

Categorization of Flow: A Review of Application of River Bodies

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Abstract:- Characterizing the flows plays significant role by affecting the environment and the nearby ecosystem. The present work based on considering the fact that flow affects the natural factors containing social, physical as well as environmental issues. This paper reviews certain applications on water bodies on the context of various flow patterns. Existing work has tended to focus around the analysis of flow characterization on water bodies. The paper concluded that the flow has several impacts on the water bodies regarding their characterization having impacts of physicochemical parameters.

Keywords:- Flow, water bodies, environment, flow characteristics, physicochemical parameters

I. Introduction

The paper is based on the assessment of flow with respect to their characterization done on water bodies. Low flows as well as high flow profiles are pointed out in this case studies. For considering the flow pattern flow behaviour should be checked whether the flow is laminar, turbulent or in transition state. High viscosity flows are considered as Laminar flow. The turbulent flow is predictable when the fluid flows in unsystematic way similarly when the fluid shows their path between these two courses those are laminar and turbulent flow patterns called as transition flow. The flow behaviour changes according to seasons, for instance in the rainy season the water level rises with the increase in velocity which ultimately raises the flow rate. Seasonal variations are also discussed in the existing work. The various impacts of such fluids on the environment and their effects are also studied in the present paper. The physicochemical parameters are analysed and their impacts on the water bodies are mentioned in the different case studies. As the flow behavioural changes cause an impact on the ecological society, flow characterization plays a very vital role in the frame of water bodies. The objectives of this paper are to analyse their impact on the selected sampling stations, to assess the effects of flow characteristics on ecological society, to examine the high and low flow rates at the respected sites and their impact on ecology. These parameters are needed to analyse the significance of the flow on the ecosystem and to provide a scientific basis for betterment of the natural river sources.

II. Case Studies

2.1 Flow Characterization in the Santee Cave System in the Chapel Branch Creek Watershed, Upper Coastal Plain of South Carolina, USA: Amy E. Edwards,

Devendra M. Amatya, Thomas M. Williams, Daniel R. Hitchcock, and April L. James

This work uses measurements of total suspended solids, dissolved calcium and magnesium, volatile suspended solids, pH, alkalinity, specific conductance, stable isotopes (d18O, d2H), dye tracing, and stage elevation measurements from both the Santee Cave spring and Lake Marion to characterize the flow regime and surface-groundwater connection in the Santee Limestone (SL) aquifer in the Chapel Branch Creek (CBC) watershed in South Carolina. The hydrology and water quality of the CBC watershed is impacted significantly by its karst terrain and the shallow carbonate aquifer of the regional SL formation.

Diffuse flow occurs when the voids in the aquifer matrix are poorly connected and typically result in a system with slow groundwater movement and longer periods of water storage as explained by Fiorillo, 2009. Conduit flow results when voids in the aquifer become well developed and possess high connectivity and thus having less water storage and more rapid response of recharge to discharge as per notified by Fiorillo, 2009. The two main types of flow which is applied to karst aquifers are diffuse and conduit as reported by Shuster and White, 1971; Atkinson, 1977; Gunn, 1986; also referred in the literature as slow and fast flow, respectively.

Dye tracing method is used in this study to determine connections between recharge and discharge areas in karst aquifers to obtain information about the response SL aquifer at the Santee Cave system during times of low and high lake elevations.

The basic goal of this study is to characterize flow in the watershed using water chemistry; hydrologic, dye tracer and stable isotope data collected in the Santee Cave system and

nearby spring seeps during the period 2008–2009. The specific objectives of this study are testing of two hypotheses: (1) the discharge from SL to CBC is predominantly a diffuse flow component from the matrix with slow surface-groundwater connection and (2) the aquifer water table at Santee Cave is influenced by stage elevations of the lower flooded portion of CBC.

Three qualitative dye traces based on visual inspection were carried out in the Santee Cave system. The first two traces were carried out on August 28; 2008. By using an Infinities Water Level Data Logger, Stage data at Santee Cave Spring (CS) were collected at 15-minute intervals. Water quality measurements were estimated on a predominantly monthly basis during various flow conditions.

Results obtained from this study indicate that the flow at CS and the spring seeps was recharged primarily from diffuse flow from the matrix, with a slow response of surface water infiltration to the conduit. In this study, “slow” indicates that surface water did not respond with immediate (storm event) movement from the surface, into the aquifer matrix, and then discharged from spring seeps in the CBC watershed.

The geochemical analysis, hydrologic and stable isotopic data collected within the CBC watershed in 2009 confirmed the first hypothesis that the discharge via CS from the Santee Limestone to CBC is primarily recharged by a diffuse flow component from the matrix with slow surface-groundwater connection stated by A.E. Edwards *et al.*

2.2 Low Flow Characterization of a Coastal River in Ghana: E. O. Bekoe, F. Y. Logah, K. Kankam-Yeboah, B. Amisigo

Low stream flow statistics, according to K. G. Ries III and P.J Friesz, implies the probable availability of water in streams during the period when conflicts between water supply and demand are most likely to arise. Due to this, statistics of low stream flow are needed by the state, regional and local agencies for water-use management, planning and regulatory activities for a variety of water resources application. These activities contains (i) siting and permitting new water withdrawals, inter-basin transfers and effluent discharges, (ii) developing environmentally sound river-basin management plans, (iii) defining minimum river flow thresholds for the maintenance of aquatic biota and (iv) land use planning and regulation. Continuous supply of water also demands continuous abstraction from the surface and from the ground water bodies. In abstracting water from rivers, deliberation should be given to the minimum flow desired to sustain the stream. Also, it is essential to mention the dependability of streams to water supply during the dry seasons where the amount of river flow is low.

