



Assessment of model fusion strategy for increasing the accuracy of autumn rainfall forecasting

F. Modaresi¹, S. Araghinejad^{2*}, K. Ebrahimi²

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Abstract

Autumn precipitation forecasting plays a key role in agricultural planning especially rainfed farming feasibility studies. In this study, model fusion technique has been used in order to increase the accuracy of autumn precipitation forecast. Based on two teleconnection signals of SOI and NINO 3.4 as predictors, five models including; Artificial Neural Network (ANN), Generalized Regression Neural Network (GRNN), Support Vector Regression (SVR), K-Nearest Neighbor (KNN), and Linear Regression (LR) with optimized structure have been implemented as individual rainfall forecasting models (IPFMs) in Seimareh subbasin of Karkheh basin, IRAN. In order to combine the IPFMs, the ordered weighted aggregation strategy (OWA) has been performed in which, two weighting methods including Orness and Orlike methods have been used and assessed for determining the weights of IPFMs. The results of this study showed that the forecasted rainfall obtained from two methods of OWA model fusion strategy has more accuracy comparing to individual forecasting models. Moreover, application of the Orlike method did a quite better job than Orness method. Besides, comparing the results of the OWA strategy methods with two other strategies viz model fusion with artificial neural network and selecting the best IPFM revealed that both Orness and Orlike methods are performing more precisely than two other strategies in forecasting rainfall.

Keywords: Model Fusion, Ordered Weighted Aggregation (OWA), Orness, Orlike, SOI, NINO 3.4

¹ Ph.D. Candidate of Water Resources Engineering, University of Tehran, Iran

² Associate Professor, University of Tehran, Iran

(*Corresponding author email address: araghinejad@ut.ac.ir)



Comparison of different regional estimation methods for daily minimum temperature (A case study of Isfahan province)

Gh. Fadavi¹, J. Bazrafshan^{2*}, N. Ghahreman²

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Abstract

The main objective of this study is to evaluate different interpolation methods for estimation of regional minimum temperature in Isfahan province, Iran. In order to explore the effect of stations number on the accuracy of the interpolation methods, two years 1992 and 2007 with different number of meteorological stations have been selected. The daily minimum temperature (T_{min}) data of 30 meteorological stations (17 synoptic and 13 climatological stations) for year 1992 year and 54 meteorological stations (31 synoptic and 23 climatological stations) for 2007 year were collected from Isfahan and neighboring provinces. In order to regionalize the point data of T_{min} , several interpolation methods, including inverse distance weighted (IDW), Kriging, Co-Kriging, Kriging-Regression, Multiple Regression and Spline were worked out. To evaluate the performance of these methods, 2 days from each month, i.e. total 24 days for both years were chosen randomly. The obtained results were compared using statistical measures including: RMSE, MBE, MAE and correlation coefficient (r). The findings revealed that the application of multiple regression method for interpolation produced the least error in estimation of minimum temperature in 1992 (with RMSE ranging from 2.33 to 5.12 and r from 0.38 to 0.85). For 2007 year, the best estimation was achieved by multiple regression and Kriging-Regression (RMSE from 2.36 to 5 and r ranging from 0.38 to 0.83) respectively. The overall performance of Kriging, Co-Kriging, IDW, and Spline methods was also acceptable and they were in next ranks respectively. In general, with increasing number of study the overall accuracy of model performance in estimation of daily minimum temperature has been improved.

Keywords: Interpolation, Minimum temperature, Isfahan, Iran

¹ M. Sc. Graduate, Agrometeorology, University of Tehran

² Associate Prof. University of Tehran

(*Corresponding author email address: jbazr@ut.ac.ir)



