

From the Concept of Isothermal Lines (1817) to the Principal Causes of the Difference of Temperature on the Globe (1827–1830–1855)

– A Curated Reading Example –

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A corpus of heterogenous material is challenging if one tries to represent all relevant connections between the different materials with different authorial and publication statuses. The corpus on which the present investigation is based consists of three major parts: 1) individual notes by attendees of A. v. Humboldt's *Kosmos-Lectures* at the Berlin University and the Sing-Akademie, complemented by 2) (ideally) all related documents from Humboldt's legacy, including his manuscript for the lectures, related manuscripts, letters sent and/or received in this context, excerpts, extracts, etc. And 3) monographic publications and journal articles by Humboldt and his contemporaries.

The following example serves to illustrate the complexity and interwovenness of different types of data and documents in the aforementioned corpus. The thematic bracket will be Humboldt's ongoing occupation with the annual average temperatures and climate zones on the planet.

We will set out just before the start of the *Kosmos-Lectures* in 1827, when Humboldt gave a presentation "Über die Haupt-Ursachen der Temperatur-Verschiedenheit" (On the Principal Causes of the Difference of Temperature on the Globe) at the Royal Prussian Academy on the 3rd of July. Obviously, there is no document recording the oral presentation and, according to the BBAW database covering Humboldt's lectures at the Berlin Academy, there also is no protocol of this particular session preserved.¹ Still, we can get an idea of the content from an excerpt that Humboldt had published in the same year in Johann Christian Poggendorff's journal "Annalen der Physik".²

Four months later, on November 3rd, 1827, Humboldt opens his *Kosmos-Lectures* at the Berlin University, and another month after that, on December 6th, the parallel course at

¹ Cf. the information on Abhandlung 8: "Über die Haupt-Ursachen der Temperatur-Verschiedenheit" in <http://pom.bbaw.de/avh/>: "Protokoll fehlt in ABBAW II–V, 8."

² Humboldt 1827.

the Sing-Akademie building starts. As Humboldt’s own manuscripts for these lectures have to be considered unknown, the only accessible witnesses of the courses are the attendee’s lecture notes published since 2014 by the *Hidden Kosmos* project.

A quantitative analysis, in this case, an NLP-assisted query encompassing the *Hidden Kosmos* and Alexander von Humboldt corpus in the DTA, reveals some striking affinities between the attendee’s lecture notes and Humboldt’s article published shortly before the *Kosmos-Lectures* in the “Annalen der Physik” (cf. Fig. 1). Indeed, passages of these two independent records of two seemingly unconnected oral presentations bear a degree of similarity that can only be explained by the assumption that Humboldt used the manuscript from his Academy presentation also for his public *Kosmos-Lectures*.

The screenshot shows the DTA search interface. At the top, there is a header 'Anmelden (DTAQ)' and the DTA logo. Below that is the title 'Suche im Deutschen Textarchiv'. The search results are displayed as a list of 13 items. The search query is 'near(Europa,\$p=ADJA,Klima,3)#less_by_date'. The results are sorted by date. The first 12 results are shown, with the 13th result truncated. The results are as follows:

Hit	Source	Context	Keywords
1	[forster_reise01_1778:]	das seiner Entfernung von	Europa und seines rauhen Klima ...
2	[nn_msgermqu2345_1827:]	rührt zum Theil das	milde Klima von Europa
3	[nn_msgermqu2124_1827:]	Klima unverkennbar . Unser	Europa verdankt sein milderes Klima ...
4	[nn_oktavgfe079_1828:]	als die Westwinde .	Europa verdankt sein gemässigtetes Klima ...
5	[parthey_msgermqu1711_1828:]	Nordamerika und China .	Europa verdankt sein gemässigtetes Klima ...
6	[hufeland_privatbesitz_1829:]	Clima unverkennbar . Unser	Europa verdankt sein mittleres Klima ...
7	[humboldt_ursachen_1830:]	T. III . Unser	Europa verdankt ein milderes Klima ... Der
8	[humboldt_kosmos01_1845:]	Halbinsel es bildet .	Europa verdankt sein sanfteres Klima ...
9	[humboldt_kosmos02_1847:]	" , alle dem	Klima des südlichen Europa angeeignet ...
10	[vogt_briefe01_1851:]	den letzten Tertiärschichten auf	tropische Climate in Europa hin ...
11	[humboldt_meer_1833:]	versucht , wie das	mildere Klima von Europa größtentheils ...
12	[berg_ostasienbotanik_1866:]	der Ursprung des für	Europa's Klima so wichtigen Golfstromes ...

