Dr. Sushindra Kumar Gupta

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Area of Interest

Rainfall-Runoff Modeling, Sediment Yield Modeling, Soil Moisture Accounting, Soil Conservation Service Curve Number (SCS-CN) Method, Spatial and Temporal Analysis of Sediment Yield, Optimization Techniques Remote Sensing and Geographical Information System (RS & GIS)

Professional Background

From	To	Designation	Organisation
2018	On Going	Assistant Professor	Poornima Institute of Engineering & Technology, Jaipur
2018	On Going	NAAC Member	Poornima Institute of Engineering & Technology, Jaipur
2018	On Going	NBA Member	Poornima Institute of Engineering & Technology, Jaipur
2014	2018	Research Scholar	Malaviya National Institute of Technology, Jaipur
2013	2014	Project Officer	Foundation for Ecological Security, Ujjain

Honors and Awards

Recipient of Best Paper Presentation entitled “Mathematical modeling of rainfall-runoff from natural watersheds”	VIT University Jaipur
Recipient of the Ministry of Human Resource Development Fellowship for Ph.D.	Malaviya National Institute of Technology, Jaipur

Educational Details

Degree	Subject	University	Year
Ph.D.	Water Resources Engineering	Malaviya National Institute of Technology, Jaipur	2019
M.Tech.	Soil and Water Conservation Engineering	Banaras Hindu University, Varanasi	2013
B.Tech.	Agricultural Engineering	Gautam Buddha Technical University, Lucknow`	2011

Sponsored Research Project

Title	Funding Agency	Year
Modeling of Sediment Yield from Indian Watershed	TEQIP-III, RTU, Kota	2019

Participation In Workshop/Training

Name	Place	Sponsored By	Date
Survey and Planning of Watershed for Soil & Water Conservation	Dehradun	Central Soil & Water Conservation Research & Training Institute,	2012
Hydrological modeling with SWAT & groundwater modeling with MODFLOW	IIT, Hyderabad	Department of Civil Engineering, IIT, Hyderabad	December 26-27, 2014
National workshop on “Research implications of econometrics & quantitative techniques	MNIT, Jaipur	MNIT, Jaipur	March 20-24, 2015
Mathematical modeling, MATLAB programming and their applications in engineering and sciences	MNIT, Jaipur	MNIT, Jaipur	January 19-23 2015
Land use/ land cover change modeling and prediction	MNIT, Jaipur	MNIT, Jaipur	July 4-8, 2016.
Hydroinformatics for integrated water resources management	IIT, Madras	IIT, Madras	November 28 to 9thDecember 2016
National workshop on “MIKE HYDRO	JK Lakshmipat University, Jaipur	JK Lakshmipat University, Jaipur	31th Oct to 1st November 2017.

Memberships

1. Universal Association of Civil, Structural and Environmental Engineers

Reviewer

Name of Journal	Publisher's
Journal of Hydrology	Elsevier
Water Resource Management	Springer

Teaching Engagements

Title	Course Code	Class Name	Semester
Water Resource Engineering	7CE01	B.Tech. 4th year (Civil)	Autumn
Water Resource Engineering	5CE4-05	B.Tech. 3rd year (Civil)	Autumn
Hydraulics Engineering	4CE4-05	B.Tech. 2rd year (Civil)	Spring

Projects and Thesis Supervised

Title of Project	Name of Students
Sediment Yield modeling based soil moisture accounting	Pranjal, Kavita & Muskan
Development of low cost water purification filter in semi-arid region of Rajasthan, India	Ibrahim, Vinay & Prasenjeet

Conferences Organised

Conference Name	Sponsored By	Date
International Conference on Smart Infrastructure & Environment	Deptt. Of Civil Engineering, Poornima Institute of Engineering & Technology, Jaipur	April 6-8, 2018

Special Lectures Delivered

Title	Place	Date
Research Methodology	Deptt. Of Civil Engineering, Poornima Institute of Engineering & Technology, Jaipur	April 15, 2018

Research Methodology	Deptt. Of Civil Engineering, Poornima Institute of Engineering & Technology, Jaipur	May 15, 2018

Books Chapter Authored

Gupta, S.K., Sharma, G., Jethoo, A.S., and Tyagi, J.V. 2017. Event and continuous based rainfall-runoff models: A Review. Springer.

