

Learning More Effectively from Climate's Past

Reproducible Data Analysis

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Introduction

This is a fully reproducible analysis written in R and Quarto. The source code for this document, including all the R code to run the preprocess the data, run the analysis, and produce the tables you see below, is available here on GitHub.

This analysis pulls data directly from the original Excel Spreadsheet at this link, so the tables will update automatically when the analysis is rerun if the spreadsheet changes.

Simple Questions

1. How many publications do we have from each discipline?

Variable	N = 1,191 ¹
Discipline	
Archaeology	149 (13%)
Economics	5 (0.4%)
Epidemiology	2 (0.2%)
Geography	25 (2.1%)
History	206 (17%)
Joint Fields	211 (18%)
Literature	35 (2.9%)
Other	13 (1.1%)
Paleoclimatology	545 (46%)

¹ n (%)

2. How many publications are from each region?

Variable	N = 1,191 ¹
Geographic Region	
Africa	45 (3.8%)
Americas	174 (15%)
Asia	271 (23%)
Europe	347 (29%)
Global	228 (19%)
Middle East	61 (5.1%)
Oceania	25 (2.1%)
Polar	40 (3.4%)

¹ n (%)

3. How many publications are from each period?

Note that N is larger here because each paper can cover multiple time periods.

Variable	N = 3,262 ¹
Period	
Pleistocene	65 (2.0%)
Early-Mid Holocene	145 (4.4%)
Ancient	345 (11%)
Medieval	569 (17%)
Early Modern	720 (22%)
Modern	751 (23%)
Present	667 (20%)

¹ n (%)

4. How many of our publications use methods that are quantitative, statistical, both, or neither?

Variable	N = 1,191 ¹
Method	
Both	164 (14%)
Neither	126 (11%)
Qualitative	219 (18%)
Quantitative	682 (57%)

¹ n (%)

5. How many of our publications are original research, a literature review, or a response article?

Variable	N = 1,191 ¹
type	
Lit. Review/Method Intervention	165 (14%)
Original Research	1,024 (86%)
Response Article	2 (0.2%)

¹ n (%)

6. How many publications are books, “book/theses” (PhD theses), articles, or “chapter/articles” (-book chapters)?

Variable	N = 1,191 ¹
Publication Type	
Article	887 (74%)
Book	55 (4.6%)
Book/Thesis	2 (0.2%)
Chapter/Article	247 (21%)

¹ n (%)

7. How many of our publications use AGW to argue for their importance?

Variable	N = 1,191 ¹
Uses AGW	658 (55%)

¹ n (%)

8. How many of our publications include lessons for the present/future?

Variable	N = 1,191 ¹
Includes lessons	194 (16%)

¹ n (%)

9. What types of lessons or recommendations are most common?

Note, some papers can have multiple recommendation types. This analysis counts those separately (like we do for periods) so our N is greater than the number of articles.

Variable	N = 1,224 ¹
rec_type	
Broad, abstract, or vague	94 (7.7%)
Specific but not actionable	77 (6.3%)
Specific and actionable	56 (4.6%)
No recommendation	997 (81%)

¹ n (%)

10. Among lessons (so leaving out “none of the above”) what types of lessons or recommendations are most common?

Variable	N = 227 ¹
rec_type	
Broad, abstract, or vague	94 (41%)
Specific but not actionable	77 (34%)
Specific and actionable	56 (25%)
No recommendation	0 (0%)

¹ n (%)

11. How many of our publications in each discipline use methods that are quantitative, qualitative, both, or neither?

Variable	Both N = 164 ¹	Neither N = 126 ¹	Qualitative N = 219 ¹	Quantitative N = 682 ¹	p-value ²
Discipline					<0.001
Archaeology	29 (18%)	16 (13%)	25 (11%)	79 (12%)	
Economics	2 (1.2%)	0 (0%)	1 (0.5%)	2 (0.3%)	
Epidemiology	0 (0%)	1 (0.8%)	0 (0%)	1 (0.1%)	
Geography	3 (1.8%)	0 (0%)	11 (5.0%)	11 (1.6%)	
History	30 (18%)	36 (29%)	127 (58%)	13 (1.9%)	
Joint Fields	91 (55%)	23 (18%)	8 (3.7%)	89 (13%)	
Literature	0 (0%)	4 (3.2%)	31 (14%)	0 (0%)	
Other	1 (0.6%)	4 (3.2%)	5 (2.3%)	3 (0.4%)	
Paleoclimatology	8 (4.9%)	42 (33%)	11 (5.0%)	484 (71%)	

