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Derleme Makalesi

Deniz Teknolojileri Mühendisliği Alanının Bibliyometrik Analizi

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ÖZET

Bu çalışma, 1989-2021 Mayıs döneminde Ocean Engineering alanında yayın yapan dergilerdeki yayınları; araştırmacıların, kurumların ve dergilerin bu alana katkılarını zamanla değişimlerini dikkate alarak incelemektedir. Çalışma kapsamında Scopus veri tabanı kullanılarak toplam 292,755 adet Ocean Engineering alanı ya da bu alanla ilişkili alanlardaki yayınlar kapsamlı bir bibliyometrik yaklaşım ile analiz edilmiştir. Çalışmada analizler yayınların year, author(s), subject area, document type, keywords, affiliations, funding sponsor(s), country, source type, language, and citations of the publications bilgileri kullanılarak yapılmıştır. En fazla yayını 14,959 adet yayın ile Proceedings of the International Offshore and Polar Engineering Conference source yaparken, 1,298 adet yayın ile C. Guedes Soares yazarı yapmıştır. Ayrıca yazarların ve dergilerin Ocean Engineering alanında yayınladıkları yayınların makale başına aldıkları ortalama atıf değerleri de gösterilmiştir. Yayın başına en fazla atıf alan yazar 17.24 oranı ile Torgeir Moan olurken 33.24 oranı ile Coastal Engineering dergisi olduğu görülmüştür. Ayrıca bu alandaki yayınlarda en sık kullanılan 160 anahtar kelimeler de analiz edilmiş olup bu anahtar kelimeler 11 ana grupta tasnif edilmiştir. Bu alanda en fazla çalışılan konu 26% oranı ile Naval Architecture olduğu görülmüştür.

Anahtar kelimeler: Bibliyometrik Analiz, Deniz Teknolojileri Mühendisliği, Gemi İnşaatı, Gemi Makineleri Mühendisliği, Nümerik Analiz, oşinografi, Off-shore Teknolojileri, Kıyı Mühendisliği, Çevre Mühendisliği, Enerji

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Review Article

Bibliometric Analysis for the Field of Ocean Engineering

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ABSTRACT

This study examines the publications in journals published in the field of Ocean Engineering from 1889 to May 2021 by noting the contributions of researchers, institutions and journals to this field as well as the changes over time. A total of 292,755 publications in the field of Ocean Engineering and related fields have been analyzed in the study through a comprehensive bibliometric approach using the Scopus database. The analyses were performed using information such as the publications' year, author(s), subject area, document type, keywords, affiliations, funding sponsor(s), country, source type, language, and citations. Proceedings of the International Offshore and Polar Engineering Conference is the most productive source with 14,959 publications. In addition, C. Guedes Soares is the most productive author in this field as an author with 1,298 publications. Also, the average number of citations per article for the articles authors and journals have made in the field of Ocean Engineering are also shown. Torgeir Moan is seen to receive the greatest number of citations per article at 17.24, while the most-cited journal is Coastal Engineering with a rate of 33.24. 160 of the most commonly used keywords in the publications in this field have also been analyzed and classified into 11 main group. The most studied topic in this field is seen to be Naval Architecture at a rate of 26%.

Keywords: Bibliometric Analysis, Ocean Engineering, Naval Architecture, Marine Engineering, Numerical Methods, Oceanography, Offshore Technologies, Coastal Engineering, Environment Science, Energy

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1. Introduction

Covering more than 70% of the Earth's surface, oceans feed not just all human civilization but also all life on Earth. Alongside the sustainable development of humanity, activities such as international politics, economics, military, science, and technology appear to be more connected by moving on to studies performed on the oceans. The water-food-energy nexus, the driving mechanism for water resource variation, the environmental impact of water usage, and the integration of footprint indicators strongly support the development of water-resource research and have become popular in recent years (Zhang et al., 2017). Ocean engineering plays a vital role as a comprehensive technological science aimed at the exploitation, conservation, and recovery of marine resources (Z.-M. Sun & Hua, 2015).

With the changing world and increase in accumulated knowledge, processing information using the old methods in ocean engineering is much more difficult. Studies have begun using artificial intelligence-based systems that mimic the human decision-making process to deal with these problems in the maritime sector with its huge network size and planning issues. This transformation has reshaped the maritime sector while also providing new opportunities to increase its productivity, efficiency and sustainability (Munim et al., 2020). Artificial intelligence (AI) has created a model of common applications and technologies that can be used collaboratively as a supportive component. The successful implementation of analytical applications and AI applications is expected to play a role in important steps such as increasing maritime efficiency, safety, security, and effectiveness of environmental protection while reducing the relevant administrative burden. An example can be given in the difficulties that standardizing and harmonizing the obtained data will form for such a diverse and common industry, especially in light of increasing growth (Meyers et al., 2021).

The intensification of studies being performed alongside the daily increase in maritime trade have given rise to pollution and dangers. These dangers are called marine geohazards. International collaborations should be performed to expand and improve early warning systems against these predictable and unpredictable geohazards and to better understand and monitor related processes (Camargo et al., 2019). The formation and lack of prevention of geohazards also negatively impacts the presence of natural resources on Earth. Despite the efforts made to mitigate the negative impacts by applying advanced technologies and implementing appropriate resource management policies, the sustainable use of natural resources has yet to be achieved, and the path has opened to the depletion of natural resources and their related environmental emissions. More than half of the studies in the subject categories of environmental sciences and ecology, engineering, and water resources have been performed for managing water resources and increasing environmental and ecologically sustainable development (Zhang et al., 2017). Natural resource accounting has critical importance in promoting sustainable natural resource management (Zhong et al., 2016).

Environmental emissions have significant effect on Ocean Engineering studies. One of example of environmental emissions is the increase in pollution forming at estuaries. The widespread effects of the eutrophication of estuarine waters can be said to have become a global phenomenon, and larger studies will take place on estuary pollution in the future (J. Sun et al., 2012).

Human activities cause a variety of impacts involving large amounts of plastic being dumped into marine ecosystems. This situation can threaten the health and integrity of the ecosystem and reduces the ability to provide the goods and services upon which human well-being depends (Pauna et al., 2019). The microplastic pollution found in the marine environment belongs to areas of developing research. Studies performed on the impacts on marine ecosystems and humans explain how

microplastics were gradually noticed in marine environments and what difficulties are faced in this field (Wu et al., 2021).

The analyses of these studies and measures taken against pollution are quite important in terms of the impacts on microorganisms living in water. With an estimated 30,000 to 1,000,000 different species, microalgae constitute a large group of microorganisms that have been extensively examined for their ecological functions in marine and freshwater environments as well as possible uses for food, produce, cosmetics, biofuels, nanomaterials, and drugs (Rumin et al., 2020).

