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# Conceptual Aspect of Hydrological Cycle in Indian Mythology of Kishkindha Kanda, Ramayana

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**Abstract**
Science and technological studies in ancient India has covered all the major branches of human knowledge and activities. The of geographical studies in India, began with the drawn of Indian civilization in ancient times, though a systematic account of classical Indian geographical concepts is not available, yet some valuable information can be found in Hindu mythology, philosophy, epics, history and scared laws (Rana, L., 2008). In this paper the main task is to extract and analysis the concept of hydrological cycle in the Ramayana Epic, reflecting ancient Indian since and culture about 5th to 8th century B.C..
**Keywords:** Ancient Indian Geographical concepts, Hindu, Hindu mythology, epic, Ramayana, Hydrological Cycle

## 1. Introduction

The concept of hydrological cycle is the central concept of the modern hydrology. According to Davi T (2002), 'this is a conceptual model of how water moves around between the earth and atmosphere in different states as a gas, liquid or solid state'14. The historical development of hydro science have been craved out by many writers like Baker and Horton, 1936; Simon Ince (1963), Chow, 1964; Tripathi, 1969; Biswas A.K., 1970; R. Nace, 1974; Rouse, Hunter; Garbrecht (1987); James C.I. Dooge (2001); and several other scholars have tried to bring light regarding the conceptual development of hydrological cycle and gave credits mainly to the Greeks and Roman scholars. But, it is still unknown that when and in which book for the first time the concept of hydrological cycle was developed? In the context of development of hydrological cycle, works of Chinese and Western European scholars like Homer (about 1000 B.C.), Thales of Miletos (640 – 540 B.C.), Xenophanes of Colophon (570 – 470 B.C.), Anaxagoras of Clazomene (500 – 478 B.C.), Theophrastos (372-287 B.C.), Plato, Aristotle in Greece, Pliny in Rome and many Bible scholars are worthy to mention, but most of the western scholars recognized the wild theories of origin of water. We have found that contributions of Indian scholars in the ancient period, was parallel to Greek, Roman and Chinese and they have a quite good understanding about the nature and its environment, but the problem lies in the language and its physical appearance to us. Although in a Symposium on the Tercentenary of Hydrology; Contributions to the development of the concept of the hydrological cycle in August, 1974 organized by UNESCO in Paris both have cited the Asian contribution with greater emphasis on Chinese literature Professor Chow V.T., 1974 points out, the history of hydrology in Asia is fragmentary at best and much insight could be obtained by further study, and this should be encouraged3. But the knowledge of science had been stated in ancient Indian literatures and epics, are conspicuously unexplored due to several reasons, like the absence of original written manuscripts, foreign rulers had no such intension to cast light on the scientific content of the Sanskrit literature and even after independence as well as the situations does not improved so much for the obvious reason that there is very little or ignorable importance was given by modern Indian scientists to glean out scientific concept from ancient Sanskrit literature. Most of the scientists never bother vividly about the scientific content in ancient Sanskrit literatures. Dr. P. Jaya Rami Reddy indicated in his book of A Text Book of Hydrology (2005) that when and where complete concept of hydrological cycle was developed is still unknown12. Although few have made some scholars like Prasad (1980), S. Chandra (Director of National Institute of Hydrology, Roorkee, India), (1990), S. Basu (2010) and B. Bera (2010) have taken initial steps towards this direction.

In this study we have found that contrast to ancient western science, ancient Sanskrit literatures contain the most valuable and highly advanced scientific concepts regarding the hydrological cycle, such as in the Gita of Beidyaic period the concept of hydrological cycle was present in an obscure manner. For the first time Chanakya in his book Arthasastra gave an idea and detail description of Rain gauge. Varahmihir (page 507-587) in his book Brihat Sanhita gave a detail discussion on Wind variance, Rain gauge and rainfall forecasting related methods; his clarification concurring colour of the soil is helpful for the estimation of groundwater, e.g. groundwater below brown soil is bad, below white colour it salty and only below bluish colour soil indicate sweet water. In case of below yellowish soil it is difficult to found any kind of groundwater1. In this study we have mainly focused in the conceptual aspects of hydrological cycle in Kiskindha Kanda of Ramayana by Valmaki.

