Modelling Homogeneous Deposition of Velocity Influenced by Porosity in Penetrating Unconfined Bed, Mbiama Coastal Location, Niger Delta of Nigeria

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Abstract: This paper monitor the rate of homogeneous velocity in soil and water environment, several experts in different ways has developed other homogeneity of velocity outside deltaic formation, but the development model were to monitor the deposition of homogeneous velocity in the study location, this will generate monitoring of yield rate in the abstraction of ground water in the study environment, such condition were found significant to bleach the gap on monitoring and evaluation of homogeneous flow rate through predictive model, groundwater abstraction will definitely reduces abortive well through this source, the derived model will definitely monitor homogeneity of flow in design and construction of water wells, the developed concept will predict the homogeneous flow velocity in deltaic environment. The study has provided various dimensions that have generated the homogeneity of velocity through application of this derived model, experts will find this study significant in determining the homogeneous velocity of flow in deltaic formation.

Keywords: Modelling Homogeneous, Velocity, Unconfined Bed

1. Introduction

The consistency in formation characteristics is a major effect on soil depositions. A variety of soils Arrangement types may cause preferential flow or water immobilization under the influences of formation characteristics [4, 5]. Formation disintegration under uniformity variation on particle size is influenced by these conditions from disintegration of soil particles soil Profile [4, 5, 15, and 16]. Soil particle size and its deposition defined the rate of porous, permeable including degree of void ratio [5]. it is observed that soil formation developed soil hydraulic properties of tilled soil varied in space and time [11, 12, and 13]. The chronological variability of the soil particles defines the stability of the formation [1, 2, 3, 4, and 14]. While [4] variation of aggregate particle size stability were observed not to positively related to living root length density; [9, 10 and 11] express higher aggregate stability was found due to crop roots, including exudates microbial by-products and wet/dry cycles. It observed that variability of the soil hydraulic properties express hydraulic conductivities, *K*),

these were examined. [9, 10, 11 and 12] showed that *K* values at tensions of 10 and 40 mm diverse temporally most time due to the tillage, wetting/drying, and plant growth. [8, 13 and 16] express values in study by decreasing it during the growing season, these was achieved through structural breakdown by rain and surface sealing. [11, 12, 13 and 14] in his research develop *K* values at tension of 20 mm it was observed through the reduction due to the rain drop impact; the *K* values at tension of 40 mm were not influenced. Moreso [1, 2, and 3] displayed that only the more homogeneous sandy soil under furrow irrigation exhibited significant decrease in sorptivity. [10] Developed it works using applying dye tracer, the result from the experiment decrease the number of active preferential flow paths.[1, 2, and 4] developed tension infiltration that determined from 0 to 90 mm, this showed that macrospores flow reducing from 69% in July to 44% in September [7, 8, 10]. The developed study to monitored impact of the rainfall intensity has been stressed by several experts [11, 12, 134, 14, 15 and 16].

2. Theoretical Background

The study of homogeneous velocity has been carried out by researcher in water and environmental engineers; deltaic environment in developing nation has not been evaluated to monitor their rate of homogeneous setting in their litho stratification. Several experts has monitored the velocity of flow in diverse measurement, these conception has develop various results, but the result for deltaic deposition in of the Niger delta location precisely mbiama has not been expressed in these dimension, it is a serious concern for ground water engineering, such deltaic environment developed other environmental crisis in exploration of ground water for human utilization, therefore the homogeneity of flows in such environment should be express in details in other to monitor their rates of flows in homogeneous setting, the rate of velocity are determined in these study location to be influenced by porosity, velocity of flow in the deltaic formation has to be monitored through these approach, these concept will monitor the behaviour of the flow base on their variations of the soil structural deposition in such deltaic formations. Base on these factors, the application of these developed modelling approach were applied to monitored the flow of velocity in homogeneous setting, the system were applied considering lots of condition under the influences of formation characteristic in the study area. The stratification of soil structure has developed some uniformity in particle grain size, thus velocity of flow in homogeneous phreatic bed, several studies on these area has not thoroughly developed the sources that has cause the heterogeneity in velocity of flow. This has influences the depositions of phreatic bed in the study area, the rate of velocity are reflected on the deposition of soil structures in the study area, homogeneity of velocity depend on the predominance of the homogeneity of the unconfined bed, most of these structure that deposit this type of unconfined bed develop several uniformity yield rate coefficient in the formation. Those area that generate low yield rate in ground water abstraction, most water resources engineer find it difficult to predict the yield rate coefficient in the design of ground abstraction in such environment, although the study location are predominant with alluvium deposition, under physical observation, the variation of heterogeneous deposition developed variation of velocity in the study area.

