A Bibliometric Analysis of NOAA Air Resources Laboratory Publications: FY2016-2021

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February 2022

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ABOUT THIS REPORT

This report presents a summary-level bibliometric analysis of the known peer-reviewed journal articles produced as a result of ocean exploration missions supported by NOAA's Air Resources Laboratory (A). This report was produced using data retrieved from the Web of Science, Science Citation Index Expanded and Social Science Index database and InCites on March 9, 2022, covering articles published from FY2016 through FY2021.

The bibliometric indicators presented in this report are based on citations from the select group of peer-reviewed journal articles indexed by Web of Science and, as such, do not reflect ARL articles from peer-reviewed journals not indexed by Web of Science (WoS) or from other sources such as book chapters, conference proceedings, or technical reports.

More information about the methodology used and a full listing of all of the articles evaluated in this report are available upon request to Sarah.Davis@noaa.gov.

PRODUCTIVITY

General productivity metrics for ARL articles October 2015 – September 2021.

Summary Metrics

Indicator	Number
Total number of publications	261
Total number times of these 233 publications have been cited	7,657
Average citations per publication	29.34
Percentage of documents cited at least once	92.72%
ARL h-index	34
Percentage of documents in the top 10%*	17.62%

Table 1. Common Bibliometric Indicators calculated for ARL peer-reviewed articles. An h-index of 34 indicates that this group of 261 articles includes 34 articles that have each received 34 or more citations. *Percentage of documents in the top 10% is calculated based on the number of articles that ranked in the top 10% of publications in Web of Science based on citations by category, year and document type; 17.62% of ARL articles published between FY2016 and FY2021 ranked in the top 10% of all articles in the same category published in the same year.

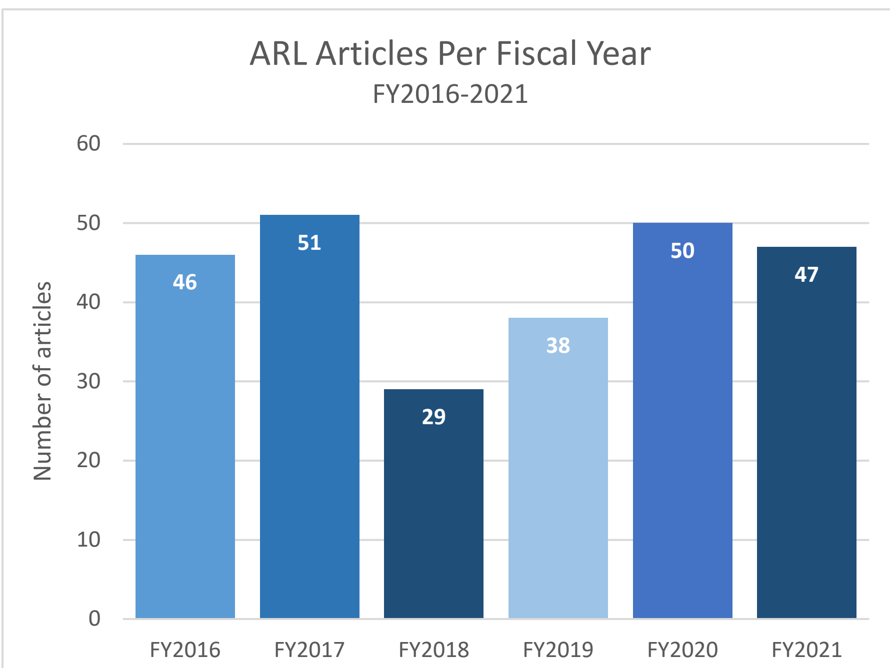

Figure 1. Number of ARL articles published annually, FY2016-2021. On average, ARL publishes 43.5 articles per year.

Table 2. ARL top-cited articles FY2016-2021	Times cited	Altmetric Score
Stein, A. F., Draxler, R. R., Rolph, G. D., Stunder, B. J. B., Cohen, M. D., & Ngan, F. (2015). NOAA'S HYSPLIT ATMOSPHERIC TRANSPORT AND DISPERSION MODELING SYSTEM. Bulletin of the American Meteorological Society, 96(12), 2059-2077. doi:10.1175/bams-d-14-00110.1	2,478	158
Rolph, G., Stein, A., & Stunder, B. (2017). Real-time Environmental Applications and Display sYstem: READY. Environmental Modelling & Software, 95, 210-228. doi:10.1016/j.envsoft.2017.06.025	636	6
Butler, A. H., Seidel, D. J., Hardiman, S. C., Butchart, N., Birner, T., & Match, A. (2015). DEFINING SUDDEN STRATOSPHERIC WARMINGS. Bulletin of the American Meteorological Society, 96(11), 1913-1928. doi:10.1175/bams-d-13-00173.1	207	188
Pastorello, G., Trotta, C., Canfora, E., Chu, H. S., Christianson, D., Cheah, Y. W., . . . Papale, D. (2020). The FLUXNET2015 dataset and the ONEFlux processing pipeline for eddy covariance data. Scientific Data, 7(1). doi:10.1038/s41597-020-0534-3	169	80
Butler, A. H., Sjoberg, J. P., Seidel, D. J., & Rosenlof, K. H. (2017). A sudden stratospheric warming compendium. Earth System Science Data, 9(1), 63-76. doi:10.5194/essd-9-63-2017	154	51
Toon, O. B., Maring, H., Dibb, J., et al. (2016). Planning, implementation, and scientific goals of the Studies of Emissions and Atmospheric Composition, Clouds and Climate Coupling by Regional Surveys (SEAC(4)RS) field mission. Journal of Geophysical Research-Atmospheres, 121(9), 4967-5009. doi:10.1002/2015jd024297	115	1
Biederman, J. A., Scott, R. L., Bell, T. W., Bowling, D. R., Dore, S., Garatuza-Payan, J., . . . Goulden, M. L. (2017). CO2 exchange and evapotranspiration across dryland ecosystems of southwestern North America. Global Change Biology, 23(10), 4204-4221. doi:10.1111/gcb.13686	90	10
Kim, H. C., Kim, E., Bae, C., Cho, J. H., Kim, B. U., & Kim, S. (2017). Regional contributions to particulate matter concentration in the Seoul metropolitan area, South Korea: seasonal variation and sensitivity to meteorology and emissions inventory. Atmospheric Chemistry and Physics, 17(17), 10315-10332. doi:10.5194/acp-17-10315-2017	86	2
Arndt, D.S., Blunden, J., et al. (2017). State of the Climate in 2016. Bulletin of the American Meteorological Society, 98(8), S1-S277. doi: 10.1175/2017BAMSStateoftheClimate.1	83	409
Tong, D. Q., Wang, J. X. L., Gill, T. E., Lei, H., & Wang, B. Y. (2017). Intensified dust storm activity and Valley fever infection in the southwestern United States. Geophysical Research Letters, 44(9), 4304-4312. doi:10.1002/2017gl073524	83	205