Fig. 1: Query results as KWIC index from the linguistic search engine in the Deutsches Textarchiv: search for the terms “Europa”, “Klima” and any attributive adjective (PoS-Tag “ADJA”) that appear “near” each other in the texts, i. e. with a maximal distance of 3 tokens.

Note that the hits 2–6 to be seen in Fig. 1 represent attendee’s note books from the *Kosmos-Lectures*, hit 7 is the article “Über die Haupt-Ursachen der Temperatur-Verschiedenheit [...]” from 1830 that will be dealt with in the following passage. Hits 8 and 9 lead us to the corresponding passages in Humboldt’s *Kosmos*, volumes I (1845) and II (1847). The similarity, at least between the keyword-in-context index (KWIC) of hits 3–8 is striking and strongly suggests instances of text re-use. Now, this hypothesis can be verified by exploring and comparing the further context of the passages from the KWIC index.

While this is an original and surprising observation in itself, as it challenges the characterisation of the *Kosmos-Lectures* as mere ‘popularisation’ in contrast to the allegedly strict

scientific background of the Academy, the context to be observed is much wider: Two years after the *Kosmos-Lectures*, in 1830, Humboldt publishes a revised version of his original article from 1827 in the Academy's own "Abhandlungen der Königlich Preussischen Akademie der Wissenschaften in Berlin".³ In this version of his text "Über die Haupt-Ursachen der Temperatur-Verschiedenheit auf dem Erdkörper", Humboldt added several new passages, which, remarkably, are also recorded in the lecture notes from the *Kosmos-Lectures*, but not present in the 1827 version of the article. For example, a whole passage has been added in the 1830 version of the article, reflecting upon the average temperature of Berlin as observed by Johann Heinrich Mädler and Johann Christian Poggendorff. Fig. 2 makes this change visible as an (automated) text comparison.

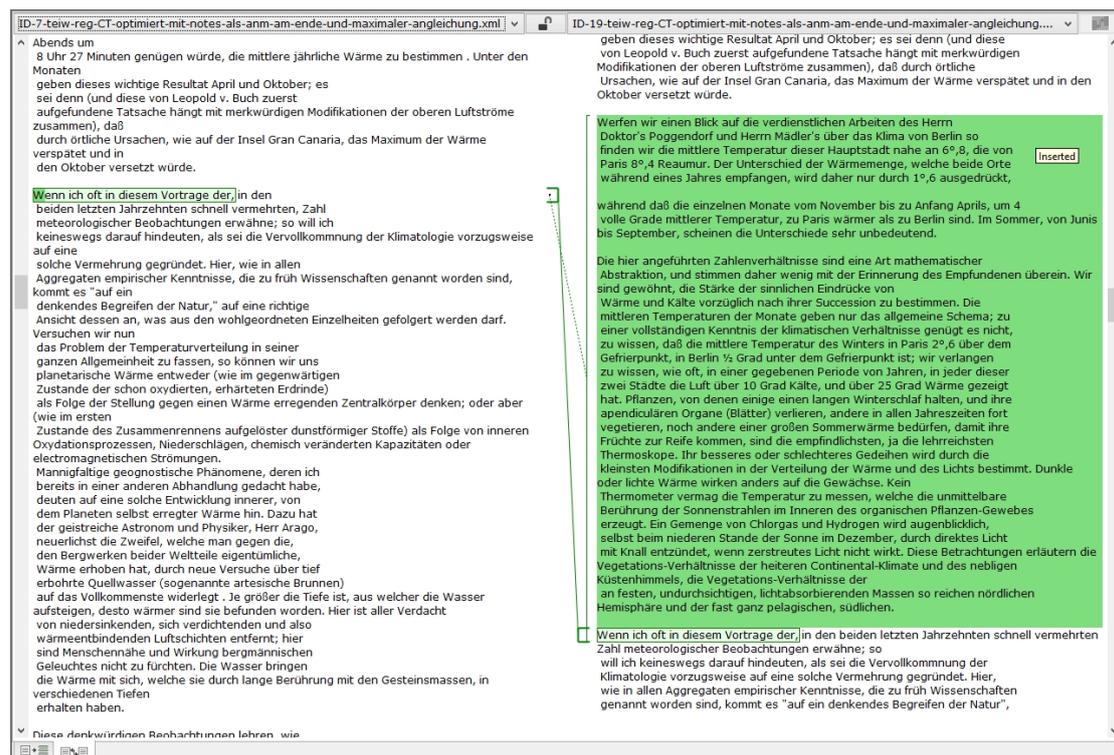


Fig. 2: Screenshot from juXta Collation Software for Scholars (<http://www.juxtasoftware.org/>): "Side-by-Side view" highlighting differences between the articles "Über die Haupt-Ursachen der Temperatur-Verschiedenheit" from 1827 resp. 1830.

