

CONTRIBUTION OF INDIAN HYDROLOGISTS IN JOURNAL OF HYDROLOGY : A SCIENTOMETRIC ANALYSIS

M. FURQAN ULLAH

National Institute of Hydrology
Roorkee

The Indian hydrologists' contributions in the Journal of Hydrology with regard to various major disciplines, authorship pattern of papers, research collaboration, institution-wise output and author's identification have been investigated. Major areas of interests of Indian contributors and prolific investigators have been identified.

INTRODUCTION

Journals are the first hand documented records of original research available widely and form one of the primary sources of information. They constitute the bulk of the literature in any discipline and serve as the forum for communicating intellectual contributions of different authors and carry current information in a particular subject field.

Study of items published in a journal may reveal the state and status of the subject field and the journal in the context of research activities in a discipline. The Journal of Hydrology holds a special and renowned position amongst hydrology and water resources journals. It is published by North Holland Publishing Company, Amsterdam, the Netherlands (now Elsevier Science Publishers) since 1963. It presents original studies, important research results and comprehensive reviews on chemical and physical aspects of surface and groundwater hydrology, hydrometeorology, hydrogeology, parametric and stochastic hydrology, agrohydrology, hydrology of arid zones and applied hydrology. The journal also includes relevant aspects of related disciplines such as climatology, hydraulic engineering, soil science and water chemistry. According to a report from Elsevier Science Publishers, the Journal publishes the results of high quality research from all over the world – 35% of the contributors belong to USA, 40% from Europe and 25% from the rest of the world. The present paper attempts to investi-

gate the Indian contributions in the Journal of Hydrology.

OBJECTIVES

Keeping in view the above perspectives it was decided to undertake the present study with the following main objectives:

- a) to obtain an overall perspective of contributions of Indian hydrologists in the Journal of Hydrology;
- b) to identify other related disciplines in which majority of Indian contributions are published in the Journal of Hydrology;
- c) to examine and analyse the authorship pattern and research collaboration;
- d) to identify the organisations where hydrological studies are being conducted; and
- e) to identify the authors actively involved in hydrological studies.

METHODOLOGY

One hundred volumes of the Journal from volumes 51 to 150, covering the period March 1981 to September 1993 were studied. Only research, review and technical papers contributed by Indian hydrologists either individually or in collaboration with foreign scientists irrespective of place of work were considered for this investigation. For subject analysis subject indexes of the Journal and selected Water Resources Abstracts have been used with certain modifications.

DISCUSSION AND RESULTS

In the total 100 volumes of the Journal investigated, a total of 2145 papers from all over the world were published. Out of these, 163 (7.6%) papers were contributed by Indians. Table 1 shows an

Table 1

Total contributions and total Indian contributions

Volume nos.	Year (s) of publication	Total contributions	Contributions by Indians	Percentage
51-60	1981-83	231	23	9.96%
61-70	1983-84	229	13	5.68%
71-80	1984-85	217	23	10.60%
81-90	1985-87	222	16	7.21%
91-100	1987-88	219	19	8.68%
101-110	1988-89	219	24	10.96%
111-120	1989-90	221	12	5.43%
121-130	1990-92	202	15	7.43%
131-140	1992	191	13	6.81%
141-150	1993	194	5	2.58%
Total 100 vols.	1981-93	2145	163	7.60%

overall picture of Indian and foreign contributions. It can be observed that a maximum of 24 contributions were made in the year 1988-89 (Vols. 101-110), followed by 23 in the years 1981-83 and 1984-85 (Vols. 51-60 and 71-80). Volume 121 to 150 shows the declining trend of contributions by

Indians. Only 5 contributions were observed in the year 1993, Volumes 141-150.

The total Indian contributions (163) were made by 238 authors (Table 2). Out of these numbers, 140 authors are associated with organisations in

Table 2

Number of authors and their contributions

Authors with contribution	Working in Indian organisations	Working in foreign organisations	Collaboration with foreign authors	Total	Percentage
One	93	22	48	163	68.49
Two	25	10	14	49	20.59
Three	13	1	1	15	6.30
Four	5	-	-	5	2.10
Five	2	-	-	2	0.84
Six	1	-	-	1	0.42
Seven	-	-	-	-	-
Eight	-	1	-	1	0.42
Nine	-	-	-	-	-
Ten	-	-	-	-	-
Eleven	1	1	-	2	0.84
Total	140	35	63	238	100%

India, 35 with foreign organisations and there are 63 foreign scientists who collaborated with these authors. 163 (68.49%) authors contributed only one paper either independently (22 contributions) or jointly (141 contributions). There are two authors who have contributed maximum number of 11 papers each - one each is working in India and abroad.