Refereed Journal Papers

1. Gupta, S. K., Tyagi, J. V, Sharma, G., Jethoo, A. S. and P.K. Singh. (2019). “Soil Moisture Accounting (SMA) based sediment graph models for small watersheds”. Journal of Hydrology.574:1129- 1151.
2. Gupta, S. K., Tyagi, J. V, Sharma, G., Jethoo, A. S. and P.K. Singh. (2019). “An event-based sediment yield and rainfall-runoff modeling using Soil Moisture Balance/ Budgeting (SMB) method” Journal of Water Resource Management. 33:3721-3741.
3. Gupta, S.K., Tyagi, J.V., Sharma, G., Jethoo, A.S., Singh, P.K. (2019). “Rainstorm-generated sediment yield model based on SMP”. Journal of Hydrological Process. (under review)
4. Gupta, S. K., Sharma, G., Tyagi, J. V, Jethoo, A. S.(2018). “Mathematical modeling of rainfall-runoff from natural watershed” ISH Journal of Hydraulic Engineering. (under review)
5. Gupta, S. K., Tyagi, J. V, Sharma, G., Jethoo, A. S. and P.K. Singh. (2018). “A critical review of rainfall-runoff and sediment yield model based on Soil Conservation Service Curve Number (SCS-CN) method” Journal of Catena. (submitted)
6. Gupta, N. K., Gupta, S. K. & Jethoo, A.S. (2016). “Rainfall and surface water resources of Rajasthan State “Journal of Water Policy.18, 276-286.
7. Gupta, S. K., Jethoo, A.S., Tyagi, J., Gupta, N. K., Gautam, P. K. (2015). “Application of hydrological models in water resources: A Review”. International Journal of Computer & Mathematical Sciences, Volume 4 ISSN 2347- 8527.
8. Gautam, P. K., Jethoo, A.S., Shrivastava, S., Gupta, S. K. (2015) “Sustainability in Civil Construction and the role of Civil Engineers” International Journal of

Engineering Technology, Management and Applied Sciences, Volume 3 ISSN 2349-4476.

9. Nayak, T.R., Gupta, S. K., & Galkate, R. (2015). “GIS based mapping of groundwater fluctuations in Bina Basin” In: Science Direct Aquatic 4 Proceedia, PP 1469-1476.
10. Vyas, A., Gupta, N. K., Gupta, S. K., Gautam, P. K., & Jethoo A.S. (2015).“Mini/Micro Hydel power system design and its implementation in Rajasthan”. In Science Direct Procedia, PP, 1537-1544.
11. Navin, P.K., Mathur, Y.P., Gupta, S.K. (2015). “Study of hourly monsoon rainfall data of Jaipur for development of critical rainfall intensity equation”. International journal of engineering technology, management and applied sciences. Volume 3(3), ISSN 2349-4476.

International Conference Papers

1. Gupta, S. K., Sharma, G., Jethoo, A. S., Tyagi, J. V. (2017) “Mathematical modeling of rainfall-runoff from natural watersheds” 22th International Conference on Hydraulics, Water Resources and Coastal Engineering 21-23 December 2017.
2. Gupta, N. K., Rao, J. P., Gupta, S. K., Sharma, G., (2017) “Hydro-meteorological trend analysis in the Bihar State India”.22th International Conference on Hydraulics, Water Resources and Coastal Engineering 21-23 December 2017.
3. Jain, P., Rao, J. P., Gupta, S. K., Sharma, G., (2017) “Estimation of crop water requirement for South-North part of Rajasthan India”.22th International Conference on Hydraulics, Water Resources and Coastal Engineering 21-23 December 2017.
4. Gupta, D. K., Rao, J. P., Gupta, S. K., Sharma, G., (2017) “Hydrological, meteorological and agricultural drought models: A-Review”.22th International Conference on Hydraulics, Water Resources and Coastal Engineering 21-23 December 2017.
5. Gupta, G. K., Rao, J. P., Gupta, S. K., Sharma, G., (2017) “A critical review of drought and drought indices”.22th International Conference on Hydraulics, Water Resources and Coastal Engineering 21-23 December 2017.