3. Governing Equation

$$\varphi \frac{d^2 v}{dt^2} + \beta \frac{dv}{dt} + K \frac{dv}{dt} = 0 \qquad (1)$$

The governing equation provides the opportunity to monitor the systems that will express homogeneity of velocity through this developed governing equation. These expressions here are base on parameters that influence the homogeneity of velocity deposition in the study location. These expressed equation will be derived considering several formation characteristics that generated the homogeneous deposition of velocity, these will be described in terms of its flow net velocity at various formation. Considering all these variation influences from formation characteristics. The developed governing equation will express some conditions that have developed homogeneity of flow velocity base on the uniformity of the lithostratgraphy applying predictive models.

$$\varphi \frac{d^2 v}{dt^2} + (\beta + K) \frac{dv}{dt} = 0 \qquad (2)$$

Let $v = \sum_{n=0}^{\infty} \alpha_n x^n$

$$v^1 = \sum_{n=1}^{\infty} n \alpha_n x^{n-1}$$

$$v^{11} = \sum_{n=2}^{\infty} n(n-1) \alpha_n x^{n-2}$$

$$\varphi \sum_{n=2}^{\infty} (n-1) \alpha_n x^{n-2} + (\beta + K) \sum_{n=1}^{\infty} n \alpha_n x^{n-1} = 0 \qquad (3)$$

The applications of power series are to determine various sources of structured strata from different applied variables in the system, this techniques will determined the rate of these variables interacting with developed homogeneity of velocity between the intercedes of the formation, the rate of porous medium of the formation are integrated with higher permeable layer, these will definitely determine the rate of velocity in the deltaic formation, the influences from these two paramount parameters predict the rate of homogeneity on the formation characteristics in the study location.

Replace n in the 1st term by n+2 and in the 2nd term by n+1, so that we have;

$$\varphi \sum_{n=0}^{\infty} (n+2)(n+1) \alpha_{n+2} x^n + (\beta + K) \sum_{n=0}^{\infty} (n+1) \alpha_{n+1} x^n = 0 \qquad (4)$$

$$\text{i.e. } \varphi \sum_{n=0}^{\infty} (n+2)(n+1) \alpha_{n+2} x^n + (\beta + K) \sum_{n=0}^{\infty} (n+1) \alpha_{n+1} = 0 \qquad (5)$$

$$\alpha_{n+2} = -\frac{(\beta+K)(\alpha+1)(\alpha_{n+1})}{\varphi_{(n+2)(n+1)}} \tag{6}$$

$$\alpha_{n+2} = -\frac{(\beta+K)\alpha_{n+1}}{\varphi_{(n+2)}} \tag{7}$$

$$\text{For } n=0, \ \alpha_2 = -\frac{(\beta+K)\alpha_1}{2\varphi} \tag{8}$$

$$\text{For } n=1, \ \alpha_3 = -\frac{(\beta+K)\alpha_2}{3\varphi} = \frac{(\beta+K)^2\alpha}{2\varphi\cdot3\varphi} \tag{9}$$

$$\text{For } n=2, \ \alpha_4 = -\frac{(\beta+K)\alpha_3}{4\varphi} = \frac{(\beta+K)}{4\varphi}\bullet\frac{(\beta+K)\alpha_1}{3\varphi\cdot2\varphi} - \frac{(\beta+K)}{4\varphi\cdot3\varphi\cdot2\varphi} \tag{10}$$

