Leaching of Triazine Pesticides in Loamy Soil and their Determination by Reversed Phase HPLC

Ali, I. and Hassan Y. Aboul-Enein,

Int. J. Environ. Anal. Chem., 81, 315-322, 2001.

The separation and identification of triazine pesticides (ametryn, atrazine, cyanazine and simazine) was carried out on Nova Pak C18 column (150 x 3.9 mm). The mobile phase used was acetonitrile-water (65:35, v/v) adjusted to pH 4.5 with acetic acid. The flow rate of the mobile phase used was 1.0 mL/min. The detection of the pesticides was carried out at 250 nm. The values of the separation factor (a) were in the range of 1.49-5.32 and the values of the resolution factors (R1) were ranged from 1.18 to 2.99 for the separated pesticides. The developed HPLC method was used to determine the concentrations of the reported pesticides in the loamy soil samples. The recovery of the pesticides from soil samples was found to be about 50%. The relative standard deviation and limit of the detection were in the range of 0.01-0.02 and 0.5-1.0 m g/mL respectively.

Distribution of Trace Metals in the Hindon River System, India

Jain, C. K. and Sharma, M. K.

Journal of Hydrology, 253, 81-90, 2001.

The distribution of trace metals (Cu, Zn, Fe, Mn, Cd, Cr, Pb. and Ni) in water, suspended and bed sediments of the river Hindon, a highly polluted river in western Uttar Pradesh (India) has been studied. The river is polluted by municipal, industrial and agricultural effluents, and flows through the city of Saharanpur, Muzaffarnagar and Ghaziabad districts. The heavy metal concentrations in water were observed to depend largely on the amount of flowing water and are negatively correlated with flow. Sediment analysis indicates that the large amount of heavy metals is associated with organic matter, the fine-grained sediment fraction and Fe/Mn hydrous oxides. A high positive correlation of most of the metal ions in sediments with iron, manganese and organic mater indicate that these constituents play a major role in transport of metal ions. The heavy metal concentrations generally increased with the decreasing particle size of the sediments. Lower metal concentrations in bed sediments during post-monsoon season established that monsoon had a slight effect on status of metals in sediments by causing renewal and mobilization of metals from the sediments.

Estimation of Soil Erosion from a Himalayan Watershed using GIS Technique

Jain, Sanjay K., Kumar, S. and Varghese, Jose

The fragile ecosystem of the Himalayas has been an increasing cause of concern to environmentalists and water resources planners. The steep slopes in the Himalayas along with depleted forest cover, as well as high seismicity have been major factors in soil erosion and sedimentation in river reaches. Prediction of soil erosion is a necessity if adequate provision is to be made in the design of conservation structures to offset the ill effects of sedimentation during their lifetime. In the present study, two different soil erosion models, i.e. the Morgan model and Universal Soil Loss Equation (USLE) model, have been used to estimate soil erosion from a Himalayan watershed. Parameters required for both models were generated using remote sensing and ancillary data in GIS mode. The soil erosion estimated by Morgan model is in the order of 2200 t km-2 yr-1 and is within the limits reported for this region. The soil erosion estimated by USLE gives a higher rate. Therefore, for the present study the Morgan model gives, for area located in hilly terrain, fairly good results.

New MOC Model of Sea Water Transport in Coastal Aquifers,

Sharma, Anupma, Kashyap, D. and Asawa, G. L.

A new miscible seawater transport model, based on a variant form of the traditional method of characteristics (MOC), is presented. The distinctive features of this model are moving packets with pre-assigned volumes instead of concentration, numerical tracking of moving packets using fourth-order Runge-Kutta method, and direct computation of total transport due to advection and hydrodynamic dispersion. In addition to quantification of seawater circulation, the model output illustrates (1) the path followed by seawater inside the aquifer; (2) the buildup of seawater storage; and (3) the position and advance/retreat of a disperse interface. The model has been assessed using two benchmark test problems and subsequently applied to the Biscayne aquifer in Florida. All model runs were characterized by flow mass balance errors (<0.2%).

Identifying Effective Distance to a Recharge Boundary

Singh S K.

