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SCImago, Eigenfactor Score and H5 Index Journal Rank Indicator: Alternatives to the Journal Impact Factor for Water Resources Journals

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ABSTRACT

Objective. This paper investigated the possibility of SCImago Journal Rank (SJR), Eigenfactor Score (ES) and H5 Index indicators as alternatives to the Journal Impact Factor (JIF) in the field of water resources.
Method. The SJR, ES, H5 index and JIF scores and ranking of water resources journals were downloaded from the relevant websites. Pearson and Spearman correlation coefficients were calculated to test hypotheses for association between the four journal quality metrics.
Result. Strong positive correlations were found between the scores and rank order based on the SJR, ES, H5 and JIF of selected journals. Hence, academics and researchers in water resources can use the SJR, ES and H5 indicators as alternatives to JIF for evaluation and judgment of scientific journals in the area.

INTRODUCTION

This paper reports a comparative study of journal quality indicators accepted by scientific and academic groups for assessment and appraisal of scientific journals in the field of water resources. The main objective of the study was to evaluate quality indices of journal scientific impact with emphasis on the Journal Impact Factor (JIF), Eigenfactor Score (ES), SCImago Journal Rank indicator (SJR) and H5-Index. Specific water resources journals were selected from the relevant category in the Web of Science (WoS) website. The selected water resources journals possess the standard of quality by virtue of being indexed in the Web of Science and Scopus databases. The 2015 JIFs and ESs were obtained from the Journal

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Citation Report, the SJR from the SCImago Journal, and H5-Index from Google Scholar metrics.

Correlations between the indices were calculated using the Pearson product-moment correlation coefficient (Pearson r) and Spearman rank correlation coefficient (Spearman rho) using the SPSS statistical software. The JIF scores ranged between 5.991 to 0.043; ES varied between 0.078 to as low as 0.00001; SJR ranged between 2.772 and 0.120; and H5 ranged between 92 and 3. A high Pearson r occurred between the JIF and SJR indicators for journals in this category (r=0.901) and between JIF and H5 indices (r=0.898), while the correlation is moderate between JIF and ES values (r=0.791). Spearman rho rank correlation showed an acceptable and identical correlation between JIF and SJR rankings, JIF and ES rankings, and between JIF and H5-Index for water resources journals (coefficient values of 0.806, 0.806 and 0.811, respectively). The metrics complement each other when used as cooperative indicators to assess the impact of water resources journals.

LITERATURE REVIEW

Journal quality metrics (also referred to as bibliometric), such as impact factors, are increasingly being used as measures of researchers' and educators' success and prestige (Brown, 2011). A study of research evaluation measures should highlight similarities within each indicator, indicate differences among alternative indicators, capture similar performance characteristics of highly cited journals, show the degree and type of correlations with indicators, and hence add significant journal informational value (Chang & McAleer, 2012). Bibliometric indicators that are used to appraise quality ranking for journals use complex algorithms. The perceived research performance of individual researchers is crucial for hiring, firing, tenure and promotion decisions (Chang, McAleer, & Oxley, 2013). Prominent water resources scientific journals sought to fulfill research publishing quality measures and norms. Such benchmarks are typically determined through scientometric tools and means. Presently applied bibliometric and scientometric indicators include: journal impact factor (JIF), Eigenfactor Score (ES), SCImago Journal Rank indicator (SJR), Article Influence Score (AIS) h5-index, and h5-median. The different bibliometric indicators have their benefits and shortcomings.

The Journal Impact Factor or Eugene Garfield factor (JIF) is the most popular (Franceschet, 2010), and widely used as a proxy of a journal's quality and scientific prestige (Bornmann, Marx, Gasparyan, & Kitas, 2012). JIF is defined as the recorded number of citations within a certain year for the items published in the journal during the two preceding years, divided by the number of such items. This would be the equivalent of the average citation rate of an item during the first and second calendar year after the year of publication (Cantín, Muñoz, & Roa, 2015; Lozano, Larivière, & Gingras, 2012), or the number of current citations to articles published in a specific journal in a two-year period divided by the total number of articles published in the same journal in the corresponding two-year period (de Haan, Hillman, & Ursprung, 2007).

SCImago research laboratory Journal Rank (SJR) index offers essential scientometric information for a large number of scholarly and professional journals based on data licensed from Elsevier's Scopus database. Especially valuable are its features of weighting the citations received based on the prestige of the citing journals, the (partial) exclusion of journal self-citations, and the broader base of source journals (Jacsó, 2010). Guerrero-Bote and Moya-Anegón (2012) suggested a new size-independent indicator of scientific journal prestige, the SJR2 indicator. This indicator takes into account not only the prestige of the

citing scientific journal but also its closeness to the cited journal using the cosine of the angle between the vectors of the two journals' co-citation profiles.