Aas, W., Mortier, A., Bowersox, V., Cherian, R., Faluvegi, G., Fagerli, H., . . . Xu, X. B. (2019). Global and regional trends of atmospheric sulfur. Scientific Reports, 9. doi:10.1038/s41598-018-37304-0	74	20
Zhang, X. L., Zhao, L. J., Tong, D. Q., Wu, G. J., Dan, M., & Teng, B. (2016). A Systematic Review of Global Desert Dust and Associated Human Health Effects. Atmosphere, 7(12). doi:10.3390/atmos7120158	73	131
Kochendorfer, J., Rasmussen, R., Wolff, M., Baker, B., Hall, M. E., Meyers, T., . . . Leeper, R. (2017). The quantification and correction of wind-induced precipitation measurement errors. Hydrology and Earth System Sciences, 21(4), 1973-1989. doi:10.5194/hess-21-1973-2017	72	3
Arndt, D.S., Blunden, J., et al. (2018). State of the Climate in 2017. Bulletin of the American Meteorological Society, 99(8), S1-S310. doi: 10.1175/2018BAMSStateoftheClimate.1	71	138
Kim, B.U., Bae, C., et al. (2017). Spatially and chemically resolved source apportionment study of high particulate matter event. Atmospheric Environment, 162, 55-70. doi: 10.1016/j.atmosenv.2017.05.006	70	0
Arndt, D.S., Blunden, J., et al. (2016). State of the Climate in 2015. Bulletin of the American Meteorological Society, 98(8), S1-S275. doi: 10.1175/2016BAMSStateoftheClimate.1	67	28
Salinger, M. J., Renwick, J., Behrens, E., et al. (2019). The unprecedented coupled ocean-atmosphere summer heatwave in the New Zealand region 2017/18: drivers, mechanisms and impacts. Environmental Research Letters, 14(4). doi:10.1088/1748-9326/ab012a	62	136
Kim, H. C., Kim, S., Kim, B. U., Jin, C. S., Hong, S., Park, R., . . . Stein, A. (2017). Recent increase of surface particulate matter concentrations in the Seoul Metropolitan Area, Korea. Scientific Reports, 7, 4710. doi:10.1038/s41598-017-05092-8	62	2
Mok, J., Krotkov, N. A., Arola, A., Torres, O., Jethva, H., Andrade, M., . . . Ren, X. R. (2016). Impacts of brown carbon from biomass burning on surface UV and ozone photochemistry in the Amazon Basin. Scientific Reports, 6. doi:10.1038/srep36940	61	13
Bodeker, G. E., Bojinski, S., Cimini, D., Dirksen, R. J., Haeffelin, M., Hannigan, J. W., . . . Wang, J. (2016). REFERENCE UPPER-AIR OBSERVATIONS FOR CLIMATE From Concept to Reality. Bulletin of the American Meteorological Society, 97(1), 123-135.	55	8

Table 2: List of the twenty most highly cited ARL articles published between FY2016 and 2021. The trophy symbol indicates that a paper received enough citations to place it in the top 1% of its academic field on a highly cited threshold for the field and publication year. Altmetric scores are calculated by algorithm based on mentions in news, blogs, Twitter, policy documents and other sources. For more information on Altmetrics please see: https://www.altmetric.com/about-altmetrics/what-are-altmetrics/

