One Dimensional Springflow Model for Time Variant Recharge

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The linear mathematical model for springflow suggested by Bear (1979) can simulate springflow for an initial instantaneous recharge. A springflow model has been developed, using the Bear model and Duhamel's approach, which can simulate springflow for time variant recharge. The suggested model can also be used to compute the time variant recharge to the springflow domain from a given springflow time series. The inverse problem, which contains linear recharge terms and nonlinear depletion terms, has been solved using the Newton-Raphson method for solving a set of nonlinear equations. The model has been tested to compute recharge for Kirkgoz spring, a first magnitude karst spring in the Mediterranean region of Turkey. The estimated annual recharge computed by the model on a monthly basis compared well with the annual recharge which had been estimated (Korkmaz, 1990) using the Bear model.

Adsorption of Metal Ions on Bed Sediments

Jain C K and Daya Ram

Hydrological Sciences Journal, vol. 42, No. 5, pp. 713-724, 1997

The adsorption of lead and zinc ions on bed sediments of the River Kali in western Uttar Pradesh, India, has been studied. The role of the coarser sediment fraction (210-250 m m) in controlling metal pollution has been elucidated and compared to those of the clay and silt fractions. The parameters controlling metal uptake, viz., solution pH, sediment dose, contact time, and particle size have been evaluated. The optimum contact time needed to reach equilibrium is of the order of 45 min for both the metal ions. The extent of adsorption increases with an increase of pH. Furthermore, the adsorption of the metal ions increases with increasing adsorbent doses and decreases with adsorbent particle size. The two geochemical phases of iron and manganese oxide act as the active support material for the adsorption of the metal ions.

Sediment Yield Estimation Using GIS

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A method has been developed in the present study for determination of the sediment yield from a catchment using the GIS. The method presented herein involves spatial desegregation of the catchment into the grids (or cells) having uniform soil erosion characteristics. The surface-erosion from each of the discretized cells is routed to the catchment outlet using the concept of sediment delivery ratio, which is defined as a function of the area of the cell covered by the forest. Sediment yield of the catchment is defined as the sum of the sediments delivered by each of the grids present in it. Spatial discretization of the catchment and derivation of the physical parameters related to erosion in the grids are performed through the GIS technique using the Integrated Land and Water Information Systems (ILWIS) package.

Flood Estimation Using a GIUH based on a Conceptual Rainfall - Runoff Model and GIS
Jain S K, Hemant Chowdhary, S M Seth and R K Nema

ITC Journal, 20-25, 1997-1

The computation of flood characteristics is a major concern of water resources engineers and scientists. The "geomorphological instantaneous unit hydrograph" (GIUH) is a recently developed approach for the simulation of flood events, especially appropriate for ungauged catchments. Many investigators have tried to relate the parameters of conceptual models to the geomorphologic characteristics of catchments. A mathematical model which enables the evaluation of the parameters of the Clark model for derivation of the instantaneous unit hydrograph (IUH) using geomorphologic characteristics of the basin has been developed. For each storm event, an IUH is found (depending upon the storm characteristics) and is used to convert rainfall into runoff. ILWIS was used to derive the necessary geomorphologic characteristics of the watershed. The model was used to estimate the standard project flood (SPF) for the Sei dam catchment in western India.

Adsorption of Lead and Zinc on Bed Sediments of the River Kali
Jain C K and Daya Ram

Water Research, Vol. 31, No. 1, 154-162, 1997

The adsorption characteristics of the bed sediments collected from the river Kali in western Uttar Pradesh , India, have been studied for the uptake of lead and zinc ions. The parameters controlling the uptake, viz. initial metal ion concentration, the solution pH, sediment dose, contact time, and particle size have been evaluated. The adsorption of metal ions increases

with increasing initial metal ion concentration. The adsorption of the two metal ions on the bed sediments follows two phases: a linear phase of adsorption and then a quasi-equilibrium state (almost flat plateau). The quasi-equilibrium state was attained within 45 min for both the metal ions. It is observed that the extent of adsorption increases with the increase of pH of the solution and metal ion concentration decreases with increase in pH value. Further, the adsorption of metal ions increases with increasing adsorbent doses and decreases with adsorbent particle size. The geochemically important elements such as Fe and Mn have also been determined in various grain size fractions of the sediments and correlated with the adsorption of metal ions. The adsorption data of the two metal ions has also been analysed with the help of the Langmuir and Freundlich models to evaluate the mechanistic parameters associated with the adsorption process, viz. monolayer capacity and sorption intensity.

