

A Topography of Climate Change Research

Max Callaghan

with Jan Minx, Piers Forster



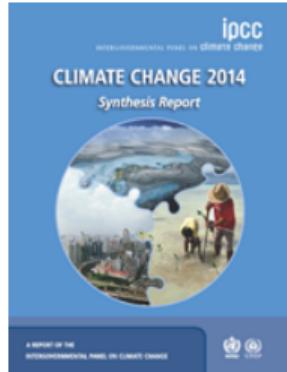
January 27, 2019

Introduction



Figure: Portrait of map-makers, Gerardus Mercator and Jodocus Hondius (Jodocus Hondius) source: Wikipedia Commons

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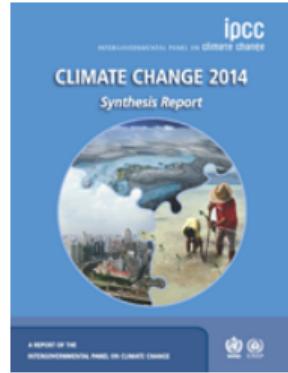
- The IPCC has a *cartographic* role at the science policy interface (Edenhofer and Minx, 2014; Edenhofer and Kowarsch, 2015)

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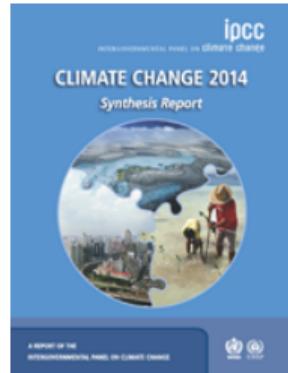


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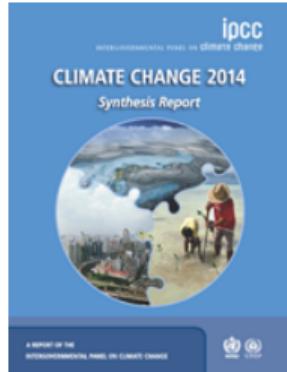
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- A topography is a description of a landscape
- Topics (from the Greek “topos”, place) can describe the features of a body of text

Outline

1 Motivation

2 Methods

3 Results

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Context - Big Literature

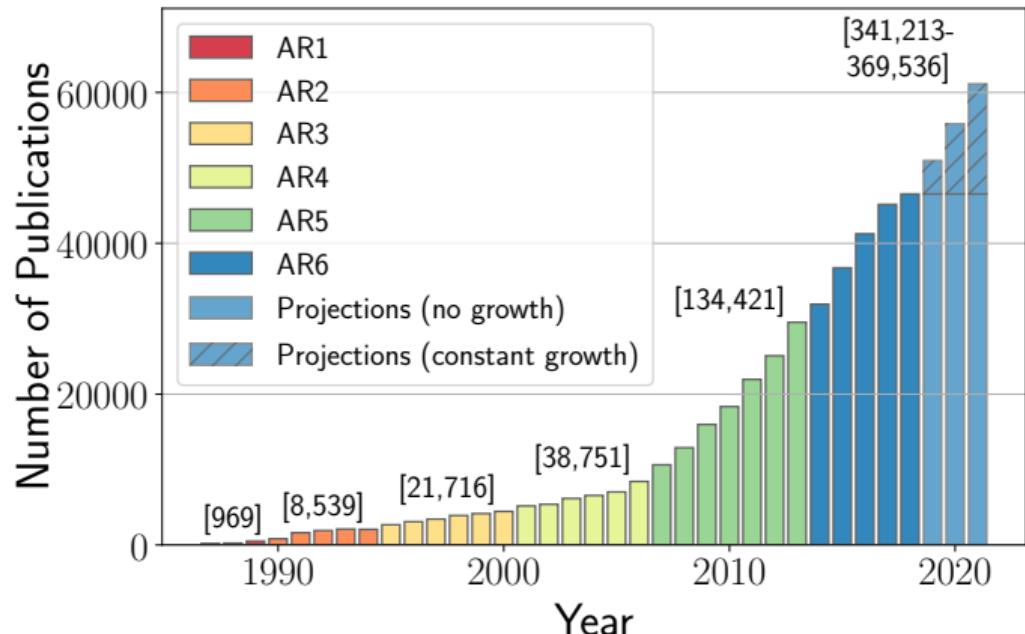


Figure: Articles on climate change in the Web of Science

A challenge for

- Global environmental assessments
- Our understanding of global environmental assessments
- Evidence synthesis more generally

The IPCC in the age of Big Literature

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The IPCC in the age of Big Literature

- We entrust the IPCC with providing a *comprehensive and transparent* assessment of the literature
- Although IPCC reports cite ever greater numbers of papers, this number decreases in proportion to the number of papers in literature

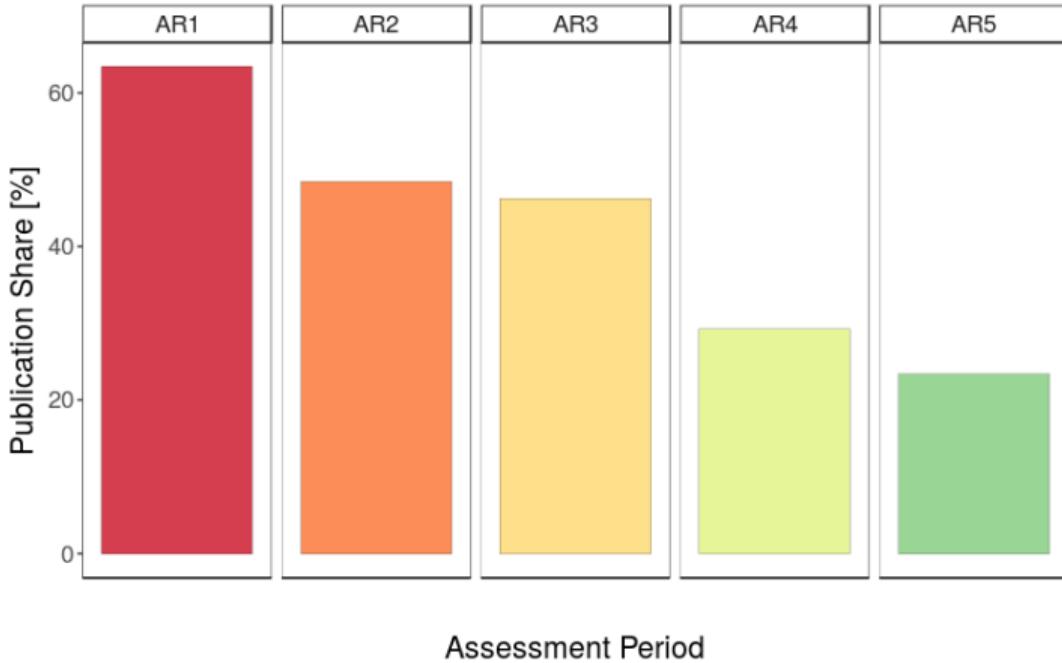


Figure: (Minx et al., 2017)

What Do We Know About the IPCC?