 

*1.1 Objective*

Present study attempts to focus on 28th sarga of 4th Kanda of Kishkindha Kanda of Ramayana by Mahakavi Valmaki, India's first poet. Here main emphasis is to glean out the concept of hydrological cycle in this 28th Sarga by which conforms with the most of the ideas of hydrological cycle of the present day. Here one question may arise that why this study put emphasis on particularly Kiskhindha Kanda of Ramayana? The answer lies in the fact that this portion is mainly the narration about the rainy season; there are extensive commentaries by the ancient commentators as rainy season occupies a prime ordeal status among other seasons. So, that's why these portions of Ramayana drew our attention.

## 2. Methodology

Several journals, books, Sanskrit literatures in the form of hard and soft copies and different sites of World Wide Web have been studied thoroughly. But, Kishkindha Kanda of Ramayana by Mahakavi Valmaki is unique in unfolding hydrological cycle. True to fact that modern concept of hydrology is taken as more reasoned scientific concept. Now the concept of hydrological cycle in Ramayana is critically evaluated in the backdrop of modern hydrological cycle.

## 3. Methodology

It is already mentioned that the Ramayana of Valmaki is a poem, narrating the story of Ram, Sita and Lakshman, that's why kavi Valmaki's writing is very much ornamental and poetical. Through readings is necessary to take the important information out. Indeed, the summery of this 28th Sarga of 4th Kanda reveals that Sugreeb became the king of Kishkindha kingdom after killing Bali with the help of Ramchandra (Ram). As a tribute to Ramachandra, Sugreeb devoted himself in assisting Ram to search Sita, kidnapped by Ravan (King of Lanka). After few months in this occasion Ram and Lakshman reached to the Malyaban Parbat (Hill) but for the onset of Barsha Kal (rainy season) they decided to stay. Ramchandra described the rainy season to his brother Lakshman from different viewpoints. This description is completed by 67 slokhs in 28th Sarga of 4th Kanda of Kishkindha Kanda of Ramayana.

Really, Kishkindha Kanda of Valmiki Ramayana, it is very exciting to find out the contemporary knowledge regarding hydrological cycle during this time of writing of Ramayana by Valmiki about 800 B.C to 500 B.C (Jacobi & McDowell, although Keith, Winternitz & Bulcke believe that it was written about 4th to 3rd century B.C. respectively. In his narratives of rainy season Ramchandra had indirectly incorporated the concept of hydrological cycle in a poetical style. Main focus of this paper is the hidden Slokes, which indirectly describe the concept hydrological cycle and its components namely evaporation, precipitation, infiltration, runoff, and subsurface flow, which is analyzed and describe below.

*3.1. Evaporation and Cloud Fromation*

Maha Kavi Valmiki in his poem '*Kishkindha*' *shloke* no. 3-28-3 said that-

नव मास धृतम् गर्भम् भास्कारस्य गभस्तिभिः |
पीत्वा रसम् समुद्राणाम् द्यौः प्रसूते रसायनम् || ३-२८-३

nava maasa dhR^itam garbham bhaaskaarasya gabhastibhiH.
piitvaa rasam samudraaNaam dyauH prasuute rasaayanam. [3-28-3]

This *shloke* beams that sustaining a nine-month pregnancy, impregnated through the Sun with his ray's drink the essence of oceans, the heaven is given birth to the elixir of life. Thus this *shloke* describe that the atmosphere bears pregnancy of rain water drawing with the help of sunrays through the processes of evaporation, and condensed to form clouds after a period of nine months, from the month of *Kaartiika* to *AaSaaDha*, which is roughly from November to July [3-28-3].