Quantifying the risk of heavy rainfall and its damage to agriculture in Iran

A. Khalili^{1*}

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Abstract

This study has been performed with two goals. Firstly, zoning the country based on risk of heavy rain damage to agricultural lands; secondly, developing a model to determine the probability of heavy rainfall damage risk (Prsk) over various regions of Iran considering their land use (e.g. rainfed or irrigated farming regions). Daily precipitation data of 405 meteorological stations across Iran with acceptable and continuous records were collected, and then the Probability Density Function (PDF) for these data was worked out using maximum likelihood method. The occurrence probability of a daily rainfall event greater than or equal to 50mm (Prsk) was also calculated based on these PDFs. The statistical analysis showed that, there exist a linear relationship (significant at 1%) between Prsk, as the dependent variable, and annual precipitation R, elevation Z and latitude Y as the predictors. The obtained regression equation; $Prsk = a + bZ + cR + dY$ was used for generating the regional risk maps. Besides, the digital precipitation model of Iran based on climatic data of 1100 stations for a 40-year period as well as the digital elevation model of Iran with a resolution of 1x1 Km² were prepared for calculating Prsk. Then, by using GIS tools, an error layer was prepared to correct the calculated values of Prsk. Finally these risk values were classified as: < 20= low, 20 – 35= medium, 35-50= high and > 50= very high risk and corresponding maps were produced. Ultimately, for practical applications, a new agro-climatic risk software namely, AgroClimRisk was introduced by which, the Digital Land-use Model and digital boundaries of administrative regions of the country were incorporated in developed Prsk model. This package is capable to calculate the maximum, minimum, mean and coefficient of variation values of Prsk and quantification of its risk of damage to farmlands over each part of the country using geo-statistical methods.

Keywords: Agro-insurance, Heavy rainfall risk, Modeling, Iran, GIS

¹ Professor, Department of Irrigation and Reclamation Engineering, University college of Agriculture and Natural Resources, University of Tehran, Karaj, Iran
(*Corresponding author email address: akhalili@ut.ac.ir)



Application of physiological equivalent temperature index for determination of suitable regions for agritourism in Kerman province

A. Bakhtiari^{1*}

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Abstract

Agritourism is one of the most important kinds of tourism in outdoors, which is mainly affected by climatic comfort indices. In this study, the climatic and geographical features of Kerman province from Agritourism point of view have been assessed. Existing record of monthly climatic data of 10 synoptic stations across the province were obtained by which, the climate comfort index of Physiological Equivalent Temperature (PET) was calculated using RayMan package. To investigate the correlation between monthly values of the index and station's elevation, a simple gradient equation was applied. Then, the maps of index changes at different elevations were worked using Arc GIS ver.10. The results indicated that the index decreases with height for entire year. Generated zoning maps showed that in January condition is favorable only in Jiroft. In month of February Jiroft and Shahdad stations, and in March Kahnooj and Bam regions are suitable for Agritourism purposes. Also in April, in Sirjan and Anar, in May, Baft, Anar, Kerman and Shahr-e Babak have found to be proper choices. During June, July and August only Lalehzar area, and in September Lalehzar, Kerman and Baft can be recommended for related activities. In general, months of January, June, July and August have got the least flexibility for any agritourism planning due to unfavorable weather conditions.

Keywords: Climate comfort, Physiological equivalent temperature index, Agritourism, Kerman

¹ Instructor, Department of Tourism and Hospitality Management, Faculty of Tourism, Higher Education Complex of Bam, Bam, Iran
(*Corresponding author email address: Bakhtiari@bam.ac.ir)



Estimating the land surface albedo using Level1-G and CDR Landsat-7 satellite images

A. A. Sabziparvar^{1*}, E. Fakharizadeh Shirazi², S. Marofi³, Y. Rezaei⁴

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Abstract

Land surface albedo, is defined as the ratio of the surface reflected to received solar radiation. It is one of the major meteorological variables required for calculation of the surface radiation budget, crop water requirement and boundary conditions of climate models. During the last several decades, the albedo has been estimated using remotely sensed data. In this study, land surface albedo is estimated by using Level1-G and CDR Landsat-7 satellite images and compared with in-situ data in a farmland located in Hamedan province in the proximity of the climatology station located at faculty of agriculture, Bu-Ali Sina University. For this purpose, 14 satellite images were used. In-situ surface albedo data were also obtained from the net radiometer installed at the study site. Surface albedo was calculated at various wavelengths after removing SLC-Off, cloud effect, and atmospheric and topographic errors. The results showed that the estimated green cover albedo values were within the range of 0.21-0.26 and snow cover albedo was approximately 0.65. Estimates of surface albedo from CDR and Level1-G images were evaluated against the surface measurements by using root mean square errors (RMSE). The calculated RMSE was within the range of 0.02 to 0.09. Furthermore, the maximum error of estimated albedo was observed in NIR wavelengths. According to the Fisher test results, there was no significant difference between the estimated surface albedo from CDR and Level1-G images. Hence, for crude estimation of surface albedo, both approaches can be recommended with no priority; especially, for coarse regional estimates.