6. Meena, S. K., Rao, J. P., Gupta, S. K., Sharma, G., (2017) " Estimation of pearl millet crop water requirement system in Rajasthan using SWAT data".22th International Conference on Hydraulics, Water Resources and Coastal Engineering 21-23 December 2017.
7. Gupta, S. K., Sharma, G., Jethoo, A. S., Tyagi, J. V. (2016) "A Critical Review of Rainfall-Runoff and Sediment Yield Models" Hydro 2016 International Organized by ISH Pune 21th International Conference on Hydraulics, Water Resources and River Engineering 8-10 December 2016
8. Gupta, S. K., Jethoo, A. S., Sharma, G., Tyagi, J. V., Gupta, N. K. (2015) "A Critical Review of Hydrological Models" Hydro 2015 International Organized by IIT Roorkee Department of Civil Engineering 20th International Conference on Hydraulics, Water Resources and River Engineering 17-19 December 2015.
9. Gupta, N., Gupta, S. K., & Jethoo, A.S. (2014). "Hydrological Modeling of Ramgarh Dam of Rajasthan State Using Soil and Water Assessment Tool (SWAT)" In: Proceeding. International conference on Hydrology and Watershed Management, Central for Water Resources, Institute of Science & Technology, JNTU, Hyderabad. PP, 985-996.

National Conference/Seminars

1. Gupta, S. K., Jethoo, A.S., Sharma, G., Tyagi, J. V., Gupta, N. K., A Critical Review of Hydrological Models. Organized by Department of Civil Engineering, Golden Jubilee Celebration, MNIT Jaipur 10-12 April, 2015 Jaipur, India**.**

2. Gupta, N. K., Jethoo A.S. Sharma, G., Gupta, S. K. Study of Temporal Variation of Inflow to the Ramgarh Dam of Rajasthan State. Organized by Department of Civil Engineering, Golden Jubilee Celebration, MNIT Jaipur 10-12 April, 2015 Jaipur, India.

References

1. Dr. Gunwant Sharma
   Professor HAG
   Department of Civil Engineering
   Malaviya National Institute of Technology, Jaipur

2. Dr. Jaivir Tyagi
   Scientist ‘G’ & Head
   Environmental Hydrology Division
   National Institute of Hydrology, Roorkee
3. Dr. Ajay Singh Jethoo
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(Sushindra Kumar Gupta)

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Research papers

Soil Moisture Accounting (SMA) based sediment graph models for small watersheds

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ARTICLE INFO

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Keywords:
Soil Moisture Accounting (SMA)
SCS-CN method
IUSG
Nash model
Sediment graph

ABSTRACT

The sediment graph models are useful for computation of sediment yield as well as total sediment out flow from watershed. In this study, the analytical development of proposed sediment graph models is based on Soil Moisture Accounting (SMA) procedure coupled Soil Conservation Service-Curve Number (SCS-CN) method, Nash's Instantaneous Unit Sediment Graph (IUSG)model and Power law. This coupling has led to the development of four sediment graph models (SGMs), i.e., SMA-SGM1, SMA-SGM2, SMA-SGM-3 and SMA-SGM4 depending on the four different hydrologic conditions as: (i) initial soil moisture (V_0) = 0 and initial abstraction (I_a) = 0, (ii) initial soil moisture (V_0) ≠ 0and initialabstractionI_a = 0, (iii) initial soil moisture (V_0) = 0 and (I_a) ≠ 0, and (iv) initial soil moisture (V_0) ≠ 0 *and* initial abstration (I_a) ≠ 0, respectively. These models are applied on six natural watersheds with nineteen storm events having different land use/land cover, climatic condition (arid, semi-arid, humid and sub-tropical), rainfall and land slope conditions. The goodness-of-fit statistics is evaluated in terms of Nash Sutcliffe efficiency (NSE) and relative error (RE) between observed and simulated (calibrated and validated) sediment graphs. Further, the performance of these models is also compared with the sediment graph model of Bhunya et al. (2010) (BSGM) on all the six study watersheds. It is found that the proposed models perform very well in simulating sediment yield generation process for all the watersheds and show significant improvement over the BSGM model.