*3.2. Landward Transportation of Cloud*

Valmaki again told in his Shloke no 3-28-17 that

क्वचित् प्रकाशम् क्वचिद् अप्रकाशम्
नभः प्रकीर्णा अंबु धरम् विभाति |
क्वचित् क्वचित् पर्वत संनिरुद्धम्
रूपम् यथा शान्त महार्णवस्य || ३-२८-१७

*kvacit prakaasham kvacit a prakaasham*
*nabhaH pra kiirNaa ambu dharam vi*
*bhaati. kvacit kvacit parvata sam*
*niruddham ruupam yathaa shaanta*
*mahaa arNavasya.* [3-28-17]

Clouds the sky is bright somewhere, and elsewhere not, thus it is glowing well with an aspect of vast but tide less ocean that is by far blocked up with cloudlike mountains. [3-28-17]

In shloke no 3-28-22 entails

 

सम् उद् वहन्तः सलिल अति भारम्
बलाकिनो वारि धरा नदन्तः |
महत्सु शृंगेषु मही धराणाम्
विश्रम्य विश्रम्य पुनः प्रयान्ति ॥ ३-२८-२२

sam ud vahantaH salila ati bhaaram
balaakinaH vaari dharaa nadantaH.
mahatsu shR^ingeSu mahii dharaaNaam
vishramya vishramya punaH prayaanti.[3-28-22]

Clouds appear like cranes are making a low continuous sound to transport water. The weighty water contained inside their wombs, and relaxes reaching loftiest mountain peaks. They are moving, moving and again repose, like pregnant women. From this shloke it is clear that Rama expressed that after being impregnated with water, clouds are being transported towards land and in their path they have to take rest on the peaks of the mountains.

*3.3. Occurrence of Rainfall*

Shloke no 3-28-7 depicts the occurrence of rainfall in the form of

एषा घर्म परिक्लिष्टा नव वारि परिप्लुता |
सीता इव शोक संतप्ता मही बाष्पम् विमुंचति ॥ ३-२८-७

eSaa gharma pari kliSTaa nava vaari pari pluta
siitaa iva shoka santaptaa mahii baaSpam vi muncati [3-28-7]

The explicit meaning of this shloke is that earth overly agonised with the searing summer, is wetted with new waters, looking like implying tearing Sit detached from Rama.

Shloke no 3-28-27 is the beautiful expression of rainfall

वहन्ति वर्षन्ति नदन्ति भान्ति
ध्यायन्ति नृत्यन्ति समाश्वसन्ति |
नद्यो घना मत्त गजा वन अन्ताः
प्रिया विहीनाः शिखिनः प्लवंगाः ॥ ३-२८-२७

vahanti varshanti nadanti bhaanti
dhyaayanti nR^ityanti samaashvasanti
nadyaa ghanaa matta gajaa vana antaaH
priyaa vihiinaaH shikhinH plavamgamaaH [3-28-27]

This implies that with the start of heavy shower rivers are surging, clouds are showering, rutty elephants are shrilling, forest interiors are shining, loveless are speculating, peacocks are rocking and monkeys are resolving to stay at one place.

Shloke no 3-28-21 is the outcomes of rain.

वर्ष उदक आअप्यायित शाद्वलानि
प्रवृत्त नृत्त उत्सव बर्हिणानि |
वनानि निर्वृष्ट बलाहकानि
पश्य अपराह्णेषु अधिकम् विभान्ति ॥ ३-२८-२१

varSa udaka aaapyaayita shaadvalaani
pravR^itta nR^itta utsava barhiNaani
vanaani nir vR^iSTa balaahakaani
pashya paraahNeSu adhikam vi bhaanti [3-28-21]

Inner meaning is after heavy shower greenery pasturelands are satiated with rainwater and peacocks enjoy dancing carnivals, thus it is extremely splendorous in afternoons.

The essence of this shlokes are; the earth that becomes heated in summer emits out hot vapours with the fall of first rain is nothing but release its agony of heat, which indicate that first rainfall does not leads to the formation of overland flow, rather than it is re-evaporate from the ground. After some time overland flow leads to the increasing discharge of river, this makes river surging. After completion of rained due to barriers of vegetation rate of overland flow slow down that leads to growth of greeneries and pasturelands, signifying infiltration obstructed by greenery and pastures. After the infiltration is over, the rivers are filled with water, causing growth of forest and pastures by infiltration and overland flow.

*3.4. Through fall and infiltration:*

Shloke no 3-28-21 is the outcomes of rain.