¹ n (%)

² Fisher's Exact Test for Count Data with simulated p-value (based on 2000 replicates)

12. How many publications that are *not* in Paleoclimatology/Historical Climatology use Quantitative Analysis?

354 publications from disciplines other than paleoclimatology use quantitative analysis.

13. What percentage of publications in every method consider each region?

Variable	Both N = 164 ¹	Neither N = 126 ¹	Qualitative N = 219 ¹	Quantitative N = 682 ¹	p-value ²
Geographic Region					<0.001
Africa	9 (5.5%)	0 (0%)	9 (4.1%)	27 (4.0%)	
Americas	18 (11%)	8 (6.3%)	38 (17%)	110 (16%)	
Asia	25 (15%)	9 (7.1%)	9 (4.1%)	228 (33%)	
Europe	66 (40%)	26 (21%)	96 (44%)	159 (23%)	
Global	22 (13%)	80 (63%)	43 (20%)	83 (12%)	
Middle East	20 (12%)	0 (0%)	12 (5.5%)	29 (4.3%)	
Oceania	3 (1.8%)	1 (0.8%)	6 (2.7%)	15 (2.2%)	
Polar	1 (0.6%)	2 (1.6%)	6 (2.7%)	31 (4.5%)	

¹ n (%)

² Fisher's Exact Test for Count Data with simulated p-value (based on 2000 replicates)

Compound Questions

1. What percentage of publications in each discipline and method use AGW to argue for their importance?

Variable	No N = 533 ¹	Yes N = 658 ¹	p-value ²
Discipline			<0.001
Archaeology	74 (14%)	75 (11%)	
Economics	2 (0.4%)	3 (0.5%)	
Epidemiology	0 (0%)	2 (0.3%)	
Geography	8 (1.5%)	17 (2.6%)	
History	130 (24%)	76 (12%)	
Joint Fields	121 (23%)	90 (14%)	
Literature	15 (2.8%)	20 (3.0%)	
Other	3 (0.6%)	10 (1.5%)	
Paleoclimatology	180 (34%)	365 (55%)	
Method			<0.001
Both	95 (18%)	69 (10%)	
Neither	54 (10%)	72 (11%)	
Qualitative	122 (23%)	97 (15%)	
Quantitative	262 (49%)	420 (64%)	

¹ n (%)

² Fisher's Exact Test for Count Data with simulated p-value (based on 2000 replicates); Pearson's Chi-squared test

2a. What percentage of publications in Paleoclimatology/Historical Climatology use modern global warming to argue for their significance? What percentage of publications in all *other* disciplines do the same?

Variable	All other disciplines N = 646 ¹	Paleoclimatology N = 545 ¹	p-value ²
Uses AGW	293 (45%)	365 (67%)	<0.001

¹ n (%)

² Pearson's Chi-squared test

2b. What percentage of publications using quantitative analysis use modern global warming to argue for their significance? And what percentage of publications using the other methods do the same?

Note that here we again combine Quantitative and Both categories.

Variable	Other Methods N = 345 ¹	Quantitative N = 846 ¹	p-value ²
Uses AGW	169 (49%)	489 (58%)	0.006

¹ n (%)

² Pearson's Chi-squared test

3a. What percentage of publications from each region use AGW to argue for their importance?

