A Topography of Climate Change Research - Results

Max Callaghan[1,2]

[1]Mercator Research Institute on Global Commons and Climate Change, Torgauer Straße, 10829 Berlin, Germany
[2]School of Earth and Environment, University of Leeds, Leeds LS2 9JT, United Kingdom

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1 Results

1.1 Literature growth

	AR1	AR2	AR3	AR4	AR5	AR6
Documents	1167	8539	21716	38750	134413	201606
Words	2000	12480	23346	34637	71867	94746
New words	change (560)	oil (287)	downscaling (217)	sres (234)	biochar (1791)	mmms (313)
	climate (428)	deltac (283)	degreesc (187)	petm (95)	redd (1113)	cop21 (234)
	co2 (318)	whole (256)	ncep (130)	amf (88)	cmip5 (679)	c3n4 (214)
	climatic (289)	tax (254)	fco (107)	sf5cf3 (86)	cmip3 (587)	sdg (187)
	model (288)	landscape (249)	pfc (98)	clc (81)	mofs (299)	zika (182)
	atmospheric (281)	alternative (243)	otcs (98)	embankment (81)	sdm (297)	ndcs (168)
	effect (280)	availability (242)	dtr (95)	cwd (79)	mof (275)	indc (164)
	global (224)	life (239)	nee (89)	etm (75)	biochars (252)	indcs (134)

Table 1: Growth in climate change literature

1.2 Disciplinary structure

Label some topics particularly representative of certain disciplines, and their growth with reference to below