Selected study area for this work is Ayensu river basin which is part of the Coastal river system of Ghana with an area of approximately 171 km² and length of 98km² as per WARM. It lies between latitudes 5°20’N to 6°05’N and

longitude 0°30’W to 0°50’W. According to E. O. Bekoe *et al.* the main tributary of the river is Akora. The basin is located in two climatic regions; i.e. the wet Semi-Equatorial in the northern. The required data used for the study was the mean daily stream flow data series collected from the Ayensu basin at the Okyereko river station in Ghana.

The determination and establishment of minimum flow of streams is not only important to water users, but also very crucial for planning water supplies, managing water quality, assessing the impact of prolonged droughts on aquatic ecosystems, among others. Low flow study is necessary since it educates stream users on the desirable minimum flow needed to sustain in stream uses. Hydrological assessment is dependent on stream flow data and predictions for the future are based on historical data or information. It is therefore essential that adequate resources are set for the establishment of reliable monitoring stations to collect both hydrological data and meteorological data and also to enhance scientific research in stream flow studies in the river basins of Ghana. Thus, promoting sustainable water supply for irrigation, drinking, aquaculture, fisheries, mining and manufacturing industries, ecological balance and socio-economic development of the country as stated by E. O. Bekoe *et al.*

2.3 Characteristics of Water and Water Bodies in the Natural Environment: Yuri. S. Dolotov and I.S. Zektser

In this study some important points such as atmospheric water, surface water including oceans, interior seas, coastal zones and estuaries are taken into consideration. The flow regime plays a vital role in the context of the water parameters. This paper indicates the need of these parameters with respect to flow pattern.

Present study explained the peculiarities of surface water in different natural environments, i.e. oceans and seas of different types, atmosphere, coastal and estuarine zones and river systems of different groups, lake basins, artificial reservoirs and swamps.

The brief explanation is mentioned in this paper according to the betterment for the environment as concluded by Yuri. S. Dolotov and I.S. Zektser. The characterization of water and the water bodies plays a significant role in the environment as it affects the environment so it is a basic need to find out whether these parameters are causing ill effects to the environment or not.

2.4 Seasonal Variability of Physico-Chemical Characteristics of the Haldia Channel of Hooghly Estuary, India: Y Sadhuram, V V Sarma, T V Ramana Murthy and B Prabhakara Rao

The salinity intrusion is confined to 70km from the mouth even during the dry season. Hooghly River is a part of the Ganges and serves as a navigable waterway to Haldia and Calcutta ports. Tidal erect is noticeable in the river up to

nearly 200km from the mouth at Sagar Island. The tidal variation at the mouth is from 6.1m at springs to 0.22m at neaps. The fresh water discharge ranges from a peak value of 4250m³ to almost zero in the dry season. The average values of fresh water discharge are 3000m³ during monsoon season (June-September) and 1000m³ during a dry season (November-May).

Salinity at surface varied from low values under ebb tide conditions and high values under tide conditions during summer. Salinity values are lower during post-monsoon season. Physicochemical characteristics of the Haldia channel of Hooghly estuary have been studied during winter, summer and post-monsoon seasons. Effective currents exceeding the required value were observed during peak ebb and tide conditions irrespective of the season. Longitudinal eddy diffusion coefficient (K_x) was estimated during summer and post-monsoon seasons respectively. The vertical eddy diffusion coefficient ("v) was noted during post-monsoon season.

Values of pH, DO and BOD are within the threshold limits of the estuarine environment. In the study area, the reference density is suggested for dry and low discharge conditions for modeling circulation in the estuary. In spite of high concentrations of nutrients, seasonal variation of these parameters attributed to the biological intake and replenishment of nutrients coinciding with phytoplankton blooms showing their involvement in the biogeochemical cycle. High values of Total Suspended Matter (TSM) were noticed both at the surface and bottom in the study region showing the impact of fresh water and sediment transportation which is reported by Y Sadharam *et al.*

III. Conclusion

Analysis of Flow plays a significant role as proven by the various studies mentioned above. Flow characterization is done on the water bodies such as rivers, bays, estuaries, tributaries. The flow variability deals with density variations, bathymetric data, external forcing such as tidal elevations, external current and some other relevant conditions. This work is very useful for evaluating flow patterns on the various water bodies. Most of the work reviewed in this work is based on the concept of fluid behavior. This paper gives an impression about how the flow is affecting the natural water bodies and their impacts on the environment. The main focus of analytical interest for the various studies reviewed in this paper has been in flow field predictions, flow behavior pattern, external forcing and river discharge. In all of the studies reviewed, the flow parameters were taken into consideration.

IV. References

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