1. Introduction

Time-distributed sediment yield modeling has paramount importance in hydrology, water resources and environmental engineering. It has been recognized to be fundamental to a range of applications such as river morphology, natural resource conservation planning, land management, soil and water conservation and agricultural and water resource planning. The process of sediment yield generation is extremely complex and mainly consists of detachment and transport of sediment particles by raindrop and runoff (Tyagi et al., 2008). The sediment yield modeling is more complex as compared to other types of watershed modeling, as it arises from a complex interaction of several hydro-geological processes, and the knowledge of the actual process and extent of suspended materials is far less detailed (Bennett, 1974).

The sediment flow rate plotted as a function of time during a storm at a given location is known as sediment graph. Without a sediment graph, only the average sediment rate for the storm can be computed. The average sediment yield is not adequate for computing dynamic suspended sediment load and pollutants load during the storm (Raghuwansh et al., 1994). Rendon-Herrero (1978) developed a sediment graph model based on unit sediment graphs (USG) approach defined as the unit sediment graph generated from one unit of sediment for a given duration distributed uniformly over a watershed.

The sediment yield models can be classified into three groups: (1) lumped, (2) quasi-lumped and (3) distributed (Singh et al., 2015a, 2015b). Probably the most widely used lumped model for estimating sediment yield from small agricultural watersheds (agricultural, forest, and urban) is the Universal Soil Loss Equation (USLE) developed by Wischmeier and Smith (1978). To apply USLE to large watersheds, the concept of sediment delivery ratio (ratio of sediment generated to the amount of erosion) has been incorporated. Another lumped sediment yield model was developed by Mishra et al. (2006a, 2006b) by coupling the Soil Conservation Service Curve Number (SCS-CN) method (SCS, 1956) and USLE. Later on, a sediment yield was developed by Tyagi et al. (2008) by utilizing the SCS-CN based infiltration model for computation of rainfall-excess rate and the SCS-CN-inspired

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An Event-Based Sediment Yield and Runoff Modeling Using Soil Moisture Balance/Budgeting (SMB) Method

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Abstract
The Soil Conservation Service Curve Number (SCS-CN) method is frequently used for the estimation of direct surface runoff depth from the small watersheds. Coupling the SCS-CN method with the Soil Moisture Balance (SMB) method, new simple 2-parameters rainfall-runoff model and 3-parametrs rainfall-sediment yield models are derived for computation of runoff and sediment yield respectively. The proposed runoff (R2) and sediment yield (S2) models have been tested on a large set of rainfall-runoff and sediment yield data (98 storm events) obtained from twelve watersheds from different land use/land cover, soil and climatic conditions. The improved runoff (R2) and sediment yield (S2) models show superior results as compared to the existing Mishra et al. (S1) and original SCS-CN (R1) models. The results and analysis justify the use of the proposed models for field applications.

Keywords Sediment yield model · Rainfall-runoff model · SMB · Watershed

1 Introduction

Estimation of runoff and sediment yield is of paramount importance in water resources, environmental engineering and hydrology. The estimates of these variables are mainly required for assessing the water resources, planning of soil and water conservation structures, and for assessing the impact of climate change on watershed output (Mishra and Singh, 1999). The

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Water Policy 18 (2016) 276–287

Rainfall and surface water resources of Rajasthan State, India

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Abstract

The water resources in Rajasthan State are facing a crucial stage even after average/good rainfall. Temporal distributions as well as the spatial variability of rainfall within the state were investigated by applying an analysis of variance (ANOVA) test. The effect of change in catchment characteristics and anthropogenic activities on overland flow are also investigated in this paper by applying a regression technique. Inflow to the surface water resources of the state is regularly decreasing. Time series analysis and sequential cluster analysis reveals that 1994 was the critical year, which divides the two consecutive non-overlapping epochs viz. pre-disturbance and post-disturbance. Due to increasing population and the subsequent increase in agriculture (specifically using groundwater sources) having increased catchment interceptions, there is a regular decreasing trend of surface runoff and surface water availability. The study highlights that, in spite of an increasing trend of rainfall witnessed during the last 100 years, inflow to the surface water resources of the state is decreasing at a fast pace owing to a decrease in the percentage area contributing to surface runoff.