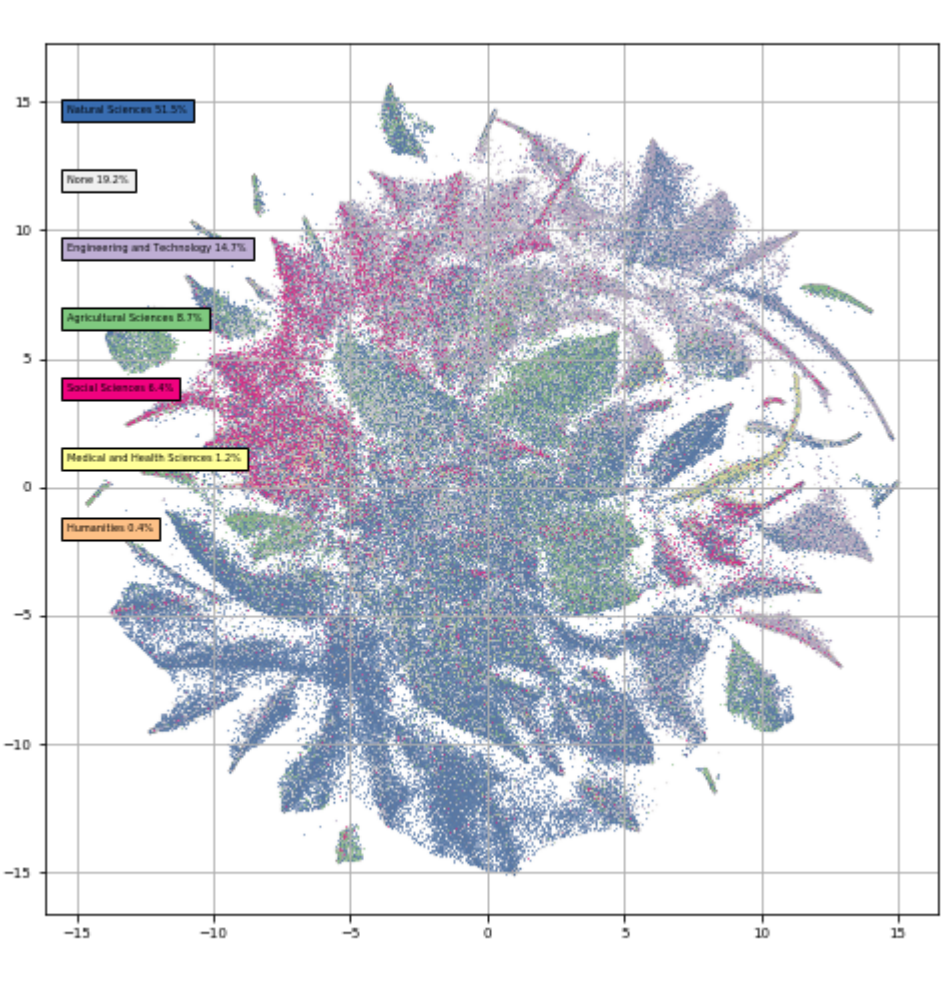

Figure 1: A map of the literature on climate change. Document positions are obtained by reducing the topic scores to two dimensions via t-SNE Documents are coloured by web of science discipline category. See SI table for topic composition of each grid square

- The thematic structure of the topics reflects journal disciplinary categories.
- Different disciplines clearly deal with different themes, although some topics are more inter-disciplinary
- Medicine has the most specialized topic distribution
- (Some examples of individual topics using the labels to be added)