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Embed the social sciences in climate policy

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Figure: (David G. Victor, 2015)

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- The evidence is simply the relative shares of the different disciplines in IPCC citations

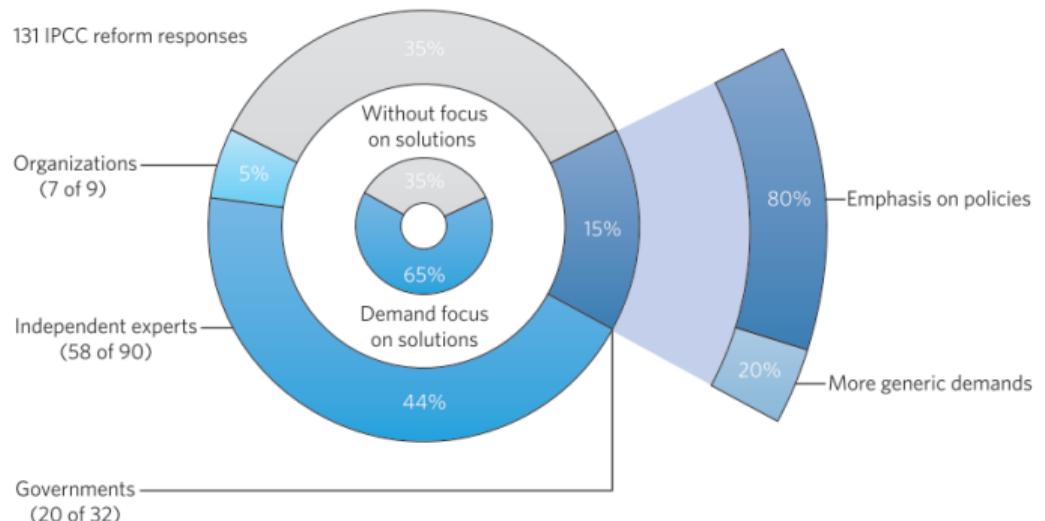


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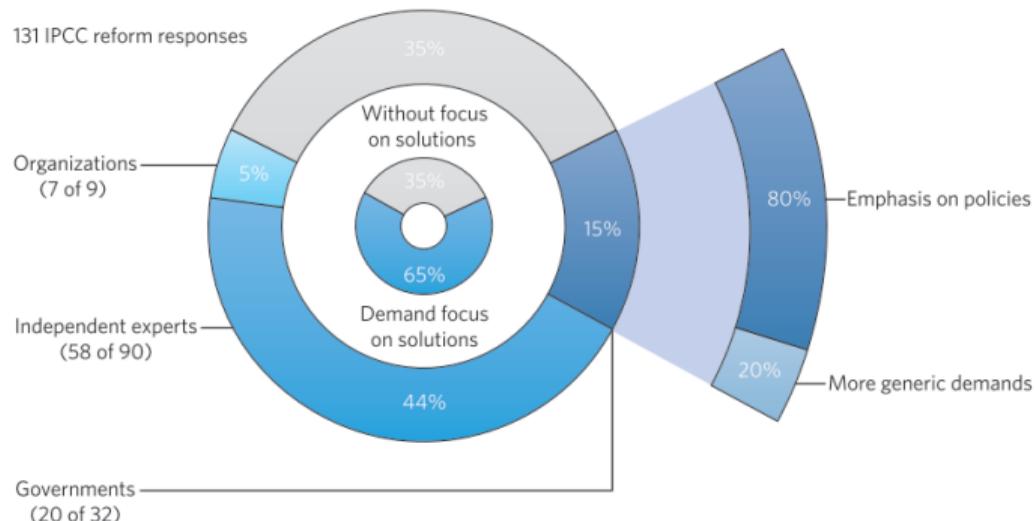
The Age of Climate Solutions?



- Demand for solutions is increasing

Figure: (Kowarsch et al., 2017)

The Age of Climate Solutions?



- Demand for solutions is increasing
- We know little about the supply of solutions in the literature

Figure: (Kowarsch et al., 2017)

1 Motivation

2 Methods

3 Results

Investigating bibliometric and text data

To understand the representation of social science and solutions relevant knowledge in IPCC reports, we look at journal classification and document abstracts

Data:

400,000 papers on climate change from the Web of Science (query following Grieneisen and Zhang (2011)), matched with 70,000 IPCC citations (Using Doc2Vec)

Topic modelling:

We use topic modelling (with NMF (Lee and Seung, 1999)) to understand the thematic content of papers

Topographic mapping:

We project the documents' topical locations into 2 dimensions using t-SNE (van der Maaten and Hinton, 2008)

Measuring representation:

We compare the proportions of categories of documents in the whole of the literature with the subset of the literature that is cited by the IPCC

Words, words, words

	AR1	AR2	AR3	AR4	AR5	AR6
Years	1986-1989	1990-1994	1995-2000	2001-2006	2007-2013	2014-
Documents	1,167	8,539	21,716	38,750	134,413	201,606
Unique words	2,000	12,480	23,346	34,637	71,867	94,746
New words	change (560)	oil (287)	downscaling (217)	sres (234)	biochar (1,791)	mmms (313)
	climate (428)	deltac (283)	degreesc (187)	petm (95)	redd (1,113)	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: Growth in climate change literature

Data from WoS Core Collection, query following Grieneisen and Zhang (2011)

Approach - What is the matter?

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V is approximated by the product of W and H

$V: 8769 \times 3495$



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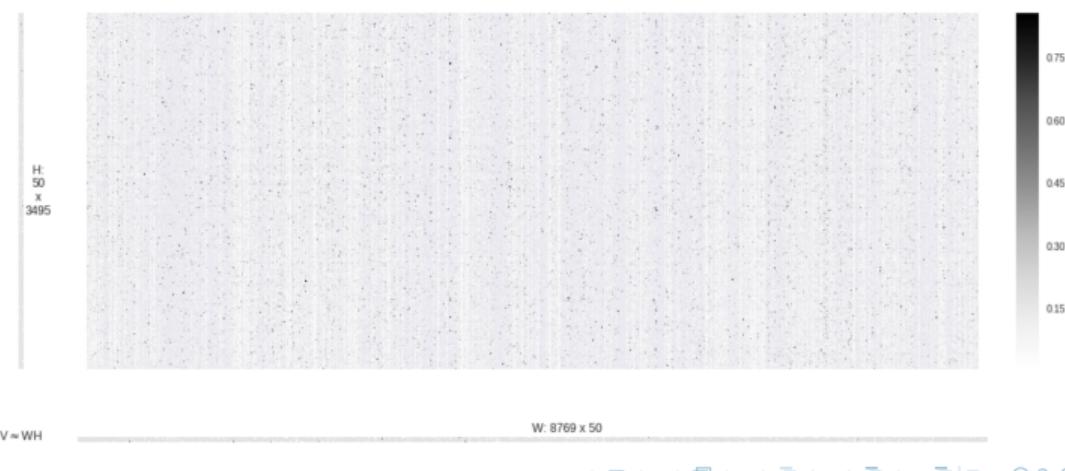
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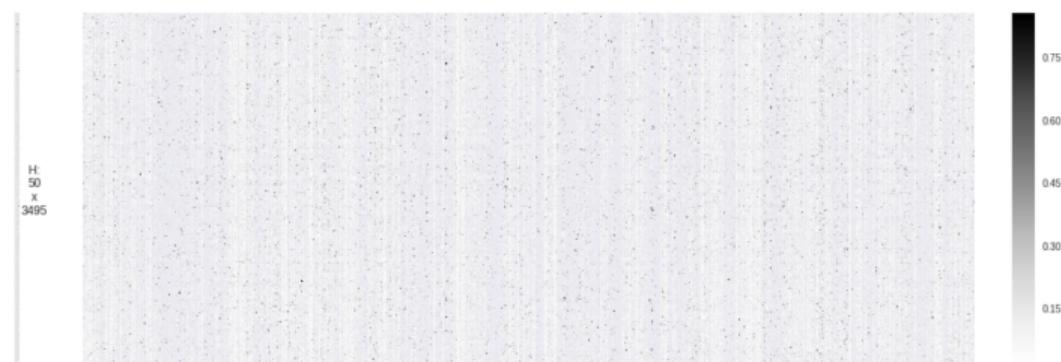
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- A document's topic scores describe its association with each topic