The solution to the problem of reduced recharge where pumping is planned near a stream, requires determining effective distance to the line of recharge. This is generally accomplished by analysing the drawdowns observed during the pumping test conducted near a recharge boundary. Traditional methods of estimating the distance between observation well and image well either use the concept of fully developed straight lines or make use of the type curves for matching. Hantush's method requires the locating of the inflection point on the drawdown curve. The curve matching or the Hantush method is subjective and hence involves errors due to personal judgment. A long-duration pumping test is required to be conducted in order to obtain a fully developed second straight line. In many situations, such a long-duration pumping test is not feasible. In this paper, a robust optimization method is presented that allows the use of shorter-duration pumping test data, for estimating aquifer parameters, and distance to the effective line of recharge. Thus, it saves time and costs involved in conducting a long-duration pumping test. Application of the method on published data sets shows that the new method yields reliably accurate estimates of the parameters.

Confined Aquifer Parameters from Temporal Derivative of Drawdowns

Singh S.K.

A simple method that uses the time derivative of drawdowns is proposed for the evaluation of confined aquifer parameters. Explicit expressions are proposed for evaluation of the aquifer parameters as well as a graphical procedure. A reliable and accurate scheme to calculate the numerical derivative of drawdowns is developed based upon an analytical approach. The method requires early drawdown data ($m > 0.01$, where m is the argument of well function), and is shown to converge to the Cooper-Jacob method for late drawdowns ($m \pounds 0.01$). It does not require curve matching or an initial guess for the parameters. Calculations for the method can be performed on a hand-held calculator. The method has been applied to published data sets and the results have been compared with those obtained using traditional methods. The

method accurately estimates the aquifer parameters using only early drawdown data, thereby indicating savings in time and money.

Identifying Impervious Boundary and Aquifer Parameters from Pump-test Data

Singh S K

The common field problem of identifying the locating impervious aquifer boundaries is generally solved by analyzing the pump-test data. The estimate of the distance between the image well and the observation well (r') is required for locating the boundary. Popular methods of estimating r' either use the concept of fully developed two straight lines or rely on curve matching. Curve-matching methods are subjective and involve errors due to personal judgment. A very long duration pump test is required in order that the second straight line is developed. In many cases, the first straight line is not developed at all, especially when the observation well is at a greater distance from the pumped well. In this paper, a derivative-based robust optimization method has been proposed for the identification of aquifer parameters (transmissivity, T and storage coefficient, S) and r' from the drawdowns observed at an observation well. It returns unbiased estimates of the parameters (T, S, and r') even with a poor initial guess. The method can yield the estimates of the parameters from shorter duration pump-test data, thus saving time and money involved in conducting the pump test with the purpose of identifying r'. It is observed that the hydraulic diffusivity (T/S) of the aquifer and r' can be estimated even when the constant rate of pumping is not known.

Luminescence Dating of Loess-Palaeosol Sequence and Coversands : Methodological Aspects and Palaeoclimatic Implications

Singhvi A.K., Bluszcz A., Bateman M.D. and Rao Someshwar M

Of the terrestrial archives, loess-palaeosol sequence provide a most complete record of climatic change. This may be compared with the Marine oxygen isotope stratigraphy, and may help in the reconstruction of past atmospheric circulation patterns. Numerical chronometry a loess-palaeosol sequence has generally been based on correlation of variations in climatic proxies (such as magnetic susceptibility and particle size) with Marine isotopic data. Such chronometric

assignments involve implicit assumptions about the constancy of sedimentation rates and particle fluxes through time. This review presents a brief survey of the present status, methodology, outstanding problems and interpretational aspects of luminescence techniques, and discusses the important luminescence ages on global land-sea correlation. Statistical analysis of the ages suggests episodicity of loess accumulation with extended periods of quiescence. A review of source-proximal coversand deposits of northwest Europe is also presented. Evidence of the onset of coversand deposition at 15 ka, with a peak in accretion during the Younger Dryas and subsequent minor reactivation episodes, is discussed.

