prepared by kriging with the least amount of errors. The next step is to draw longitudinal profile of the height of the tropopause in 3D Analyst software plugin named slice of the North West (to a maximum height of the tropopause) to the South East of the country (as a minimum altitude of the tropopause). These were drawn for each of the months of the year.

Results and discussion

The results of this research show that in spring equinox the highest altitude of tropopause layer on Iran belongs to the southeast areas. In this mouth, the altitude of tropopause layer in southeast Iran is 16475 meters and the lowest altitude with 11008 meters belongs to the areas in northwest Iran. Thus, the highest altitudinal gradient between southeast and north part of Iran was happened and this gradient reached to 5600 meters. This is as thick as the middle troposphere. From May onward, the area of southern elevation of the layer is wider and this condition continues until the end of October. In other words, in a large part of the southern half of Iran, tropopause height variabilities is very negligible. In contrast, in the months of December, January, February, March, April and May (cold months), this condition is observed in northwest Iran. With the spread of cold waves from northern latitudes due to southward expansion of the polar vortex, northern part of Iran in terms of temperature was more homogeneous and tropopause height variations is function of latitude. Thus, this isoheight has eastern and western extension. However, almost in all months iso-height line has northeast-southwest tendency. Due to north-south extension of Zagros Mountains, tropopause isoheight in westward slopes of Zagros Mountains is toward southwestern areas. The highest tropopause isoheight gradient in south Iran was happened in January, February and April. The highest tropopause isoheight gradient was in the centurial part of Iran in March, May and November and in northern part of Iran in June, July, August, September and October. Tropopause height change in the south Iran is very low and in any of the months it is not higher than 520 meters. The highest variation in tropopause height in southern part of Iran was happened in February and the lowest in July. Monthly changes in tropopause altitude in northern part of Iran were very extreme. In some months this change has exceeded 3000 meters. The highest change was happened in June (3490 m) and the lowest occurred in August. In north belt of Iran, tropopause height increases gradually from March and continued for 5 months, and in July it reaches the highest elevation. The highest tropopause height difference between south and north of Iran takes place in February. In this month tropopause height difference was more than 6000 meters. Northward expansion of warm air from vast pester in center of country during the warm months and accumulation in southern slopes of Alborz Mountains caused that isoheight layer in this part of Iran between north east and northwest areas.

Conclusion

The height of the tropopause layer of Iran has seasonal fluctuations with the intensity of the incoming topography and activity of the system. However, the impact of the tropopause height changes is more pronounced in the input system from the effects of topography. Although in July, it reaches its peak height. But fluctuations in tropopause height between the south and north parts of the country are minimal. In other months of the year, maximum height of the tropopause in the south and north parts of the country is minimal. In August, the height of the tropopause is in the center of Iran. In the other months of the year, the maximum height of the tropopause is in the South East and the lowest in the North West. During the cold period in the northern slope of the layer it reaches its minimum. During the warm season, the southern slope of the tropopause layer is minimized. This phenomenon has spread in south polar vortex in the Siberian high pressure in cold period of year. The study also showed that during the months of monsoon activity in the South East, it is reducedr.

Keywords: height of the tropopause layer, Iran, tropopause, tropopause height profile.

How much the Remote Sensing Indices can Improve Suspended Sediment Predictions?

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Extended Abstract

Introduction

In the recent decades, the prediction of suspended sediment load was highly regarded by water resources management and engineering researches, particularly in flood prone areas. Nowadays, the methods and artificial intelligence techniques to predict hydrologic properties have become very popular. In recent studies, we have used various parameters such as the spectral reflection bands of satellite images, land use and geology maps and climatic data. Landsat satellite images have good spatial resolution. Da Silvia (2015) also used spectral calibration of multispectral satellite images to assess suspended sediment concentration. Their results showed that the concentration of suspended sediment has been strongly influenced by seasonal rainfall. The yellow river sediment using Landsat satellite images were evaluated by Zhang et al (2014). The results showed that, using the modified algorithm and recovery appropriate climate models, TM / ETM + can be used to quantify the concentration of suspended sediment at the mouth of the Yellow River. In this study, they have investigated mining indices of satellite images and watershed geomorphometry parameters derived from the characteristics of the basin surface to evaluate and compare the performance of these parameters in prediction of the suspended sediment. In this study, the methods such as artificial neural networks, linear regression, K nearest neighbor, Gaussian processes, support vector machine and evolutionary support vector machine have been selected with the purpose to check the role of these parameters in prediction of suspended sediment load. The purpose of the detecting the impact of these parameters is to improve the assessment models.