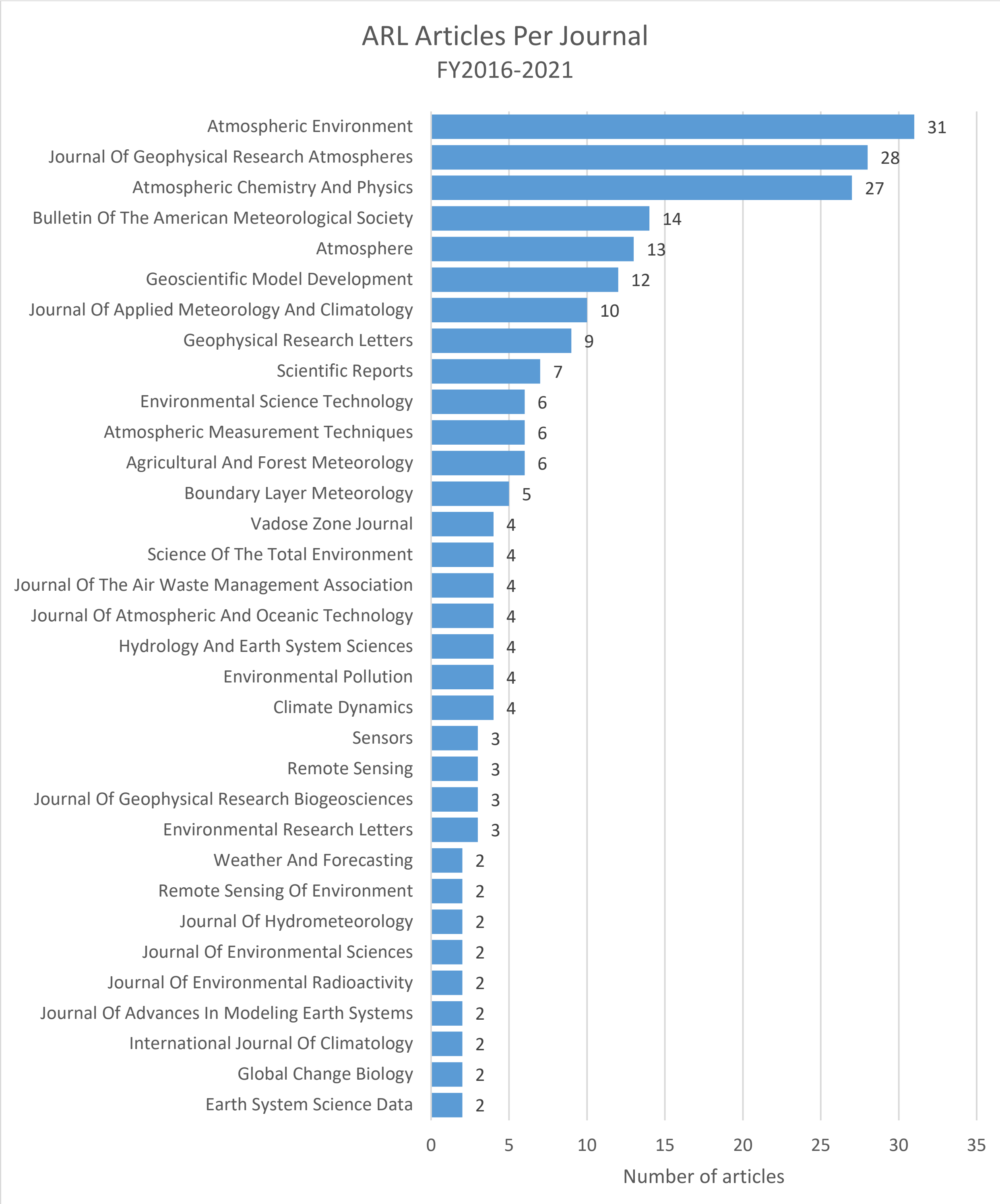

Figure 2. Journals in which ARL has published in three or more times between FY2016 and FY2021.

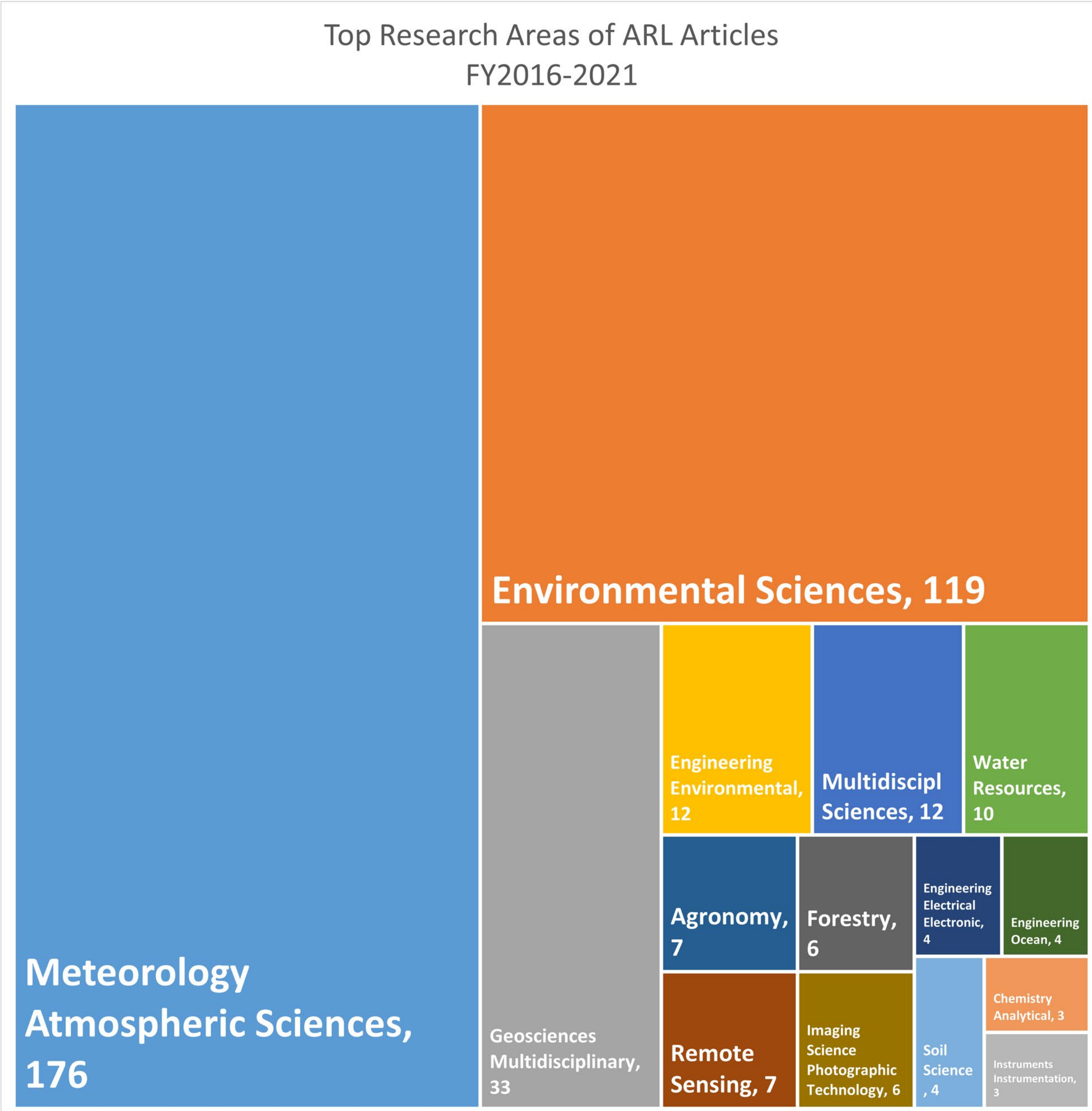

Figure 3. ARL articles appeared in journals categorized in 26 distinct research areas as defined and assigned by Web of Science. The top fifteen research areas by number of publications are presented here. Articles are assigned to subject categories by WoS based on the journal in which the article appeared. These subject categories are not mutually exclusive.

ARL's Productivity and Performance in the context of other OAR Labs

	Total number of articles FY2016-2021	Total number of citations	Average citations per article	% of articles cited at least once	h-index	% of articles in top 1%	% of articles in top 10%
AOML	623	18,204	29.22	89.73	50	4.17	20.87
ARL	**261**	**7,657**	**29.34**	**92.72**	**34**	**2.3**	**17.62**
CSL	786	20,425	25.99	94.27	68	5.73	29.77
GFDL	870	25,186	28.95	92.87	76	7.24	29.95
GLERL	234	4,279	18.29	91.45	31	0.85	17.52
GML	485	15,219	31.38	93.2	56	6.8	27.63
GSL	254	4,567	17.98	87.4	32	3.94	15.75
NSSL	557	7,219	12.96	86.54	37	1.8	12.96
PMEL	633	16,261	25.59	92.73	54	5.85	28.59
PSL	697	14,141	20.29	91.1	55	3.3	21.23

Table 3: Summary metrics for ARL articles published FY2016-2021 alongside metrics for articles published by the nine other OAR laboratories during the same period.