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Doc Topic Example

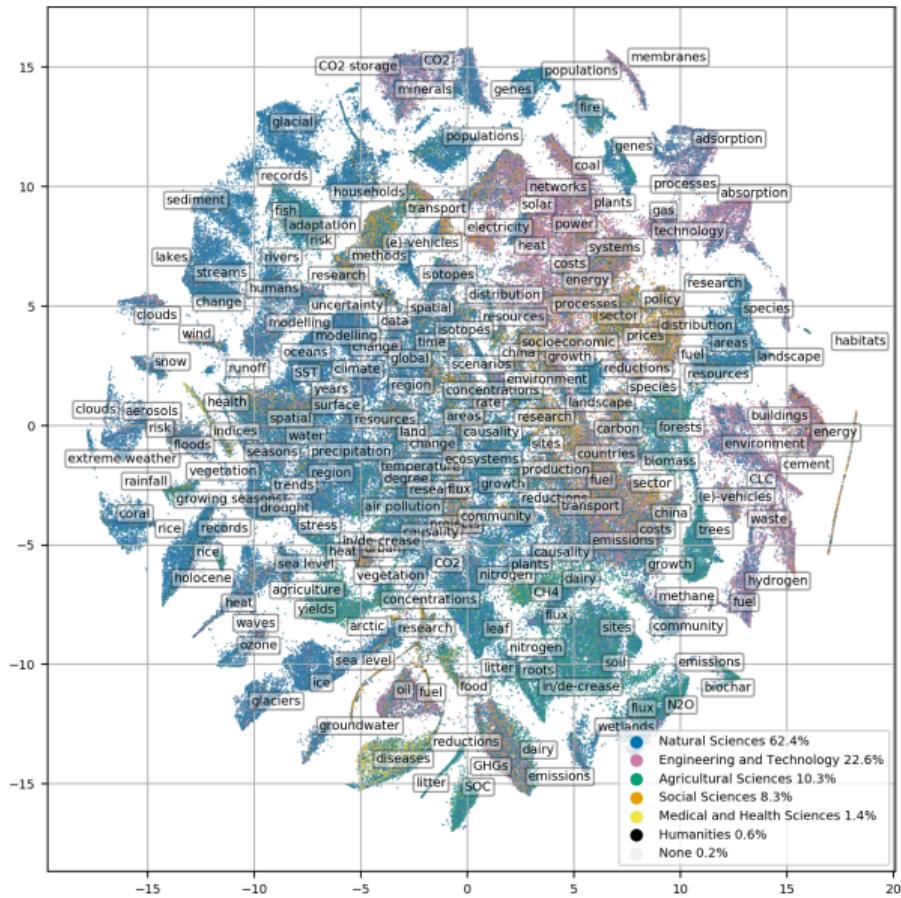


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2 Methods

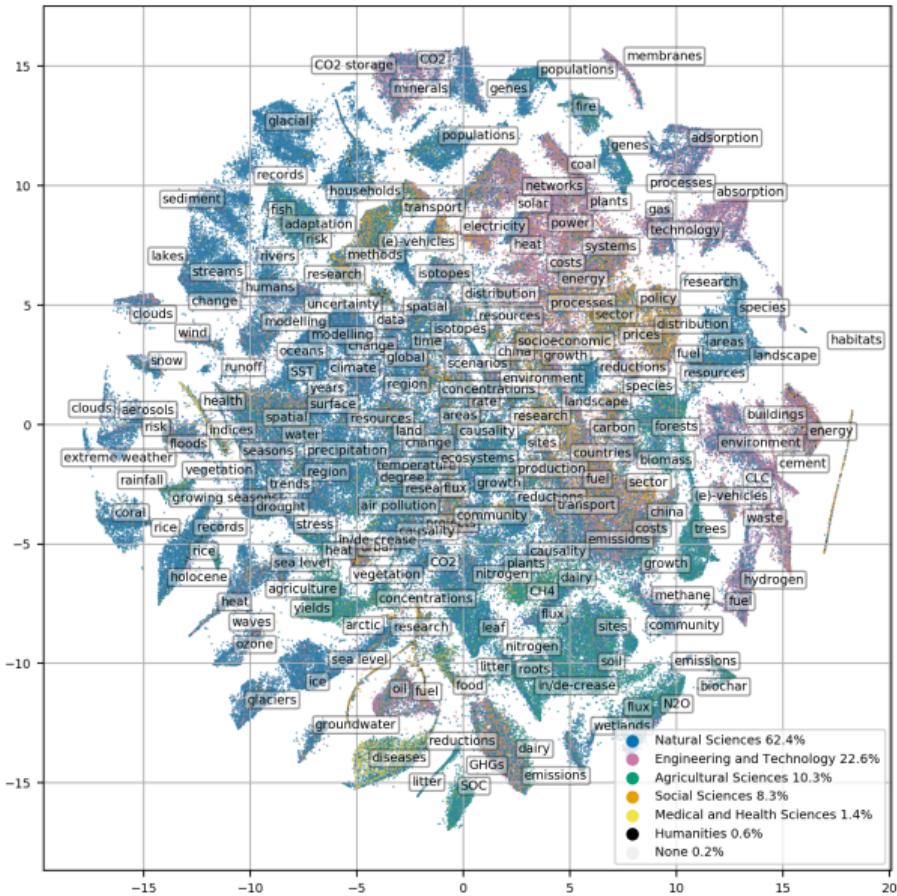
3 Results

A Topography of Climate Change Literature



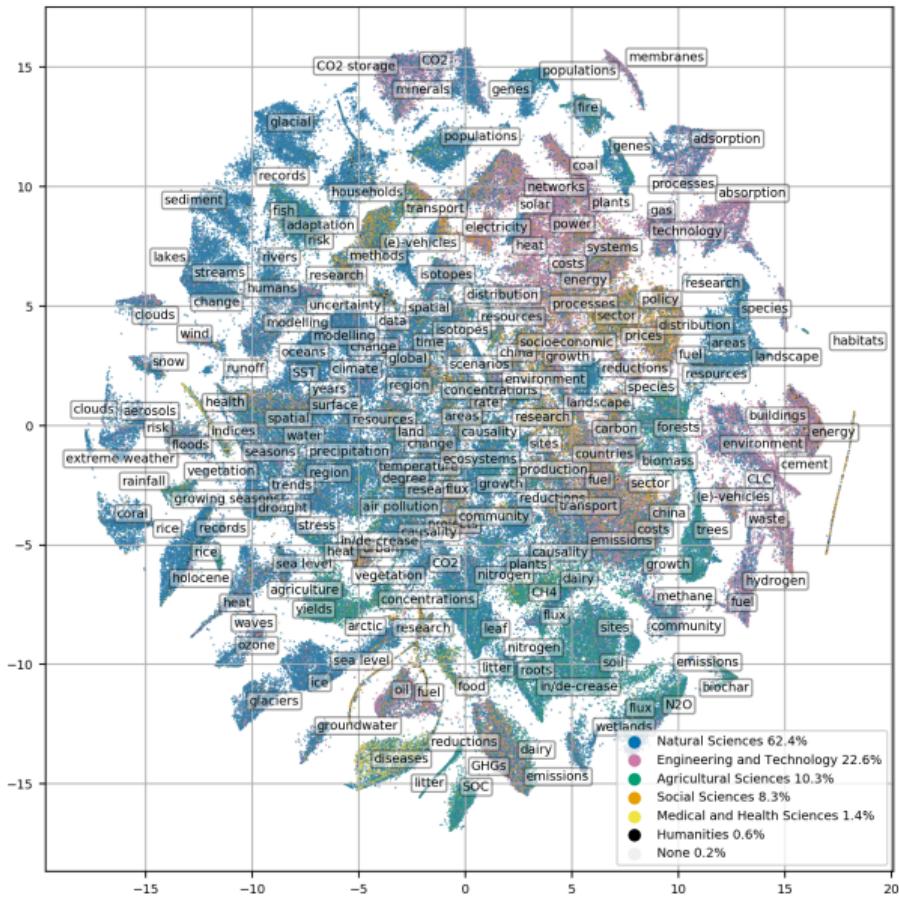
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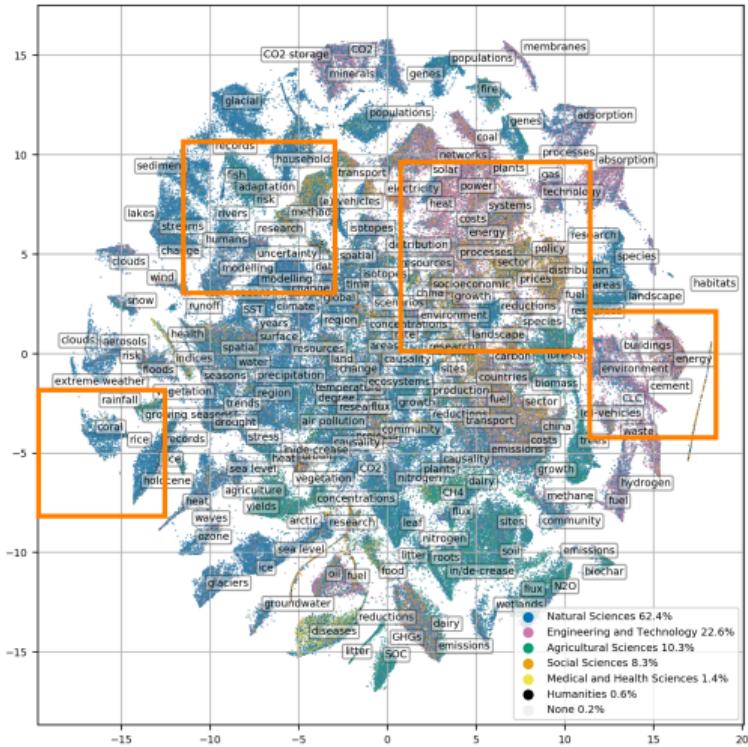