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Materials and Methods

1- Study Areas

There were 68 catchment areas located in the provinces of Gilan and Lorestan from Iran. (Figure 1)

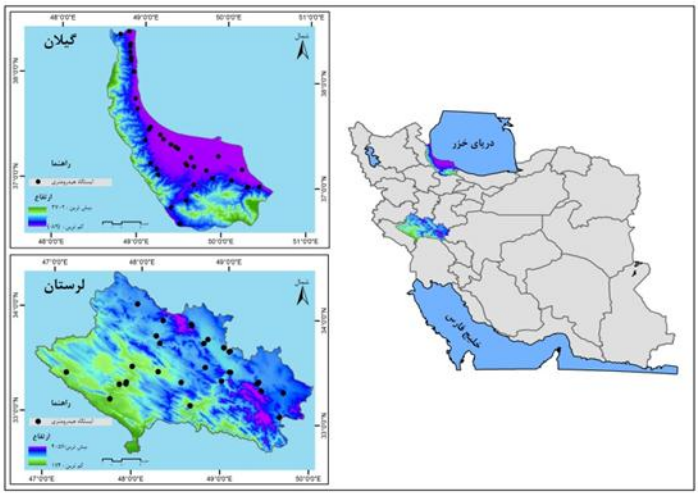

Figure 1. The location and studied stations

2- Data processing

Data mining geomorphometry

After determining the study area, geomorphometry parameters were extracted. Geomorphometry parameters was extracted from 30-meter area digital elevation model (Table 1)

Table1. Geomorphometry parameters extracted from DEM

Analytical Hillshading	MRRTF[1]
Aspect	MRVBF[2]
Catchment Area	Plan Curvature
Channel Network Base Level	Profile Curvature
Convergence Index	Relative Slope Position
Cross-Sectional Curvature	Slope
Discharge	Strahler Order
Drainage Density	Stream Power Index
Flow Accumulation	Suspension Load
Flow Directions	Tangential Curvature
General Curvature	Topographic Wetness Index
Longitudinal Curvature	Vertical Distance to Channel Network
LS Factor	Watershed Basins

1. Multi resolution ridge top flatness index
2. Multi resolution index off valley bottom flatness

3- The modeling process

In this study, we have used the input parameters in the prediction of suspended sediment load of data mining models such as linear regression, Gaussian processes, neural networks, k-nearest neighbor, support vector machine and evolutionary support vector machine.

- Linear regression

Linear regression to model the value of a quantitative dependent variable is based on a linear relationship with one or more independent variables.

- Artificial Neural Network

Artificial neural networks including computational models can be used even if the relationship between inputs and outputs of a physical system is complex and nonlinear, with a network of interconnected nodes that all are joined together.

- K-Nearest Neighbor

K-Nearest Neighbor algorithm including the selection of a specific number of vector data is randomly selected from the set for the simulation period.

Gaussian process

A Gaussian process is a stochastic process consisted of random values at any point in space or time domain so that each of the random variables is normally distributed.

- Support Vector Machine

Support vector machines are a class of supervised learning methods for classification and regression problems.

- Evolutionary Support Vector Machine

Evolutionary vector machine model is used as an evolutionary strategy to optimize the results. It offers an evolutionary algorithm to solve the problem of dual optimization in a support vector machine.

4- Evaluation Model

In order to evaluate the algorithms applied to the data, we used the evaluation criteria of Root Mean Squared Error (RMSE), relative error (Re), Correlation coefficient (r), and Absolute error (AE).

5- Weighting parameters

To weight input parameters of support vector machine algorithm, we determine these algorithm coefficients in a normal vector of linear support machine as the weight of characteristics.

Results and discussion

At first, the different algorithms were applied on the data of the geomorphometry parameters. The results showed that with use of geomorphometry parameters, Gaussian process model with RMSE = 10.35 and R = 0.986 is the best model to predict suspended sediment load. In the next phase models, we used the input data indices of satellite images. Then, index satellite images and geomorphometry parameters as input have been together and the models were run on them.