COLLABORATION

This section explores coauthor and institutional relationships.

Type of Collaboration	Rate
Intramural collaboration within NOAA	25.8%
Extramural collaboration with other institutions	97.3%
Extramural collaboration with international institutions	44.81%

Table 4: Collaboration rates at various levels of aggregation for ARL articles published FY2016-2021. Each rate gives the percentage of the 261 ARL articles analyzed in this report that feature at least one co-authorship pair at each level of collaboration.

Institutional Affiliation	Number of occurrences
University System Of Maryland	128
NASA	57
US Department Of Energy	38
University Of Colorado System	38
NCAR	35
George Mason University	32
Oak Ridge National Laboratory	22
Environment Climate Change Canada	22
University Of California System	22
Ajou University	20
Georgia Environ Protect Div	20
Universities Space Research Association	19
US Department Of Agriculture	17
State University Of New York SUNY System	16
U.S. Environmental Protection Agency	15
Pennsylvania Commonwealth Sys Of Higher Ed	14
Chinese Academy Of Sciences	14
University of Illinois System	14
California Institute of Technology	13
Colorado State University	13
Nanjing Univ of Information Science Technology	13
Universite Paris Saclay	13
University of Wisconsin System	13
Centre National de la Recherche Scientifique	12
University of Virginia	12

Table 5. Top institutional affiliations of collaborating authors on ARL articles showing institutions that collaborated with ARL authors on 12 or more articles between FY2016 and FY2021.

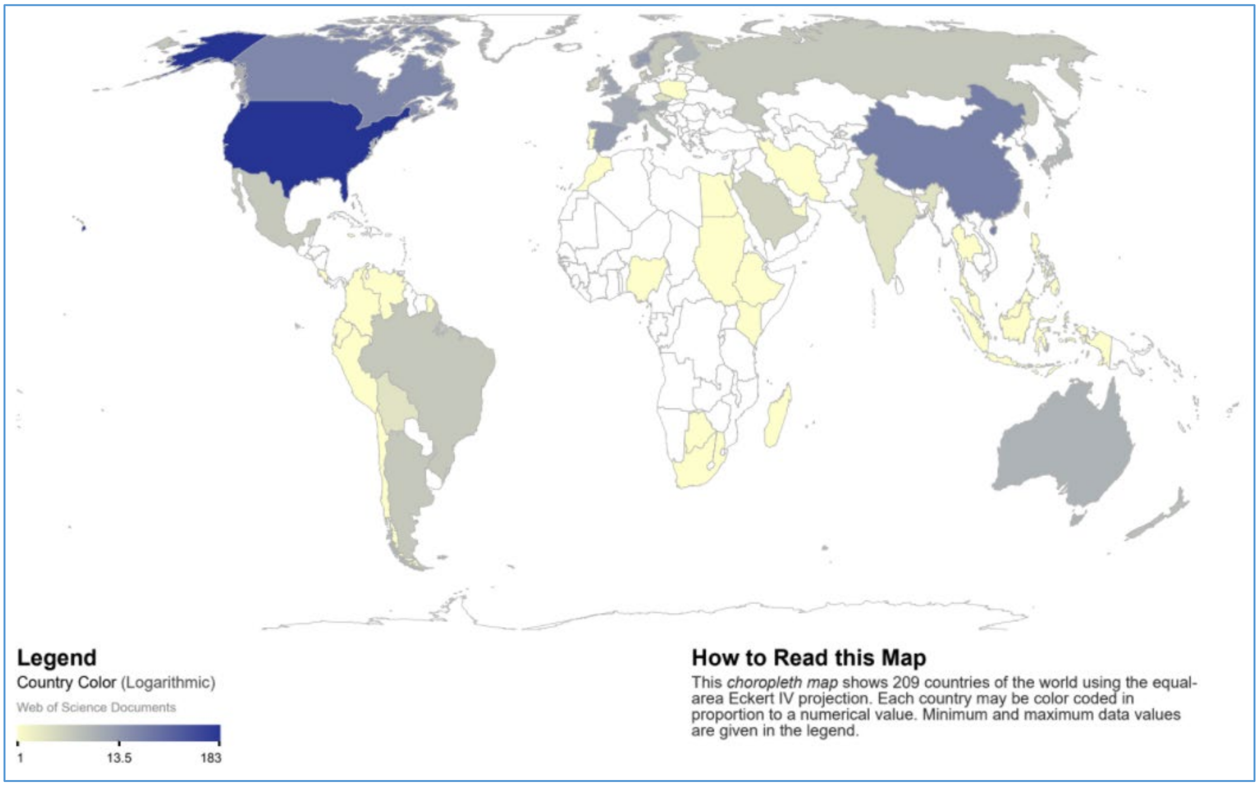

Figure 4. Geographic map illustrating ARL's international collaborations on articles published between FY2016 and 2021.