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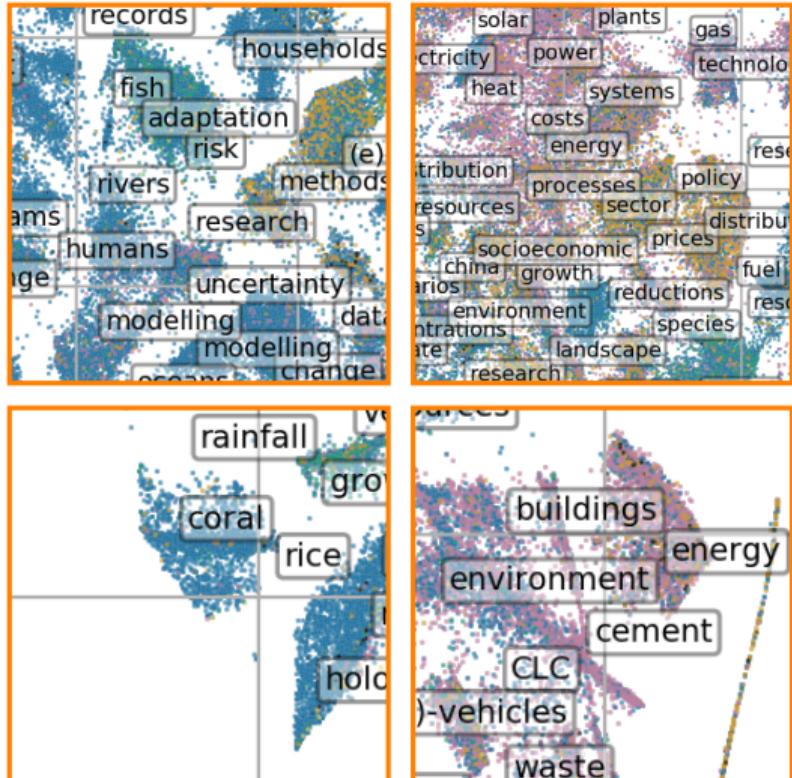
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- We can see the preponderance of natural sciences, and the greater or lesser clustering of disciplines in certain topic areas

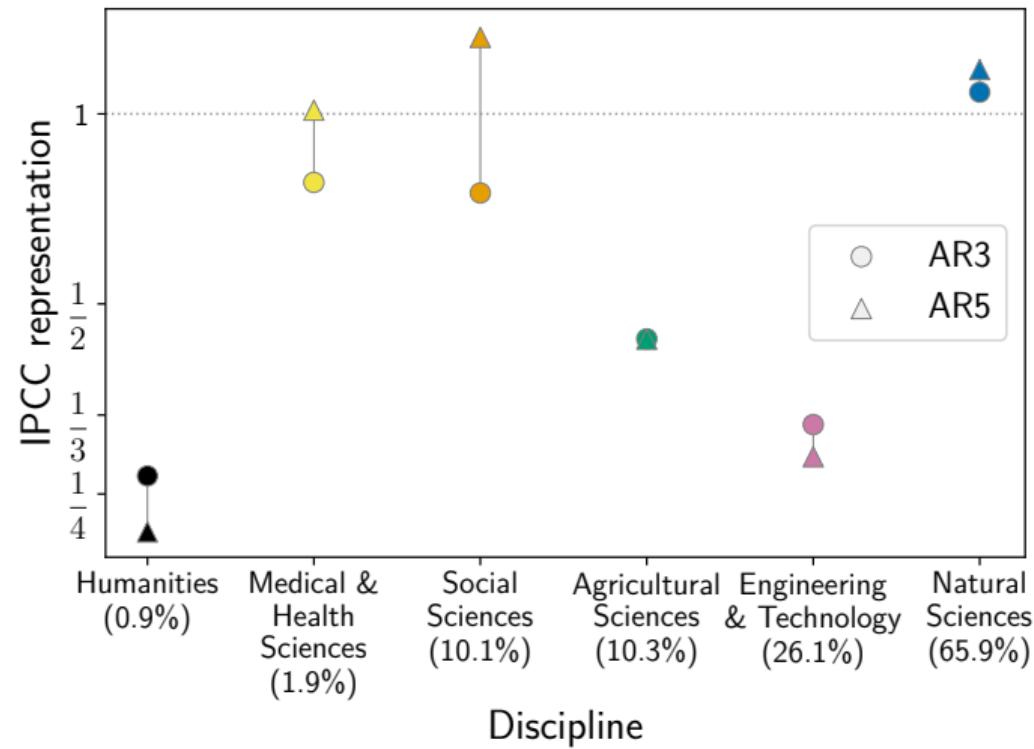


(a)