Bibliometric studies have been increasing these days to form more standard information by increasing and digitalizing databases. The production of the standard data needed for data analyses has also developed accordingly. Bibliometric studies are produced in a specific field, analyze the relevant field using published metadata, and present the report on the relevant field. The developments and changes in a field can be seen thanks to bibliometric studies. The current study will examine the publications in the literature on Ocean Engineering using the method of bibliometric analysis. Although serious studies have been performed in this field (Meyers et al., 2021; Z.-M. Sun & Hua, 2015), no comprehensive study such as this is seen to have been published yet.

2. Methods

The most important element required for bibliometric analysis studies is the data to be analyzed; they must have high accuracy and be classified and standardized. Although many academic databases exist today, Web of Science (WoS) and Scopus are among the most important and useful platforms. Scopus contains more inclusive results than WoS and offers the keywords occurring in publications and the information WoS provides. Scopus has been chosen in this study because it provides a source of high-quality bibliometric data (Baas et al., 2020).

This study searches all publications in the field of Ocean Engineering since 1989 to the present and published in Scopus. While making queries within the scope of the study, the All Science Journal Classification (ASJC) feature in which Scopus classifies journals has been used in place of keywords representing the field of Ocean Engineering. Scopus gives an ASJC code to each journal within the scope of its publication area. While querying, 2212 has been entered as the ASJC code in the SUBJTERMS field (What Is the Complete List of Scopus Subject Areas and All Science Journal Classification Codes (ASJC)? - Scopus: Access and Use Support Center, 2020). As of May 20, 2021, 292,755 publications were found published as a result of this query; the list of these publications being analyzed can be accessed from the file prepared within the scope of this study at (Gunes, 2021).

Analyses have been done using the program OriginLab with respect to the values for year, author(s), subject area, document type, keywords, affiliations, funding sponsor(s), country, source type, language, and citations of the publications. Data have been standardized as much as possible while performing the analyses. For example, authors who are found with different names in Scopus have been combined under one author. Another example is that keywords similar to one another have been grouped in order to achieve more generalizable results. Studies published in journals within the scope of Ocean Engineering have been analyzed over time using the number of publications, number of citations, number of citations/number of publications, h-index, CiteScore, SCImago, Journal Rank (SJR), and Source Normalized Impact per Paper (SNIP) (Measuring a Journals Impact, 2021; Toom, 2018)

The sum of values in some analyses is greater than 100%. This is due to the relevant article being evaluated separately for different properties. For example, if an article is related to two fields, this

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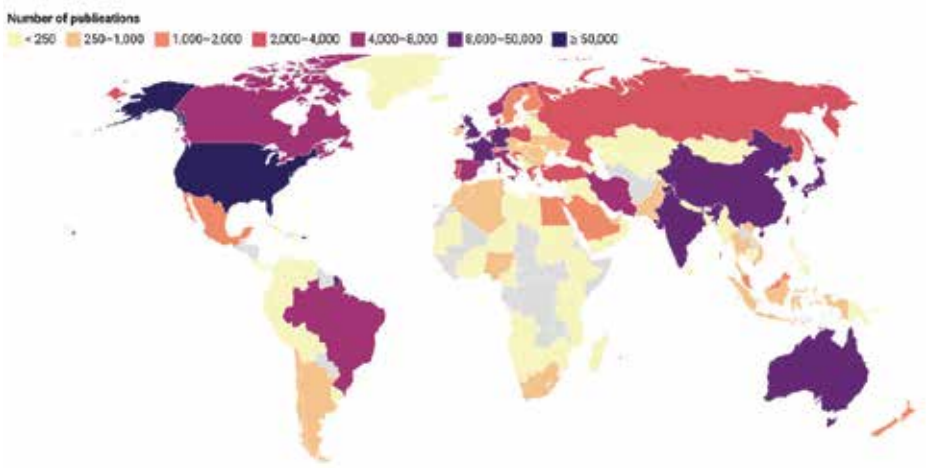
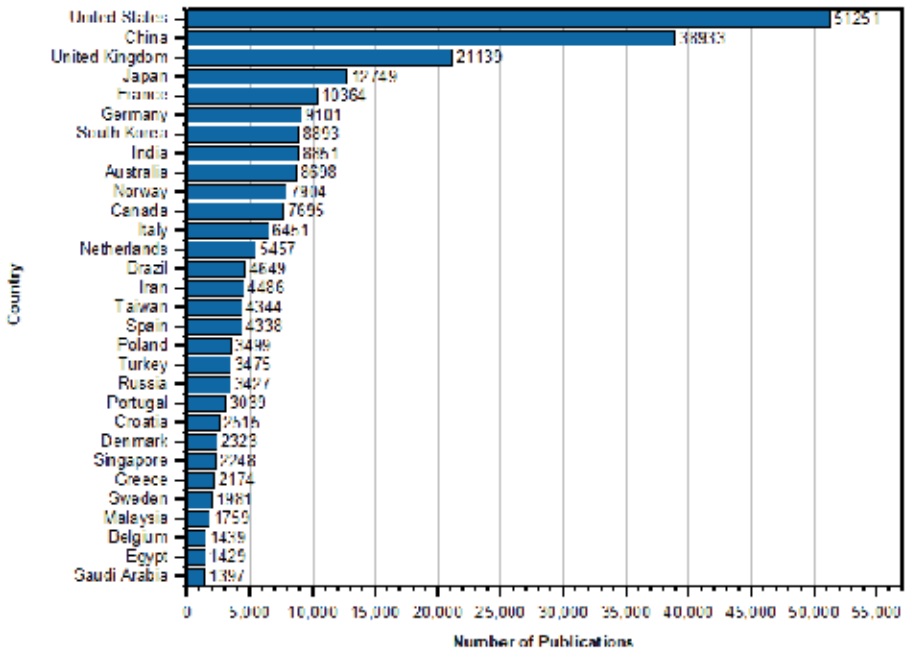
article is included in both fields for the analysis. Likewise, because each article uses various keywords, each article is evaluated separately under the relevant keyword analysis.

3. Results and Discussion

A total of 295,275 articles in the field of Ocean Engineering were published between 1889 and May 2021 according to SCOPUS. When examining these studies in terms of Country/Territory, five countries are seen to have published more than 10,000 publications.



(a)



(b)

Figure 1. Distribution of publications with respect to country in the field of ocean engineering from 1970 to 2021.

Of these, 17.5% (51,251) were made by authors from the USA, followed by China with 13.3% (38,933) and the UK in third at 7% (21,139). Figure 1a shows the publications produced by countries between 1970-2021 under 7 groups: 250, 250-1,000, 1,000-2,000, 2,000-4,000, 4,000-8,000, 8,000-50,000, and

over 50,000. Figure 1b provides the publication information from the 30 countries that published the most in this field. The other two countries in the top five are Japan at 4.4% (12,749) and France at 3.5% (10,364). These are followed by Germany, South Korea, India, Australia, Norway, Canada, Italy, Netherlands, Brazil, Iran, Taiwan, Spain, Poland, Turkey, Russia, and Portugal, respectively.