वर्ष उदक आअप्यायित शाद्वलानि
प्रवृत्त नृत्त उत्सव बर्हिणानि |
वनानि निर्वृष्ट बलाहकानि
पश्य अपराह्णेषु अधिकम् विभान्ति ॥ ३-२८-२१

varSa udaka aaapyaayita shaadvalaani
pravR^itta nR^itta utsava barhiNaani
vanaani nir vR^iSTa balaahakaani
pashya paraahNeSu adhikam vi bhaanti [3-28-21]

General meaning of this shloke is that after heavy shower greenery forest and pasturelands are satiated with rainwater and peacocks enjoy dancing carnivals, thus it is extremely splendorous in afternoons.

The essence of this shlokes is that some portions of the earth's surface is covered with forest and pastureland and during the rainfall these zones is satiated with the rainfall, that indicate the concept of throughfall and on the other hand waited pastureland signifying the concept of infiltration and resulting storage of rainwater in form of soil moisture storage.

 

*3.5. Storage of water, Runoff and Overland flow:*

Shloke no 3-28-44 entails that

मेघाः समुद् भूत समुद्र नादा
महाजल ओघैः गगन अवलंबाः |
नदीः तटाकानि सरांसि वापिः
महीम् च कृत्स्नाम् अपवाहयन्ति || ३-२८-४४

meghaaH sam ud dhuuta samudra naadaa
mahaa jala oghaiH gagana avalambaaH |
nadiiH taTaakaani saraamsi vaapiH
mahiim ca kR^itsnaam apa vaahayanti || 3-28-44

The meaning of the shloke is that the clouds having torrential water are soaring the sky, and spurning the oceans water over the earth surface and as a result they are inundating rivers, lakes, pools and tanks. So, directly from this shloke it is clear that the concept of storage water, runoff and overland flow is precedent here.

*3.6. Back to the Ocean*

Shloke no 3-28-25 narrates the return of overland flow to the sea through rivers.

निद्रा शनैः केशवम् अभ्युपैति
द्रुतम् नदी सागरम् अभ्युपैति |
हृष्टा बलाका घनम् अभ्युपैति
कान्ता स कामा प्रियम् अभ्युपैति || ३-२८-२५

nidraa shanaiH keshavam abhi upaiti
drutam nadii saagaram abhyupaiti
hRiSTaa balaakaa ghanam abhyupaiti
kaantaa sa kaamaa priyam abhyupaiti [3-28-25]

Literally this *shloke* mean that, these days sleep is slowly getting closer to Vishnu, rivers are rapidly getting closer to oceans, cranes are gleefully getting closer to clouds, and women are passionately getting closer to their beloveds. In relation to modern hydrological cycle the *shlokes* of 3-28-21, 3-28-7 ad 3-28-25, indicate that after the occurrence of rain earth satiated with rainwater and mixed with earthen material flow rapidly towards ocean.

## 4. Result and Discussion

So from the above discussion it became clear that the notion of hydrological cycle was present at that time, but the central focus of our question is that up to what extent the knowledge of hydrological cycle posses at that time of 8th to 4th century B.C. as well as how far it is similar to the present scientific concept of the hydrological cycle.