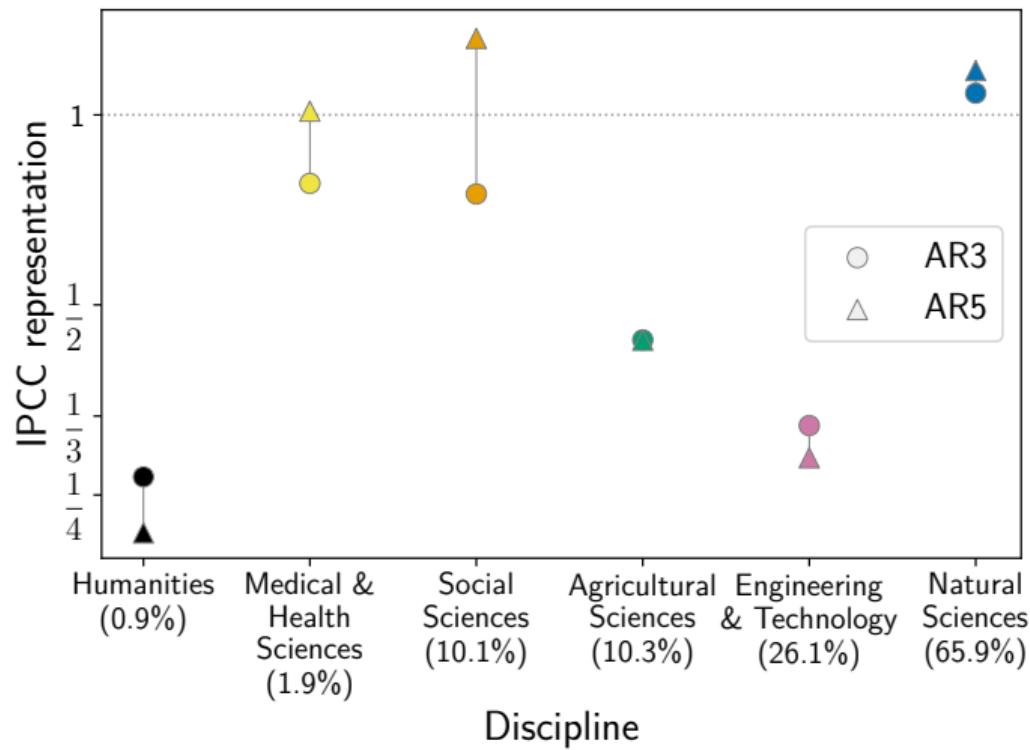
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- The social sciences were under-represented in AR3, but by AR5 are over-represented



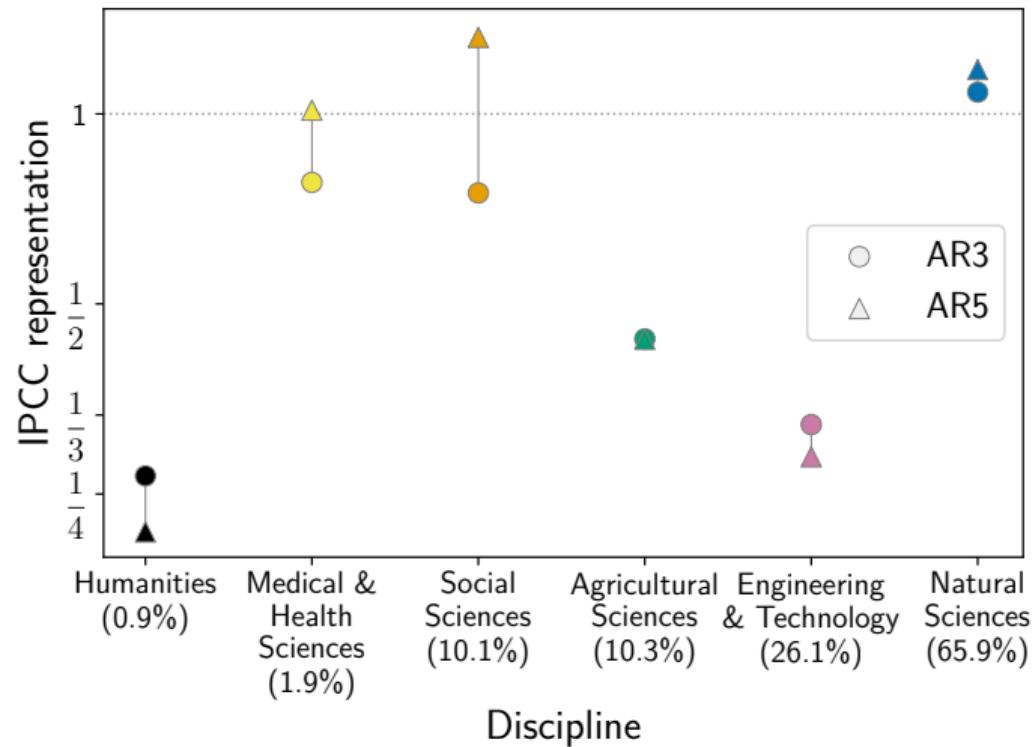
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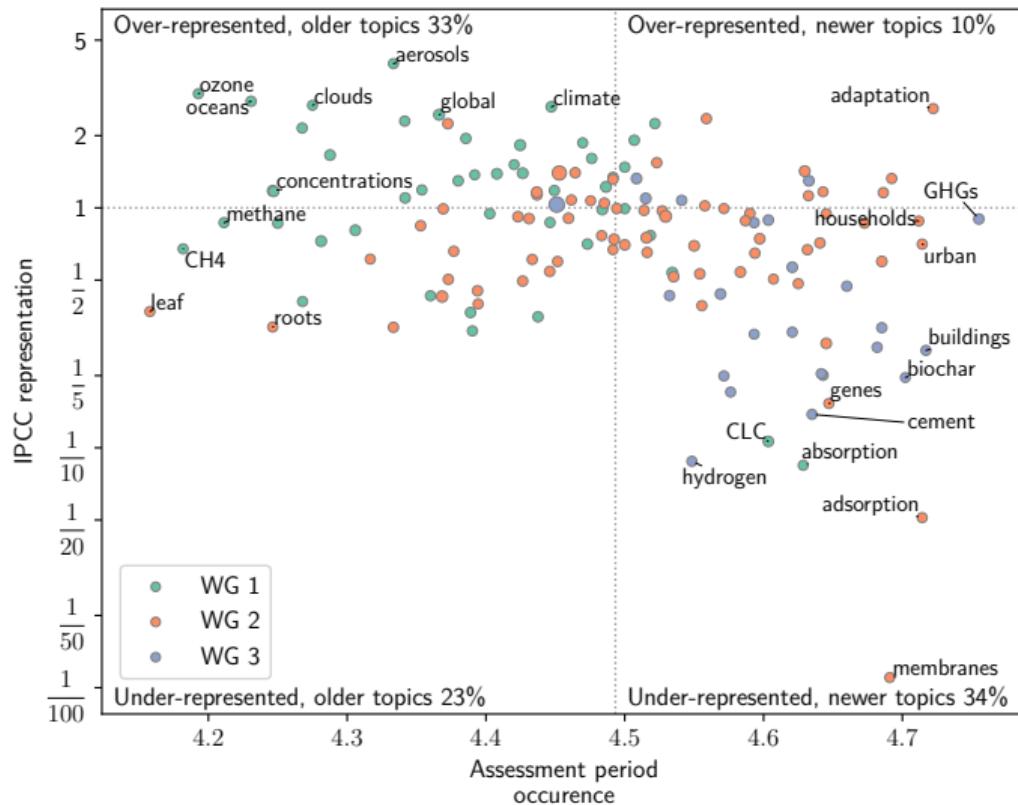