Table 1 provides information about the top 30 authors who've published the most in the field of ocean engineering. When examining these authors, C. Guedes Soares with 1,298 publications is seen to have published the most. Jeremy Beckman is second with 515 publications, followed by Torgeir Moan with 313. When looking at the most-cited authors in the field of ocean engineering, C. Guedes Soares is seen to come in first with 17,174 citations, Torgeir Moan in second with 5,913, and Jeom Kee Paik in third with 3,972. The authors with the highest h-index value who have publications in the field of ocean engineering in order are C. Guedes Soares with an h-index of 59, Torgeir Moan with an h-index of 37, and Jeom Kee Paik with an h-index of 33. The h-index values here are only in regard to publications in the field of engineering. When considering all publications, C. Guedes Soares is seen to have an h-index of 74.571 with a total of 1,946 total publications and 30,177 citations, Torgeir Moan to have an h-index of 49 with a total of 74,571 publications and 10,136 citations, and Jeom Kee Paik to have an h-index of 44 with a total of 370 publications and 6,530 citations.

When calculating authors' number of publications and citations in this field and their average number of citations per paper, Torgeir Moan comes in first with 17.24, Bin Teng is second with 16.73, Jeom Kee Paik is third with 16.35, Moohyun Kim is fourth with 16.09, and Atilla Incecik is fifth with 15.43.

Figure 2 shows the publishing language for the publications in the field of ocean engineering. When examining these publications, the publishing languages in order are seen as English at 93% (271,786) followed by French (7,261), Chinese (4,985), and German (4,446) each at 2%. The other publication languages in order of frequency are Croatian, Korean, Turkish, Serbian, Japanese, Spanish, Slovenian, Russian, Bosnian, and Portuguese.

Figure 3 shows the types of publications published in the field of ocean engineering. When examining these publications, 65.7% are found to be articles (192,444), 26.8 % to be conference papers (78,358), 2.8% to be notes (8,118), 1.7% to be reviews (5,058), and 0.9 % to be editorials (2,602). Editorials are typically identified as editor's opinions, introductions, lead-in articles, forwards, or prefaces and are usually located prior to the table of contents. After editorials are also found short surveys (2,065) at 0.7%, letters (1,032) at 0.4%, and book chapters (931) at 0.3%.

Figure 4 shows the number of publications per year in the field of ocean engineering. The number of annual publications is seen to have increased exponentially over time. Publications in the field in the years 1995-1998, 2007, 2010, and 2016 are seen to have increased more than the previous increase trend.

Figure 5 shows the increase in the number of annual citations appearing in publications in this field. When examining the average citations per publication ratio, this ratio is seen to have continuously increased over the years. This ratio, which was 0.12 in 1970, was 3.09 in 2000, 6.5 in 2010, 10.14 in 2015, 14.70 in 2018, and 18.02 in 2020.

Table 2 shows the 160 most-used keywords in publications in the fields of ocean engineering as well as how many keywords were used in total for the various categories of ocean engineering. The 10 most frequently used keywords in publications in order are Offshore Oil Well Production (n = 17,593) at 6.01%, Ships (n = 12,442) at 4.25%, Arctic Engineering (n = 11,555) at 3.95%, Computer Simulation (n = 11,458) at 3.91%, Mathematical Models (n = 10,206) at 3.49%, Finite Element Method (n = 9,768) at

3.34%, Water Waves (n = 9,683) 3.31%, Hydrodynamics (n = 9,268) at 3.17%, Oceanography (n = 8,980) at 3.07%, Offshore Structures (n = 8,896) at 3.04 %, and Offshore Technology (n = 8,468) at 2.89%.

Figure 6 gathers the 160 most frequently used keywords under 11 categories. Many keywords actually fall under more than one category. This study groups the keywords under the closest relevant category.

Table 1. The Most Productive Authors and their Scores in the Field of Ocean Engineering from 1970 to 2021.

Authors	Number of Publications	Number of Citations	Document h-index	Average Citations per paper
C. Guedes Soares	1,298	17,174	59	13.23
Jeremy Beckman	515	27	2	0.05
Torgeir Moan	343	5,913	37	17.24
Jeom Kee Paik	243	3,972	33	16.35
Elaine Maslin	231	11	1	0.05
Decheng Wan	225	1,172	17	5.21
Moohyun Kim	217	3,492	32	16.09
Dag Myrhaug	211	2,114	24	10.02
Gene Kliewer	209	10	2	0.05
Yordan Garbatov	193	2,071	24	10.73
David Tinsley	183	4	1	0.02
Dong-Sheng Jeng	182	2,679	32	14.72
Judy Maksoud	181	10	2	0.06
Bruce A. Beaubouef	180	1	1	0.01
Nick Terdre	179	20	2	0.11
Ove Tobias Gudmestad	173	822	14	4.75
Weicheng Cui	171	1,270	15	7.43
William Furlow	169	22	2	0.13
Hocine Oumeraci	162	1,745	21	10.77
William C. Vantuono	161	9	2	0.06
Christophe Bouchet	157	1	1	0.01
Bin Teng	154	2,576	30	16.73
Tamaki Ura	153	1,204	18	7.87
B. J. Leira	150	881	17	5.87
Jennifer Pallanich	150	8	2	0.05
Yong Bai	147	1,036	17	7.05
Sayoung Hong	147	1,135	17	7.72
Atilla Incecik	146	2,253	26	15.43
Yonghwan Kim	144	1,906	22	13.24
Menglan Duan	142	916	17	6.45

Figure 7 shows the classification of publications in the field of ocean engineering according to SCOPUS Subject Area. All publications (N = 292,970) in this field fall under the category of engineering. Publications also involve the other SCOPUS Subject Areas of Environmental Science (n = 81,823) at 27.9%, Earth and Planetary Sciences (n = 77,681) at 26.5%, Energy (n = 72,186) at 24.7%, Mathematics (n = 20,67) at 7.1%, Agricultural and Biological Sciences (n = 14,392) at 4.9%, Social Sciences (n =

12,329) at 4.2%, Chemical Engineering (n = 11,721) at 4.0%, Computer Science (n = 8,116) at 2.8%, and Physics and Astronomy (n = 5,754) at 2.0%.

