

# **2013 Environmental Monitoring, Evaluation, and Protection (EMEP) Citation Analysis**

*Final Report*

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## Notice

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## Abstract

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This report summarizes the results of a citation analysis, conducted by Thomson Reuters and Research Into Action Inc., of the projects that result from NYSERDA's Environmental Monitoring, Evaluation, and Protection (EMEP) program. EMEP funding supports research that is being widely disseminated in the academic literature. Despite differences in methodology at Thomson Reuters that reduced the match rate among uncategorized publications from 2009 to 2013, the 2013 update of the Institutional Citation Report (ICR) found that EMEP papers continue to be cited at a higher rate than other literature in the field, as demonstrated by the mean C-Index value of 1.3. This 2013 update of the ICR updated the citation information from prior years and added projects completed since 2009. Thomson identified 245 matched papers from 374 categorized publications, a match rate of 66%. Changes in the methodology at Thomson reduced the match rate among uncategorized publications. Including those publications dropped the 2013 match rate to 61%, the same percentage found in the 2009 ICR update for EMEP. This analysis captures only part of the academic reach of EMEP and these results indicate that the research is being utilized by academics at a greater rate than other literature in the field.

## Acknowledgements

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## Executive Summary

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NYSERDA's Environmental Monitoring, Evaluation, and Protection program (EMEP) funding supports research that is being widely disseminated in the academic literature. Despite differences in methodology at Thomson Reuters that reduced the match rate among uncategorized publications, the 2013 update of the Institutional Citation Report (ICR) found that EMEP papers continue to be cited at a higher rate than other literature in the field, as demonstrated by the mean C-Index value of 1.3. This 2013 update of the ICR updated the citation information from prior years and added projects completed since 2009. Thomson identified 245 matched papers from 374 categorized publications, a match rate of 66%. Changes in the methodology at Thomson reduced the match rate among uncategorized publications. Including those publications dropped the 2013 match rate to 61%, the same percentage found in the 2009 ICR update for EMEP. This analysis captures only part of the academic reach of EMEP and these results indicate that the research is being utilized by academics at a greater rate than other literature in the field.



## 2013 EMEP Citation Analysis

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### 1.1 Institutional Citation Report (ICR) Update Project

Research Into Action (RIA) contracted with Thomson Reuters (Thomson) to update the Institutional Citation Report (ICR) produced for the Environmental Monitoring, Evaluation, and Protection program (EMEP) in 2006 and again in 2009. In 2006, Thomson identified 98 matched papers in its dataset, covering program years 1999-2006. In 2009 Thomson identified 154 matched papers. For 2013, updating the ICR involved updating the citation information for the original records and adding projects completed since 2009. Thomson identified 247 matched papers in 2013.

Using its *Web of Science*<sup>®</sup> bibliographic database, Thomson algorithmically matches the records of authors with articles in the *Web of Science*. Thomson does not guarantee a 100% match rate. For this ICR update, citation counts were created for matched projects up to December 20, 2013.

Obtaining an ICR allows EMEP to document if and how the research findings supported by the program are being communicated. EMEP staff would like to confirm that program-sponsored projects are being cited in academic journals as a way to: 1) document the performance of research through citation metrics; 2) evaluate the outcomes of funding decisions; and 3) identify opportunities for future collaboration or information transfer. In response to this request, Thomson provided a copy of a customized database created for RIA on behalf of NYSERDA. This database documents the results of the *Web of Science* analysis.

### 1.2 Thomson Reuters Database

In November 2013, RIA provided a list of 401 EMEP papers to Thomson. Of these papers, 374 were categorized into one of four topical areas: air quality, ecosystems, climate change, and crosscutting research. The remaining 27 publications were not categorized. Ultimately, Thomson was able to match 247 of the 401 records in their *Web of Science* database (Table 1).

There are two primary explanations for why 154 of the products submitted to Thomson did not match their database.