Show disciplinary entropy of topics in SI, give examples

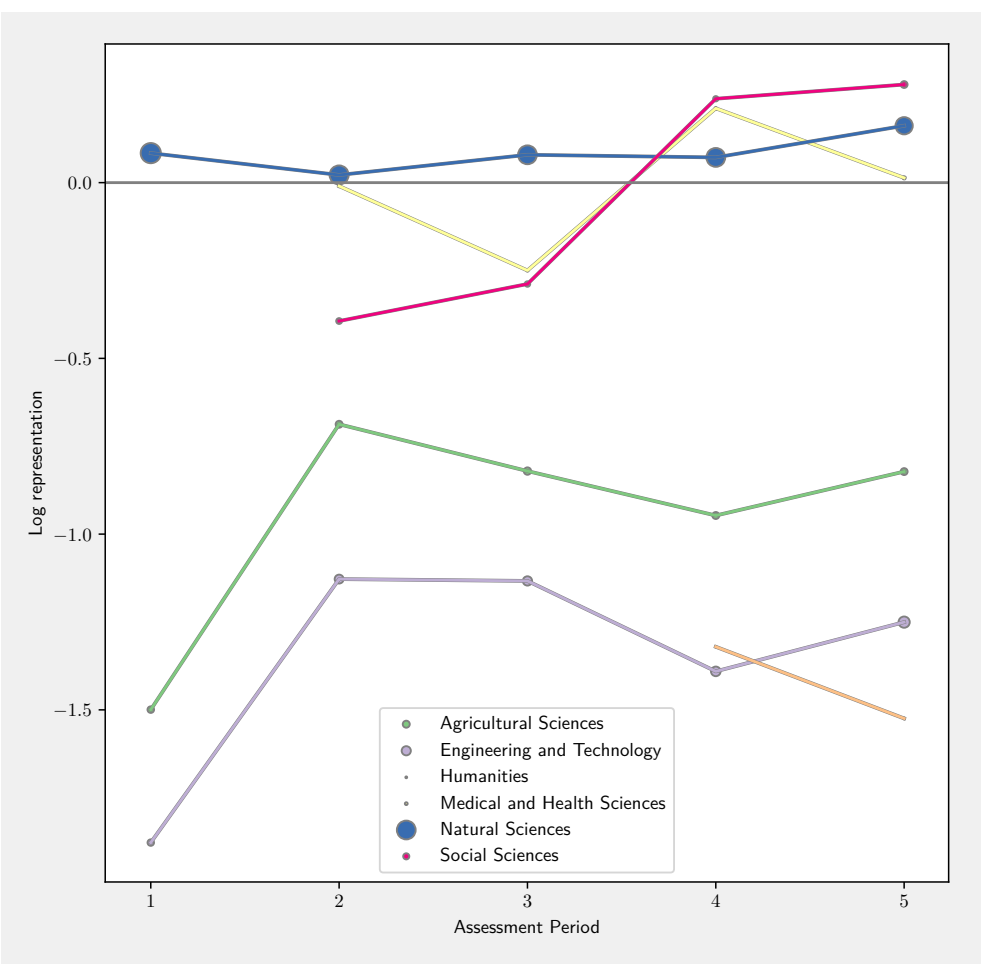

Figure 2: The representation within the IPCC of each discipline over time

- The natural sciences have always made up the greatest share of IPCC citations and documents about climate change
- The natural sciences were particularly over-represented in earlier assessment periods
- contrary to what is claimed, the natural sciences are not over-represented as compared to social sciences, these are now the most over-represented
- the disciplines that are under-represented are the agricultural sciences and engineering (also humanities to a small extent although they make up an extremely small share of all documents about climate change)
- (some examples of topics which portray this story - the ones which will be labelled above)

1.3 IPCC working group structure

Just 4 subplots, mashing together ar1-2, and 3-4

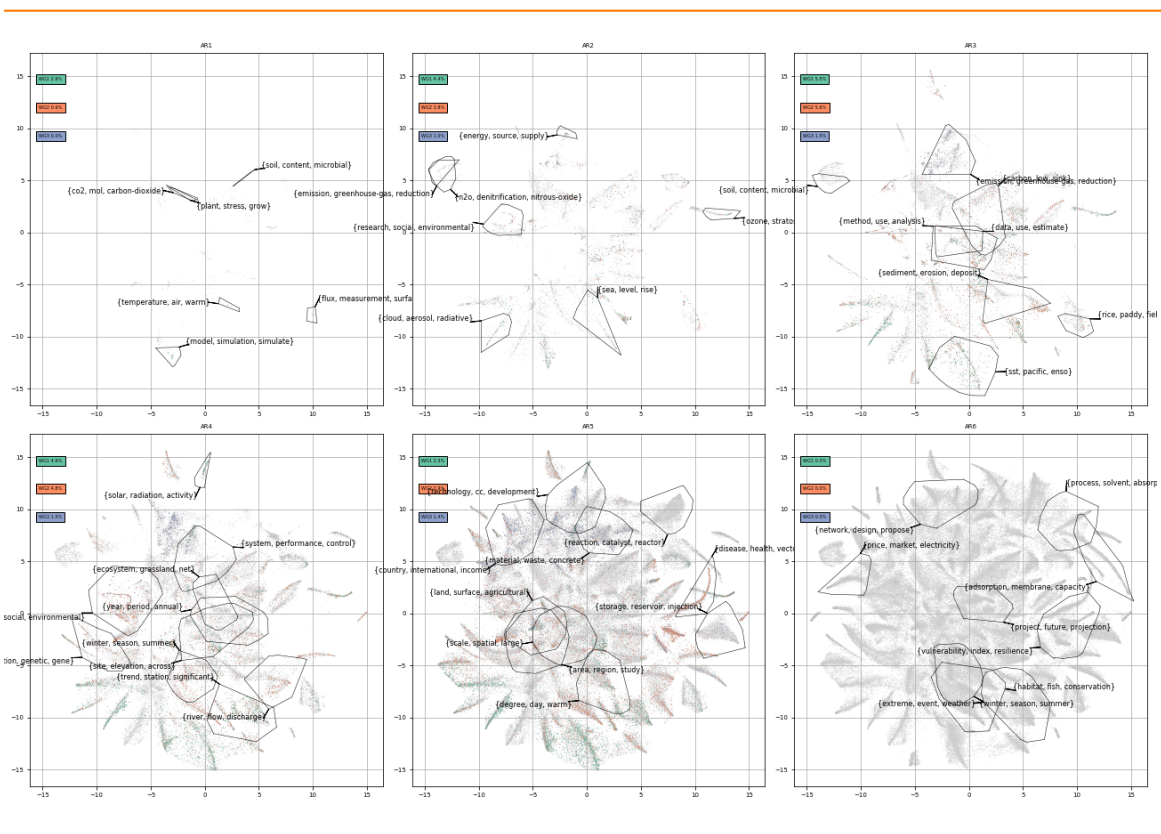

Figure 3: A map of the literature on climate change. Document positions are obtained by reducing the topic scores to two dimensions via t-SNE Documents are coloured by working group citations. In each assessment period, the largest cluster of documents relating to each of the 10 fastest growing topics is outlined.