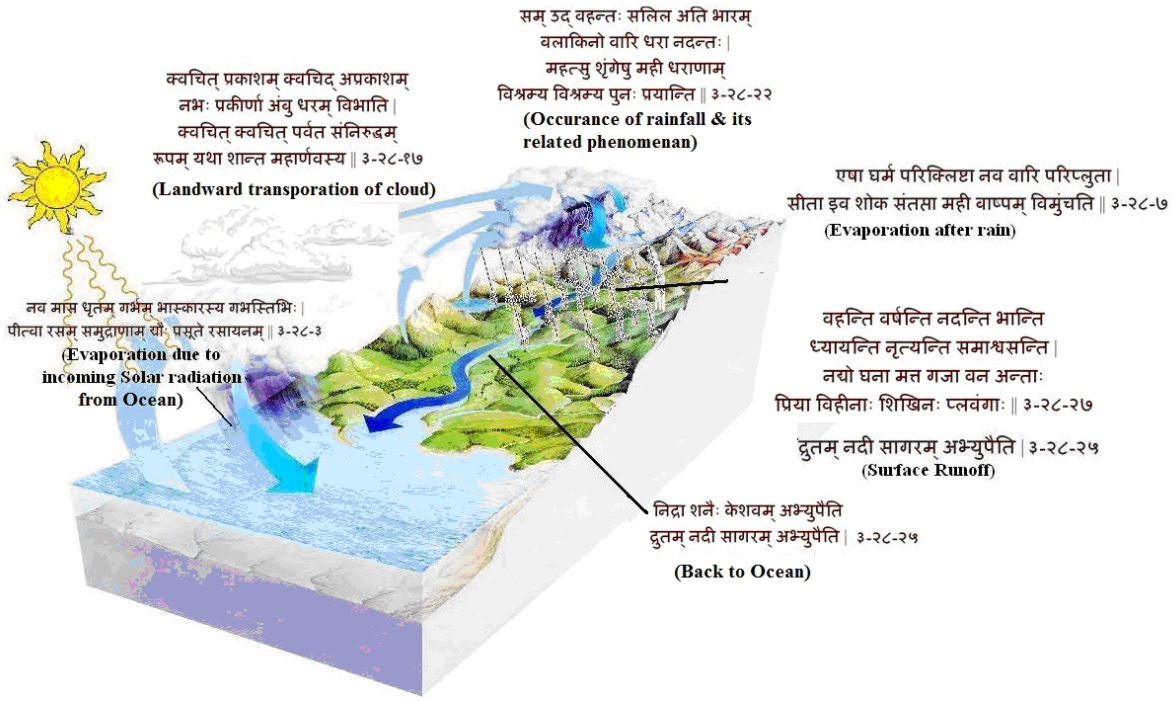


Fig: 1 Schematic Representation of Hydrological Cycle extracted from Kishkindha Kanda of Ramayan by Kavi Valmaki by Author.

 

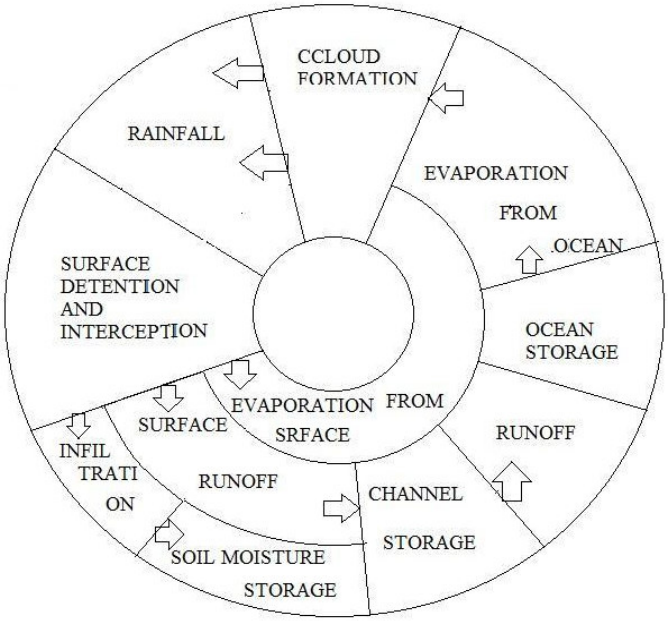


Fig: 2 Schematic representation of Hydrological cycle during 800 B.C to 500 B.C's

*4.1. Comparison of concept of Hydrological Cycle in Ramayan with respect to its present form and its significant*

In reflecting this perspective figure 3 depicts the symmetry and asymmetry of these two types of idea. The modern concept of hydrological cycle is composed of several components like insolation, evaporation, transportation, condensation, precipitation, and run-off; it seems to be exciting, that during the time of Valamaki most of these components and processes of hydrological cycle such as insolation, evaporation, transportation, condensation, precipitation, and run-off are found in the literature. But to maintain lyrical style the concept has been arrange not in a systematic narration of process that is found in the modern concept, but it has significantly mentioned the formation of cloud rainfall and runoff.