The Eigenfactor Score (ES) may be interpreted as measuring the journal influence and it reflects both the number of citations and the prestige of citation source. The main attributes of ES are: exclusion of journal self-citation in its calculation, high emphasis for citations from original works published in top-tier journals and subscription to the concept of large network of citations (Yin, 2011).

The Article Influence Score (AIS) uses the Thomson Reuters ISI Web of Science data for the most highly cited journals in each of the Sciences and Social Sciences. It measures the relative importance of a journal's citation influence on a per-article basis (Chang et al., 2013). It is freely available and ranks journals by a similar algorithm as Google's Page Rank (Kianifar, Sadeghi, & Zarifmahmoudi, 2014). The AIS is derived from ES and is conceptually similar to IF in that there is a numerator as well as a denominator (i.e. number of citable papers), except that it uses ES (rather than the total number of citations) as the numerator. Thus, dissimilar to IF where all citations are counted equally regardless of their source, in AIS, each citation is multiplied by the "quality" of the citing journals, resulting in greater weight accorded to citations that come from highly cited journals, and less weight to poorly cited journals (Rizkallah & Sin, 2010).

The H-index, originally proposed by Jorge Hirsh, is the largest number h such that at least h articles in that publication were cited at least h times each. The h-core of a publication is a set of top cited h articles from the publication. The h-median of a publication is the median of the citation counts in its h-core. The h-median is a measure of the distribution of citations to the articles in the h-core (Delgado-López-Cózar & Cabezas-Clavijo, 2013). The index is launched as a bibliometric tool, free of charge to access, offering the H-index for a wide range of scientific journals and other bibliographic sources (Delgado-López-Cózar & Cabezas-Clavijo, 2013). The h-index is dependent on the journal's "age", its visibility and how frequently cited its articles are. The H-index reflects both the number of publications ("productivity") and the number of citations per publication ("impact") (Leydesdorff, 2009).

Source normalized impact per paper (SNIP) measures a journal's contextual citation impact, taking into account the characteristics of its properly defined subject field, frequency with which authors cite other papers in their reference lists, rapidity of rapidity of citation impact maturity and the extent to which a database used for assessment covers the field's literature. SNIP is defined as the ratio of journal's citation count per paper and the citation potential in its subject field. It aims to allow for the direct comparison of sources in different subject fields. Citation potential is shown to vary not only between journal subject categories—groupings of journals sharing a research field or disciplines (e.g., journals in mathematics, engineering and social sciences tend to have lower values than titles in life sciences), but also between journals within the same subject category (Moed, 2010).

Table 1 gives an overview of the most used quality indicators and their features, including: journal history, journal's indexing in an accredited database, rate of international cooperation, and country of publication, popularity, use in journals advertising, journal's inclusion, inclusion of other citations, inclusion of self-citations, modification abilities, selection flexibility, compatibility with other indicators, information management, easiness of use, self-citations limitations, online access, English language bias, free availability, single journals assignments category, developer, quality assessment algorithm, metrics ranking and time window.

Table 1. Common bibliometric journal indicators and their features

Bibliometric features, requirements, functionality, use	Journal Impact factor (JIF)	SCImago journal rank indicator (SJR)	SJR2	Eigenfact -or Score	H-index (h5-index and h5-median)	Article Influence Score (AIS)	SNIP
Popularity	●	●			●		
Use in journals advertising	●	●		●	●		
Journal's inclusion		●					
Inclusion of other citations (editorials, letters, etc.)	●						
Closeness to the cited journal			●				
Inclusion of self-citations	●						
Modification abilities	●	●		●			
Selection flexibility	●	●		●	●		
Compatibility with indicators	●	●		●	●	●	●
Information management	●	●	●				
Easiness of use	●	●		●	●		
Self-citations limitations		●					
Online access		●					
English language bias	●						
Free availability		●		●		●	
Single journals assignments category				●			
Institute for Scientific Information (ISI) developer	●						
Scopus database [Elsevier]. developer		●					
Google's Page Rank developer				●			●
Scopus, (WoS), and Google Scholar Citations developer					●	●	
Thomson Reuters ISI Web of Science data						●	