With the whole legacy now digitised, we are able to track back these and other important changes in Humboldt's (re-)publications to his archive conserved in the legacy collections in Berlin and Krakow. As Mädler's and Poggendorff's findings were not published in total by 1830, i. e. at the time Humboldt was (re)writing his article from 1827, Humboldt must have gotten their observation tables in advance to work with. Indeed, he kept these tables along with several other related documents in his "Kollektaneen zum Kosmos"⁴ collection,

³ Humboldt 1830.

⁴ Cf. Erdmann/Thomas 2014 and Erdmann/Weber 2015, esp. p. 60–63.

for example this handwritten table with meticulous observations of the average temperature in Berlin between 1801 and 1825.⁵

Mittlere Temperatur
der Jahre 1801 bis 1825 zu Berlin.

	Dic.	Jan.	Feb.	Winter	Mrz.	Apr.	Mai	Frühling	Jun.	Juli	Aug.	Sommer	Sep.	Okt.	Nov.	Herbst	Jahr meteorolog.	Jahr gemeines
1801	0.39	0.29	0.72	0.24	4.12	6.94	14.26	8.48	12.36	14.55	14.20	13.75	12.84	8.56	5.34	8.31	7.61	7.68
1802	0.52	2.39	1.87	0.41	3.33	7.34	2.89	6.74	12.72	13.62	16.57	14.24	11.15	16.20	5.29	8.47	7.28	7.36
1803	1.49	6.95	2.52	1.12	2.12	3.75	10.00	7.22	12.27	11.19	16.20	15.45	10.07	6.71	3.29	6.67	7.69	6.91
1804	0.71	0.05	1.10	0.64	0.05	5.85	12.26	5.20	10.29	15.26	14.27	14.25	13.00	7.14	0.21	6.78	6.57	6.28
1805	0.24	5.20	1.64	3.27	1.80	3.01	12.72	6.63	12.20	13.98	13.17	13.13	12.24	3.63	0.03	5.33	5.35	5.72
	0.65	2.95	0.08	1.27	2.28	7.03	11.69	6.98	12.53	14.92	15.02	14.16	12.00	7.25	2.09	7.11	6.78	6.80
1806	0.22	1.15	1.24	1.20	2.47	4.07	12.35	6.32	11.47	13.31	14.02	13.12	12.24	7.04	4.08	7.12	7.14	7.38
1807	3.22	0.05	0.48	1.46	0.31	3.46	10.24	3.57	12.25	15.52	12.72	13.54	9.63	7.24	3.72	6.28	7.39	7.17
1808	1.21	0.76	0.77	0.03	4.11	4.09	12.14	3.00	10.31	16.35	15.69	15.14	11.29	5.60	1.51	6.13	6.39	6.10
1809	4.72	4.20	1.94	2.68	1.19	2.55	12.35	5.72	12.04	14.62	13.36	14.30	10.12	6.17	2.63	6.97	6.44	6.69
1810	1.91	2.57	1.56	0.66	2.82	3.48	8.42	5.82	11.80	15.11	14.53	13.23	12.29	5.23	2.70	7.15	6.39	6.51
	0.63	1.36	0.31	0.15	1.11	4.53	11.46	5.71	12.33	15.11	15.67	14.39	11.66	6.38	2.93	6.98	6.76	6.76
1811	0.26	4.22	0.22	1.37	4.29	6.74	14.43	2.31	10.40	16.10	14.41	15.00	11.11	5.37	2.36	7.23	7.74	7.13
1812	1.12	2.70	0.03	0.51	1.23	2.91	10.16	4.72	13.05	12.29	14.22	13.35	11.03	4.30	1.04	6.47	6.03	5.44
1813	5.24	2.79	2.62	2.13	2.52	7.02	10.63	7.01	12.50	15.29	12.50	13.11	11.01	3.82	2.64	6.50	6.16	6.71
1814	0.72	0.27	5.22	2.66	0.56	2.89	2.44	5.26	11.74	16.12	10.64	13.22	9.60	5.95	5.11	6.23	5.73	5.75
1815	0.94	4.20	1.44	0.75	3.09	6.41	11.21	7.17	14.34	12.12	12.43	13.31	9.22	7.52	1.92	6.41	6.53	6.35
	0.42	3.63	0.30	1.48	2.28	6.37	10.98	6.54	13.61	14.23	13.73	13.86	10.32	7.41	2.35	6.70	6.40	6.36
1816	1.63	0.64	1.97	1.39	1.60	6.64	8.62	5.64	12.10	13.24	12.41	12.22	10.10	5.23	0.66	5.56	5.67	5.75
1817	0.71	0.29	2.09	0.74	2.09	3.03	10.27	5.36	14.77	15.59	14.45	14.26	13.26	4.53	4.29	7.52	7.02	7.04
1818	0.26	0.05	0.40	0.32	3.24	7.42	11.52	7.61	14.62	15.82	13.53	14.12	11.97	6.52	2.01	6.85	7.41	7.35
1819	1.23	0.22	1.27	0.50	3.87	7.74	12.36	7.99	16.01	16.52	16.60	16.40	12.64	6.73	1.95	7.11	8.04	7.90
1820	2.23	4.67	1.64	2.32	2.26	2.41	12.27	2.64	11.35	13.03	16.23	13.57	11.02	2.13	1.04	6.77	6.42	6.42
	1.40	0.49	0.62	0.44	2.73	6.66	11.15	6.85	13.80	14.52	14.66	14.35	11.83	6.40	2.15	6.77	6.91	6.90
1821	2.20	0.07	0.23	1.02	2.47	10.71	10.22	7.80	11.56	13.65	10.22	13.16	12.74	2.29	5.22	9.03	7.29	7.13
1822	3.12	1.92	3.06	2.60	5.76	2.53	14.47	8.52	14.11	14.22	14.61	14.54	10.26	9.00	4.59	7.96	8.46	8.02
1823	2.17	3.36	0.25	4.10	3.01	4.97	10.21	6.30	13.01	12.16	15.27	13.22	11.71	2.90	4.13	8.02	6.02	6.44
1824	2.15	1.66	2.09	1.96	2.96	6.36	3.20	6.44	13.15	14.43	13.82	13.23	12.91	2.90	4.98	8.15	7.76	7.90
1825	3.21	1.91	0.76	2.12	0.24	7.63	10.75	6.32	12.66	14.26	14.27	13.92	12.19	7.69	4.42	8.11	7.62	7.62
	0.94	0.85	0.89	0.33	2.95	7.38	10.74	7.09	12.90	14.18	14.13	13.86	11.96	8.40	4.80	8.39	7.46	7.55
Summe	0.18	1.37	0.31	0.60	2.26	6.43	11.20	6.63	13.04	14.60	14.71	14.11	11.55	7.17	2.84	7.17	6.86	6.87
Paris	2.2	2.2	3.7	2.6	4.6	5.9	12.5	7.7	13.5	14.7	14.7	14.2	11.9	8.6	5.8	8.4		