Variable	No N = 533 ¹	Yes N = 658 ¹	p-value ²
Geographic Region			<0.001
Africa	22 (4.1%)	23 (3.5%)	
Americas	73 (14%)	101 (15%)	
Asia	89 (17%)	182 (28%)	
Europe	211 (40%)	136 (21%)	
Global	85 (16%)	143 (22%)	
Middle East	38 (7.1%)	23 (3.5%)	
Oceania	9 (1.7%)	16 (2.4%)	
Polar	6 (1.1%)	34 (5.2%)	

¹ n (%)

² Pearson's Chi-squared test

3b. What percentage of publications from each period use AGW to argue for their importance?

Variable	No N = 1,235 ¹	Yes N = 2,027 ¹	p-value ²
period			<0.001
Pleistocene	27 (2.2%)	38 (1.9%)	
Early-Mid Holocene	71 (5.7%)	74 (3.7%)	
Ancient	164 (13%)	181 (8.9%)	
Medieval	247 (20%)	322 (16%)	
Early Modern	276 (22%)	444 (22%)	
Modern	252 (20%)	499 (25%)	
Present	198 (16%)	469 (23%)	

¹ n (%)

² Pearson's Chi-squared test

4. What percentage of publications that cover each region use global warming to argue for their significance?

Variable	Africa N = 45 ¹	Americas N = 174 ¹	Asia N = 271 ¹	Europe N = 347 ¹	Global N = 228 ¹	Middle East N = 61 ¹	Oceania N = 25 ¹	Polar N = 40 ¹	p-value ²
Uses AGW	23 (51%)	101 (58%)	182 (67%)	136 (39%)	143 (63%)	23 (38%)	16 (64%)	34 (85%)	<0.001

¹ n (%)

² Pearson's Chi-squared test

5. What percentage of publications that include lessons come from each discipline? What percentage comes from each method?

Variable	No N = 997 ¹	Yes N = 194 ¹	p-value ²
Discipline			<0.001
Archaeology	110 (11%)	39 (20%)	
Economics	3 (0.3%)	2 (1.0%)	
Epidemiology	1 (0.1%)	1 (0.5%)	
Geography	19 (1.9%)	6 (3.1%)	
History	160 (16%)	46 (24%)	
Joint Fields	175 (18%)	36 (19%)	
Literature	24 (2.4%)	11 (5.7%)	
Other	5 (0.5%)	8 (4.1%)	
Paleoclimatology	500 (50%)	45 (23%)	
Method			<0.001
Both	130 (13%)	34 (18%)	
Neither	101 (10%)	25 (13%)	
Qualitative	156 (16%)	63 (32%)	
Quantitative	610 (61%)	72 (37%)	

¹ n (%)

² Fisher's Exact Test for Count Data with simulated p-value (based on 2000 replicates); Pearson's Chi-squared test

6a. What percentage of publications in each discipline include lessons for the present/future?

Variable	Archae- ology N = 149 ¹	Eco- nomics N = 5 ¹	Epi- demiol- ogy N = 2 ¹	Geogra- phy N = 25 ¹	History N = 206 ¹	Joint Fields N = 211 ¹	Litera- ture N = 35 ¹	Other N = 13 ¹	Paleo- clima- tology N = 545 ¹	p-value ²
In- cludes lessons	39 (26%)	2 (40%)	1 (50%)	6 (24%)	46 (22%)	36 (17%)	11 (31%)	8 (62%)	45 (8.3%)	<0.001

¹ n (%)

² Fisher's Exact Test for Count Data with simulated p-value (based on 2000 replicates)

6b. What percentage of publications in each method include lessons for the present/future?

Variable	Both N = 164 ¹	Neither N = 126 ¹	Qualitative N = 219 ¹	Quantitative N = 682 ¹	p-value ²
Includes lessons	34 (21%)	25 (20%)	63 (29%)	72 (11%)	<0.001

¹ n (%)

² Pearson's Chi-squared test

7. What percentage of publications that include lessons focus on each region and period?

Variable	No N = 997 ¹	Yes N = 194 ¹	p-value ²
Geographic Region			<0.001
Africa	35 (3.5%)	10 (5.2%)	
Americas	140 (14%)	34 (18%)	
Asia	247 (25%)	24 (12%)	
Europe	304 (30%)	43 (22%)	
Global	171 (17%)	57 (29%)	
Middle East	49 (4.9%)	12 (6.2%)	
Oceania	18 (1.8%)	7 (3.6%)	
Polar	33 (3.3%)	7 (3.6%)	