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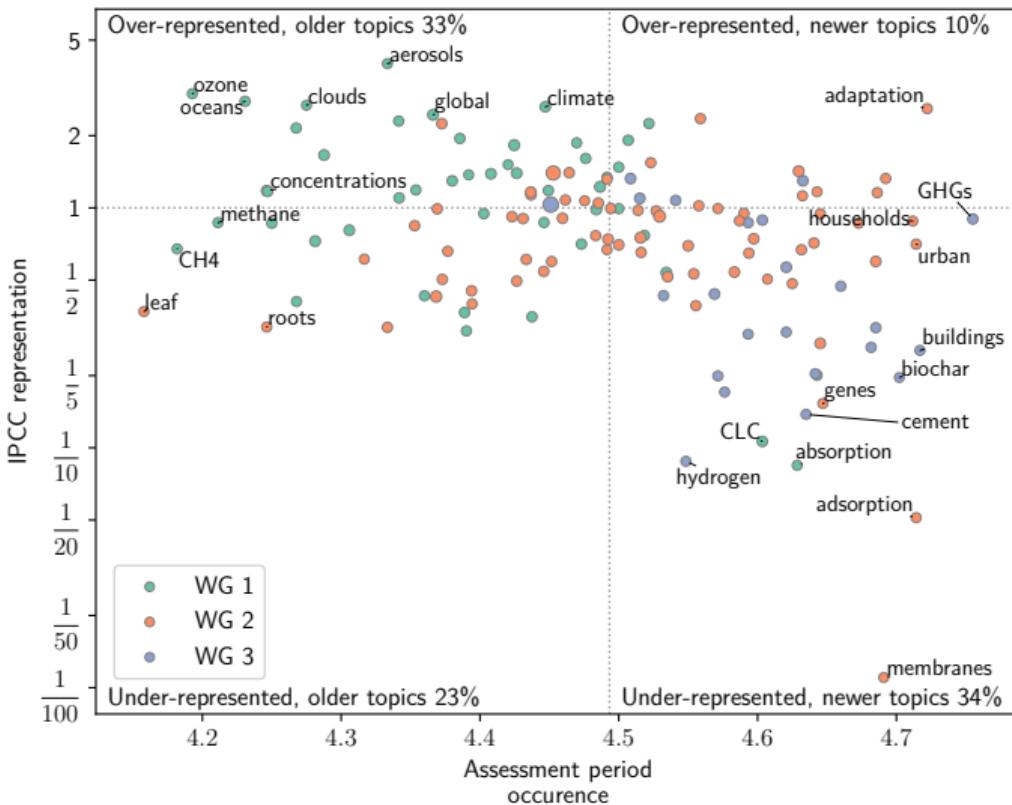


Topics on solutions are newer and under-represented



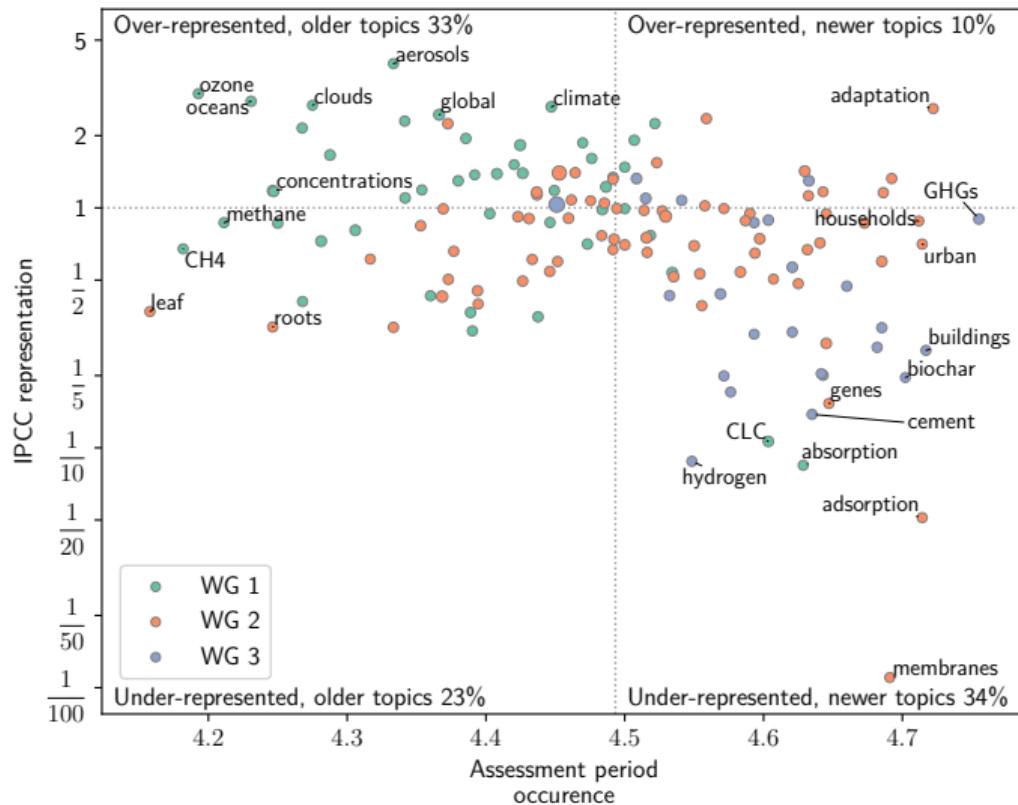
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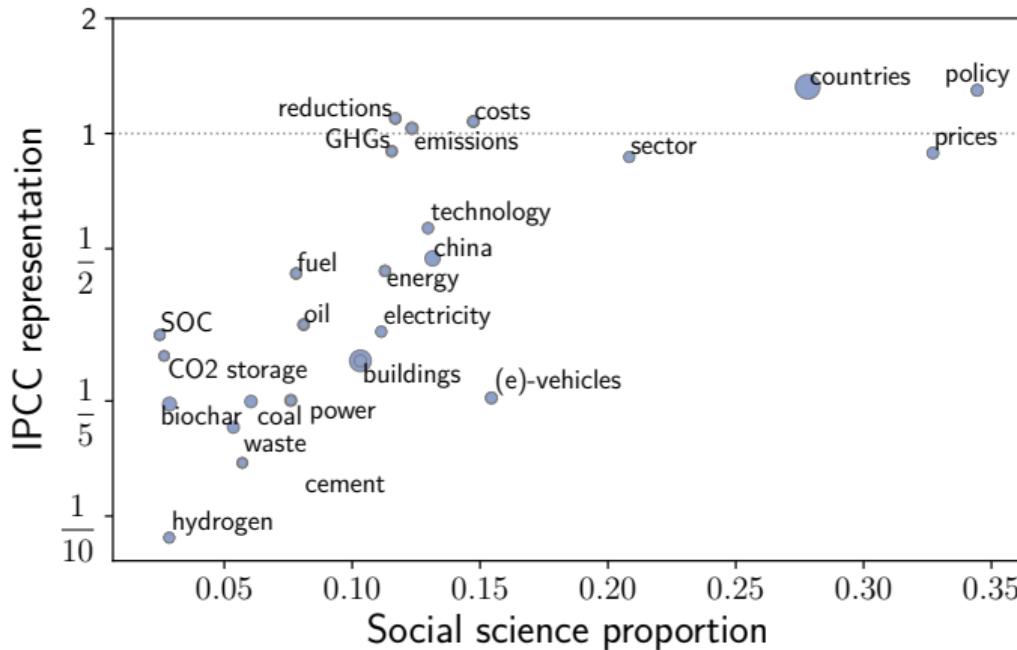
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- Newer WGII topics are better covered than newer WGIII topics