Fig. 3: Johann Heinrich Mädler: “Mittlere Temperatur der Jahre 1801 bis 1825 zu Berlin.” From Humboldt’s legacy in the Berlin State Library. Humboldt, in his typical manner of annotating documents in the process of his work, has noted temperature values observed in Königsberg in the top left corner and values he got from Erman and Poggenдорff in the top right corner; additionally, he has noted corresponding values from Paris in the last row of the table.

The wider thematic context, i. e. Humboldt’s quest for the principal causes of the differences of temperature on the globe, as well as his statement that the distribution of the global temperature had been one of his major topics of interest for many years⁶ leads to

5 Mädler, J. H.: “Mittlere Temperatur der Jahre 1801 bis 1825 zu Berlin.” (Fig. 3.) For another example see Mädler’s “Tabelle mit Temperaturmessungen aus Berlin 1755–1828”. References for both can be found in the bibliographical section.

6 The 1827 article starts with the statement: “Vertheilung der Wärme auf dem Erdkörper ist seit vielen Jahren ein Haupt-Gegenstand meiner Untersuchungen gewesen”, that is repeated after a short introduction in the 1830 version, cf. Humboldt 1830, p. 3.

an earlier publication and one of the best-known examples of Humboldt's creativity and the long-lasting influence he had on generations to come: In 1817, he introduced his concept of isothermal lines and developed his legendary "Carte des Lignes Isothermes"⁷.

Humboldt continued to work with all these texts, charts, and tables until his death in 1859, as not only the respective passages in the *Kosmos* (1845–62), but also two separate printings proof dealing with the influence of sea currents on the global temperature in Marbach (Cotta Archiv)⁸ and in Krakow,⁹ but also Humboldt's own translation of the 1817 article on isothermal lines into German for his 1853 publication of several important "Kleinere Schriften"¹⁰ demonstrate.