Characterization of Flood Waves by Rating Curves
Mishra S K, M K Jain and S M Seth

Nordic Hydrology, Vol. 28 (1), 51-64, 1997

The flood waves are characterized within the frame-work of loop (or hysteresis) of rating curves. The National Weather Service's Dam Break Flood Forecasting Model is used to generate the flood waves in the downstream valley of the Bargi dam located in Central India. The quantified hystereses, h , of non-dimensional rating curves are related with the corresponding flood wave characteristics, viz., speed of travel, wave number, phase difference, and attenuation. The analysis has led to the development of an exact relationship between h and phase difference. Using the concept of wave zoning, the better performance of the hysteresis based criteria compared with the available criteria is verified using Convex and Muskingum-Cunge routing in the wave zones. h limits are specified for the applicability of these simplified routing models. Furthermore, the envisaged applications of the based analysis are introduced

Surface Albedo and Water Resources: Hydroclimatological Impact of Human Activities
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Journal of the Hydrological Engineering, Vol. 2 No. 4 October 1997

Budyko's hydroclimatological model of a coupled land surface-atmosphere system is used to assess changes in climate and water resources that may be related to changes in land use and surface albedo. Changes in land use may lead to changes in surface albedo. In turn, changes in

surface albedo are linked to climate changes at the various atmospheric spatial scales. Climatic changes affect water resources, i.e., rainfall amounts, rainfall patterns, runoff amounts, and runoff coefficients. Mean annual precipitation separated across the climatic spectrum, from hyperarid to hyperhumid regions, into (1) runoff; (2) nonrecyclable evaporation; and (3) recyclable evaporation. A set of water balance coefficients is developed to assess the hydrological impact of human activities.

A Study of Sedimentation in Chenab Basin in Western Himalayas
Rao S.V.N., Rao M.V. and Ramasastri K.S. and Singh, R.N.P.

Nordic Hydrology, 28(3),1997, 201-216.

The young Himalayas have a series problem of soil erosion and consequent sedimentation in river reaches downstream. The study reveals the high rates of sedimentation in Chenab basin and its effect on an existing reservoir. Correct estimation of sediment yield at any given point in space and time is of vital importance for water resources development and management. In the present study, data of 17-27 years were used to develop statistically significant spatial models to estimate sediment yield in the Chenab basin (22,000 km.) using geomorphological, climatic and landuse parameters. The sediment yield was estimated for total and fine sediments for monsoon, pre-monsoon seasons and that year.

Estimation of Snow and Glacier-Melt Contribution to the Chenab River, Western Himalaya.
Singh Pratap, Jain, S.K. and Kumar Naresh.

Mountain Research and Development, Vol.17, No.1, 1997, pp.49-56.

The contribution of snow and glacier-melt runoff to Himalayan rivers is significant and an estimation of the amount is necessary for the development, planning and management of water resources. In this study, the average contribution of snow and glacier-melt runoff in the annual streamflow of the Chenab River at Akhnoor was estimated using a water balance approach. For a period of 10 years (October 1982-September 1992) the total water budget of the basin was assessed; rainfall data of 25 well-distributed stations were used to compute total rainfall input to the basin, and total volume of flow was computed using

discharge data at the Akhnoor gauging site. Evapotranspiration losses only from the snow-free area were taken into account, considering that evaporation from rain falling on the snow-covered area, and from the snow-covered area itself, is negligible. The snow-covered area in

the basin was determined using satellite imagery. it is observed that, on average, about 70% of the area of the basin is covered with snow in March/April and this is reduced to about 24% in September/October. The average snow and glacier runoff contribution to the annual flow of the Chenab River at Akhnoor is estimated to be about 49 percent.

Effect of Orography on Precipitation in the Western Himalayan Region
Singh Pratap and Naresh Kumar

Journal of Hydrology, Vol. 199, pp. 183-206, 1997

The present study deals with precipitation distribution with altitude for the Satluj and Beas basins in the western Himalayas. Rainfall increases linearly with elevation for both basins in the outer Himalayan range. The middle Himalayan range of the Beas basin has exceptionally heavy rainfall on the windward side and much less rain (less than half) on the leeward side. Rainfall gradients are 106 mm per 100 m to windward and 13 mm per 100 m to leeward of this range. Different trends of rainfall variation with elevation are observed in different seasons in the middle Himalayan range with a linear increase in annual rainfall. Rainfall follows an exponential decreasing trend with altitude in the greater Himalayan range. Average annual rainfall decreases from the outer Himalayas to the greater Himalayas in the Satluj basin. In the greater Himalayas, it is about one-sixth of outer Himalayas rainfall. Maximum rainfall is in the middle Himalayan range in the Beas basin. Monsoon rainfall contributes the largest part of the annual rainfall for all the Himalayan ranges.

Snowfall increases linearly with elevation in the greater Himalayas. Snowfall gradients for the Spiti and Baspa sub-basins are 43 mm per 100 m and 10 mm per 100m, respectively. The ratio of snowfall to annual precipitation varies linearly with altitude. All stations recorded more than 60% snow contribution to annual precipitation. Extrapolation of the relationship indicates that snow and rain contribute equally at about 2000 m, and all the precipitation occurs as snow above 5000 m.