- The thematic structure is also reflected in the division of labour between IPCC working groups. Documents cited by each working group appear in discrete parts of the map (which correspond also to the disciplinary structure)
- Some topics cut across working groups [e.g. Urban, say more about]
- Some fast growing topics [e.g. health] are well represented in IPCC [WGII], whereas others (particularly on negative emissions) are not so well represented.

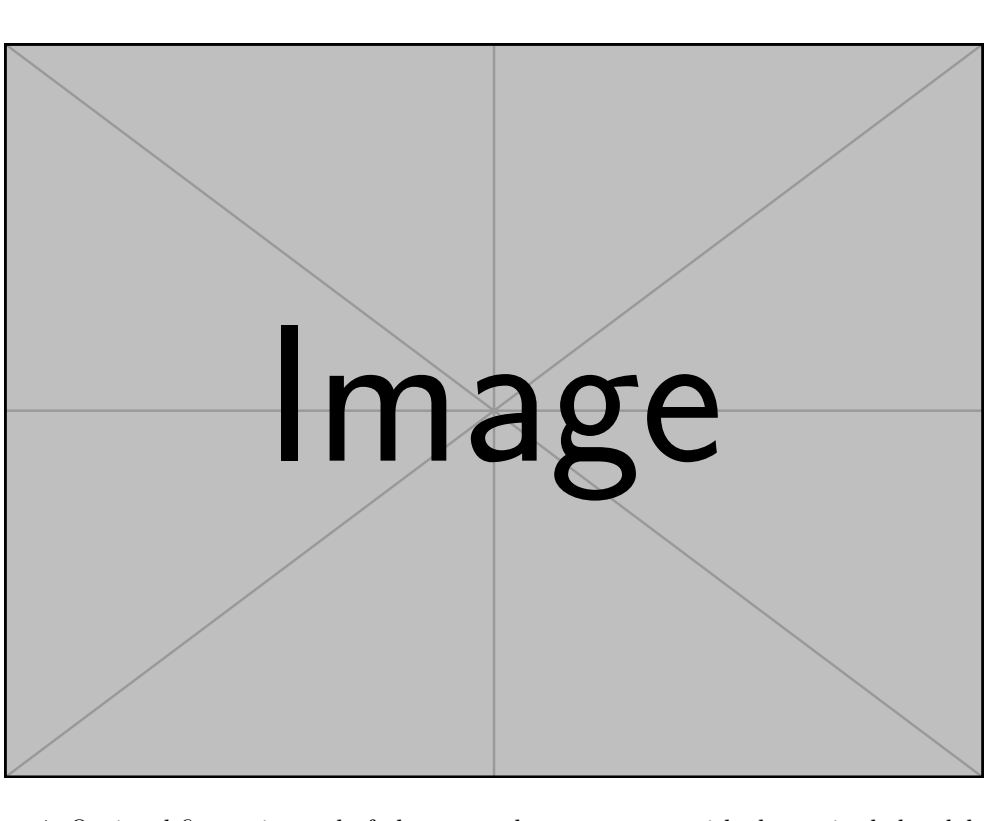

Figure 4: Optional figure, instead of above, one large wg map, with the topics below labelled