WGIII topics with little social science are under-represented



- Technical solutions topics in WGIII contain little social science research and are under-represented

Conclusions

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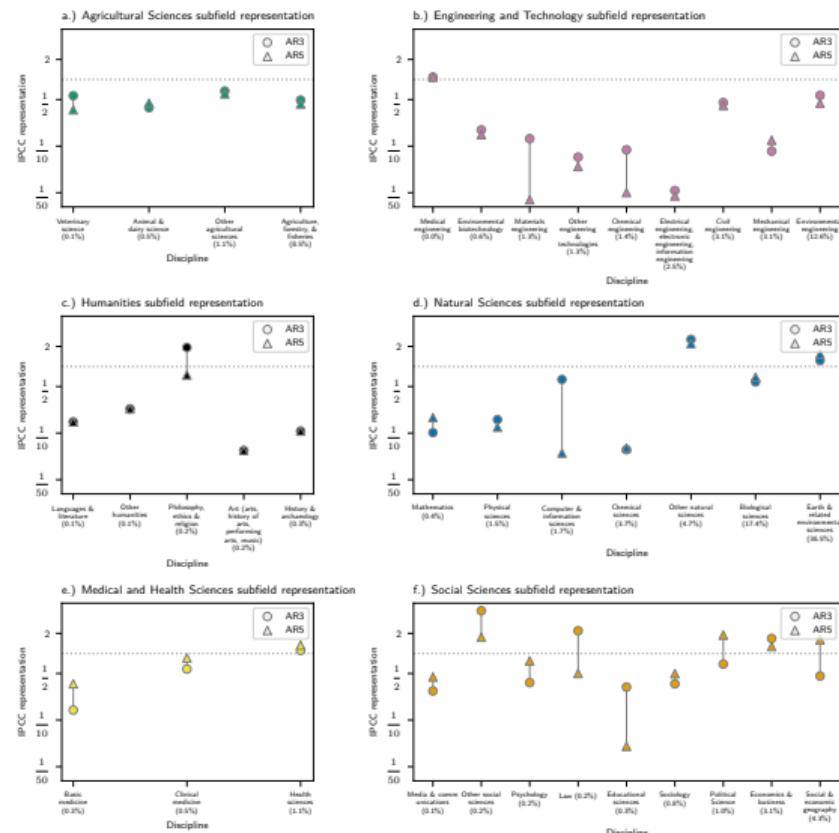
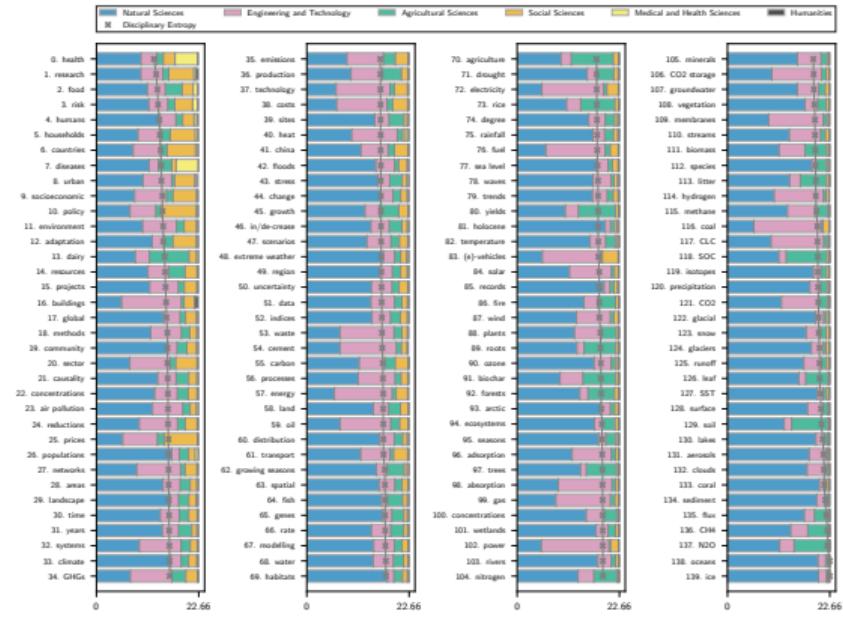
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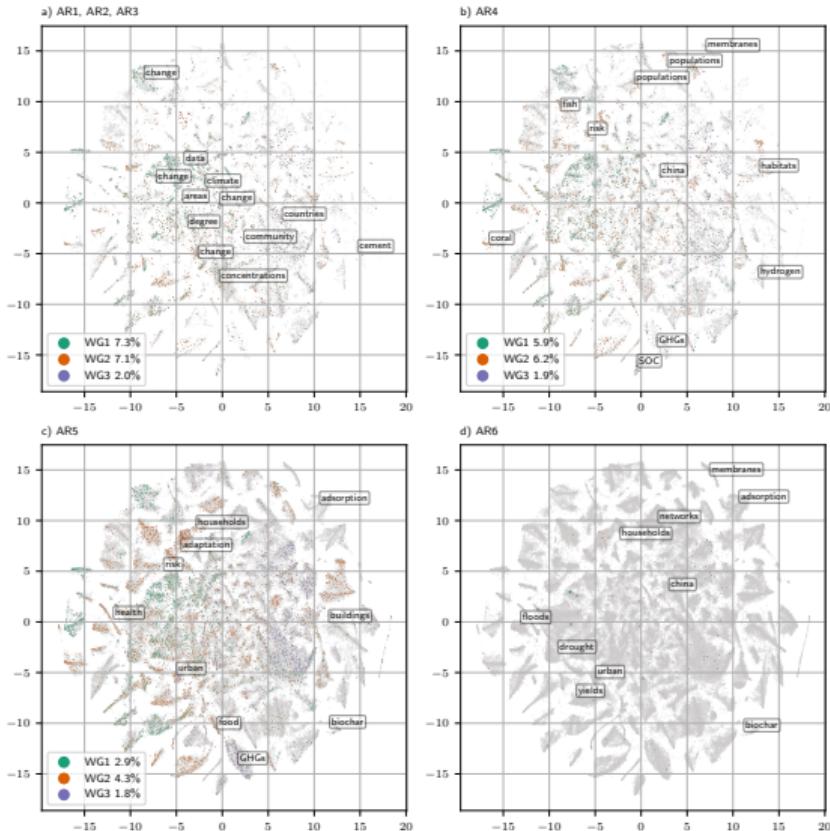
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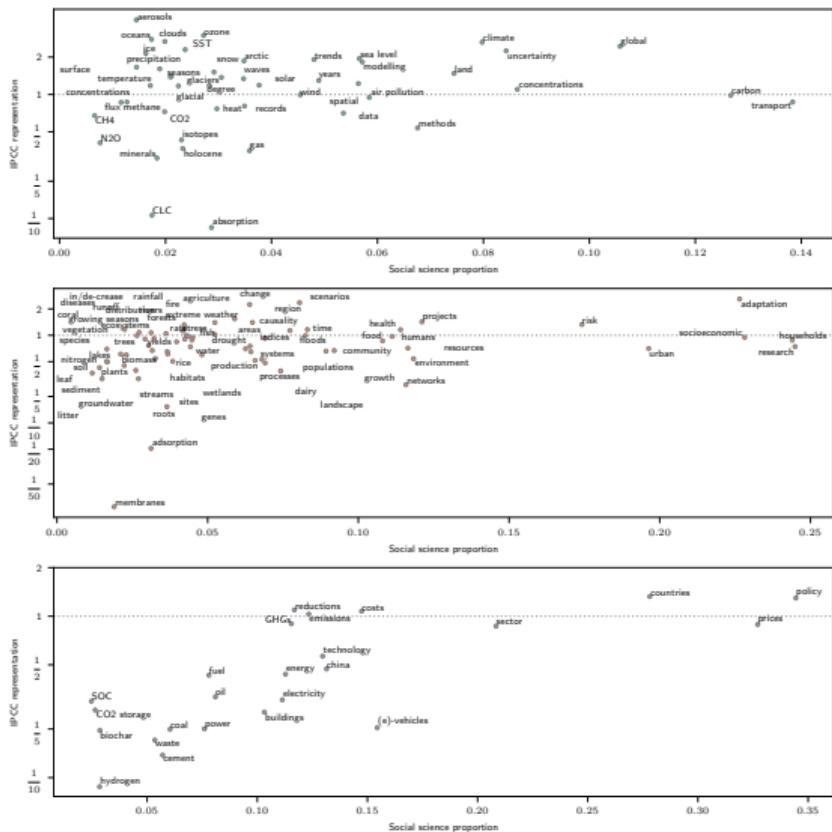
Topic disciplinary entropy and subdiscipline representation