Also, the results showed the Gaussian process model with RMSE =5.026 and R=0.99. It has the highest accuracy for predicting suspended sediment load. (Figure 2)

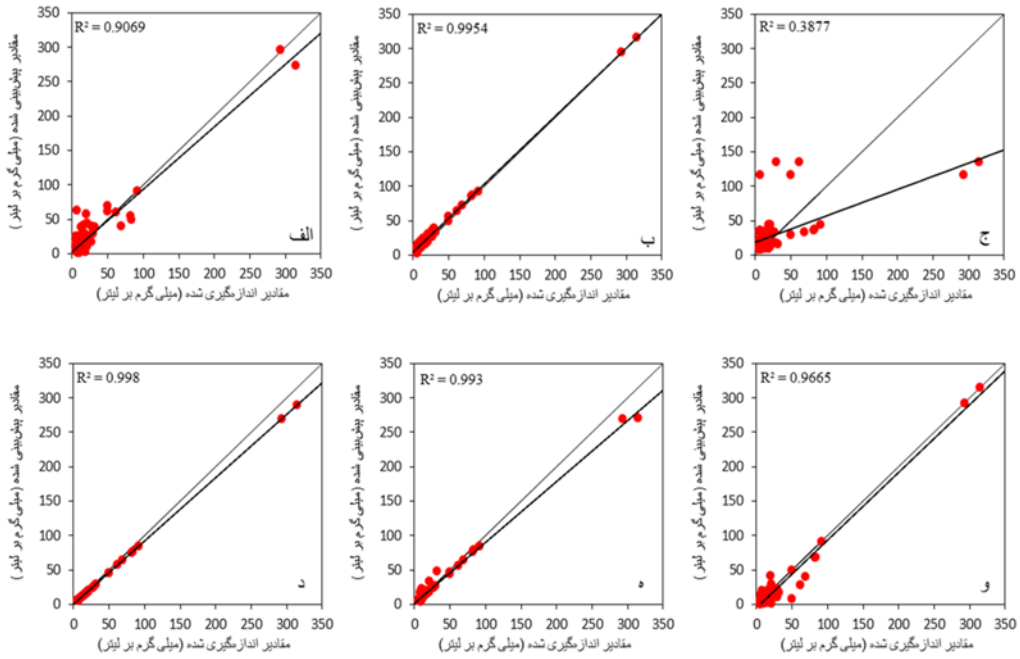

Figure 2. The scatter plot of the observed and predicted values of the models A: linear regression, B: Artificial Neural Networks, C: nearest neighbor, D: Gaussian process, E: support vector machine, F: evolutionary support vector machine, using a combination of geomorphometry parameters and indicators of satellite images.

It can be concluded that the models applied in this study compared with those with climate data as their input have more accuracy. Also, the parameters of satellite images have a greater impact on the increase in the accuracy of the models.

Conclusion

The use of satellite image indices and geomorphometry parameters as model input cause increases in the accuracy of data mining algorithms to predict suspended sediment load. The results of the study indicated that satellite imagery indices have been more effective in predicting suspended sediment load and using these indicators increase the accuracy of the models more effective than geomorphometry parameters. Therefore, with the indices of satellite images, Gaussian Process Model with RMSE =7.513 is using the geomorphometry parameters of the Gaussian process model with RMSE =10.35 as the highest accuracy. Combining geomorphometry parameters and indicators has increased the accuracy of all models and Gaussian process model with RMSE = 5.026 as the highest accuracy. The results of weighting also showed influence of satellite image indices to predict suspended sediment load.

Keywords: Data mining, Digital Elevation Model, Geomorphometry Parameters, Satellite Images.

Evaluation of the Performance of Artificial Neural Network and Support Vector Machine Models in Estimation of Daily Evaporation amounts (Case study: Tabriz and Maragheh Synoptic Stations)

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Extended Abstract

Introduction

Evaporation is a fundamental component of the hydrology cycle and has an important role in water resources management. Daily evaporation is an important variable in reservoir capacity, rainfall-runoff modeling, crop management and water balance. Measurement of actual evaporation is almost impossible, but evaporation can be estimated using several methods. There are two general viewpoints for estimation of evaporation: direct and indirect methods. It is inoperative to measurement of the evaporation by direct methods in all locations. The direct methods are usually used for proximate reservoirs or irrigation projects. The indirect methods of evaporation estimation need various input data that are not easily available. Moreover, the evaporation have very complex and nonlinear process that simulation of its complex process using simple methods is impractical. In recent years, the artificial intelligent methods such as Artificial Neural Network (ANN) and Support Vector Machine (SVM) have been successfully utilized for modeling the hydrological nonlinear process such as rainfall, precipitation, rainfall-runoff, evaporation, temperature, water quality, stream flow, water level and suspended sediment, etc. Therefore, this research evaluates the performance of ANN and SVM models in daily evaporation estimation.