Numerical Study of Flows with Multiple Free Surfaces

Mohapatra P.K., S.Murty Bhallamudi and V. Eswaran

Intern. Journal for Numerical Methods in Fluids, 36, 165-184, 2001

This paper demonstrates that a numerical method based on the generalized simplified marker and cell (GENSMAC) flow solver and Youngs' volume of fluid (Y-VOF) surface-tracking technique is an effective tool for studying the basic mechanics of hydraulic engineering problems with multiple free surface and non-hydrostatic pressure distributions. Two-dimensional flow equations in a vertical plane are solved numerically for this purpose. The numerical results are compared with experimental data and earlier numerical results based a higher-order depth-averaged flow model available in the literature. Two classical problems, (i) flow in a free overall and (ii) flow past a floor slot, are considered. The numerical results correspond very well with the experimental data for both sub-critical and supercritical flows.

Adsorption of Zinc onto Bed Sediments of the River Ganga: Adsorption Models and Kinetics, C. K. Jain

Hydrological Sciences Journal, 46(3), 419-434, 2001.

A laboratory study has been performed to study the effect of various operating factors, viz., initial metal ion concentration, solution pH, amount of sediment, contact time, particle size and temperature on the adsorption of zinc ions onto the bed sediments of the River Ganga (India). The equilibrium time was found to be of the order of 60 minutes. The adsorption curves are smooth and continuous leading to saturation, suggesting the possible monolayer coverage of

zinc ions on the surface of the adsorbent. The extent of adsorption increases with an increase of pH. Furthermore the adsorption of zinc increases with increasing amount of adsorbent and decreases with adsorbent particle size. The adsorption data have been analysed with the help of Langmuir and Freundlich adsorption models to determine the mechanistic parameters associated with the adsorption process. An attempt has also been made to determine thermodynamic parameters of the process, viz., free energy change, enthalpy change and entropy change. The negative values of free energy change (   ) indicated the spontaneous nature of the adsorption of zinc onto the bed sediments and positive values of enthalpy change (   ) suggest the endothermic nature of the adsorption process. The intraparticle diffusion of zinc in the adsorbent was found to be the main rate-limiting step.

Pollution Potential of Toxic Metals in River Yamuna at Delhi, India
Imran Ali and C. K. Jain

J. Environmental Hydrology, 9, Paper 12, 1-9, June 2001.

The water quality of river Yamuna at Delhi has been studied with reference to toxic metals during pre-monsoon and post-monsoon seasons. The various metals analysed include cadmium, cobalt, chromium, copper, iron, manganese, lead and zinc. The quality of river water has deteriorated due to the continuous discharge of municipal and industrial effluents from various drains. The metal load discharged by various drains is quite high. It is apparent from the results that maximum load of metal ions was transported from Najafgarh, Barapullah and Shahdara drains. Most of the metal ions show higher concentrations in the post-monsoon season. The main sources of metal pollution in river Yamuna include municipal and industrial effluents. The river water is not safe due to the higher levels of toxic metals. The presence of toxic metals in groundwater indicates contamination in ground water, however the impact is not well pronounced. The water supply for domestic purpose from the river Yamuna should be treated for toxic metal ions and immediate action should be taken to control the quality of the river water.

Relationship Between the Common Climatic Parameters and Average Drought Frequency
R P Pandey and K S Ramasastri
Hydrological Processes, vol. 15, No. 6, pp 1019-1032, April 2001

The parameters commonly considered to define climate are the mean annual precipitation and mean annual potential evapotranspiration. In this study an attempt has been made to develop a relationship between average drought frequency and the evapotranspiration / precipitation ratio for the arid, semi-arid and subhumid climatic regions of India. The climatic regions are delineated using two climatic indices: namely (I) the ratio of mean annual precipitation (Pa) to global terrestrial mean annual pecipitation (Pg) and (ii) the ratio of mean annual potential evapotranspiration (Ep) to mean annual precipitation (Pa). It was noted that the average drought frequency (i.e. year) decreases gradually from dry to wet regions. The return period varies from 2 to 3 years in the arid regions (12>Ep/Pa >5), 3 to 5 years was developed between the average frequency of drought occurrence and the ratio of mean annual deficit to mean annual precipitation, (Ep - Pa)/Pa. The results have been compared with the drought experiences documented for other regions of the world.