Subject Analysis

Table 3 gives an account on subject areas according to the decreasing productivity of contributions, total number of contributors in these areas and average authorship. All the 163 contributions are divided into 14 broad areas of hydrology. Groundwater hydrology, the study of wa-

Table 3

Subject-wise break-up of Indian contributions

Subject area	Number of papers	% of papers	No. of authors	Average author per paper
Groundwater Hydrology	50	30.67	107	2
Stochastic Hydrology	30	18.40	69	2
Surface Water Hydrology	29	17.79	63	2
Environmental Hydrology	14	8.59	36	3
Pedo-hydrology	13	7.98	33	3
Hydrometeorology	6	3.68	19	3
Nuclear Hydrology	4	2.45	11	2
Geophysical Methods	3	1.84	7	2
Glaciohydrology	3	1.84	12	4
Sedimentology	3	1.84	7	2
Water Management	3	1.84	6	2
Conjunctive Use Hydrology	2	1.23	6	3
Limnology	2	1.23	4	2
Geomorphology	1	0.61	2	2
Total	163	100.00	382	

ter underneath the surface of the earth attracted the maximum attention of Indian authors. 30.67% of the total contributions were recorded in that area followed by stochastic hydrology (18.40%) and surface water hydrology (17.79%).

An average of two authors per paper was observed as maximum productivity in the areas like groundwater hydrology, stochastic hydrology and surface water hydrology. There were average three

authors per paper recorded in the areas of moderate productivity in environmental hydrology, pedohydrology and hydrometeorology.

Team Work and Research Collaboration

Authorship pattern reveals that the single - author papers are 22 (13.5%) only, while number of articles written in co-authorship is 141 (86.5%) (Table 4).

Table 4

Collaborative authorship pattern

Authorship	Papers	Percentage
Single-authored papers	22	13.50
Two-authored papers	88	53.99
Three-authored papers	38	23.31
Four-authored papers	8	4.91
Five-authored papers	5	3.07
Six-authored papers	1	0.61
Seven-authored papers	1	0.61
Total	163	100%

Maximum number of papers (53.99%) were published in collaboration with two authors, followed by 38 (23.31%) papers with three authors. A maximum number of seven authors in collaboration were noticed. It can be observed that degree of collaboration has inverse relationship with the number of papers. Only 15 (9.2%) papers have more than three authors.

Table 5 presents the research collaboration between the authors (Indians) working in Indian and foreign organisations in association with foreigners. On the basis of the Indian and foreign organisations affiliation, five types of collaboration were observed: a) the contributors working in India and collaborated with each other (53.19% papers); b) authors working in India and collabo-

Table 5

Research collaboration with foreign authors

Papers with	Two authors	Three authors	Four authors	Five authors	Six authors	Seven authors	Total	Percentage
All authors working in India	45	25	3	2	-	-	75	53.19%
Authors working in India and collaborated with Indians working in foreign	-	2	-	-	-	-	2	1.42%
All authors (of Indian origin) working in foreign	5	-	-	-	-	-	5	3.55%
Authors working in India and collaborated with foreigners	6	1	2	3	1	1	14	9.93%
Authors (of Indian origin) working abroad & collaborated with foreigners	32	10	3	-	-	-	45	31.91%
Total	88	38	8	5	1	1	141	100%

CONTRIBUTION OF INDIAN HYDROLOGISTS IN JOURNAL OF HYDROLOGY

rated with Indians working abroad (1.42% papers); c) the authors of Indian origin working abroad and collaborated with each other (3.55%); d) authors working in India and collaborated with foreigners (9.93%) and e) authors of Indian origin working abroad and collaborated with foreigners (31.91%).

Institution-wise Distribution

In the present study, all organisations engaged in hydrological studies were classified into three broad categories, viz. (1) educational institutions (85); (2) research institutions (52); and (3) others (26). Figures shown under parenthesis are total number of papers under each of them. The higher

percentage of research student working for degrees appears to be the main reason for a high proportion of papers being published from educational institutions.

For this study, organisations of only first author have been taken into consideration. Table 6 presents ten organisations contributing more than two papers. Their contribution is 41.7% (64 papers) of total papers. Table shows that maximum number of papers (13 papers) were contributed by NGRI, Hyderabad, followed by 10 papers from Indian Institute of Science, Bangalore. J.N.U., New Delhi and University of Roorkee have contributed 9 papers each. Major contribution of N.G.R.I.,

Table 6

Organisations contributing more than two papers

S.no.	Organisations	Papers
1.	National Geophysical Research Institute, (NGRI), Hyderabad	13
2.	Indian Institute of Science (IISc), Bangalore	10
3.	Jawaharlal Nehru University (JNU), New Delhi	9
4.	University of Roorkee (UOR), Roorkee	9
5.	Centre for Water Resources Development & Management (CWRDM), Calicut	6
6.	Central Arid Zone Research Institute (CAZRI), New Jodhpur	5
7.	Indian Agricultural Research Institute (IARI), New Delhi	5
8.	Central Soil Salinity Research Institute (CSSRI), Karnal	4
9.	Punjab Agricultural University (PAU), Ludhiana	3
10.	Orissa University of Agriculture and Technology (OUAT), Bhubaneswar	3