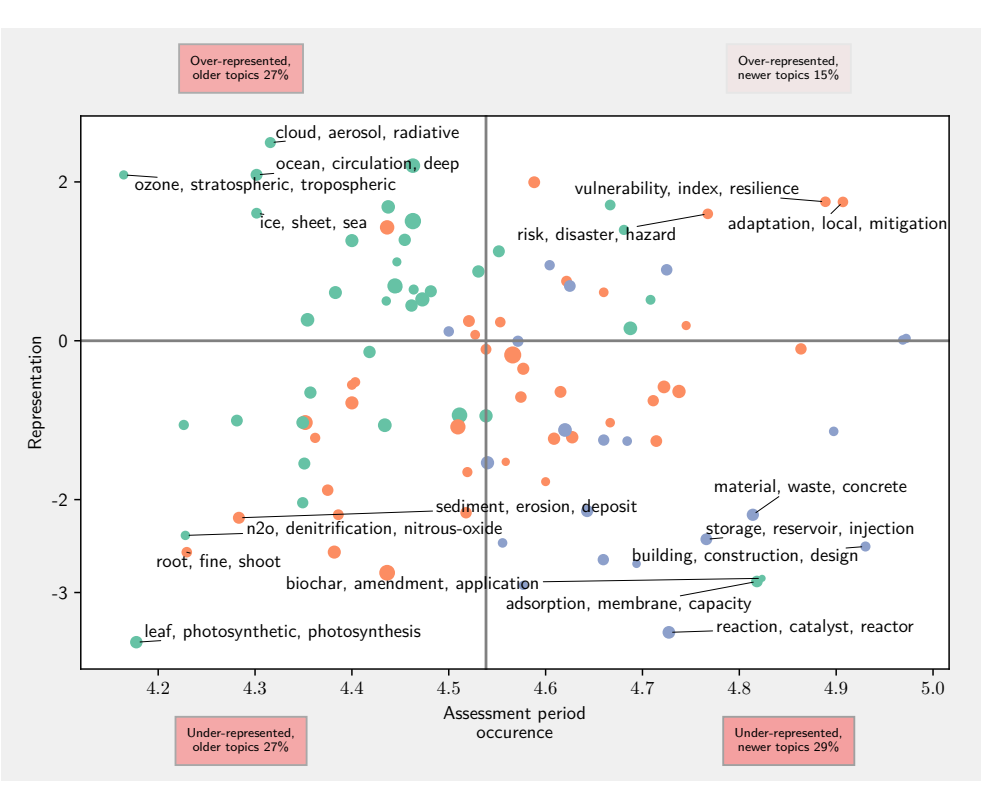

Figure 5: The IPCC representation and age of the topics. Representation shows the log of the share of topic documents in IPCC citations divided by the share of topic documents among all documents. Assessment period occurence shows the assessment period in which the mean topic document was published

- Those topics that deal with working group III issues (materials and recycling, negative emissions, buildings) are in general fast growing and under-represented in IPCC reports
- Some working group III topics (on scenarios, on policies, and on international trade and cross country comparisons) are however over-represented in IPCC reports [see SI]
- Working group I topics are in general older and better represented. Could also be same topics but new knowledge
- Of the newer topics that are well represented, many are on WG III issues [detail required]
- Are WGII better at reflecting changes in the literature?
- Another plot showing lines for each topic showing growth in literature and growth in ipcc?

2 SI

2.1 Glossary

ncep fco pfc otcs dtr sres petm amf sf5cf3 clc cwd etm cmip5 cmip3 mofs sdm mmms cop21 c3n4 sdg indc