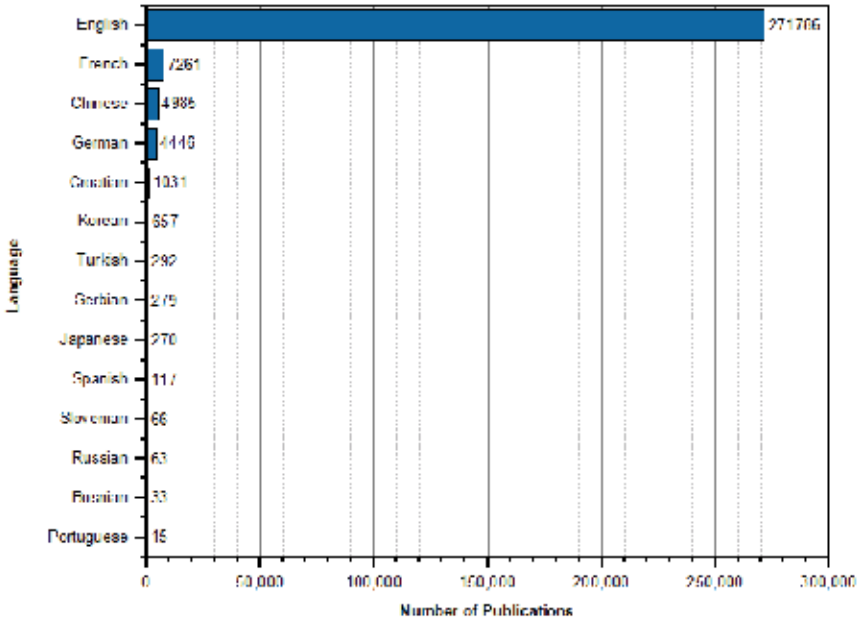


Figure 2. Distribution of publications with respect to language in the field of ocean engineering from 1970 to 2021.

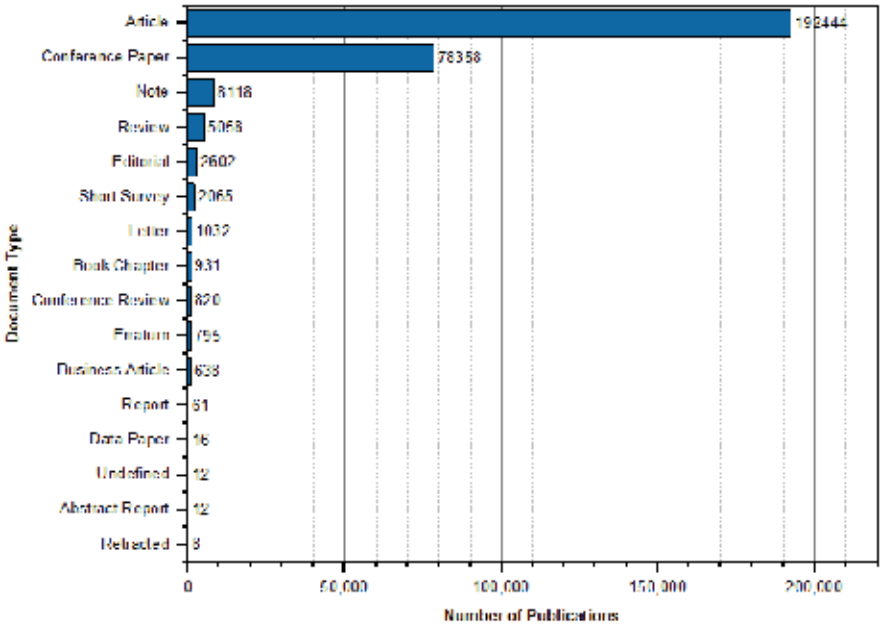


Figure 3. Types of publications in the field of ocean engineering from 1970 to 2021.

Figure 8 provides the number of authors in the publications in the field of ocean engineering. Of the publications, 21.9% (63,892) have single authors, followed respectively by 20.8% (60,597) with two authors, 18.8% (54,912) with three authors, 12.8% (37,498) with four authors, 11.1% (32,280) with five authors, and 14.7% (42,821) with more than five authors.

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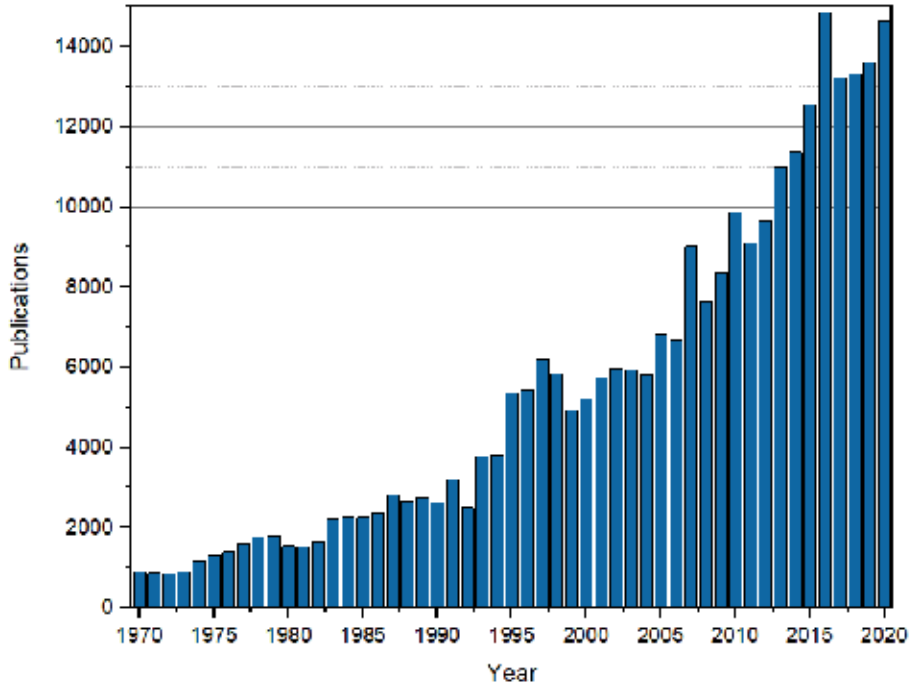

Figure 4. Timeline of publications in the field of ocean engineering from 1970 to 2021.

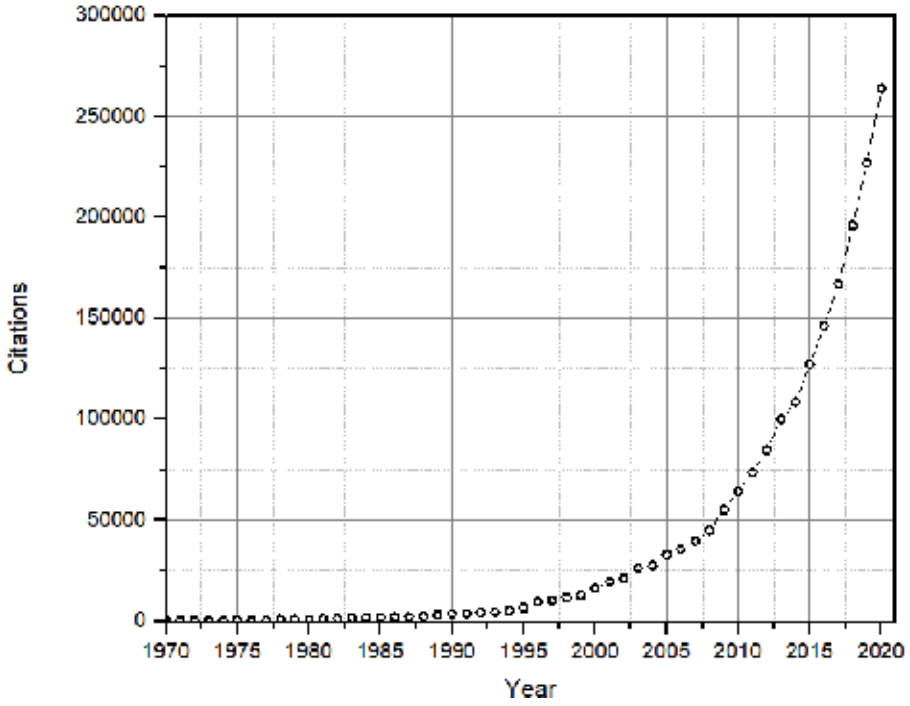

Figure 5. Timeline of the number of citations in the field of ocean engineering from 1970 to 2021.