Topic growth

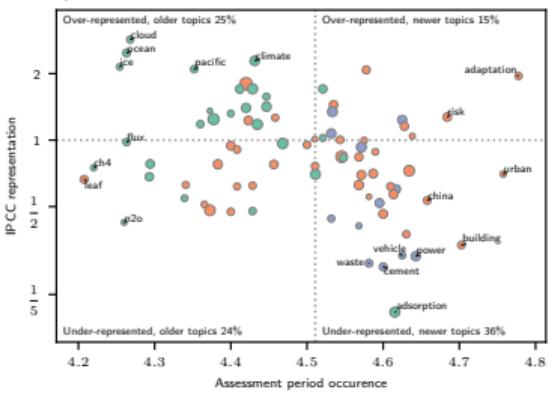


Social sciences and topic representation

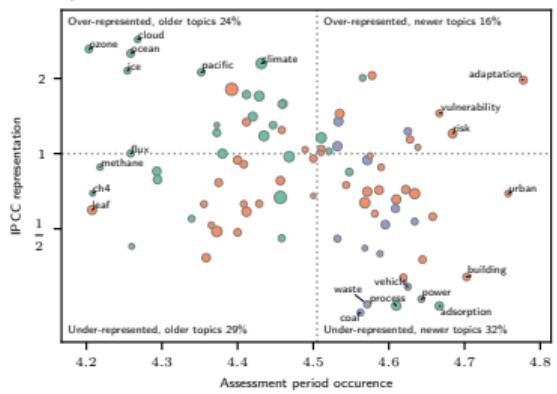


n Topics

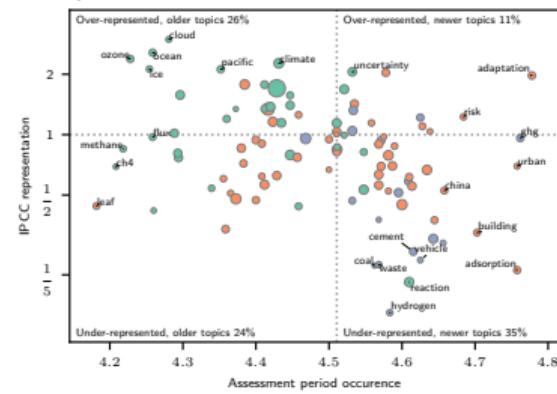
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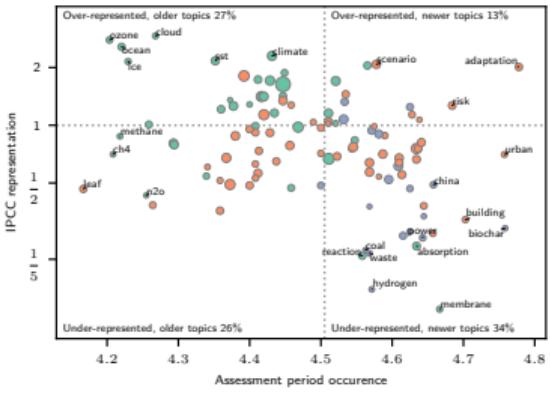
b) K = 90



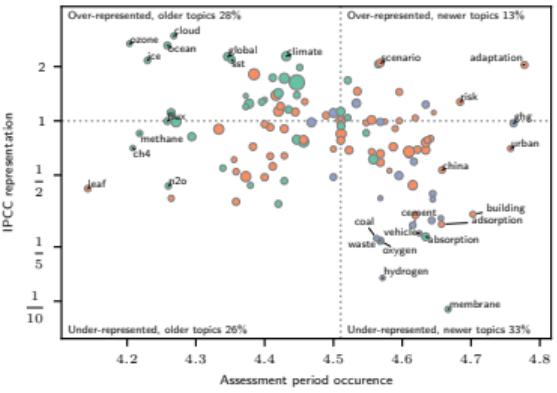
c) K = 100



d) K = 110



e) K = 120



f) K = 130