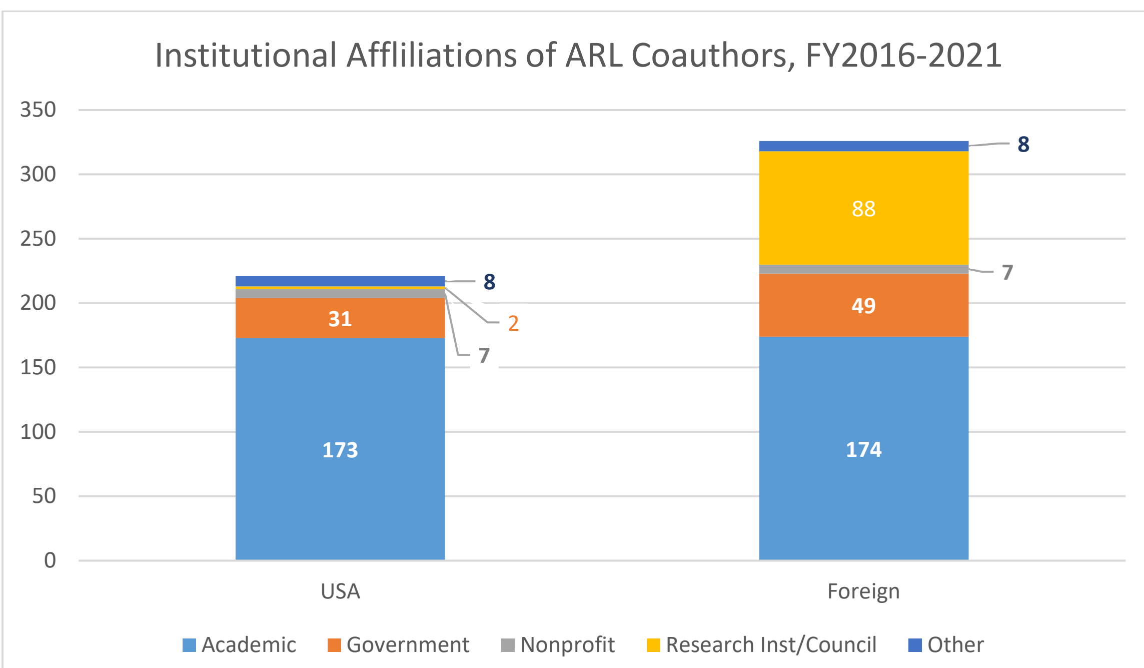

Figure 5. Count of coauthoring organizations as sorted by type.

IMPACT

This section analysis the 5,890 publications citing 261 ARL articles for insights into the value and impact of ARL research.

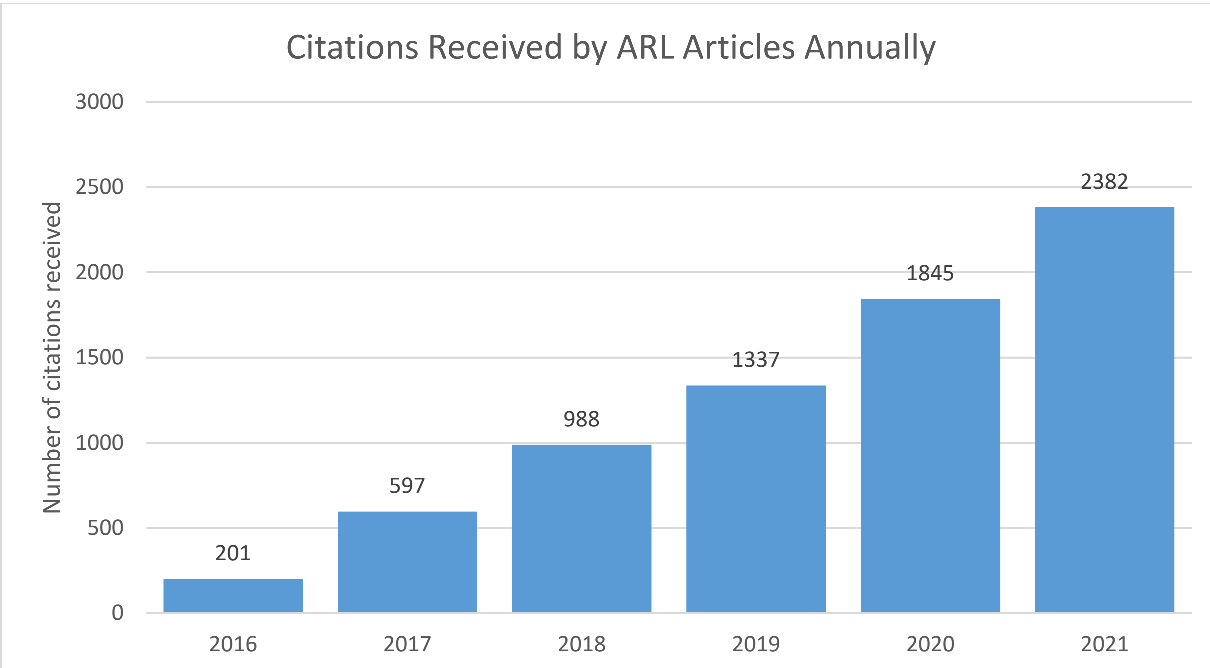

Figure 6: Non-cumulative number of citations received by this set of ARL articles between 2016 and 2021.