Hydrological Response of Snowpack Under Heavy Rain-on Snow Event: A Field Study
Singh Pratap, Gerhard Spitzbart, H Huebl and H W Weinmeister

Journal of Hydrology, Vol. 202, pp. 1-20, 1997

The hydrological response of rain-on-snow events has been studied on a plot scale at 2640 m altitude in the Austrian Alps. Three artificial rain events with different intensities and durations

were simulated over two snow plots on a natural snowpack and the behaviour of emerging outflow was examined. Measurements of meteorological parameters, soil temperature and snowpack properties were also made. The investigations show that the impeding characteristics of the ice layers more than doubled the storage capacity of the snowpack. The speed of water movement was estimated to be about 6 m h-1 when the snow pack was fully saturated. Accelerated metamorphism under saturated conditions and preferential flow paths created owing to uneven snow surface caused by the impact of intense rain over the snow surface, are understood to be responsible for the high speed of water flow. This indicates that heavy rain water moves several times faster than the natural snowmelt under non-rainy conditions. Moreover, under rainy conditions, natural snowmelt also percolates faster along with rain water. Observations of the time of arrival of runoff, ta and time to equilibrium concentration of liquid water in snow, te, for different rain events indicate that after conditioning of the snowpack, a significant reduction of rain intensity (by half in the present study) is not able to change the distribution of runoff much; fast response of water was also observed under reduced rain-intensity. Another important aspect of the snowpack worth noting was that most of the input appeared as runoff.

Impact Assessment of Climate Change on the Hydrological Response of a Snow and Glacier Melt Runoff Dominated Himalayan River

Singh Pratap and Naresh Kumar

Journal of Hydrology, 193, pp. 316-350, 1997

The effect of climate change on snow water equivalent, snowmelt runoff, glacier melt runoff and total streamflow and their distribution is examined for the Spiti river. This is a high altitude Himalayan river located in the western Himalayan region. The total streamflow of this river has a significant contribution from snow and glacier melt runoff. Plausible hypothetical scenarios of temperature and precipitation changes based on the simulation of climate change over the Indian subcontinent by the Hamburg climate model are adopted in the present study. The UBC watershed model was used to simulate the hydrological response of the basin under changed climatic scenarios. The adopted changes in temperature and precipitation covered a range from 1 to 3 oC and from – 10 to + 10%, respectively.

Snow water equivalent reduces with an increase in air temperature. However, no significant change is found in the snow water equivalent of the Spiti basin by the projected increase in air

temperature (T + 1 to T + 3 oC). An increase of 2 oC in air temperature reduced annual snow water equivalent in the range of 1 to 7%. Changes in precipitation caused proportional changes in snow water equivalent. It is found that annual snowmelt runoff, glacier melt runoff and total streamflow increase linearly with changes in temperature (1-3 oC), but the most prominent effect of increase in temperature has been noticed on glacier melt runoff for this high altitude basin.

Hydrodynamic Modelling of Basin Irrigation
Singh, V. and S. Murty Bhallamudi

J. of Irrigation and Drainage Engineering (ASCE), 123(6), 407-414, 1997

In this study, a hydrodynamic model is presented for simulating basin irrigation. An explicit, second order accurate, finite-volume technique is used for the solving the two-dimensional governing equations of basin irrigation. The empirical Kostiakov-Lewis infiltration equation is used for the calculation of infiltration. The model is validated using (i) the field data and (ii) the earlier numerical results available in literature. The proposed model is used for simulating the basin irrigation in an irregular field with a high spot inside the flow domain in order to demonstrate the applicability of the model. The proposed model is found to give less mass balance errors. The proposed model is also used for studying the effect of basin shape on the time of advance. In case of a rectangular field with a partial line inflow, the two-dimensionality effects become significant when the ratio of inflow width to the field width is less than particular value. A simple subgrid technique is introduced in order to obtain a high grid resolution near the advancing front and at the same time achieve a low computational cost.

Effectivity of Multiple Sheet Piles in Weir Design
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Journal of Irrigation Drainage Engineering, ASCE 123 (3), 218-221, 1997

As a protection measure against scour and undermining, sheet piles are provided at the upstream and the downstream ends of a weir. One or two rows of intermediate sheet piles are also provided to reduce the uplift pressures on the downstream floor. Due to the complexities of analysis, it is not known whether the provision of intermediate sheet piles is economical. This paper investigates the effectivity of multiple sheet piles as a means of reducing the floor thickness and, eventually, the cost.

Determination of Pesticides in Water Sediments and Soils by Gas Chromatography

Jain, C K and Imran Ali

International Journal of Environment : Analytical Chemistry, Vol. 68,

83-101, 1997

The determination of pesticides and their degradation products by gas chromatography has been reviewed and evaluated. The review covers the determination of organochlorine, nitrogen containing, oroganophosphorus and other pesticides in various water bodies, sediments and soils. The sources of pollution, sampling procedures, extraction, purification and preconcentration techniques and other gas chromatographic conditions for pesticides determination have been discussed. The various gas chromatographic conditions used for the analysis of different pesticides are summarized in tabular form.