Keywords: Catchment degradation; Critical year; Infiltration; Rainfall; Runoff; Surface water resources

1. Introduction

Rainfall is the ultimate source of water resources in Rajasthan State. Partitioning of precipitation into different hydrological processes at any place largely depends on precipitation intensity. Surface flow, or we can say the overland flow, depends upon rainfall pattern and catchment characteristics. The amount of falling rain that can be utilized depends greatly on the intensity, drop size, velocity of the rain, catchment roughness and other catchment characteristics. Infiltration results in recharge of the aquifer system and discharge as sub surface flow (Alfa *et al*., 2011).

If rainfall intensity exceeds the infiltration capacity of the soil, rain will accumulate on the surface and, depending on the surface roughness, the gradient of the land surface, and the available depression storage, Hortonian Overland Flow (HOF) may occur, as according to Horton's Infiltration-excess Overland Flow (IOF) theory (Alfa *et al*., 2011). Horton considered infiltration as central to the

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INTERNATIONAL CONFERENCE ON WATER RESOURCES, COASTAL AND OCEAN ENGINEERING (ICWRCOE 2015)

GIS Based Mapping of Groundwater Fluctuations in Bina Basin

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Abstract

Groundwater is a precious and most widely distributed distinguished resource of the earth and unlike any other natural resource, it gets annual replenishment from the precipitation. Knowledge of spatial and temporal behavior of groundwater is utmost important for its management. Levels of groundwater are generally gathered at random points. But for groundwater modelling, the measured groundwater levels are often required to be interpolated at the grid nodes. In the present study Kriging technique was used to interpolate the groundwater levels in Bina river sub-basin of Betwa river Basin in drought affected Bundelkhand region of Madhya Pradesh. Spherical Model was found the best fit after drawing a semi-variogram from the output of the spatial correlation operation. Also, the best parameters for nugget, sill and range were obtained from the best fit spherical model. Interpolation of pre and post monsoon groundwater levels was carried out for the year 1995, 2000, 2005 and 2010. Finally, the water table fluctuation maps were generated showing the fluctuation in the pre monsoon period between the years, 1995-2000, 1995-2005 and 1995-2010 and the areas under rising/falling trend of groundwater table were delineated. The study shall be useful for planning groundwater development in Bina river basin and to suggest alternate cropping pattern for sustainable water resource development in part of Sagar and Raisen districts. The results reveal that the groundwater table in the central to northwest part of Bina watershed is declining in recent years. The groundwater recharge may be improved by construction of percolation tanks and farm ponds in the lower most corner of thegricultural fields.

Peer-review under responsibility of organizing committee of ICWRCOE 2015

Keywords: Groundwater level mapping, groundwater fluctuation, Kriging, Bina watershed.

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INTERNATIONAL CONFERENCE ON WATER RESOURCES, COASTAL AND OCEAN ENGINEERING (ICWRCOE 2015)

Mini/Micro Hydel Power System Design and its Implementation in Rajasthan

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Abstract

Small Hydel Power Projects have proved to be a blessing in the power generation sector, but a question arises that does it finds a successful way in the arid and semi arid areas of Rajasthan state? To investigate the fact the authors have tried to accumulate the required information in context with the small hydro projects. This paper contains the feasibility analysis, design methodology and the points to be considered during the estimation of cost with special emphasis to the state of Rajasthan. A site was discovered on the Indira Gandhi Canal of Rajasthan state for the preliminary design to be made, involving the latest technologies to increase the efficiency. A message has also been conveyed by the paper to promote the use of renewable energy sources and to keep the benefits which in fact contributes in achieving the path of self sufficiency for a nation. Finally some points have been concluded which can be kept in mind for the future planning in the hydel generation in an arid or semi arid region. Pay back computation is showing a 12.36 year to return the capital investment. The research has been done on the prevailing sites and identification of the potential sites and the problems related to implementation in rural areas of Rajasthan. Combined Solar-Hydro hybrid system is proposed to optimally utilize the infrastructure and manpower.

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Keywords: Rajasthan; Hydel; Feasibility; Analysis; Design; Cost

1. Introduction

Hydropower is a Renewable non- polluting and environmentally benign source of energy. It is perhaps the oldest renewable energy technique known to mankind for mechanical energy generation as well as electricity generation. Since our environment suffers from gas emission, the use of clean and renewable energy sources is one

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