	ipcc_share	share	representation	primary_wg	title	year_av
0	0.001476	0.005231	0.282130	3	{biochar, application, amendment}	4.750000
1	0.003186	0.008295	0.384082	3	{oil, biodiesel, palm}	4.695652
2	0.002360	0.007757	0.304271	3	{power, generation, electricity}	4.659091
3	0.006647	0.013308	0.499460	3	{energy, consumption, demand}	4.651163
4	0.011804	0.009582	1.231926	3	{policy, tax, sector}	4.651163
5	0.002172	0.007335	0.296183	3	{vehicle, electric, transport}	4.634146
6	0.001146	0.007246	0.158202	3	{hydrogen, catalyst, cell}	4.632653
7	0.002137	0.005510	0.387745	3	{soc, stock, soil}	4.630435
8	0.002861	0.011114	0.257421	3	{cement, material, concrete}	4.627907
9	0.010778	0.011162	0.965569	3	{cost, price, technology}	4.600000
10	0.016243	0.012001	1.353438	3	{country, develop, international}	4.595745
11	0.001480	0.005529	0.267688	3	{coal, combustion, technology}	4.588235
12	0.001508	0.006596	0.228565	3	{waste, landfill, treatment}	4.586957
13	0.003876	0.007937	0.488317	3	{fuel, fossil, engine}	4.560000
14	0.018589	0.017141	1.084467	3	{emission, ghg, reduction}	4.551020
15	0.010033	0.010648	0.942243	3	{carbon, low, sink}	4.530612
16	0.019166	0.009443	2.029604	2	{adaptation, vulnerability, farmer}	4.783784
17	0.004838	0.006800	0.711486	2	{urban, city, urbanization}	4.764706
18	0.002535	0.007666	0.330639	2	{building, design, construction}	4.717949
19	0.014287	0.011136	1.282994	2	{risk, disaster, vulnerability}	4.700000
20	0.001672	0.007167	0.233350	2	{adsorption, capacity, adsorbent}	4.675676
21	0.006691	0.011923	0.561208	2	{china, province, chinese}	4.675000
22	0.003102	0.009564	0.324295	2	{genetic, diversity, gene}	4.674419
23	0.003612	0.009224	0.391591	2	{storage, reservoir, injection}	4.659574
24	0.005945	0.005535	1.074085	2	{coral, reef, bleaching}	4.653061
25	0.007807	0.011444	0.682218	2	{management, resource, conservation}	4.651163
26	0.007568	0.010597	0.714164	2	{population, size, habitat}	4.645833
27	0.009763	0.008601	1.135212	2	{health, disease, human}	4.644444
28	0.020933	0.027325	0.766059	2	{research, social, issue}	4.644444
29	0.009519	0.013136	0.724671	2	{specie, distribution, habitat}	4.638298
30	0.003110	0.011201	0.277666	2	{process, membrane, solvent}	4.636364
31	0.005697	0.008857	0.643292	2	{community, microbial, composition}	4.627907
32	0.009337	0.013307	0.701647	2	{environmental, impact, life}	4.627907
33	0.005229	0.005866	0.891301	2	{drought, stress, index}	4.609756
34	0.005803	0.005757	1.007890	2	{flood, flooding, damage}	4.604651
35	0.010915	0.014922	0.731477	2	{production, food, farm}	4.600000
36	0.003627	0.006461	0.561418	2	{groundwater, recharge, aquifer}	4.600000
37	0.020661	0.009868	2.093696	2	{scenario, future, project}	4.595745
38	0.007511	0.011614	0.646723	2	{system, performance, design}	4.586957
39	0.006552	0.008477	0.772935	2	{river, basin, flow}	4.571429
40	0.004917	0.004751	1.034883	2	{fire, burn, wildfire}	4.568627
41	0.013464	0.015880	0.847837	2	{area, region, distribution}	4.565217
42	0.015998	0.010870	1.471793	2	{extreme, event, weather}	4.565217
43	0.012221	0.011233	1.087930	2	{ecosystem, terrestrial, net}	4.562500
44	0.008284	0.008467	0.978463	2	{crop, yield, wheat}	4.558140
45	0.006225	0.005740	1.084623	2	{runoff, catchment, hydrological}	4.551020
46	0.004990	0.007132	0.699621	2	{wetland, marsh, habitat}	4.520833
47	0.008846	0.006869	1.287774	2	{rainfall, monsoon, rain}	4.520000
48	0.010155	0.012861	0.789619	2	{water, resource, irrigation}	4.510638