Table 3 provides information about the 30 most published sources in this field. In order beginning with the most publications published, Proceedings of the International Offshore and Polar Engineering Conference ranks first with 14,959 publications, Desalination and Water Treatment ranks second with

Table 2. Distribution of the Top 160 Keywords in the Field of Ocean Engineering.

Naval Architecture	125,690	Hydrodynamics	72,182	Offshore Technologies	56,366
Ships	12,442	Water Waves	9,683	Offshore Oil Well Production	17,593
Design	5,977	Hydrodynamics	9,268	Offshore Structures	8,896
Shipbuilding	4,665	Dynamic Response	3,243	Offshore Technology	8,468
Hulls	4,434	Fluid Dynamics	2,996	Offshore Oil Wells	3,221
Mooring	4,178	Damping	2,955	Pipelines	2,821
Structural Design	4,145	Dynamics	2,872	Piles	2,524
Deformation	3,526	Ship Propulsion	2,872	Production Platforms	2,340
Ship Design	3,430	Equations Of Motion	2,820	Offshore Engineering	2,132
Underwater Acoustics	3,430	Nonlinear Equations	2,600	Offshore Structure	1,787
Structural Analysis	3,390	Navier Stokes Equations	2,588	Offshore Pipelines	1,772
Vessel	3,304	Vortex Flow	2,534	Offshore Oil Fields	1,681
Time Domain Analysis	3,204	Reynolds Number	2,357	Infill Drilling	1,586
Fatigue Of Materials	2,776	Fluid Structure Interaction	2,337	Drilling Platforms	1,545
Uncertainty Analysis	2,604	Cylinders	2,331	**Coastal Engineering**	**28,220**
Plates	2,501	Degrees of Freedom	2,299	Coastal Engineering	7,250
Velocity	2,487	Wave Propagation	2,281	Coastal Zones	3,674
Loading	2,485	Stability	2,228	Sediment Transport	2,901
Sailing Vessels	2,353	Drag	2,184	Soils	2,876
Probability	2,337	Friction	2,088	Breakwaters	2,580
Autonomous Underwater Vehicles	2,314	Wave-structure Interaction	1,713	Beaches	2,533
Vibrations	2,296	Turbulence	1,667	Ports And Harbors	2,449
Stiffness	2,287	Ship Motion	1,576	Sand	2,040
Performance Assessment	2,237	Water Depth	1,573	Floods	1,917
Costs	2,129	Loads	1,565	**Environmental Science**	**27,344**
Reliability	2,100	Corrosion	1,552	Water Treatment	3,010
Decision Making	1,994	**Numerical Methods**	**75,273**	Water Quality	2,391
Submersibles	1,974	Computer Simulation	11,458	Seawater	2,275
Cracks	1,952	Mathematical Models	10,206	Sediments	2,227
Stress Analysis	1,906	Finite Element Method	9,768	Erosion	2,148
Modeling	1,900	Numerical Model	6,942	Wastewater Treatment	2,126
Buckling	1,892	Numerical Methods	6,832	Wastewater	2,092
Parameter Estimation	1,839	Computational Fluid Dynamics	5,608	Concentration	2,077
Sonar	1,839	Numerical Models	4,182	Environmental Impact	1,986
Stochastic Systems	1,795	Algorithms	3,454	Aqueous Solution	1,964
Maintenance	1,737	Algorithm	2,231	Membrane	1,879
Three Dimensional	1,732	Numerical Simulation	2,161	Pollutant Removal	1,617
Sensitivity Analysis	1,731	Boundary Conditions	2,104	Desalination	1,552
Welding	1,709	Numerical Results	1,866	**Energy**	**23,457**
Monte Carlo Methods	1,701	Boundary Element Method	1,856	Ocean Currents	5,932
Shipyards	1,665	Numerical Analysis	1,794	Adsorption	3,695
Welds	1,664	Computer Software	1,605	Marine Risers	3,606
Geometry	1,653	Computational Methods	1,604	Wave Energy Conversion	3,007
Tanks	1,643	Differential Equations	1,602	Gas Industry	2,004
Installation	1,600	**Oceanography**	**31,415**	Water Wave Effects	1,777
Frequency Domain Analysis	1,595	Oceanography	8,980	Water Levels	1,742
Reliability Analysis	1,578	Forecasting	3,436	Reaction Kinetics	1,694
Naval Architecture	1,560	Navigation	3,046	**Marine Engineering**	**18,140**
Arctic Engineering	**15,844**	Storms	2,585	Marine Engineering	3,903
Arctic Engineering	11,555	Atlantic Ocean	2,371	Diesel Engines	1,653
Ice	2,436	Remote Sensing	2,167	Optimization	5,521
Sea Ice	1,853	Climate Change	2,065	Experimental Study	3,285
Ocean Engineering	**11,792**	Monitoring	1,864	Cost Effectiveness	2,114
Ocean Engineering	6,723	Seismology	1,699	Experiments	1,664
Risk Assessment	3,417	Rivers	1,623		
Accident Prevention	1,652	North Sea	1,579		