Continued…

Bibliometric features, requirements, functionality, use	Journal Impact factor (JIF)	SCImago journal rank indicator (SJR)	SJR2	Eigenfactor Score	H-index (h5-index and h5-median)	Article Influence Score (AIS)	SNIP
Cosine of the angle between the vectors of the two journals' co-citation profiles			•				
PageRank algorithm		•					
Quality assessment algorithm				•			
Google Scholar Metrics ranking					•		
Time window, previous 3 years		•					
Time window, previous 5 years				•			

Sources: Abrizah, Zainab, Kiran, & Raj, 2013; Ahmad, Abdel-Magid, & Abdel-Magid, 2016; Cantín, Munoz & Roa, 2015; Elkins, Maher, Herbert, Moseley, & Sherrington, 2010; Franchignoni & Lasa, 2011; García-Pachón & Arencibia-Jorge, 2014; Guerrero-Bote & Moya-Anegón, 2012; Jamali, Salehi-Marzijarani, & Ayatollahi, 2014; Ram, Kataria, & Ahmad, 2014; Ramin & Shirazi, 2012; Zarifmahmoudi, Jamali, & Sadeghi, 2015

METHOD

Pertinent information for the selected water resources journals was obtained from the journal ranking section of SCImago journal and country ranking website1 and from Web of Science2 (WoS) Core Collection official website. ISI indexed journals were used for computation of impact factor. The 2015 JIFs and ESs were acquired from the Journal Citation Report (JCR) through WoS. The 2015 SJR indicator is offered by the SCImago Journal, and country rank provided by Scopus and Google Scholar Citations (GS) metrics under the category of Water resources. Journals with JIFs and ESs were tabulated, and information regarding their ranking in the SJR indicator list was retrieved by matching their ISSN. Likewise, journals with the SJR indicators were listed and their ranking was identified in the inventory of journal JIFs.

The ranks of each journal according to each metric were also compared statistically. The correlations between the extracted indices were evaluated using both Pearson and Spearman correlation coefficients. All analyses were conducted using the Statistical Package for the Social Sciences (SPSS) 21.0, version 2012.

Eighty-five journals were identified with water resources as the specific scope and focus. They are listed in the Appendix, together with their scores and rankings according to SCImago, JIF, ES and H5-Index in 2015.

The information in the Appendix indicates that none of the selected water resources journals had the same ranking in all four classifications and metrics indices under review. All investigated journals are high quality journals since they are indexed in the two most prestigious databases, WoS and Scopus.

[1] http://www.scimagojr.com/
[2] http://www.accesowok.fecyt.es/

RESULTS AND DISCUSSION

Following the JIF indicator, the top three most cited journals were Water Research (JIF 5.991), Water Research and Desalination (JIF 4.412) and Advances in Water Resources (JIF 4.349). These were closely followed by Chemical Engineering Journal (JIF 5.31). In contrast, the lowest citations were obtained by Wasserwirtschaft (JIF 0.102) and Tecnologia Y Ciencias Del Agua (JIF0.043).

Following the Eigenfactor Score, the journals that ranked top three were Water Research (ES 0.0782), Water Resources Research (ES 0.05653) and Journal of Hydrology (ES 0.04961). Lowest ES were recorded for Tecnologia Y Ciencias Del Agua (ES 0.00008) and Environmental Science-Water Research and Technology (ES 0.00001).

The SJR indicator agreed with JIF in ranking the top three as Water Research (SJR 2.772) Environmental Science & Technology (SJR 2.664) and Applied Catalysis B-Environmental (SJR 2.322). Geomatics Natural Hazards and Risk brought up the rear (SJR 0.12).

The top three journals following the H5 index were Water Research (H5 of 92), followed by Desalination (H5 of 83), with Water Resources Research and Journal of Hydrology tying for third place (H5 of 64). Hydrologie Und Wasserbewirtschaftung was last with an H5 index of 3.

Table 2 lists the bivariate correlation between the four indicators (JIF, ES, SJR and H5) for the water resources journals. There is a high Pearson correlation between JIF and SJR indicators (r=0.901), and between JIF and H5 indices (r=0.898). JIF and ES obtained a moderately high correlation of r=0.791. With respect to Spearman rho rank correlation, an acceptably high correlation obtained between JIF and SJR rankings, JIF and ES, and between JIF and H5-Index (coefficient values of 0.806, 0.806 and 0.811 respectively).

The results suggest that the use of the SJR index does not substantially modify the classification of water resources journals from the JIF indicator. Since SCImago Journal and Country Rank is accessible for free, SJR may be considered as an alternative to JIF for water resources journals. This finding is in agreement with García-Pachón and Arencibia-Jorge (2014) and Ahmad et al. (2016).