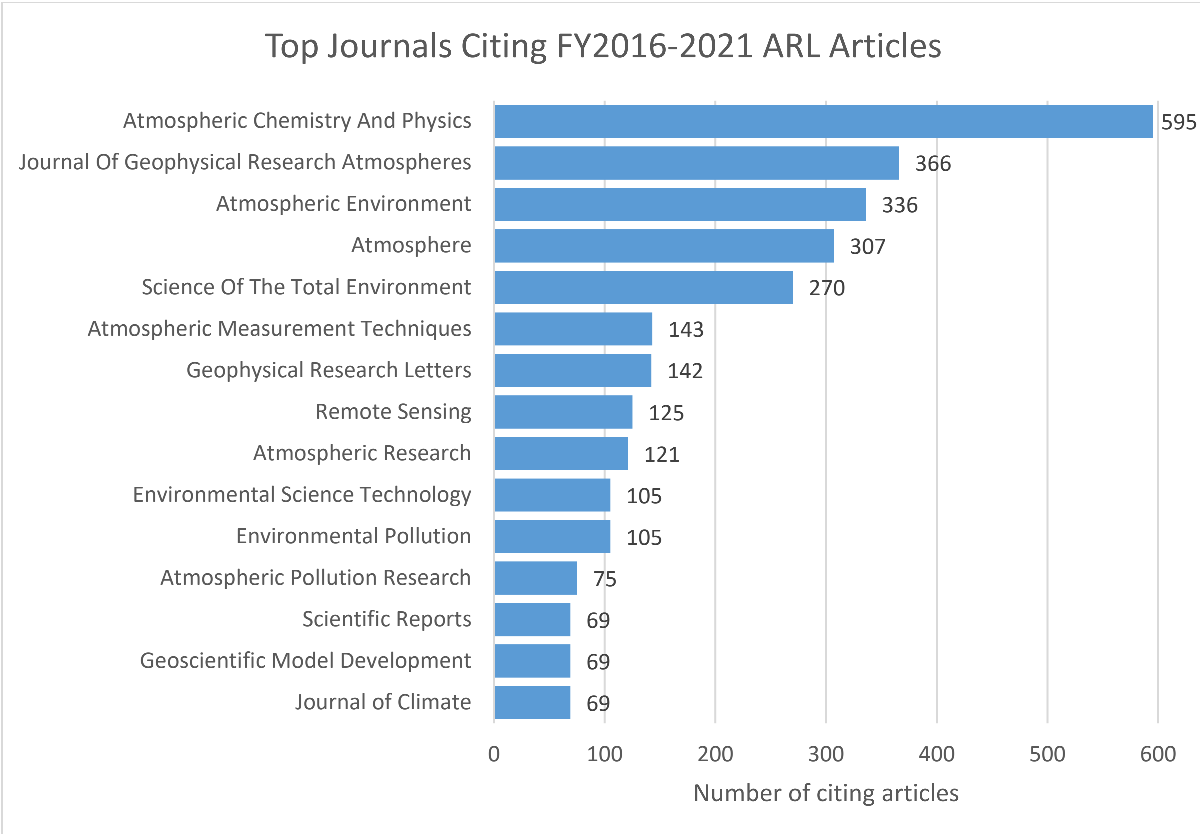

Figure 7: The 233 ARL articles analyzed in this report have been cited in 797 distinct titles. The top fifteen titles are shown here.

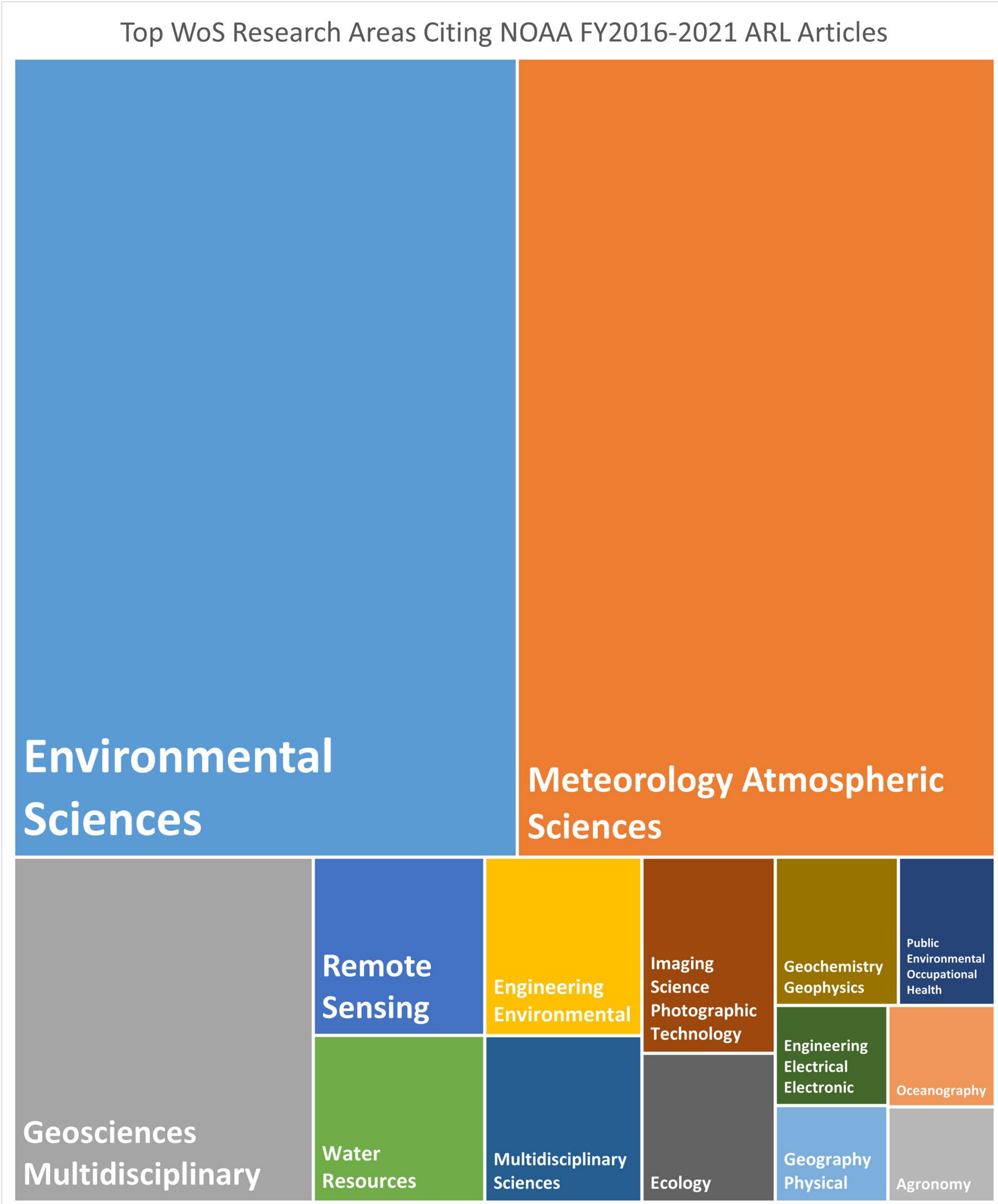

Figure 8: The fifteen most common Web of Science research areas in which these ARL articles were published in. Articles are assigned to subject categories by WoS based on the journal in which the article appeared. These subject categories are not mutually exclusive.