Pollution Potential of Pesticides in the Hindon River, India

Imran Ali and C. K. Jain,

J. Environmental Hydrology, Vol. 9, Paper 1, 1-7, January 2001.

The pollution potential of pesticides in Hindon river (India) has been studied. The different pesticides monitored include lindane, malathion, BHC, p,p'-DDD, o,p'-DDT and methoxychlor. The water and sediment samples were collected during pre- and post-monsoon seasons. The concentrations of pesticides were found quite high in sediments compared to the associated water column. It has been observed that the agricultural runoff is the main source of pesticide pollution.

Envrironmental Isotope Study On Hydrodynamics of Lake Naini, Uttar Pradesh, India

U.Sarvana Kumar, Noble Jacob, S.V. Navada, S.M. Rao, Rm.P. Nachiappan, Bhishm Kumar and J.S.R. Murthy

Hydrological Processes, Hydrol. Process, 15, 425-439, 2001

Environmental isotopes (d 18O, D and 3H) were used to understand the hydrodynamics of Lake Naini in the State of Uttar Pradesh, India. The data was correlated with the in situ physico-chemical parameters, namely temperature, electrical conductivity and dissolved oxygen. The

analysis of the data shows that Lake Naini is a warm monomictic lake (i.e. in a year, the lake is stratified during the summer months (March/April to October/November) and well mixed during the remaining months. The presence of a centrally submerged ridge inhibits the mixing of deeper waters of the lake's two sub-basins, and they exhibit differential behaviour. The rates of change of isotopic composition of hypolimnion and epilimnion waters of the lake indicate that the water retention time of the lake is very short, and the two have independent inflow components. A few groundwater inflow points to the lake are inferred along the existing fractures, fault planes and dykes. In addition to poor vertical mixing of the lake due to the temperature-induced seasonal stratification, the lake also shows poor horizontal mixing at certain locations of the lake. The lake-groundwater system appears to be a flow-through type.

Development of Integrated Sediment Rating Curves Using Artificial Neural Networks

Jain, S.K.

Journal of Hydraulic Engineering, ASCE, 127(1), 30-37, 2001.

Correct estimation of sediment volume being carried by a river is very important for many water resources projects. Conventional sediment rating curves, however, are not able to provide sufficiently accurate results. Artificial Neural Networks (ANN) are a simplified mathematical representation of the functioning of the human brain. Three layer feed-forward ANNs have been shown to be a powerful tool for input-output mapping and have been widely used in water resources problems. The ANN approach is used to establish an integrated stage-discharge-sediment concentration relation for two sites on the Mississippi River. Based on the comparison of the results for two gauging sites, it is shown that the ANN results are much closer to the observed values than the conventional technique.

On Seddon Speed Formula

Mishra, S.K. and Vijay P. Singh

J. Hydrological Sciences-Journal-des Sciences Hydrologiques, IAHS, Vol. 46, No. 3, June, 2001

The Seddon speed formula expressed mathematically as $c = dQ/dA$ (or alternatively, as $c = (1 + m)u_o$; where Q is the discharge, A is the area of cross-section, c is the wave speed, u_o is the normal flow velocity, and m is a dimensionless parameter) is revisited in the context of

elasticity and thermodynamics. Its link with the linearized solution of St Venant's equations for wave celerity, which does not appear to have been reported in the hydrological literature, is established. The rating exponent m is shown to be equivalent to the dimensionless relative celerity and is found to be the ratio of two specific heats, viz. cp and cv which are the specific heats at constant pressure and volume, respectively. The use of the parameter m as a complex variable helps describe shallow wave characteristics, the damping capacity of a wave, and the mechanism of occurrence of the hysteretic phenomenon. The damping capacity is found to describe the magnitude of wave subsidence, whereas the hysteresis also describes the speed of subsidence.