1. Articles are likely to be either not published yet (under review), appear in a non-peer-reviewed publication (graduate theses or conference proceedings), or were published in a journal outside of Thomson's scope.
2. Thomson's 2013 analysis was unable to match the uncategorized publications at as high a rate as in 2009. This discrepancy is a result of differing methodologies used in 2013 versus 2009 by Thomson Reuters. This difference particularly affected the uncategorized publications. Due to the

low match rate and the inconsistencies with the 2009 information, several of the tables provided below exclude two uncategorized publications that were matched.

As a result of matching about three-fifths of the articles, the analysis below demonstrates the *minimum level* intellectual reach of EMEP-sponsored research.

**Table 1. Comparison of EMEP Records to Thomson Search Results**

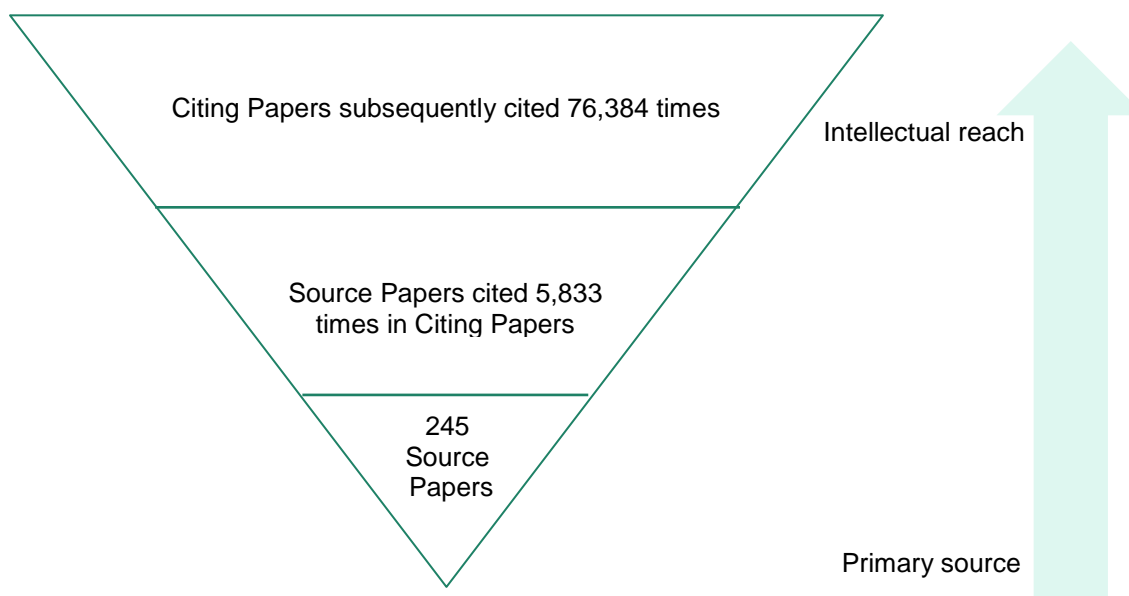
Category	2009 Analysis NYSERDA List of Articles	2009 Analysis Thomson Database Match	2009 Analysis Percent Match	2013 Analysis NYSERDA List of Articles	2013 Analysis Thomson Database Match	2013 Analysis Percent Match
Air Quality	116	64	55%	206	145	70%
Ecosystems	100	60	60%	148	89	60%
Climate Change	2	1	50%	7	2	29%
Crosscutting	13	6	46%	13	9	69%
<b>Subtotal</b>	<b>231</b>	<b>131</b>	<b>57%</b>	<b>374</b>	<b>245</b>	<b>66%</b>
Uncategorized	23	23	100%	27	2	7%
<b>Total*</b>	<b>254</b>	<b>154</b>	<b>61%</b>	<b>401</b>	<b>247</b>	<b>61%</b>

\* Including the “uncategorized” category drops the percentage matched. Because all of these papers were matched in 2009, the research team calculated the matched percent with and without this category to illustrate the effect of including them in the ICR.