Figure 1 depicts a bump chart for the top ten JIF ranked water resources journals in comparison with SJR ranking. The figure clearly shows the changing pattern of both indicators for the selected water resources journals. The Journal of Environmental Toxicology and Catena underwent the greatest change.

Figure 2 shows a bump chart for the top ten JIF ranked water resources journals in comparison with ES ranking. The first eight journals showed reasonable correlation and fluctuation between the two indices. The journals Agricultural Water Management and Hydrological Processes suffered the greatest differences.

Figure 4 shows scatter plots showing correlation of values and rankings between JIF, ES and SJR, as well as their fit lines for 85 water resources journals. A linear correlation between the different indices (ES versus JIF and SJR versus JIF) is clearly revealed in the figure. Likewise, linearity of relationship is obvious between both ranks of ES versus JIF, and of SJR versus JIF as shown in Figure 3.

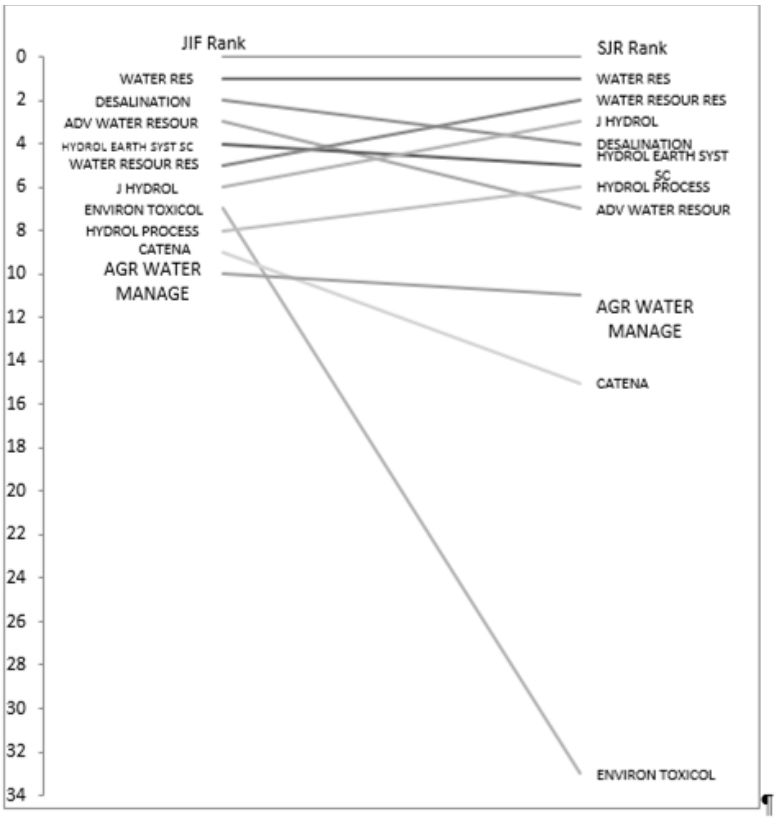

Figure 1. Bump chart for the top 10 JIF ranked Water Resources journals in comparison with SJR ranking