¹ n (%)

² Fisher's Exact Test for Count Data with simulated p-value (based on 2000 replicates)

Variable	No N = 2,701 ¹	Yes N = 561 ¹	p-value ²
period			0.068
Pleistocene	46 (1.7%)	19 (3.4%)	
Early-Mid Holocene	115 (4.3%)	30 (5.3%)	
Ancient	292 (11%)	53 (9.4%)	
Medieval	484 (18%)	85 (15%)	
Early Modern	601 (22%)	119 (21%)	
Modern	619 (23%)	132 (24%)	
Present	544 (20%)	123 (22%)	

¹ n (%)

² Pearson's Chi-squared test

8a. What percentage of publications from each region include lessons for the present/future?

Variable	Africa N = 45 ¹	Americas N = 174 ¹	Asia N = 271 ¹	Europe N = 347 ¹	Global N = 228 ¹	Middle East N = 61 ¹	Oceania N = 25 ¹	Polar N = 40 ¹	p-value ²
Includes lessons	10 (22%)	34 (20%)	24 (8.9%)	43 (12%)	57 (25%)	12 (20%)	7 (28%)	7 (18%)	<0.001

¹ n (%)

² Fisher's Exact Test for Count Data with simulated p-value (based on 2000 replicates)

8b. What percentage of publications from each period include lessons for the present/future?

Variable	Pleis- tocene N = 65 ¹	Early-Mid Holocene N = 145 ¹	Ancient N = 345 ¹	Medieval N = 569 ¹	Early Mod- ern N = 720 ¹	Modern N = 751 ¹	Present N = 667 ¹	p-value ²
Includes lessons	19 (29%)	30 (21%)	53 (15%)	85 (15%)	119 (17%)	132 (18%)	123 (18%)	0.068

¹ n (%)

² Pearson's Chi-squared test

9a. What percentage of publications in each discipline include distinct types of recommendation?

Variable	Archae- ology N = 158 ¹	Eco- nomics N = 5 ¹	Epi- demiol- ogy N = 2 ¹	Geogra- phy N = 27 ¹	History N = 213 ¹	Joint Fields N = 217 ¹	Litera- ture N = 35 ¹	Other N = 16 ¹	Paleo- clima- tology N = 551 ¹	p-value ²
rec_ type										<0.001
Broad, ab- stract, or vague	15 (9.5%)	1 (20%)	0 (0%)	5 (19%)	27 (13%)	21 (9.7%)	8 (23%)	4 (25%)	13 (2.4%)	
Spe- cific but not ac- tionable	20 (13%)	0 (0%)	1 (50%)	2 (7.4%)	19 (8.9%)	12 (5.5%)	1 (2.9%)	3 (19%)	19 (3.4%)	
Spe- cific and action- able	13 (8.2%)	1 (20%)	0 (0%)	1 (3.7%)	7 (3.3%)	9 (4.1%)	2 (5.7%)	4 (25%)	19 (3.4%)	
No recom- menda- tion	110 (70%)	3 (60%)	1 (50%)	19 (70%)	160 (75%)	175 (81%)	24 (69%)	5 (31%)	500 (91%)	

¹ n (%)

² Fisher's Exact Test for Count Data with simulated p-value (based on 2000 replicates)

9b. What percentage of publications in each method include distinct types of recommendation?

Variable	Both N = 175 ¹	Neither N = 131 ¹	Qualitative N = 233 ¹	Quantitative N = 685 ¹	p-value ²
rec_type					<0.001
Broad, abstract, or vague	23 (13%)	11 (8.4%)	39 (17%)	21 (3.1%)	
Specific but not actionable	12 (6.9%)	11 (8.4%)	25 (11%)	29 (4.2%)	
Specific and actionable	10 (5.7%)	8 (6.1%)	13 (5.6%)	25 (3.6%)	
No recommendation	130 (74%)	101 (77%)	156 (67%)	610 (89%)	

¹ n (%)

² Pearson's Chi-squared test

10a. What percentage of publications from each region include distinct types of recommendation?