Materials and methods

The daily climatic data, air temperature, wind speed, air pressure, relative humidity, rainfall, dew point temperature and sun shine hours of Tabriz and Maragheh synoptic stations are used

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as inputs to the ANN and SVM models to estimate the daily evaporation. For this purpose, 75 percent of the daily evaporation data were selected to calibrate the models and 25 percent of the data were used to validate the models. Different combinations of seven input and then individual inputs have been applied for evaporation estimation.

ANNs are parallel information processing systems consisting of a set of neurons arranged in layers. These neurons provide suitable conversion functions for weighted inputs. In this study, we used Multilayer feed-forward perceptron (MLP) network. The MLP is trained with the use of back propagation learning algorithm. The back-propagation training algorithm is a supervised training mechanism and is normally adopted in most of the engineering applications. The neurons in the input layer have no transfer function. The logarithmic sigmoid transfer function was used in the hidden layer and linear transfer function was employed as an activation function from the hidden layer to the output layer, because the linear function is known to be robust for a continuous output variable. The optimal number of neuron in the hidden layer was identified using a trial and error procedure by varying the number of hidden neurons from 1 to 20. In recent years, SVM as one of the most important data-driven models has been considered in this regards. This model is a useful learning system based on constrained optimization theory that uses induction of structural error minimization principle and results as a general optimized answer. The SVM is a computer algorithm that are learnt by example to find the best function of classifier/hyperplane to separate the two classes in the input space. The SVM analyzes two kinds of data, i.e., linearly and non-linearly separable data. For a given training data with N number of samples, represented by $(x_1, y_1),\ldots,(x_N, y_N)$, where x is an input vector and y is a corresponding output value, SVM estimator (f) on regression can be represented by:

$$f(x) = w.\varnothing(x) + b$$

Where w is a weight vector, b is a bias, and "." denotes the dot product and $\emptyset$ is a non-linear mapping function. Typically, three kernel functions, radial basis, polynomial and linear are applied in SVM. Use of each function with various parameters for evaporation estimation may have different results. Therefore, it is necessary to evaluate the accuracy of each of these functions and select the appropriate kernel functions for evaporation estimation. Two performance criteria are used in this study to assess the goodness of fit in the models. These are Correlation Coefficient (CC) and Root Mean Square Error (RMSE).

Results and discussion

In this paper, ten different combinations of seven inputs and then individual inputs are applied to estimate the evaporation. Results of evaporation estimation in Tabriz station indicate that the first and eighth combinations have minimum RMSE and maximum CC in test period of ANN and SVM models, respectively. Also results of evaporation estimation in Maragheh station indicate that the first and Seventh combinations have minimum RMSE and maximum CC in test period of ANN and SVM models, respectively. The ANN model using first combination including air temperature, wind speed, air pressure, relative humidity, rainfall, dew point temperature and sun shine hours of climate data can achieve the values of 2.12 (mm) and 0.78 for RMSE and R statistics in test period for Tabriz station. The SVM model using eighth combination including wind speed, air pressure, relative humidity, rainfall, dew point

temperature and sun shine hours of climate data, also achieve the values of 2.17 (mm) and 0.78 for RMSE and R statistics in test period for Tabriz station. Evaporation estimation of Maragheh station using ANN and SVM models, respectively, returned 1.62 (mm) and 1.43 (mm) for RMSE statistic in the test period. In next step, individual input results show that ANN model has better estimation of evaporation values in Tabriz station and SVM model in Maragheh station. The results also indicate that the SVM and ANN models have better estimation of evaporation values using individual inputs including average temperature and sun shine hours compaired with other inputs, respectively.

Conclusion

The results of these models indicate that both ANN and SVM models have acceptable performance in evaporation estimation. Evaluation results show that the average temperature is better input than other six parameters in estimation of evaporation. The investigations of this study indicate that although there is no significant difference in the results of three kernel functions of support vector machine, but the Radial Basis kernel function has high accuracy and better performance in estimation of daily evaporation in comparison to other kernel functions.

Keywords: artificial neural network, evaporation estimation, Maragheh, Support Vector Machine, Tabriz.