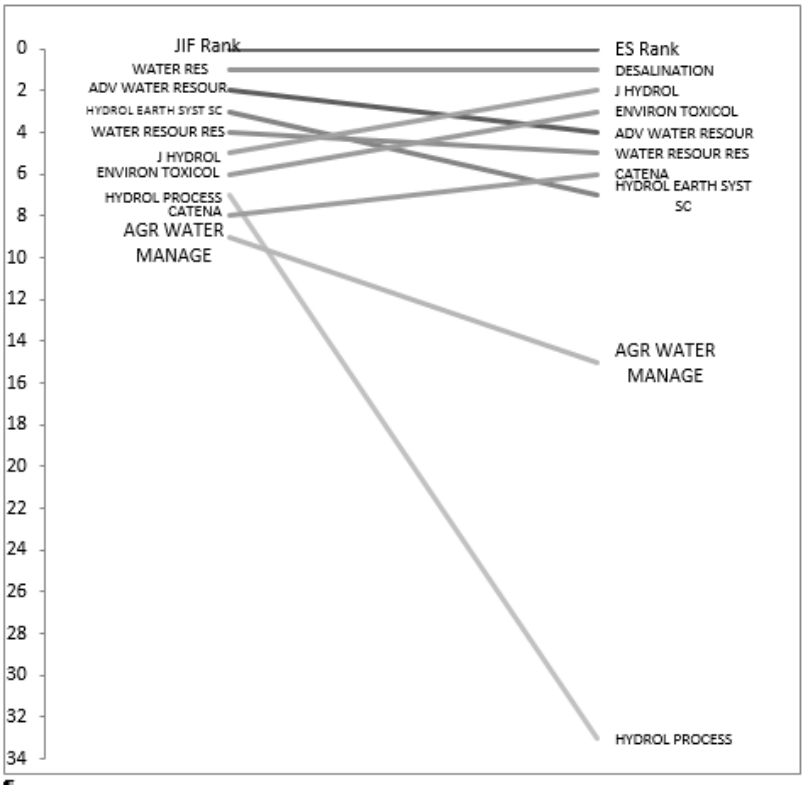

Figure 2. Bump chart for the top 10 JIF ranked Water Resources journals in comparison with ES ranking

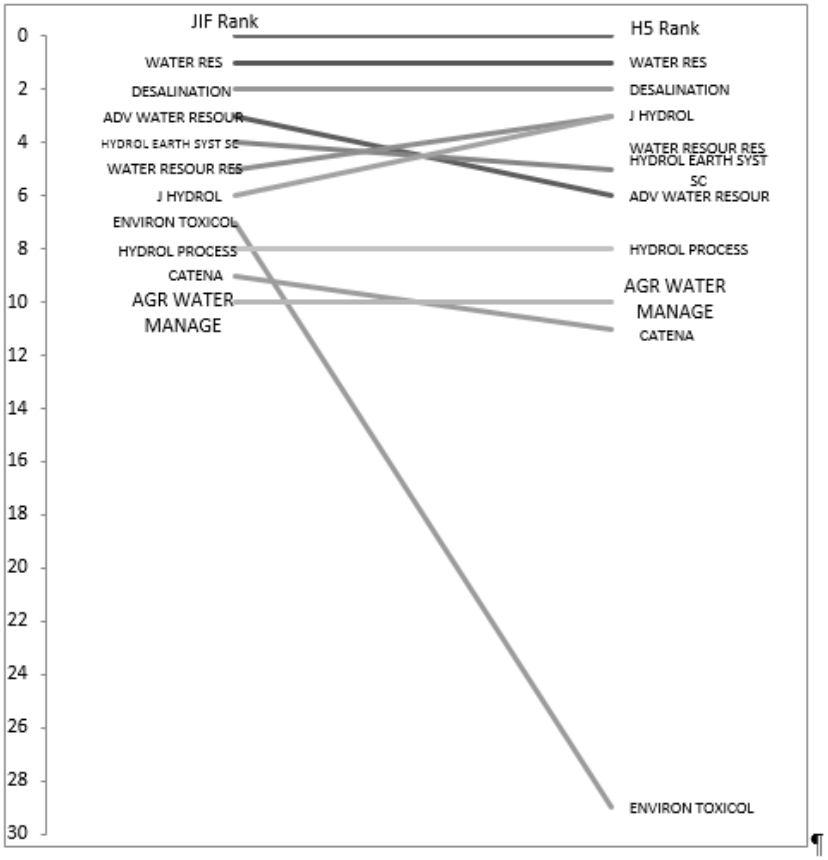

Figure 3. Bump chart for the top 10 JIF ranked Water Resources journals in comparison with H5 ranking

CONCLUSION

The study has compared four journals qualities indices—JIF, SJR, ES and H5-Index for water resources journals. The Journal Impact Factor (JIF) is the chief index used by researchers and academicians for ranking water resources journals. While a number of shortcomings appear in using only the JIF indicator, the SJR and ES could be more precise quality indices for water resources journals. It is recommended to use all four indices when measuring the quality of water resources journals. All the four metrics are highly correlated with one another (Spearman's rho > 0.8)

JIF, ES and SJR indicators of journals are important for librarians, researchers, academicians, authors, writers, inventors and environmental engineers alike when targeting quality journals for publishing their work. All the analyzed water resources journals possess the standard of quality of being indexed in esteemed databases such as Web of Science (WoS) and Scopus. A high Pearson r correlation was obtained between JIF and SJR indicators (r=0.901) and between JIF and H5 indices (r=0.898), while a moderately high correlation was found between JIF and ES values (r=0.791). Spearman rho rank correlation found acceptable correlations between JIF and SJR rankings, JIF and ES rankings, and JIF and H5 rankings (coefficient values of 0.806, 0.806 and 0.811 respectively). The metrics may be taken as complementary in assessing the quality and impact of water resources journals.