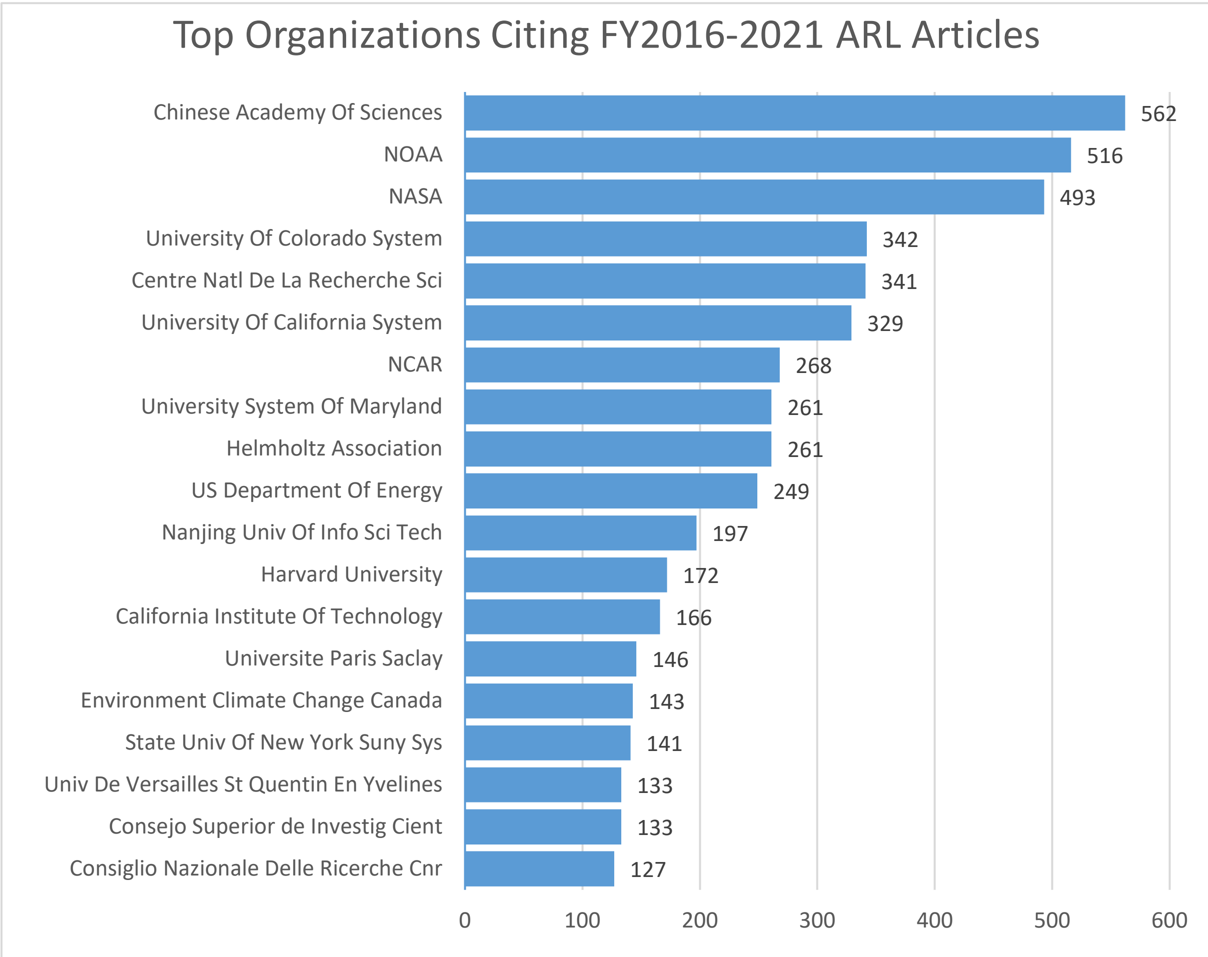

Figure 9: The 261 ARL articles analyzed in this report have been cited by authors affiliated with more than 4,000 organizations. The top twenty of these organizations are shown here.

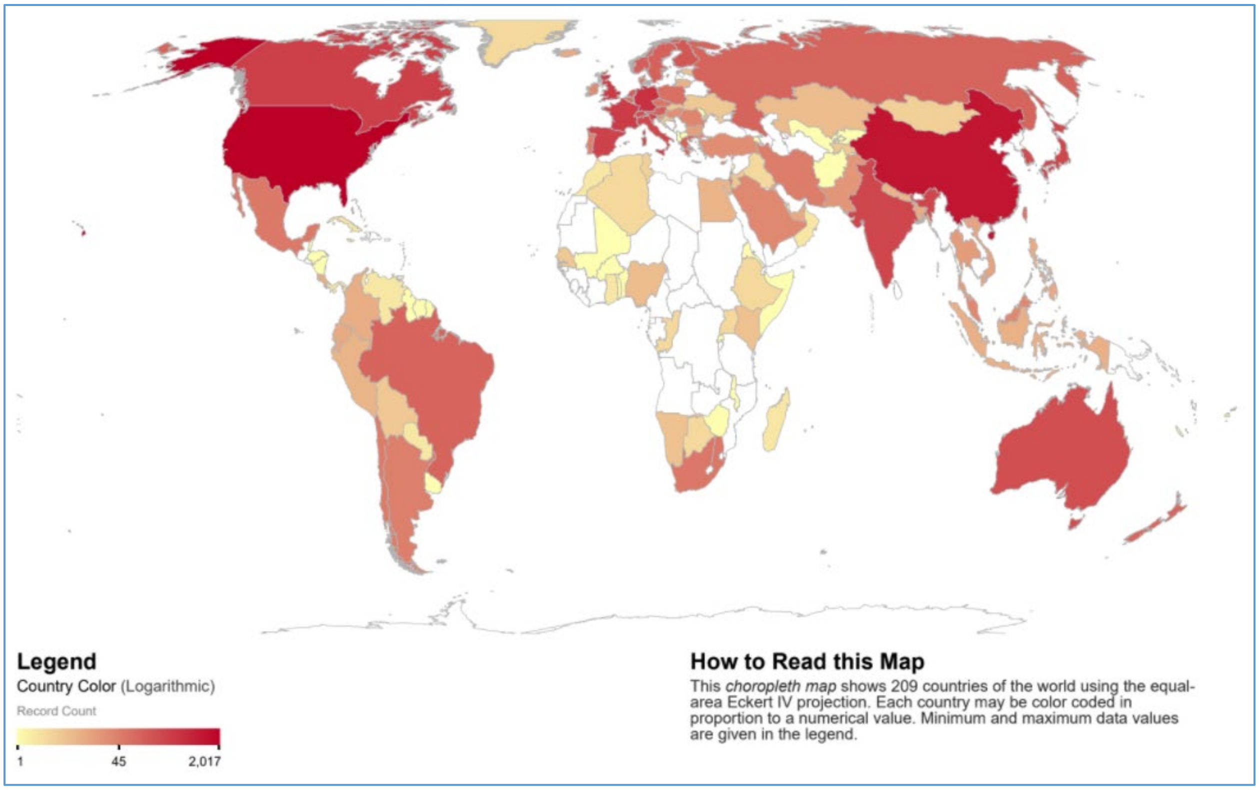

Figure 10: Geographic map illustrating international citations of ARL articles published between 2016 and 2021.