To further increase the distribution and availability of research projects funded by EMEP, program staff have begun to encourage researchers that receive EMEP funding to publish their articles in open access journals. Open access journals provide access to published scientific work, typically without subscription requirements. In some cases, EMEP funds have helped make articles published in subscription-based journals publicly available.

### 1.3 Findings

The 245 EMEP-funded and categorized papers matched in the *Web of Science* database search are called *source papers*. These *source papers*, attributed to 695 authors, were cited 5,833 times between 1999 and 2013. The 2,784 citations appear in *citing papers*. These *citing papers* were in turn cited 76,384 times (Figure 1).

**Figure 1. Intellectual Reach of EMEP Funding as Matched to *Web of Science*<sup>®</sup> in 2013**

An ICR results in several other measures of reach or success. The first measure is called a C-Index. A C-Index communicates the actual citations relative to expected citations. EMEP-funded papers appear to be cited at a higher rate, as demonstrated by the mean C-Index value of 1.3. A value of 1.0 would indicate that the EMEP funded papers were cited at the same rate as other papers in the *Web of Science* database. As of 2013, over 94% of EMEP funded papers have been cited at least once. The second measure of intellectual reach is an H-Index. An H-Index is a statistic that reflects the number of papers cited at least that many times. The 245 matched EMEP source papers in 2013 earned an H-Index of 39 – meaning that 39 of the source papers were cited at least 39 times each (Table 2).

**Table 2. Summary Analytics<sup>a</sup>**

Statistic	Average Cites <sup>b</sup>	Median Citations <sup>c</sup>	H-Index <sup>d</sup>	C-Index <sup>e</sup>	Percentage Cited <sup>f</sup>
Air Quality	24.4	11	32	1.5	93.8%
Climate Change	6	6	1	0.8	50%
Crosscutting	40.7	23	7	1.0	100%
Ecosystem	21.5	12	24	1.4	95.5%
<b>2013 Overall Results</b>	<b>23.8</b>	<b>12</b>	<b>39</b>	<b>1.3</b>	<b>94.3%</b>
2009 Overall Results	18.0	12.5	29	1.7	92.2%

<sup>a</sup> Due to differences in Thomson Reuters methodology, uncategorized papers are not included in this analysis.

<sup>b</sup> Total number of citations divided by number of source papers

<sup>c</sup> Half of the source papers received fewer citations, half received more

<sup>d</sup> The number of papers (N) in a given dataset having N or more citations.

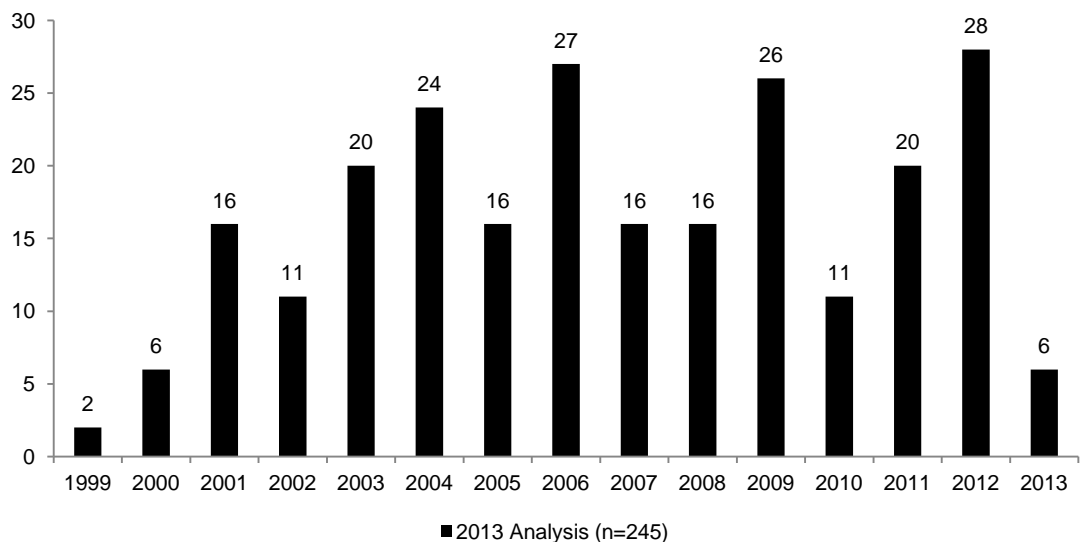
<sup>e</sup> The sum of all actual citations divided by the sum of expected citations