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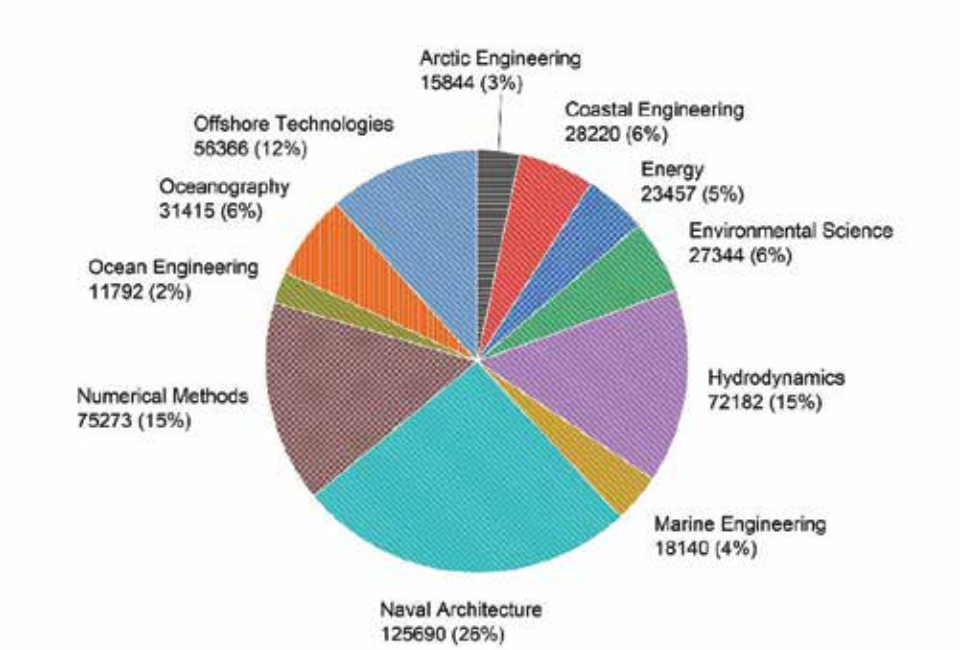

Figure 6. Distribution of keywords in the core research areas of ocean engineering.

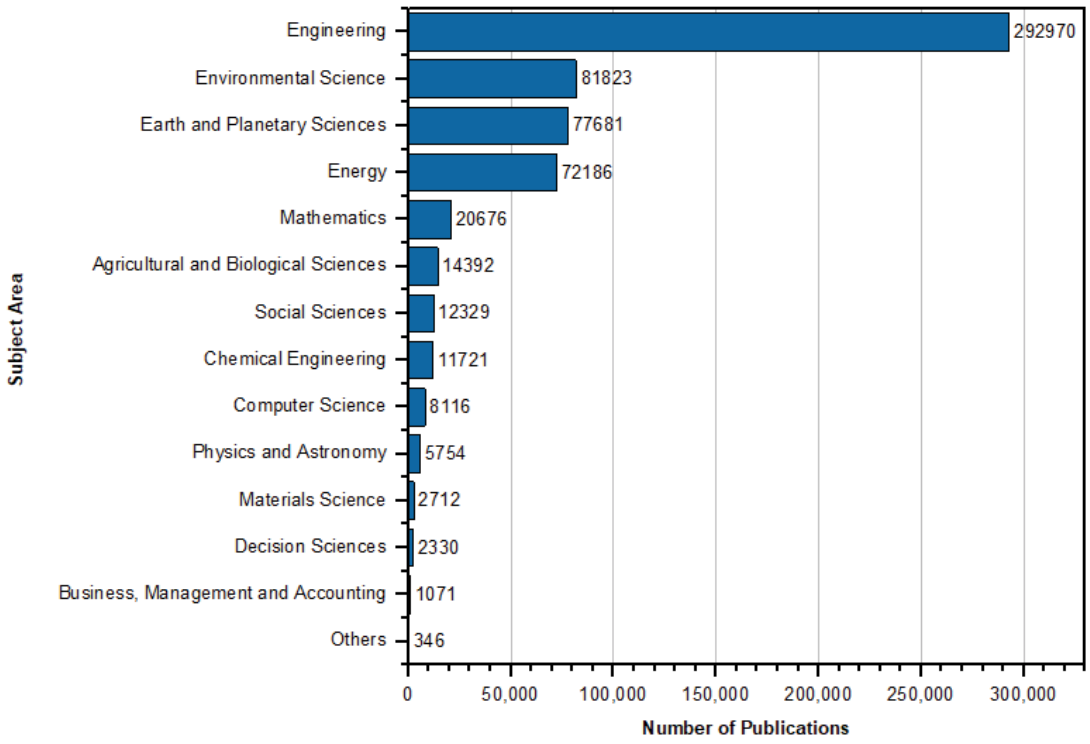

Figure 7. Distribution of ocean engineering publications by Scopus Subject Area.

14,814 publications, Proceedings of the International Conference on Offshore Mechanics and Arctic Engineering ranks third with 14,194 publications, Proceedings of the Annual Offshore Technology Conference ranks fourth with 11,895 publications, Geological Society Special Publication Book Series

comes in fifth with 10,200 publications, and the journal Ocean Engineering comes in sixth with 8,970 publications.

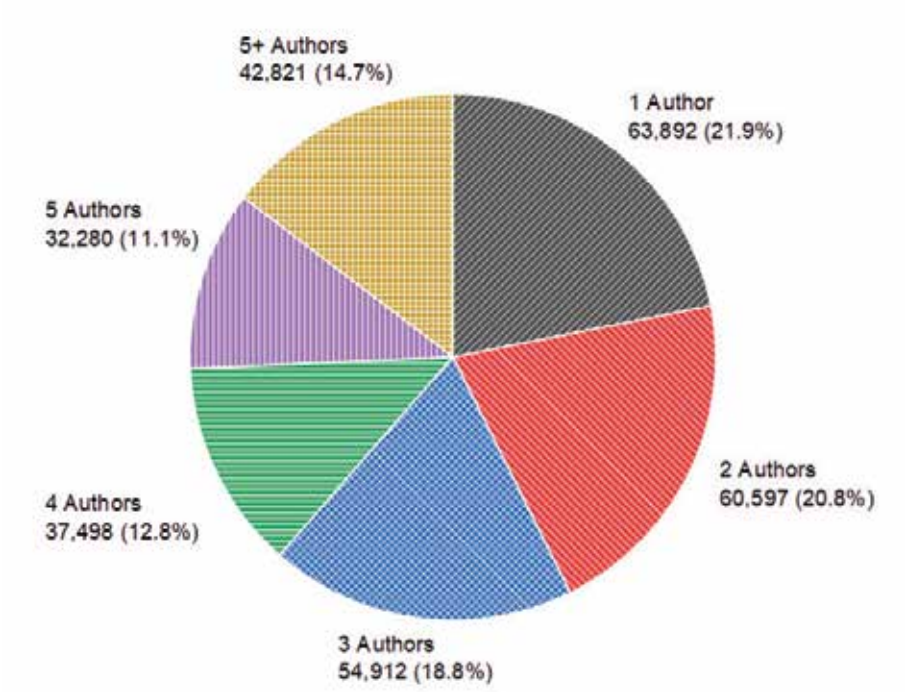

Figure 8. Percentages for the number of authors per publication in the field of ocean engineering.

When analyzed in terms of total number of citations, Geological Society Special Publication is first with 240,568 citations, Nonlinear Dynamics is second with 178,400 citations, Ocean Engineering is third with 139,030 citations, International Journal of Impact Engineering is fourth with 127,918 citations, and the Journal of Atmospheric and Oceanic Technology is fifth with 112,540 citations.