Name	Division	2016-2021 publications	h-index for 2016-21 articles
Baker, Barry	ASMD	10	5
Baker, Bruce	ATDD	8	6
Brewer, Matthew	FRD	2	2
Buban, Michael	ATDD	15	7
Campbell, Patrick	ASMD	17	6
Chai, Tianfeng	ASMD	15	7
Cohen, Mark	ASMD	15	8
Crawford, Alice	ASMD	7	5
Diamond, Howard	ASMD	13	8
Dumas, Ed	ATDD	9	6
Hall, Mark	ATDD	5	3
Heuer, Mark	ATDD	7	4
Jeong, Gill-ran	ASMD	2	1
Kelley, Paul	ASMD	10	6
Kim, Hyun	ASMD	36	14
Kochendorfer, John	ATDD	31	14
Krishnan, Praveena	ATDD	5	3
Lee, Temple	ATDD	23	8
Li, Yunyao	ASMD	8	6
Lichiheb, Nebila	ATDD	5	3
Loughner, Christopher	ASMD	14	9
Luke, Winston	ASMD	13	8
Meyers, Tilden	ATDD	19	9
Myles, LaToya	ATDD	7	5
Ngan, Fong (Fantine)	ASMD	7	6
Pendergrass, William	ATDD	2	2
Ren, Xinrong	ASMD	43	17
Rich, Jason	FRD	2	2
Ring, Allison	ASMD	4	4
Saylor, Rick	ATDD	13	3
Schuyler, Travis	ATDD	7	5
Senn, David	ATDD	11	5
Stein, Ariel	ASMD	20	9
Stunder, Barbara	ASMD	5	5
Tang, Youhua	ASMD	18	9
Tong, Daniel	ASMD	42	18
Wang, Julian	ASMD	10	6
Wilson, Timothy	ATDD	5	2

Table 6: Publication counts for the review period of 2016-2021 and h-indices for that set of articles for all ARL scientists. All counts and indices based calculated using Web of Science data and only include peer-reviewed scholarly articles which are indexed in that database.

APPENDIX 1: RESPONSIBLE USE OF BIBLIOMETRICS

When used alongside other evaluative measures, bibliometrics can be a useful tool for evaluating research. However, all bibliometric indicators have limitations and should not be used out of context or applied without a full understanding of their intended use. No single metric can provide a rounded overview of research performance so responsible use of metrics requires using multiple metrics and providing context for those metrics. It can be helpful to think of a bibliometric analysis as a story where each indicator is a plot point. Additionally, bibliometrics should not be used as the sole basis for decision-making or for evaluating the work of either an individual or group.

Some Pros & Cons of Bibliometrics

Pros

- Quantitative, objective and reproducible
- Easy to understand and easily updated
- Fully scalable - from individual- to country-level

Cons

- Datasets, particularly from standard databases like Web of Science (WOS), may represent only a portion of existing publications
- Most indicators are skewed and are vulnerable to manipulation by authors & publishers. H-index for example highly favors authors with longer careers.
- Indicators don't necessarily mean what we think they mean (e.g. a high citation count may be the result of "negative" citations rather than an indicator of quality)

Further reading on the responsible use of bibliometrics:

Aksnes, D. W., L. Langfeldt, & P. Wouters. 2019. Citations, Citation Indicators, and Research Quality: An Overview of Basic Concepts and Theories. SAGE Open, 9. doi:10.1177/2158244019829575.

Barnes, C. 2017. The h-index debate: An introduction for librarians. The Journal of Academic Librarianship 43:487-494, doi:10.1016/j.acalib.2017.08.013.

Belter, C.W. 2015. Bibliometric indicators: Opportunities and limits. Journal of the Medical Library Association. 103(4):219-221. doi:10.3163/1536-5050.103.4.014.

Clarivate Analytics. 2020. InCites benchmarking & analytics: Responsible use of research metrics. http://clarivate.libguides.com/incites_ba/responsible-use. Accessed 12/16/2020.

Haustein, S., V. Lariviere. 2015. The use of bibliometrics for assessing research: Possibilities, limitations and adverse effects. In: Welpe IM, J. Wollersheim, S. Ringelhan, M. Osterloh, eds. Incentives and performance. Springer, Cham. Pg. 121–139. doi:10.1007/978-3-319-09785-5_8.

Hicks, D., P. Wouters, L. Waltman, S. de Rijcke and I. Rafois. 2015. Bibliometrics: The Leiden Manifesto for research metrics. Nature 520:420-531. doi:10.1038/520429a.

Pendlebury, D.A. 2010. White paper: Using bibliometrics in evaluating research. Thomson Reuters, Philadelphia, PA. https://lib.guides.umd.edu/ld.php?content_id=13278687.

APPENDIX 2: METHOD AND SOURCES

This report provides a bibliometric analysis of publications produced by the NOAA Air Resources Laboratory (ARL) from October 2016 through September 2021. For our data source, we used the NOAA Central Library's database of all NOAA articles 2012 to present to extract a list of ARL articles published during the review period of FY2016-2021. Publications were identified by searching for ARL and variations of ARL in the authors stated affiliations. Search results were manually reviewed and verified for accuracy and assigned to line office and research labs based on the authors' listing in the NOAA staff directory. Because we use the WoS analytical tools for our bibliometric analyses, ARL publications that do not appear in WoS have been omitted from the data set. Bibliographic citations and citation data were downloaded from WoS and Clarivate InCites. Altmetric data was obtained from Dimensions.

Although we have included publication and citation data through September 2021 in our data set, it is generally agreed that publications must be at least two years old for citation reporting to be meaningful. Therefore it should be noted that the citation data for the more recent publications is preliminary and is most likely not indicative of their eventual impact.

The list of current ARL authors, for the individual author metrics (table 6), was obtained from the ARL staff directory. H-indices and career publication counts were acquired from WoS using author ORCIDs and the WoS Author Search.

Publication and citation data were downloaded from Web of Science and InCites on March 9, 2022. Because of slight differences in indexing schedules and algorithms, citation data can vary slightly between WoS and InCites. The full publication list and data sets are from Sarah.Davis@noaa.gov.