<sup>f</sup> The portion of source papers cited at least one time

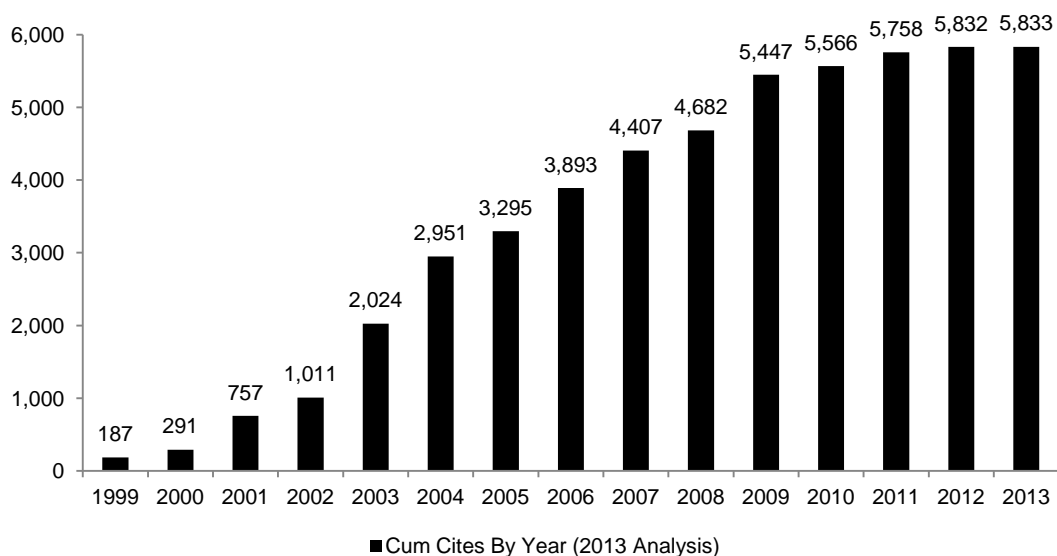
Since the 2009 analysis, the average number of cites increased, the H-index increased, and the percentage of all EMEP funded papers cited increased. The median number of citations remained close to the same and only the C-index decreased, likely reflecting the fact that Thomson could not match many of the uncategorized papers in 2013. However, the C-index of 1.3 still shows that EMEP-funded work is 1.3 times more likely to be cited than other literature in the field.

The ICR also identifies the number of articles published each year. Figure 2 shows that EMEP articles were cited most frequently in 2003 and 2004, with over 1/3 of all EMEP article citations happening in those two years. The low number of citations in 2013 is expected because of the time required for published work to be cited elsewhere. (Figure 2 shows the number of EMEP articles cited by the year the article entered the Thomson database, not necessarily the publication year.)

**Figure 2. Number of Articles Cited by Year Articles Entered Database**



From 1999-2013, EMEP articles were cited over 5,800 times in the *Web of Science* database with the largest increases happening from 2002 to 2003, and 2003 to 2004. This corresponds with the substantially larger numbers of articles published in 2003 and 2004. While there are fewer citations in recent years, this should be expected – the more recent the publication date, the less time there has been for citation. (Figure 3 shows the number of citations by publication year, rather than the year an article entered the database.)