49	0.005098	0.008187	0.622666	2	{biomass, aboveground, bioenergy}	4.480000
50	0.007313	0.012833	0.569862	2	{site, elevation, high}	4.471698
51	0.007674	0.008303	0.924322	2	{forest, stand, tropical}	4.470588
52	0.004958	0.007752	0.639595	2	{tree, ring, stand}	4.470588
53	0.026598	0.014656	1.814824	2	{change, climatic, response}	4.452830
54	0.004392	0.009012	0.487355	2	{plant, seed, stress}	4.450980
55	0.010987	0.012667	0.867345	2	{rate, litter, decomposition}	4.442308
56	0.009974	0.013288	0.750552	2	{growth, economic, relationship}	4.437500
57	0.009435	0.018665	0.505501	2	{soil, moisture, microbial}	4.433962
58	0.022989	0.019927	1.153663	2	{increase, concentration, effect}	4.431373
59	0.004003	0.007631	0.524600	2	{lake, level, diatom}	4.425926
60	0.008672	0.008962	0.967600	2	{vegetation, ndvi, index}	4.423077
61	0.003778	0.010649	0.354791	2	{sediment, erosion, core}	4.418182
62	0.003259	0.005365	0.607542	2	{rice, paddy, field}	4.413043
63	0.001751	0.004899	0.357442	2	{root, fine, litter}	4.327273
64	0.003527	0.007666	0.460028	2	{leaf, photosynthesis, photosynthetic}	4.232143
65	0.009283	0.016805	0.552391	1	{method, use, approach}	4.613636
66	0.027283	0.012961	2.105020	1	{uncertainty, estimate, projection}	4.591837
67	0.015975	0.009220	1.732693	1	{trend, station, significant}	4.580000
68	0.008020	0.007699	1.041678	1	{wind, speed, turbine}	4.571429
69	0.028312	0.023966	1.181354	1	{scale, spatial, variability}	4.571429
70	0.005978	0.007061	0.846558	1	{heat, wave, stress}	4.568182
71	0.011383	0.014051	0.810092	1	{data, use, satellite}	4.510204
72	0.013545	0.009377	1.444487	1	{land, cover, agricultural}	4.510204
73	0.017351	0.014745	1.176686	1	{degree, day, latitude}	4.500000
74	0.030144	0.013012	2.316559	1	{climate, future, global}	4.490566
75	0.017550	0.008862	1.980422	1	{arctic, warm, tundra}	4.481481
76	0.030064	0.017317	1.736093	1	{model, simulation, simulate}	4.480000
77	0.003953	0.008421	0.469484	1	{gas, natural, hydrate}	4.480000
78	0.015667	0.009617	1.629061	1	{precipitation, annual, moisture}	4.480000
79	0.016265	0.009344	1.740611	1	{sea, level, rise}	4.471698
80	0.018413	0.012939	1.423031	1	{temperature, warm, air}	4.470588
81	0.011250	0.009070	1.240376	1	{permafrost, thaw, layer}	4.460000
82	0.016362	0.013899	1.177200	1	{year, season, period}	4.454545
83	0.006649	0.004792	1.387340	1	{glacier, mass, balance}	4.444444
84	0.009897	0.007431	1.331933	1	{snow, cover, winter}	4.444444
85	0.002615	0.005658	0.462152	1	{cal, pollen, holocene}	4.440678
86	0.008515	0.007036	1.210228	1	{solar, radiation, irradiance}	4.423077
87	0.025430	0.011594	2.193472	1	{pacific, sst, enso}	4.410714
88	0.003498	0.006519	0.536520	1	{delta, isotope, value}	4.406780
89	0.018381	0.005610	3.276517	1	{aerosol, forcing, radiative}	4.362069
90	0.020180	0.011032	1.829170	1	{ozone, air, stratospheric}	4.357143
91	0.010142	0.013020	0.778990	1	{co2, mol, concentration}	4.346154
92	0.011092	0.011639	0.953008	1	{record, glacial, late}	4.338710
93	0.010530	0.010335	1.018868	1	{flux, measurement, surface}	4.327869
94	0.014068	0.005863	2.399568	1	{cloud, feedback, radiative}	4.315789
95	0.002732	0.006355	0.429918	1	{n2o, denitrification, emission}	4.313725
96	0.012937	0.005966	2.168370	1	{ice, sheet, sea}	4.285714
97	0.024596	0.009525	2.582329	1	{ocean, surface, deep}	4.278689
98	0.006208	0.007005	0.886203	1	{methane, oxidation, source}	4.267857
99	0.004046	0.005705	0.709267	1	{ch4, oxidation, emission}	4.265306