Hyderabad is in groundwater hydrology, nuclear hydrology, environmental hydrology, stochastic hydrology and conjunctive use of surface and groundwater. I.I.Sc., Bangalore seems to be active on stochastic modelling and simulation, ground and surface water studies. River basin studies, sediment dynamics and glaciohydrology are the major research areas of J.N.U., New Delhi. Institutions like University of Roorkee; CWRDM, Calicut; CAZRI, Jodhpur; IARI, New Delhi; CSSRI,

Karnal, P.A.U., Ludhiana and O.U.A.T., Bhubaneswar have contributed mainly on pedohydrology, groundwater studies, sedimentology, surface water and environmental hydrology. Authors' Identification.

Table 7 (a) & (b) list 25 authors along with the number of papers each has contributed. Out of them 22 authors are working in India and 3 authors are working abroad. Most of these authors

Table 7

*Authors contributing three or more papers*7(a) : *Authors working in India*

Authors	Organisations	Inde- pendent	As 1st author	As 2nd author	As 3rd author	As 4th author	As 5th author	As 6th author	As 7th author	Total
Subramanian V	JNU, New Delhi	-	-	10	1	-	-	-	-	11
Sridharan K	IISc, Bangalore	-	4	1	1	-	-	-	-	6
Gupta C P	NGRI, Hyderabad	-	3	2	-	-	-	-	-	5
Rao N H	IARI, New Delhi	1	3	1	-	-	-	-	-	5
Shakya Shrikrishna	PAU, Ludhiana	1	1	2	-	-	-	-	-	4
Satish Chandra	NIH, Roorkee	-	-	1	2	-	-	-	1	4
Sarma P B S	IARI, New Delhi	-	-	3	1	-	-	-	-	4
Singh S R	PAU, Ludhiana	-	2	2	-	-	-	-	-	4
Singh V S	NGRI, Hyderabad	-	2	2	-	-	-	-	-	4
Basak P	CWRDM, Calicut	1	2	-	-	-	-	-	-	3
Choudhari J S	CAZRI, Jodhpur	1	1	-	1	-	-	-	-	3
Lakshmana Rao N S	IISc, Bangalore	-	-	-	3	-	-	-	-	3
Misra C	OUAT, Bhubaneswar	-	1	2	-	-	-	-	-	3
Mohan Kumar M S	IISc, Bangalore	-	1	1	1	-	-	-	-	3
Rai S N	NGRI, Hyderabad	-	1	2	-	-	-	-	-	3
Rajagopalan S P	CWRDM, Calicut	1	1	1	-	-	-	-	-	3
Ramesh R	JNU, New Delhi	-	3	-	-	-	-	-	-	3
Rastogi A K	IIT, Bombay	2	1	-	-	-	-	-	-	3
Singh R N	NGRI, Hyderabad	-	2	1	-	-	-	-	-	3
Singhal B B S	UOR, Roorkee	-	-	-	2	-	1	-	-	3
Srinivasalu N V	Mysore Paper Mills Karnataka	-	-	-	2	1	-	-	-	3
Sukhija B S	NGRI, Hyderabad	-	3	-	-	-	-	-	-	3

7 (b) : *Authors working abroad*

Singh V P	Louisiana State Univ. Baton Rouge	-	2	8	1	-	-	-	-	11
Sharma M L	CSIRO, Wembley (Australia)	-	4	4	-	-	-	-	-	8
Rao A R	Purde Univ. West	-	1	2	-	-	-	-	-	3

are working on surface and ground water hydrology, sedimentology, pedohydrology and stochastic hydrology. Maximum number of papers were contributed by Dr. V. Subramanian from J.N.U., New Delhi and Dr. V.P. Singh from Louisiana State University, Baton Rouge (11 papers each), but both of the authors have no independent contribution to their credit. Some other prominent Indian hydrologists who have contributed at least five papers are K. Sridharan, C.P. Gupta, N.H. Rao and M.L. Sharma.

CONCLUSION

In 100 volumes of Journal of Hydrology, good proportions of papers are contributed by Indian sci-

entists. Indian contributions in hydrology and water resources are highly scattered among various organisations. However, a good proportion of the output comes from a few organisations like NGRI, Hyderabad; I.I.Sc., Bangalore; J.N.U., New Delhi and University of Roorkee. The publications profile of important hydrological studies related organisations like Central Water Commission, India Meteorological Department, Central Ground Water Board, National Institute of Hydrology is very meagre. It is observed that maximum numbers of papers have two authors and next to it have three authors. Based on the publications output it can be inferred from this study that the Indian hydrologists are mainly contributing on the groundwater related problems.