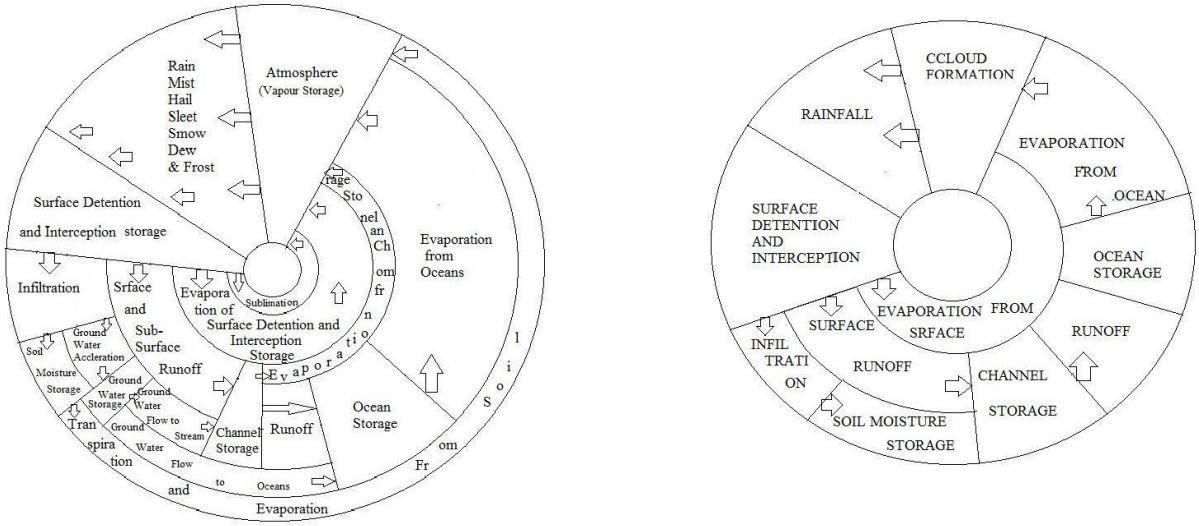


Fig: 3 Schematic comparisons between Modern Hydrological cycle after Reddy, P. J. R., 2005 and extracted hydrological cycle concept of about 800 B.C to 500 B.C's[4-5].

In the modern concept sun throughout the year evaporates the oceanic water or water from others water bodies coupled with transpiration. But in the epic, there is no signature of transpiration. Once again, contrasting difference occurs for run-off where present concept considering run-off, infiltration and sub-surface flow. In the epic concept of infiltration and sub-surface flow are found to be lacking. Apart from such few limitations the concept is unique.

**6.0 Conclusion**

Above all from the above discussion and analysis we can say that the concept of hydrological existed during

 

Valmaki's time, which was pity much similar to the modern concept of hydrological cycle, in a broader way, in terms of components and processes which operate them in a poetic way in his great historic mythology of Ramayana. Another significant fact is that here we have extracted a complete cyclic concept of hydrological cycle, which was thought to be never exist at that time. Here it must be mentioned that although few concepts like condensation, infiltration, subsurface flow etc are not present here, there may be a reason which might have been leads to ignore some the facets of hydrological cycle, as here kavi Valmaki's main emphasis was to highlight the Ram & Sita's story instead of hydrological cycle, but that is not indicate that at that time this kind of concepts were not present, e.g., infiltration, subsurface flow processes have been found in the Rig Veda (3000 B.C. or before).

Last of all we can concluded that in the words of V.T. Chow, the history of hydrology in Asia is fragmentary at best and much insight could be obtained by further study, but in case of India reasons may be domination of foreign rulers for long time did not help in bringing the scientific content of the Sanskrit literature to come to the fore and even after independence, the situation did not improve for the obvious reason that there is no interaction between modern scientists and the Sanskrit scholars. The scientists never bother to know about the scientific content in ancient Sanskrit literature, above all due to absence of original written manuscript it is kept in ignorance. If we overcome the mentioned barrier then we will found that Valmaki's Ramayana is not only the one, there are several ancient Indian literature, where several scientific concept was hidden, we have to just keep patient and work through multidisciplinary way to explore the rich scientific treasure from our ancient Indian literature.

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