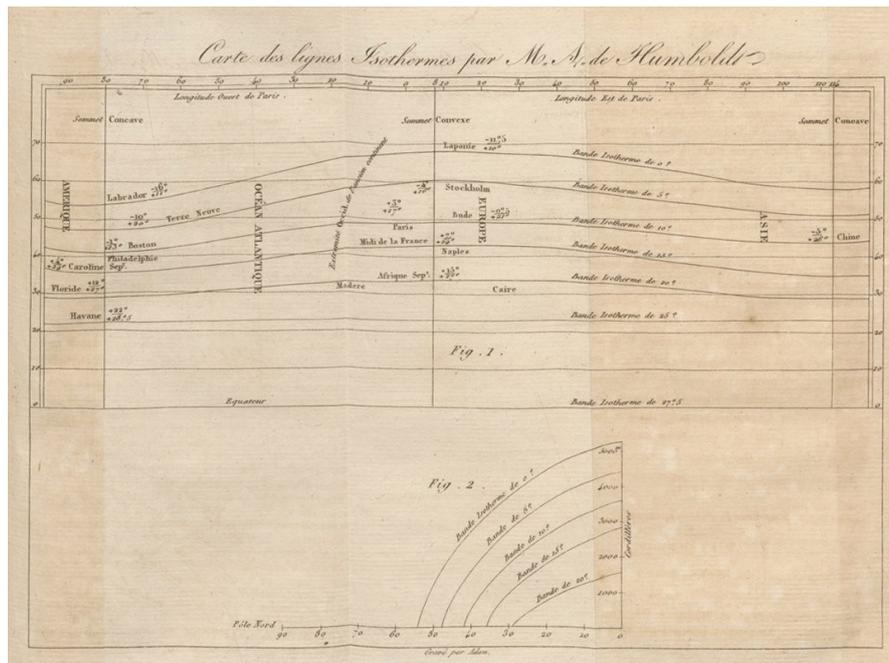


Fig. 4: "Carte des Lignes Isothermes par M. A. de Humboldt" from 1817; image retrieved from BnF/Gallica, <http://gallica.bnf.fr/ark:/12148/bpt6k6568603v/f109.image>.

The strong connections between the articles on isothermal lines resp. on the main causes of different temperatures across the globe, published in several iterations over a period of more than four decades (1817 until Humboldt's death in 1859), the unpublished *Kosmos-Lectures* and the likewise unpublished material in Humboldt's legacy are undeniable, yet they

7 First published alongside the article „Sur les lignes isothermes. Par A. de Humboldt. (Extrait)“ in 1817. Interestingly, two of the attendee's note books from the *Kosmos-Lectures* in 1827/28 also contain this chart; one is obviously cut out from a printed version of the article (http://www.deutschestextarchiv.de/parthey_msgermqu1711_1828/607) while the other scribe made a very neat and exact copy by hand (http://www.deutschestextarchiv.de/nn_msgermqu2345_1827/325). And of course, Humboldt himself also kept a copy of this important work of his, cf. SBB-PK, Nachlass Humboldt, gr. Kasten I, Mappe 8, Nr. 24, <http://resolver.staatsbibliothek-berlin.de/SBB000162900000000>.

8 Humboldt 1833.

9 Cf. Druckfahnen zum zweiten, nicht erschienenen Band der "Kleinere Schriften".

10 Humboldt 1853.

are not visible in the digitised resources itself. In order to bring to light such connections we propose a concept of *scalable reading*, which would offer different views on the corpus with varying scale and allow for a seamless movement between them.

The distant level is to provide a first overview over the whole corpus, where we observe surrogates in an abstract representation without details. Still, we might be able to identify succinct formal features of the documents, images, notes, letters, etc. Generally, this distant view can take on different forms: One possible form would be the depicted network view that shows quantitative and qualitative links. Qualitative links might be based on certain readings that have already been constructed or defined on different scales, quantitative connections could, for example, be based on correspondences between Humboldt and his contemporaries, geographical references or the affiliation to a certain publication. A variety of other organizing principles is conceivable here.

By organizing and filtering the material according to different attributes—for example by executing a keyword-in-context analysis to receive a subselection of surrogates as described before—, one can zoom in to a close level. Based on this new view, a reader will get a first impression of documents that might be connected through text re-use. These possible connections can then be assessed, verified and refined on this close scale adding qualitative connections between documents. Close reading individual surrogates might also lead to the discovery of new patterns that can be formalized and quantified as searchable patterns. In a further step, zooming out again can make visible the newly identified or refined qualitative connections as well as the distribution of the new pattern discovered, offering an insight on how this pattern is distributed over the corpus. Once more, occurrences of this pattern might have to be inspected and verified on a close scale again to define further qualitative connections between surrogates that contain this pattern. Step by step, a reading is carved out by iteratively moving between different scales of the corpus.

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