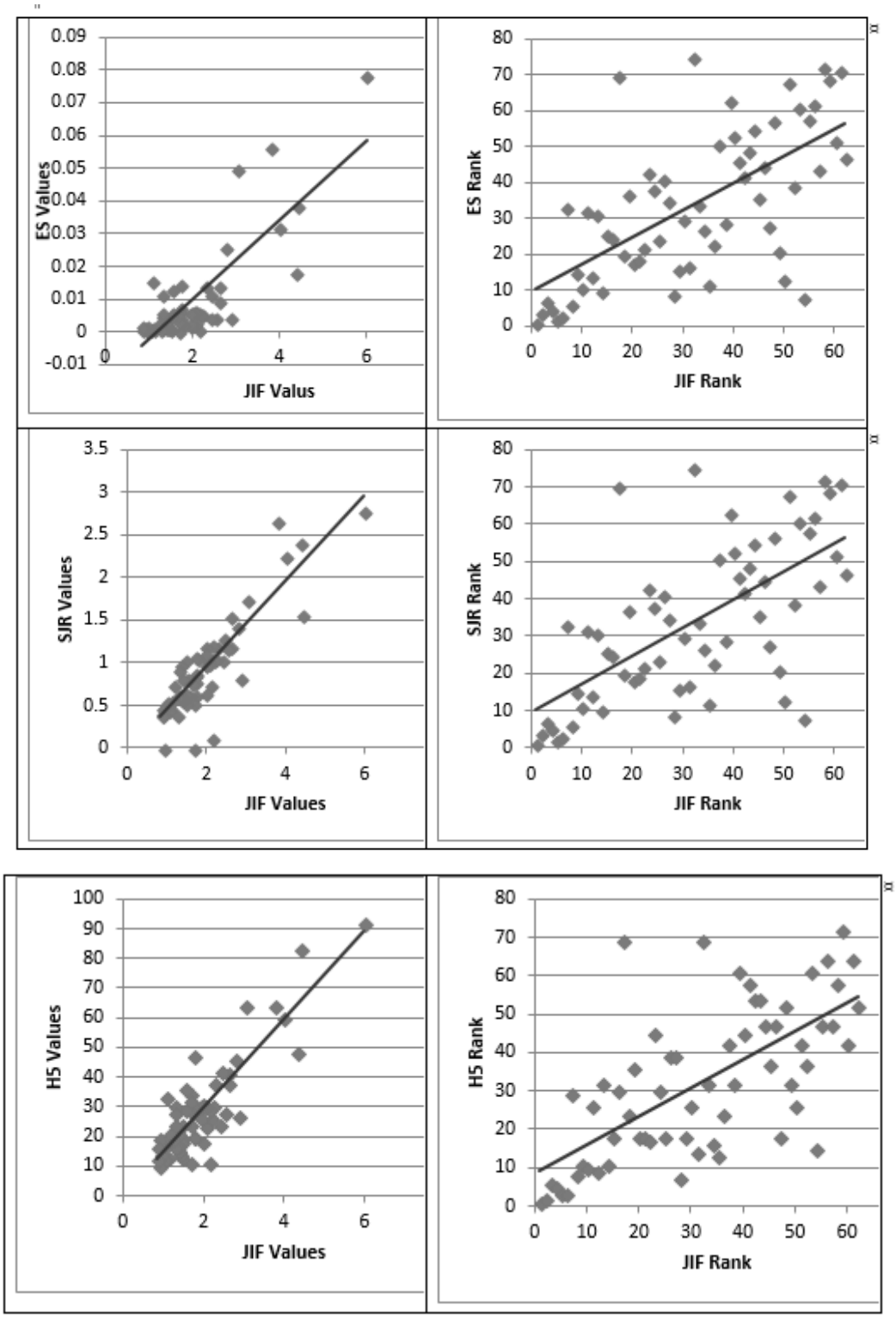

Figure 4. Scatter plots showing correlation between JIF, ES, SJR and H5-Index (values and rankings) as well as their fit lines for 60 Water Resources journals

Table 2. Bivariate correlations between the four indicators for ranking water resources journals

Correlation statistic	Coefficient value	Sig.
Pearson r between JIF and ES values	0.791	.000
Pearson r between JIF and SJR values	0.901	.000
Pearson r between JIF and H5 values	0.898	.000
Spearman rho between JIF and ES rankings	0.806	.000
Spearman rho between JIF and SJR rankings	0.806	.000
Spearman rho between JIF and H5 rankings	0.841	.000