When examining the total number of received citations with respect to number of articles published, the top 10 sources in order are Coastal Engineering with 33.24, International Journal of Impact Engineering with 30.75, Journal of Atmospheric and Oceanic Technology with 28.60, IEEE Journal of Oceanic Engineering with 27.31, Geological Society Special Publication with 23.59, Computational Mechanics with 23.41, Nonlinear Dynamics with 21.09, Journal of Waterway Port Coastal and Ocean Engineering with 17.88, Applied Ocean Research with 15.98, and Ocean Engineering with 15.50.

Table 4 provides information on the 30 most impactful publications in the field of ocean engineering. Coming first among these publications and published in 1989 is the article Chemical and Isotopic Systematics of Oceanic Basalts: Implications for Mantle Composition and Processes" with 12,222 citations. Published in 1998, the article "A New Meshless Local Petrov-Galerkin (MLPG) Approach in Computational Mechanics" comes in second with 2,093 citations. While the article "Efficient Inverse Modeling of Barotropic Ocean Tides" published in 2002 received 2,038 citations, the 1998 article "The Tropical Rainfall Measuring Mission (TRMM) Sensor Package" received 1,781 citations. In fifth place with 1,701 citations is the article "Generalizing the Finite Element Method: Diffuse Approximation and Diffuse Elements" published in 1992.

Table 3. The Top 30 Most Productive Sources in the Field of Ocean Engineering from 1970 to 2021.

Source Title	Type	ISSN	CiteScore	SJR	SNIP	Number of Publications	Number of Citations	Citations/ Publications
Proceedings of the International Offshore and Polar Engineering Conference	Proceeding	-	0.6	0.211	0.347	14,959	41,368	2.765
Desalination and Water Treatment	Journal	1944-3994	2.7	0.327	0.476	14,814	92,116	6.218
Proceedings of the International Conference on Offshore Mechanics and Arctic Engineering	Proceeding	-	0.8	0.282	0.486	14,194	48,763	3.435
Proceedings of the Annual Offshore Technology Conference	Proceeding	0160-3663	0.5	0.202	0.526	11,895	34,776	2.924
Geological Society Special Publication	Book Series	0305-8719	4.7	0.701	0.811	10,200	240,568	23.585
Ocean Engineering	Journal	0029-8018	4.8	1.281	2.210	8,970	139,030	15.499
Nonlinear Dynamics	Journal	0924-090X	8.7	1.394	1.728	8,459	178,400	21.090
Offshore	Journal	0030-0608	0.0	0.100	0.000	6,501	1,134	0.174
Hydrotechnical Construction	Journal	0018-8220	-	-	-	6,022	1,026	0.170
Proceedings of the Coastal Engineering Conference	Proceeding	-	-	-	-	5,064	17,978	3.550
Journal of the American Society for Naval Engineers	Journal	0028-1425	-	0.149	0.491	4,833	1,068	0.221
International Journal of Impact Engineering	Journal	0734-743X	6.9	1.671	2.405	4,160	127,918	30.750
Journal of Navigation	Journal	0373-4633	3.7	0.544	1.438	4,069	22,071	5.424
Journal of Atmospheric and Oceanic Technology	Journal	2296-7745	4.4	1.420	1.164	3,935	112,540	28.600
Frontiers in Marine Science	Journal	0739-0572	4.2	0.940	1.110	3,909	29,800	7.623
Computational Mechanics	Journal	0178-7675	5.2	1.612	1.381	3,852	90,161	23.406
Soil Mechanics and Foundation Engineering	Journal	0038-0741	0.9	0.284	0.795	3,722	3,010	0.809
Naval Architect	Trade Journal	0306-0209	0.1	0.106	0.126	3,187	1,231	0.386
Naval Engineers Journal	Journal	0028-1425	-	0.149	0.149	3,013	5,609	1.862
Sea Technology	Trade Journal	0093-3651	0.1	0.105	0.000	2,972	4,452	1.498
Coastal Engineering	Journal	0378-3839	7.2	1.820	2.179	2,813	93,510	33.242
IEEE Journal of Oceanic Engineering	Journal	0364-9059	5.9	0.808	2.071	2,804	76,575	27.309
Journal of Ship Mechanics	Journal	1007-7294	0.4	0.230	0.454	2,781	7,045	2.533
Applied Ocean Research	Journal	1187	4.2	1.288	2.144	2,711	43,316	15.978
Offshore Engineer	Trade Journal	0305-876X	0.0	0.100	0.000	2,616	159	0.061
Journal of Marine Science and Engineering	Journal	2077-1312	1.8	0.544	1.134	2,351	6,865	2.920
Motor Ship	Trade Journal	0027-2000	0.0	0.100	-	2,296	86	0.037
Journal of Waterway Port Coastal and Ocean Engineering	Journal	0733-950X	3.6	0.799	1.429	2,071	37,029	17.880
Coastal Zone Proceedings of the Symposium on Coastal and Ocean Management	Proceeding	-	-	-	-	2,012	1,798	0.894
International Journal of Earth Sciences and Engineering	Journal	0974-5904	0.2	0.103	0.065	1,974	1,699	0.861

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Table 4. The Top 30 Most-Cited Publications in the Field of Ocean Engineering from 1970 to 2021.