Regional Flow Duration Models For 1200 Ungauged Himalayan Watersheds For Planning Micro-Hydro Projects
Singh, R.D., S.K. Mishra, and H. Chowdhary

In Himalayan region of India, most prospective sites for micro hydro projects are ungauged and there is insignificant data for analysis. Design flow estimates are made using a regional flow duration curve. Regional studies on Himalayan watersheds do not appear to have been reported in literature. Therefore, models are developed for 1200 ungauged watersheds of Lower Himalayas. To this end, the region, comparatively larger in size than the catchment, is assumed to be hydro-meteorologically homogeneous in its behavior. Models' formulation is based on data transfer between gauged watersheds of the same region, statistical normalization, and empirical regional relation. The performance of a specific model developed for Himachal Pradesh (Region C) is evaluated using the data of 13 watersheds in calibration and 4 watersheds in validation. It is found that the statistical approach of quantile estimation (non-dimensional) performs satisfactorily in calibration as well as in validation. The simple power relation for mean flow estimation performs well in calibration and less satisfactorily in validation due to short length of data, and so does the complete model.

Derivation of Operation Policies for the Multi-Purpose Ramganga Reservoir
Mishra, S.K., D.K. Srivastava, S.M. Seth, and N.K. Goel

Reservoir operation policies are derived for improving project performance. Their derivation lies in the resolution of six basic questions (James and Lee, 1971) using economic data. The first three questions pertaining, in sequence, to the operation for flood control, flood control and conservation, and conservation, respectively, are relevant to the multipurpose Ramganga reservoir (India) operation, for which policies are derived for known priorities of demands in hydrological context using simulation. For the flood control operation, the derived strategy is based on the cut-off storage and inflow and the inflow pattern, whether rising or receding. It is evaluated using available hourly flood records including design flood and is found to perform satisfactorily. The policy proposed for flood control and conservation operation in high flow season analyses for daily releases the future hypothetical storage derived from flow forecasts and assumed release patterns. Employment of this strategy to a critical year has been found to be beneficial by Rs. 411.91 million over historic performance. For the conservation operation, a multiple zoning-based policy utilising daily flows is derived. Its application to 16-year data yields net annual benefits of Rs. 71.31 million (over historic performance) in drinking water supply and irrigation.

Refinement of Predictive Reaeration Equations for a Typical Indian River

Jha R, C S P Ojha and K K S Bhatia,

Dissolved oxygen mass balance has been computed for different reaches of River Kali in western Uttar Pradesh (India) to obtain the reaeration coefficient (K2). A total of 270 field data sets have been collected during the period from March 1999 to February 2000. Eleven most popular predictive equations, used for reaeration prediction and utilizing mean stream velocity, bed slope, flow depth, friction velocity and Froude number, have been tested for their applicability in the River Kali using data generated during field survey. The K2 values computed from these predictive equations have been compared with the K2 values observed from dissolved oxygen balance measurements in the field. The performance of predictive equations have been evaluated using error estimation, namely standard error (SE), normal mean error (NME), mean multiplicative error (MME) and correlation statistics. The equations developed by

Smoot and by Cadwallader and McDonnell showed comparatively better results. Moreover, a refined predictive equation has been developed using least-squares algorithm for the River Kali that minimizes error estimates and improves correlation between observed and computed reaeration coefficients.

Hysteresis-based Flood Wave Analysis Using the Concept of Strain

Mishra S K and V P Singh

Hysteresis represents a loop in a rating curve and is a phenomenon, which closely resembles that occurring in stress-strain curves used for studying the elastic properties of solid substances in engineering mechanics. Earlier hysteresis-based studies used for defining floodwave propagation in open channels have qualitatively shown that hysteresis is an index of energy loss during floodwave propagation. Using the concept of elasticity, this paper introduces a new term called flow strain (defined as the ratio of change in discharge to the initial discharge) for investigating hysteresis. The usefulness of this new term is evaluated with use of four dam-break studies. The study reveals that:

strain is a function of three wave speeds, Seddon speed, Lagrange speed, and elastic speed;

single linear reservoir concept frequently used in flood routing is a specific variant of the Seddon speed formula;

- the non-linear storage-discharge relationship, widely used in overland flow modelling, is a variant of the kinematic wave representation;

- the discharge ordinates on the recession part of a hydrograph follow a simple first-order autoregressive form;

- the hysteresis, phase difference and logarithmic decrement all define attenuation and are indices of energy loss during floodwave propagation.