Variable	Africa N = 45 ¹	Americas N = 178 ¹	Asia N = 273 ¹	Europe N = 351 ¹	Global N = 243 ¹	Middle East N = 65 ¹	Oceania N = 28 ¹	Polar N = 41 ¹	p-value ²
rec_type									<0.001
Broad, abstract, or vague	2 (4.4%)	17 (9.6%)	7 (2.6%)	27 (7.7%)	28 (12%)	5 (7.7%)	4 (14%)	4 (9.8%)	
Specific but not actionable	3 (6.7%)	6 (3.4%)	9 (3.3%)	14 (4.0%)	28 (12%)	10 (15%)	3 (11%)	4 (9.8%)	
Specific and actionable	5 (11%)	15 (8.4%)	10 (3.7%)	6 (1.7%)	16 (6.6%)	1 (1.5%)	3 (11%)	0 (0%)	
No recommendation	35 (78%)	140 (79%)	247 (90%)	304 (87%)	171 (70%)	49 (75%)	18 (64%)	33 (80%)	

¹ n (%)

² Fisher's Exact Test for Count Data with simulated p-value (based on 2000 replicates)

10b. What percentage of publications from each period include distinct types of recommendation?

Note, because each paper can have multiple periods *and* recommendation types, there are different ways to do this. Here we just look at all combinations, which is not necessarily the best way to do this!

Variable	Pleis- tocene N = 77 ¹	Early-Mid Holocene N = 158 ¹	Ancient N = 360 ¹	Medieval N = 587 ¹	Early Mod- ern N = 743 ¹	Modern N = 775 ¹	Present N = 688 ¹	p-value ²
rec_type								0.020
Broad, abstract, or vague	11 (14%)	12 (7.6%)	23 (6.4%)	42 (7.2%)	54 (7.3%)	59 (7.6%)	47 (6.8%)	
Specific but not ac- tionable	12 (16%)	20 (13%)	29 (8.1%)	34 (5.8%)	50 (6.7%)	55 (7.1%)	53 (7.7%)	
Spe- cific and actionable	8 (10%)	11 (7.0%)	16 (4.4%)	27 (4.6%)	38 (5.1%)	42 (5.4%)	44 (6.4%)	
No rec- ommenda- tion	46 (60%)	115 (73%)	292 (81%)	484 (82%)	601 (81%)	619 (80%)	544 (79%)	

¹ n (%)

² Fisher's Exact Test for Count Data with simulated p-value (based on 2000 replicates)

11. What percentage of publications that use AGW to argue for their importance include lessons for the present/future?

Variable	No N = 533 ¹	Yes N = 658 ¹	p-value ²
Includes lessons	31 (5.8%)	163 (25%)	<0.001

¹ n (%)

² Pearson's Chi-squared test

What percentage of paleosciences/history/literature, etc. articles that use AGW to argue for their importance include lessons for the present/future?

Variable	Archae- ology N = 75 ¹	Eco- nomics N = 3 ¹	Epi- demiol- ogy N = 2 ¹	Geogra- phy N = 17 ¹	History N = 76 ¹	Joint Fields N = 90 ¹	Litera- ture N = 20 ¹	Other N = 10 ¹	Paleo- clima- tology N = 365 ¹	p-value ²
In- cludes lessons	36 (48%)	1 (33%)	1 (50%)	5 (29%)	36 (47%)	28 (31%)	9 (45%)	7 (70%)	40 (11%)	<0.001

¹ n (%)

² Fisher's Exact Test for Count Data with simulated p-value (based on 2000 replicates)

Same as above, but now broken down by region:

Variable	Africa N = 23 ¹	Americas N = 101 ¹	Asia N = 182 ¹	Europe N = 136 ¹	Global N = 143 ¹	Middle East N = 23 ¹	Oceania N = 16 ¹	Polar N = 34 ¹	p-value ²
Includes lessons	9 (39%)	30 (30%)	21 (12%)	31 (23%)	47 (33%)	11 (48%)	7 (44%)	7 (21%)	<0.001

¹ n (%)

² Fisher's Exact Test for Count Data with simulated p-value (based on 2000 replicates)

Broken down by period:

Variable	Pleistocene N = 38 ¹	Early-Mid Holocene N = 74 ¹	Ancient N = 181 ¹	Medieval N = 322 ¹	Early Modern N = 444 ¹	Modern N = 499 ¹	Present N = 469 ¹	p-value ²
Includes lessons	17 (45%)	26 (35%)	44 (24%)	74 (23%)	100 (23%)	113 (23%)	105 (22%)	0.014

¹ n (%)

² Pearson's Chi-squared test

Broken down by method:

Variable	Both N = 69 ¹	Neither N = 72 ¹	Qualitative N = 97 ¹	Quantitative N = 420 ¹	p-value ²
Includes lessons	27 (39%)	23 (32%)	48 (49%)	65 (15%)	<0.001

¹ n (%)

² Pearson's Chi-squared test

Broken down by publication type:

Variable	Lit. Review/Method Intervention N = 97 ¹	Original Research N = 561 ¹	p-value ²
Includes lessons	36 (37%)	127 (23%)	0.002

¹ n (%)

² Pearson's Chi-squared test

Broken down by publication format:

Variable	Article N = 533 ¹	Book N = 39 ¹	Book/Thesis N = 2 ¹	Chapter/Article N = 84 ¹	p-value ²
Includes lessons	114 (21%)	20 (51%)	2 (100%)	27 (32%)	<0.001

¹ n (%)

² Fisher's exact test

12. Are there journals which are particularly correlated with including lessons for the present/future?

Of the journals with 10 or more entries in our database, the following journals have the highest proportion of papers with recommendations for the present or future. However, only Climate and American Literature has a significantly higher proportion of recommendations than the average for all papers, after correcting for multiple comparisons.

```
# A tibble: 29 × 7
  journal          n_papers n_recs prop_recs    pval  p_adj significant
  <chr>          <int>  <int>    <dbl> <dbl>  <dbl> <lgl>
1 Climate and American Li...    19     9    0.474 0.00155 0.0449 TRUE
2 Proceedings of the Nati...   39    12    0.308 0.0265  0.192 FALSE
3 Global and Planetary Ch...   20     6     0.3  0.122  0.393 FALSE
4 Nature                10     3     0.3  0.214  0.402 FALSE
5 Nature Communications     10     3     0.3  0.214  0.402 FALSE
6 Environmental Research ...   11     3    0.273 0.403  0.556 FALSE
7 Geophysical Research Le...   24     6    0.25  0.265  0.404 FALSE
8 Climate Changes in the ...   14     3    0.214 0.488  0.643 FALSE
9 Climate Change and Huma...   10     2     0.2  0.671  0.695 FALSE
10 Climatic Change          25     5     0.2  0.588  0.682 FALSE
# i 19 more rows
```

13. What percentage of each publication type provides lessons versus AGW justifications?

Variable	Article N = 887 ¹	Book N = 55 ¹	Book/Thesis N = 2 ¹	Chapter/Article N = 247 ¹	p-value ²
Includes lessons	130 (15%)	26 (47%)	2 (100%)	36 (15%)	<0.001
Uses AGW	533 (60%)	39 (71%)	2 (100%)	84 (34%)	<0.001

¹ n (%)

² Fisher's Exact Test for Count Data with simulated p-value (based on 2000 replicates)

Variable	Article (combined) N = 1,134 ¹	Book N = 55 ¹	Book/Thesis N = 2 ¹	p-value ²
Includes lessons	166 (15%)	26 (47%)	2 (100%)	<0.001
Uses AGW	617 (54%)	39 (71%)	2 (100%)	0.015

¹ n (%)

² Fisher's Exact Test for Count Data with simulated p-value (based on 2000 replicates)