Publication Year	Document Title	Authors	Journal Title	Total Citations
1989	Chemical and isotopic systematics of oceanic basalts: Implications for mantle composition and processes	Sun S.-S., McDonough W.F.	Geological Society Special Publication	12,222
1998	A new Meshless Local Petrov-Galerkin (MLPG) approach in computational mechanics	Atluri S.N., Zhu T.	Computational Mechanics	2,093
2002	Efficient inverse modeling of barotropic ocean tides	Egbert G.D., Erofeeva S.Y.	Journal of Atmospheric and Oceanic Technology	2,038
1998	The Tropical Rainfall Measuring Mission (TRMM) sensor package	Kummerow C., Barnes W., Kozu T., Shiue J., Simpson J.	Journal of Atmospheric and Oceanic Technology	1,781
1992	Generalizing the finite element method: Diffuse approximation and diffuse elements	Nayroles B., Touzot G., Villon P.	Computational Mechanics	1,701
2002	A predictor-corrector approach for the numerical solution of fractional differential equations	Diethelm K., Ford N.J., Freed A.D.	Nonlinear Dynamics	1,447
2008	Characterizing dissolved organic matter fluorescence with parallel factor analysis: A tutorial	Stedmon C.A., Bro R.	Limnology and Oceanography: Methods	1,436
2001	Estimation of small failure probabilities in high dimensions by subset simulation	Au S.-K., Beck J.L.	Probabilistic Engineering Mechanics	1,291
2009	Overview of the CALIPSO mission and CALIOP data processing algorithms	Winker D.M., Vaughan M.A., Omar A., Hu Y., Powell K.A., Liu Z., Hunt W.H., Young S.A.	Journal of Atmospheric and Oceanic Technology	1,231
1999	Review of fish swimming modes for aquatic locomotion	Sfakiotakis M., Lane D.M., Davies J.B.C.	IEEE Journal of Oceanic Engineering	1,176
1977	Rapid Method for Source Rock Characterization and for Determination of Their Petroleum Potential and Degree of Evolution	Espitalie J., Laporte J.L., Madec M., Marquis F., Leplat P., Paulet J., Boutefeu A.	Rev Inst Fr Pet	1,144
2004	Development and validation of a three-dimensional morphological model	Lesser G.R., Roelvink J.A., van Kester J.A.T.M., Stelling G.S.	Coastal Engineering	1,106
1991	Stable Adaptive Teleoperation	Niemeyer G., Slotine J.-J.E.	IEEE Journal of Oceanic Engineering	1,093
2003	An unstructured grid, finite-volume, three-dimensional, primitive equations ocean model: Application to coastal ocean and estuaries	Chen C., Liu H., Beardsley R.C.	Journal of Atmospheric and Oceanic Technology	1,014
1983	Sonar Tracking of Multiple Targets Using Joint Probabilistic Data Association	Fortmann T.E., Bar-Shalom Y., Scheffe M.	IEEE Journal of Oceanic Engineering	948
1993	Alternative form of Boussinesq equations for nearshore wave propagation	Nwogu O.	Journal of Waterway, Port, Coastal and Ocean Engineering	935
1997	Quality control and flux sampling problems for tower and aircraft data	Vickers D., Mahrt L.	Journal of Atmospheric and Oceanic Technology	915
2012	An overview of the global historical climatology network-daily database	Menne M.J., Durre I., Vose R.S., Gleason B.E., Houston T.G.	Journal of Atmospheric and Oceanic Technology	829
2000	What do experiments tell us about the relative contributions of crust and mantle to the origin of granitic magmas?	Patino Douce A.E.	Geological Society Special Publication	810
1999	Tethyan sutures of northern Turkey	Okay A.I., Tuysuz O.	Geological Society Special Publication	808

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Table 5 gives information about the 30 institutions that have published the most in this field. While Shanghai Jiao Tong University is first with 3,098 publications, Norwegian University of Science and Technology is second with 2,935. Dalian University of Technology is third with 2,736 publications, Ministry of Education of the People's Republic of China is fourth with 2,643, Ocean University of China is fifth with 2,423, Chinese Academy of Sciences is sixth with 2,387, and Harbin Engineering University is seventh with 2,080.

Table 5. The Top 30 Most Productive Institutions in the Field of Ocean Engineering from 1970 to 2021.

Affiliation	Country	Number of Publications
Shanghai Jiao Tong University	China	3,098
Norwegian University of Science and Technology	Norway	2,935
Dalian University of Technology	China	2,736
Ministry of Education China	China	2,643
Ocean University of China	China	2,423
Chinese Academy of Sciences	China	2,387
Harbin Engineering University	China	2,080
Delft University of Technology	Netherlands	1,890
Instituto Superior Técnico	Portugal	1,783
University of Lisbon	Portugal	1,682
Dalian Maritime University	China	1,629
The University of Tokyo	Japan	1,612
French National Center for Scientific Research (CNRS)	France	1,562
Texas A&M University	USA	1,504
DNV GL®	Norway	1,424
Korea Institute of Ocean Science & Technology	South Korea	1,356
Zhejiang University	China	1,234
The University of Western Australia	Australia	1,218
National Oceanic and Atmospheric Administration	USA	1,215
Equinor ASA	Norway	1,197
Hohai University	China	1,193
Wuhan University of Technology	China	1,152
Tianjin University	China	1,150
China Ship Scientific Research Center	China	1,149
Seoul National University	South Korea	1,144
National Taiwan Ocean University	Taiwan	1,143
Universidade Federal do Rio de Janeiro	Brazil	1,101
National University of Singapore	Singapore	1,090
State Key Laboratory of Coastal and Offshore Engineering	China	1,089
Petrobras	Brazil	1,072

Table 6 provides information about the top 30 institutions supporting publications in the field of ocean engineering. While the National Natural Science Foundation of China is in first place by supporting 14,028 publications, the Ministry of Education of the People's Republic of China is in second place by supporting 2,846 publications. While the European Commission takes third with its support for 2,767 publications, the Ministry of Science and Technology of the People's Republic of China comes in fourth with its support for 2,425 publications. The Fundamental Research Funds for the Central Universities is fifth with its support of 2,301publications, and the U.S. Department of Defense is in sixth with its support of 2,149 publications.

Table 6. The Top 30 Funding Sponsor Institutions in the Field of Ocean Engineering from 1970 to 2021.

Funding Sponsor	**Number of Publications**
National Natural Science Foundation of China	14,028
Ministry of Education of the People's Republic of China	2,846
European Commission	2,767
National Science Foundation	2,718
Ministry of Science and Technology of the People's Republic of China	2,425
Fundamental Research Funds for the Central Universities	2,301
U.S. Department of Defense	2,149
Ministry of Finance	2,017
Office of Naval Research	1,688
U.S. Navy	1,573
National Key Research and Development Program of China	1,437
UK Research and Innovation	1,432
Ministry of Education, Culture, Sports, Science and Technology	1,097
National Research Foundation of Korea	1,067
Engineering and Physical Sciences Research Council	1,056
Japan Society for the Promotion of Science	989
China Postdoctoral Science Foundation	879
China Scholarship Council	806
Australian Research Council	797
Norges Forskningsråd	792
Seventh Framework Programme	785
U.S. Department of Energy	783
Government of Canada	773
Natural Sciences and Engineering Research Council of Canada	765
National Oceanic and Atmospheric Administration	724
National Basic Research Program of China	722
Natural Environment Research Council	693
U.S. Department of Commerce	664
Fundação para a Ciência e a Tecnologia	658
Conselho Nacional de Desenvolvimento Científico e Tecnológico	656

3. Conclusions

The field of Ocean Engineering has had great importance throughout human history. Humanity has had freedom of movement and the opportunity to perform commerce thanks to the developments in this field. The field of Ocean Engineering has been in direct interactions with fields such as Naval Architecture, Marine Engineering, Numerical Methods, Oceanography, Offshore Technologies, Coastal Engineering, Environmental Science, and Energy. Developments in this field have also led to developments in many other fields.

Thanks to bibliometric analyses, which studies have been published in the field of Ocean Engineering, which authors, institutions, and countries have been the most active on this area can be seen over the years. Additionally, impact values have been determined by showing the average number of citations per author and per source for those published in journals in this field. The institutions that contributed with the most publications in this field both in terms of the number of publications as well as funding sponsors is also shown.

Thanks to this study, general results related to this field have been presented, as well as a numerical summary of the field for researchers. Researchers who wish to work on these issues will be able to easily access information about which direction studies have been evolving, which keywords are prominent, which institutions and countries have been more active, and most importantly which institutions provide funding sponsors.

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