$$\text{For } n=3, \ \alpha_5 = -\frac{(\beta+K)}{5\varphi} + \frac{(\beta+K)^4 a_1}{5\varphi\cdot4\varphi\cdot3\varphi\cdot2\varphi} \tag{11}$$

$$\text{For } n: \ \alpha_n = \frac{(-1)^n(\beta+K)^{n-1}a_1}{\varphi^{n-1}n!} \tag{12}$$

$$C(x) = \alpha_0 + \alpha_1 t - \alpha_2 t^2 + \alpha_3 t^3 - \alpha_4 t^4 + \alpha_5 t^5 + \dots\dots\alpha_n{}^n \tag{13}$$

$$= \alpha_0 + \alpha_1 t - \frac{(\beta+K)\alpha_1 t^2}{2!\varphi} + \frac{(\beta+K)\alpha_1 t^3}{3!\varphi2} - \frac{(\beta+K)t^4}{4!\varphi3} + \frac{(-1)^n(\beta+K)\alpha_1 t^5}{5!\varphi4} + \dots \tag{14}$$

$$C(x) = \alpha_0 + \alpha_1\left[t - \frac{(\beta+K)t^2}{2!\varphi} + \frac{(\beta+K)t^3}{3!\varphi2} - \frac{(\beta+K)t^4}{4!\varphi3} + \frac{(\beta+K)^4 t^5}{5!\varphi4} + \dots \right]. \tag{15}$$

$$C(t) = \alpha_0 + \alpha_1 \ell^{-\frac{(\beta+K)}{\varphi}t} \tag{16}$$

The expression in [16] are known to be the developed model for the study, this is base on the derived expression at various phase that determined the variation of velocity in homogeneous formation, the structures of the strata in unconfined aquifers determined the behaviour of velocity in the phreatic depositions. The deltaic environment are the centre of the study, due to its geological structural condition, this defined the rate of depositions of the formation thus the rate of porosity and permeability effect on homogeneous velocity in the study location.

If $t = \dfrac{d}{v}$

$$C(t) = \alpha_0 + \alpha_1 \ell^{-\frac{(\beta+K)}{\varphi}\frac{d}{v}} \tag{17}$$

The developed model at these stage, show how the system defined the significant of different depth, since soil formation are deposited in various bed to the unconfined environment, the system never consider the variation of soil formation with respect to depth in the governing equation, therefore, the change of soil deposition generating different permeation and porosity that should allowed to monitor the system are based on variation of depth. The derived equation expresses these conditions considering this aspect from the derived solution.

While $d = v \bullet t$, this also implies that it can be expressed as:

$$C(t) = \alpha_0 + \alpha_1 \ell^{-\frac{(\beta+K)}{\varphi}v\bullet t} \tag{18}$$

Monitoring homogeneous velocity under the system will also provide the platform where time of flow will be monitored in the study; such conditions were express through the expansion of the derived model by considering velocity and time in the system. The deltaic formation generate some homogeneous setting base on the geologic history, the homogeneity of velocity with respect to time of flow at this model are considered in the system applying the derived expression in [18].

4. Conclusion

Velocity of flow in unconfined bed were monitor using these developed techniques, this developed derived governing equation produce these model solution considering various phase of velocity influences, the state of groundwater velocity in deltaic formation were thoroughly study through its characteristics in the system, this mathematical method were applied to monitor the deposition of velocity under the influences of permeation and porous deposition rate in various strata, the structure of the formation were consider under it disintegration at various bed from the particle structured size in the soil, the homogeneity of flow under the influences of unconsolidated rock at various grain size resulted to this homogeneity of velocity between the intercedes. The study is imperative because the application of mathematical modelling approach has defined various influences that will definitely generate homogenous flow velocity in the study area. Experts will definitely find these concepts as another way of monitoring and evaluating the velocity of flow in the study applying this predictive model.