Table 2: Top 10 topics in climate change literature

title	top words	top docs	share
climat, chang, impact	[climat, chang, impact, respons, futur, effect, shift, sensit, affect, may]	Climate oscillations and changes over Russia; World Regionalization of Climate Change (1961-2010)	2.73%
soil, moistur, microbi	[soil, moistur, microbi, organ, respir, content, miner, depth, matter, efflux]	PARTITIONING OF SOIL RESPIRATION IN A FIRST ROTATION BEECH PLANTATION; Responses of soil respiration to N fertilization in a loamy soil under maize cultivation	2.73%
emiss, reduct, reduc	[emiss, reduct, reduc, greenhous, factor, total, estim, inventori, nox, measur]	China's CH4 and CO2 emissions: Bottom-up estimation and comparative analysis; Monitoring total emissions from industrial installations	2.21%
carbon, dioxid, sequestr	[carbon, dioxid, sequestr, sink, organ, cycl, storag, stock, terrestri, atmospher]	Interpreting carbon-isotope excursions: carbonates and organic matter; PARTICULATE FLUXES OF CARBONATE AND ORGANIC-CARBON IN THE OCEAN - IS THE MARINE BIOLOGICAL-ACTIVITY WORKING AS A SINK OF THE ATMOSPHERIC CARBON	1.74%
temperatur, air, mean	[temperatur, air, mean, surfac, minimum, maximum, daili, increas, effect, degreesc]	Observed changes in shallow soil temperatures in Northeast China, 1960-2007; Beyond the Mean: Biological Impacts of Cryptic Temperature Change	1.71%
record, dure, glacial	[record, dure, glacial, reconstruct, last, period, holocen, event, late, core]	HIGH-RESOLUTION CLIMATE RECORDS FROM THE NORTH-ATLANTIC DURING THE LAST INTERGLACIAL; HIGH-RESOLUTION CLIMATIC INFORMATION FROM SHORT FIRN CORES, WESTERN DRONNING MAUD LAND, ANTARCTICA	1.7%
speci, distribut, rang	[speci, distribut, rang, rich, invas, nich, predict, extinct, shift, abund]	Northward range extensions of some mesopelagic fishes in the Northeastern Atlantic; Natural occurrence and backwater infection of C-4 plants in the vegetation of the Yangtze hydropower Three Gorges Project region	1.7%
increas, concentr, decreas	[increas, concentr, decreas, effect, atmospher, doc, result, organ, nutrient, may]	TERRESTRIAL HIGHER-PLANT RESPONSE TO INCREASING ATMOSPHERIC [CO2] IN RELATION TO THE GLOBAL CARBON-CYCLE; Hydrological response to climate change in the Black Hills of South Dakota, USA	1.61%
forest, tropic, stand	[forest, tropic, stand, deforest, disturb, stock, boreal, redd, harvest, wood]	Spatially explicit estimates and temporal changes of forest tree biomass in a typical department of forest management, Turkey; Analysis of the changes in forest ecosystem functions, structure and composition in the Black Sea region of Turkey	1.56%
energi, renew, consumpt	[energi, renew, consumpt, effici, demand, save, sector, sourc, industri, use]	Energy issues and energy priorities; Energy efficiency and CO2 emissions in Swedish manufacturing industries	1.56%

Table 3: Top 10 topics in climate change literature