**Figure 3. Cumulative Number of Citations by Publication Year**

The 245 source papers matched in 2013 appeared in 68 unique journals, an increase of almost 60% from the 2009 analysis, which identified 43 journals. In addition, while almost 60% of the source papers appear in 10 of the 68 journals (15%), the spread of the papers appears to becoming more diffuse compared to 2009 when two-thirds of the source papers appeared in nine of the 43 journals (20%).

**Table 3. Journals Publishing EMEP-Funded Project Citations by Frequency – 1999-2013**

Journal	Papers	Cumulative Papers	Cumulative Percent
Atmospheric Environment	47	47	19%
Environmental Science and Technology	20	67	27%
Journal of Air and Waste Management Associations	18	85	35%
Journal of Geophysical Research-Atmospheres	12	97	40%
Aerosol Science and Technology	8	105	43%
Environmental Pollution	8	113	46%
Hydrological Processes	8	121	49%
Environmental Fluid Mechanics	7	128	52%
Atmospheric Chemistry and Physics	6	134	55%
Ecotoxicology	6	140	57%

EMEP research focuses on environmental issues related to energy production and use, and this is evidenced in the papers published in environmental science and ecological fields. The field associated with the largest number of papers is *Environmental Sciences* followed by *Meteorology and Atmospheric Sciences* (see Table 4).

**Table 4. Articles by Thomson Reuters' Field**

Field	Papers	Rank
Environmental Sciences	105	1
Meteorology and Environmental Sciences	97	2
Engineering, Environmental	33	3
Engineering, Chemical	14	4
Water Resources	8	5
Oceanography	7	6
Mechanics	7	6
Toxicology	5	7
Public, Environmental, Occupation Health	5	7
Geochemistry (in 2013 "& Physics")	3	8
Energy and Fuels	3	8
Environmental Studies	3	8
Transportation	3	8
Transportation Science & Technology	3	8
Chemistry, Analytical	3	8
Geosciences, Multidisciplinary	1	9
Computer Sciences, Interdisciplinary Applications	1	9
Chemistry, multidisciplinary	1	9
Construction & Building Technology	1	9
Engineering, Civil	1	9
Engineering, Electrical and Electronic	1	9
Instruments & Instrumentation	1	9
No Category	1	9

## 1.4 Options for Future Citation Analysis Work

In addition to Thomson Reuters Web of Science ICR analysis, Research Into Action identified five other firms that provide citation analysis tools aimed at determining the reach of academic literature. Based on an analysis of these five, the Elsevier Scopus product appears to come closest to competing with Thomson Reuters *Web of Science* analysis. The remaining four firms do not provide the depth of information that Thomson and Elsevier provide. In the future, if budget allows, it may be helpful to conduct a citation analysis using the Elsevier product to see if results are similar to Thomson and to see if these products produce a better match rate. EMEP may need to run both analyses simultaneously for a year in order to reliably identify and assess any differences.



**Table 5. Firms that Provide Citation Analysis Services**

Vendor	Tool Name	Calculates H-Index?	Summary
Elsevier	Scopus	Yes	Provides citation analysis statistics similar to Thomson Reuters Web of Science
Google	Google Scholar	Yes	Best used for identifying the reach of one article at a time. Does not allow for "batch" analysis.
Harzing	Publish or Perish	Yes	Uses Google Scholar with an improved interface to better search Google Scholar. Does not allow for "batch" analysis.
Microsoft	Academic Search	No	Relies on proprietary rating system to determine "reach" of articles.
SCImago	SCImago Journal & Country Rank	Yes	Uses Scopus to generate reports; for journal visibility only; does not appear to give author-specific citation data

## 1.5 Conclusion

EMEP funding supports research that is being widely disseminated in the academic literature. This analysis captures only part of the academic reach of EMEP and these results indicate that the research is being utilized by academics at a greater rate than other literature in the field. Promoting public access by publishing EMEP-funded research in open access journals should continue to help further disseminate findings. In the future, using another citation analysis product such as Elsevier's Scopus may provide NYSERDA with additional insights about the reach of EMEP funded research.