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APPENDIX.
Comparative rankings of Water Resources journals by 2015 JIF, ES, SJR and H5 Index

	Journal Impact Factor (JIF)		Eigenfactor Score (ES)		SCImago Journal Rank (SJR)		H-5 Index	
Journal	**Value**	**Rank**	**Value**	**Rank**	**Value**	**Rank**	**Value**	**Rank**
Water Research	5.991	1	0.0782	1	2.772	1	92	1
Desalination	4.412	2	0.0385	4	1.549	4	83	2
Advances in Water Resources	4.349	3	0.01833	7	2.408	7	48	6
Hydrology and Earth System Sciences	3.99	4	0.03215	5	2.257	5	60	5
Water Resources Research	3.792	5	0.05653	2	2.661	2	64	3
Journal of Hydrology	3.043	6	0.04961	3	1.743	3	64	3
Environmental Toxicology	2.868	7	0.00431	33	0.819	33	27	29
Hydrological Processes	2.768	8	0.02584	6	1.419	6	46	8
Catena	2.612	9	0.0095	15	1.191	15	38	11
Agricultural Water Management	2.603	10	0.01394	11	1.546	11	41	10
Journal of Water Resources Planning and Management	2.521	11	0.00435	32	1.173	32	28	26
Water Resources Management	2.437	12	0.01131	14	1.291	14	42	9
Aquatic Conservation-Marine and Freshwater Ecosystems	2.415	13	0.00437	31	1.047	31	24	32
Natural Hazards and Earth System Sciences	2.277	14	0.01415	10	1.189	10	38	11
Stochastic Environmental Research and Risk Assessment	2.237	15	0.00521	26	1.065	26	30	18
Hydrological Sciences Journal-Journal Des Sciences Hydrologiques	2.182	16	0.00528	25	1.04	25	26	30
Geomatics Natural Hazards and Risk	2.14	17	0.00055	70	0.12	70	11	69
Ecohydrology	2.138	18	0.00611	20	1.213	20	29	24
Environmental Geochemistry and Health	2.079	19	0.00299	37	0.729	37	23	36
Journal of Contaminant Hydrology	2.063	20	0.00633	18	0.993	18	30	18
Hydrogeology Journal	2.028	21	0.00625	19	1.049	19	30	18
River Research and Applications	1.98	22	0.00585	22	0.984	22	31	17

	Journal Impact Factor (JIF)		Eigenfactor Score (ES)		SCImago Journal Rank (SJR)		H-5 Index	
Journal	**Value**	**Rank**	**Value**	**Rank**	**Value**	**Rank**	**Value**	**Rank**
Journal of Hydro-Environment Research	1.971	23	0.00188	43	0.641	43	18	45
Irrigation Science	1.948	24	0.00275	38	1.193	38	26	30
Groundwater	1.947	25	0.00559	24	1.111	24	30	18
Hydrology Research	1.779	26	0.00209	41	1.053	41	20	39
Journal of Soil and Water Conservation	1.752	27	0.00334	35	0.888	35	20	39
Natural Hazards	1.746	28	0.0149	9	0.851	9	47	7
Vadose Zone Journal	1.737	29	0.00756	16	1.078	16	30	18
Clean-Soil Air Water	1.716	30	0.00446	30	0.635	30	28	26
Ocean and Coastal Management	1.696	31	0.00656	17	0.784	17	34	14
Water Quality Exposure and Health	1.692	32	0.00028	75	0	75	11	69
Water	1.687	33	0.0034	34	0.536	34	24	32
Journal of the American Water Resources Association	1.659	34	0.00511	27	0.771	27	32	16
Water Air and Soil Pollution	1.551	35	0.01303	12	0.632	12	36	13
Journal of Hydrologic Engineering	1.53	36	0.00579	23	0.819	23	29	24
Urban Water Journal	1.478	37	0.00134	51	0.632	51	19	42
Journal of Hydraulic Research	1.471	38	0.00472	29	1.022	29	24	32
Journal of Hydrology and Hydromechanics	1.469	39	0.00074	63	0.538	63	13	61
International Journal of Water Resources Development	1.463	40	0.0013	53	0.641	53	18	45
Wetlands Ecology and Management	1.407	41	0.00167	46	0.565	46	14	58
Environmental Fluid Mechanics	1.394	42	0.00199	42	0.585	42	15	54
International Journal of Sediment Research	1.388	43	0.00151	49	0.829	49	15	54
Journal of Flood Risk Management	1.377	44	0.00128	55	0.587	55	17	47
Journal of Irrigation and Drainage Engineering	1.364	45	0.00308	36	0.616	36	21	37
Journal of Waterway Port Coastal and Ocean Engineering	1.316	46	0.0017	45	0.977	45	17	47
Physics and Chemistry of the Earth	1.297	47	0.0049	28	0.611	28	30	18