Keywords: Surface albedo, Landsat-7, Reflectance, CDR, Hamedan

¹Professor in Meteorology, Department of Water Engineering, Faculty of Agriculture, Bu-Ali Sina University, Hamedan, Iran

(*Corresponding author email address: swsabzi@basu.ac.ir)

²Ph.D Candidate in Agrometeorology, Department of Water Engineering, Faculty of Agriculture, Bu-Ali Sina University, Hamedan, Iran

³Professor of Hydrology, Department of Water Engineering, Faculty of Agriculture, Bu-Ali Sina University, Hamedan, Iran

⁴Assistant Professor of Civil Engineering, Faculty of Engineering, Bu-Ali Sina University, Hamedan, Iran



The effects of different concentrations of carbon dioxide and irrigation regimes on quantitative and qualitative characteristics of lentil (variety Bileh-savar)

Sh. Shams¹, M. Mousavi Baygi^{2*}, A. Alizadeh², M. Shoor³, A. A. Kamgar-Haghighi⁴

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Abstract

In order to investigate the effect of increasing carbon dioxide concentration on growth and yield of lentil (*Lens culinaris*, Bileh-Savar), an experiment was conducted at Ferdowsi University's research greenhouse. The effects of increasing carbon dioxide concentration from 400 to 800 and 1200 ppm at four irrigation levels (1.25 FC, FC, 0.75 FC and 0.5 FC) under randomized complete design were studied. Elevated amounts of CO₂ concentration from 400 to 800 and 1200 ppm, increased yield by 21 and 50%, respectively which may be attributed to corresponding increase in weight of 100 seeds for 13 and 43% and also increased number of pod; 4% and 7, respectively. Also, by doubling CO₂ concentration, crop height, shoot dry matter and root dry matter were increased by 15, 28 and 22%, respectively; while tripling CO₂ raised these parameters, 24, 59 and 39% respectively. On the other hand doubling and tripling the amount of carbon dioxide concentration, led to a decrease in evapotranspiration for amount of 12 and 30%. Moreover, the protein content of the grain showed an average decrease of 10%. It should be mentioned that reducing the amount of irrigation water reduced the biomass and the amount of protein as well.

Keywords: Carbon dioxide, Evapotranspiration, Dry matter, Lentil, Yield

¹ Ph.D. student of Agrometeorology, Dept. of Water Engineering, College of Agriculture, Ferdowsi University of Mashhad, Iran

² Professor of Water Engineering Dept., College of Agriculture, Ferdowsi University of Mashhad, Iran

(*Corresponding author email address: mousavib@um.ac.ir)

³ Associate Professor, Dept. of Horticulture and Landscape Engineering, College of Agriculture, Ferdowsi University of Mashhad, Iran

⁴ Professor of Water Engineering Dept., College of Agriculture, Shiraz University, Shiraz, Iran



Technical Note

Determination of suitable regions for wheat cultivation in Fars province

Gh. Fallah Ghalhari^{1*}, M. Asadi², A. Dadashi Roudbari³

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Abstract

The aim of this feasibility study is determination of suitable zones for rainfed wheat cultivation in Fars province, south of Iran. Climatic variables including humidity, rainfall, and temperature along with elevation were employed to determine the suitable areas for wheat cultivation using Analytic Hierarchy Process (AHP) approach. The study results revealed that, from dryland cultivation point of view, the province can be regionalized into four zones i.e. 'very suitable', 'suitable', 'average', and 'non suitable'. Based on the results, the 'very suitable' areas are mostly located in the west and south west of the province (Lamerd, Shiraz and Doroudzan stations), covering an area of 3,429,000 hectares, about % 28 of the total area of the province.

Keywords: Analytic Hierarchy Process (AHP), Iran, Rain-fed wheat

¹ Assistance Professor, Faculty of Geography and Environmental Sciences, Hakim Sabzevari University, Iran
(*Corresponding authors email address: ab_fa789@yahoo.com)

² Ph.D. Candidate of Agroclimatology, Faculty of Geography and Environmental Sciences, Hakim Sabzevari University, Iran

³ M.Sc. Student of Applied Climatology, Faculty of Geography and Environmental Sciences, Hakim Sabzevari University, Iran