Nomenclature

v = Velocity [LT^1]
ϕ = Porosity [-]
β = Void Ratio [-]
K = Permeability [LT^1]
T = Time [T]

References

[1] Angulo-Jaramillo, R., Moreno, F., Clothier, B. E., Thony, J. L., Vachaud, G., Fernandez-Boy, E., Cayuela, J. A., 1997. Seasonal variation of hydraulic properties of soils measured using atension disc infiltrometer. Soil Science Society of America Journal 61, 27-32.

[2] Bodner, G., Loiskandl, W., Buchan, G., Kaul, H. P., 2008. Natural and management-induced dynamics of hydraulic conductivity along a cover-cropped field slope. Geoderma 146, 317-325.

[3] Chan, K. Y., Heenan, D. P., Ashley, R., 1994. Seasonal changes in surface aggregate stability under different tillage and crops. Soil and Tillage Research 28, 301-314.

[4] Kodešová, R., Kodeš, V., Žigová, A., Šimunek, J., 2006. Impact of plant roots and soil rganisms on soil micro morphology and hydraulic properties. Biologia 61, S339–S343.

[5] Kodešová, R., Kocárek, M., Kodeš, V., Šimunek, J., Kozák, J., 2008. Impact of soilcromorphological features on water flow andherbicide transport in soils. Vadose Zone Journal 7, 798–809.

[6] Kodešová, R., Vignozzi, N., Rohošková, M., Hájková, T., Kocárek, M., Pagliai, M., Kozák, J., Šimunek, J., 2009a. Impact of varying soilstructure on transport processes in different diagnostic horizons of three soil types, Journal of Contaminant Hydrology 104, 107-125.

[7] Kodešová, R., Rohošková, M., Žigová, A., 2009b. Comparison of aggregate stability within six soilprofiles under conventional tillage using various laboratory tests. Biologia 64, 550-554.

[8] Messing, I., Jarvis, N. J., 1993. Temporal variationin the hydraulic conductivity of a tiled clay soil as measured by tension infiltrometer. Journal of Soil Science 44, 11-24.

[9] Murphy, B. W., Koen, T. B., Jones, B. A., Huxedurp, L. M., 1993. Temporal variation of hydraulic properties for some soils with fragile structure. Australian Journal of Soil Research 31, 179-197.

[10] Petersen, C. T., Hansen, S., Jensen, H. E., 1997. Tillage-induced horizontal periodicity of preferential flow in the root zone. Soil Science Society of America Journal 61, 586-594.

[11] Somaratne, N. M., Smettem, K. R. J., 1993. Effect of cultivation and raindrop impact on the surface hydraulic properties of an alfisol under wheat. Soiland Tillage Research 26, 115-125.

[12] Strudley, W. M., Green, T. R., Ascough, I. I. J. C., 2008. Tillage effects on soil hydraulic properties inspace and time: State of the science. Soil and Tillage Research 99, 4-48.

[13] Suwardji, P., Eberbach, P. L., 1998. Seasonal changes of physical properties of an Oxic Paleustalf Red Kandosol) after 16 years of directdrilling or conventional cultivation. Soil and Tillage Research 49, 65-77.

[14] Yang, X. M., Wander, M. M., 1998. Temporal changes in dry aggregate size and stability. Soiland Tillage Research 49, 173-183.

[15] Eluozo, S. N. 2013 Modeling and simulation topredict nitrogen deposition influenced by the Porosity and the coefficient of inhibition in thecoastal area of Port Harcourt, Niger delta ofNigeria Health, Safety and Environment (2013) 1 (2) 29-40.

[16] Eluozo, S. N. 2014; Two Dimensional Flow Transport Modeling of Fungi and Arsenic Deposition on Lateritic and Silty Formation in Coastal Area of Aboluma, Niger Delta of Nigeria, ARPN Journal of Science and Technology March Vol. 4, No 3.