	Journal Impact Factor (JIF)		Eigenfactor Score (ES)		SCImago Journal Rank (SJR)		H-5 Index	
Journal	**Value**	**Rank**	**Value**	**Rank**	**Value**	**Rank**	**Value**	**Rank**
Natural Hazards Review	1.293	48	0.00116	57	0.639	57	16	52
Journal of Hydraulic Engineering	1.284	49	0.0059	21	0.908	21	24	32
Desalination and Water Treatment	1.272	50	0.01143	13	0.392	13	28	26
International Journal of Disaster Risk Reduction	1.242	51	0.00062	68	0.599	68	19	42
Journal of Hydroinformatics	1.18	52	0.00227	39	0.731	39	21	37
Lake and Reservoir Management	1.1	53	0.00081	61	0.57	61	13	61
Water Science and Technology	1.064	54	0.01566	8	0.469	8	33	15
Water International	1.04	55	0.00104	58	0.464	58	17	47
Canadian Water Resources Journal	1.018	56	0.00076	62	0.539	62	12	64
Water Policy	0.952	57	0.00177	44	0.505	44	17	47
International Journal of Disaster Risk Science	0.935	58	0.00046	72	0	72	14	58
Journal of Pipeline Systems Engineering and Practice	0.896	59	0.00056	69	0.416	69	10	72
Water and Environment Journal	0.895	60	0.00131	52	0.478	52	19	42
Mine Water and the Environment	0.864	61	0.00053	71	0.382	71	12	64
Water Sa	0.851	62	0.00166	47	0.381	47	16	52
Ground Water Monitoring and Remediation	0.848	63	0.00083	60	0.372	60	15	54
Journal of Water Supply Research and Technology-Aqua	0.807	64	0.00084	59	0.399	59	12	64
Journal of Water Sanitation and Hygiene for Development	0.799	65	0.00064	65	0.394	65	12	64
Journal of Water and Climate Change	0.775	66	0.00063	67	0.363	67	12	64
Water Environment Research	0.659	67	0.00222	40	0.334	40	20	39
Proceedings of The Institution of Civil Engineers-Water Management	0.656	68	0.00163	48	0.524	48	17	47

	Journal Impact Factor (JIF)		Eigenfactor Score (ES)		SCImago Journal Rank (SJR)		H-5 Index	
Journal	**Value**	**Rank**	**Value**	**Rank**	**Value**	**Rank**	**Value**	**Rank**
Soil and Water Research	0.58	69	0.00027	76	0.27	76	9	73
Irrigation and Drainage	0.565	70	0.00117	56	0.409	56	14	58
Water Science and Technology-Water Supply	0.532	71	0.0013	53	0.315	53	13	61
Water Quality Research Journal of Canada	0.531	72	0.00039	73	0.263	73	8	74
Journal American Water Works Association	0.505	73	0.00145	50	0.38	50	15	54
Grundwasser	0.436	74	0.00023	78	0.267	78	8	74
China Ocean Engineering	0.435	75	0.00064	65	0.422	65	0	82
Journal of Water Reuse and Desalination	0.409	76	0.00027	76	0.221	76	8	74
Membrane Water Treatment	0.4	77	0.0002	80	0.313	80	6	78
Hydrologie Und Wasserbewirtschaftung	0.39	78	0.00038	74	0.295	74	3	81
Water Resources	0.31	79	0.0007	64	0.281	64	8	74
Proceedings of the Institution of Civil Engineers-Maritime Engineering	0.281	80	0.00018	81	0.149	81	0	82
Houille Blanche-Revue Internationale De L Eau	0.212	81	0.00023	78	0.15	78	0	82
Engenharia Sanitaria E Ambiental	0.126	82	0.00018	81	0.15	81	11	69
Wasserwirtschaft	0.102	83	0.00016	83	0.205	83	5	79
Tecnologia Y Ciencias Del Agua	0.043	84	0.00008	84	0.169	84	4	80
Environmental Science-Water Research and Technology	0	85	0.00001	85	0	85	0	82