

# Generative AI: Transformation or Hype?

Use Cases from Research and Industry

Markus Leippold

[www.chatclimate.ai](http://www.chatclimate.ai)

# Dear GPT:



Write a biography about Markus Leippold



## GPT 3.5 (November 26, 2023)

Markus Leippold is a renowned figure in the world of finance and economics, celebrated for his exceptional contributions to both academia and the financial industry. **Born on February 12, 1965, in Zurich, Switzerland**, Markus embarked on a journey that would see him become a distinguished professor and an influential thought leader in the field of financial economics.

**He attended the prestigious University of Zurich, where he pursued a Bachelor's degree in Economics and subsequently earned a Master's degree in Financial Economics.** His insatiable curiosity and intellectual rigor [...]

**Markus Leippold's academic journey continued with a Ph.D. in Economics, which he obtained from the University of Zurich.** His doctoral research focused on asset pricing, financial derivatives, and risk management—a foreshadowing of the **groundbreaking work** that would define his career [...]



## GPT 4 (November 26, 2023)

Markus Leippold is a distinguished academic known for his contributions to the field of financial engineering. He currently serves as a Professor of Financial Engineering at the University of Zurich and is also a faculty member of the Swiss Finance Institute. **His early life was marked by international experiences, having spent the first three months of his life in Alabama, USA, followed by three years in Lyon, France, before settling down in St. Gallen, Switzerland for the remainder of his childhood.**



Before joining the University of Zurich, Leippold was a member of the faculty at Imperial College London, [...]

Holding a PhD from the University of St. Gallen further underscores his deep academic foundation and commitment to financial research and education [...]



“I think old -fashioned intelligence  
works pretty well”

Charly Munger of Berkshire Hathaway

# Google!

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10 results



Google Search

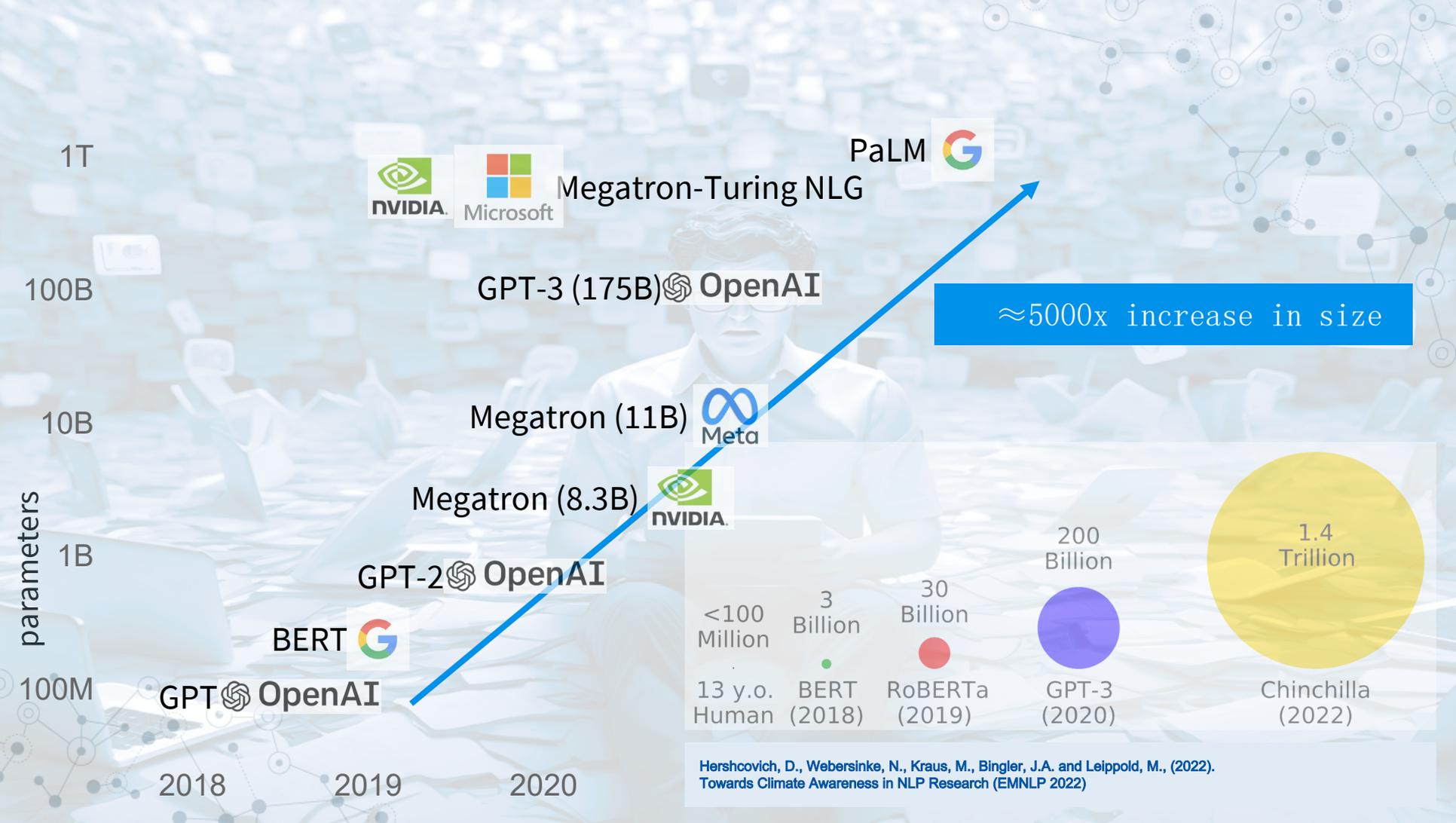
I'm feeling lucky

*Index contains ~25 million pages (soon to be much bigger)*

Our mission is to **organize** the world's **information** and make it **universally accessible** and **useful**.



What if  
AI could process all  
this information in a  
meaningful way?



$\approx 5000x$  increase in size



Hershcovich, D., Webersinke, N., Kraus, M., Bingler, J.A. and Leippold, M., (2022). Towards Climate Awareness in NLP Research (EMNLP 2022)

# The First Generation of Foundation Models



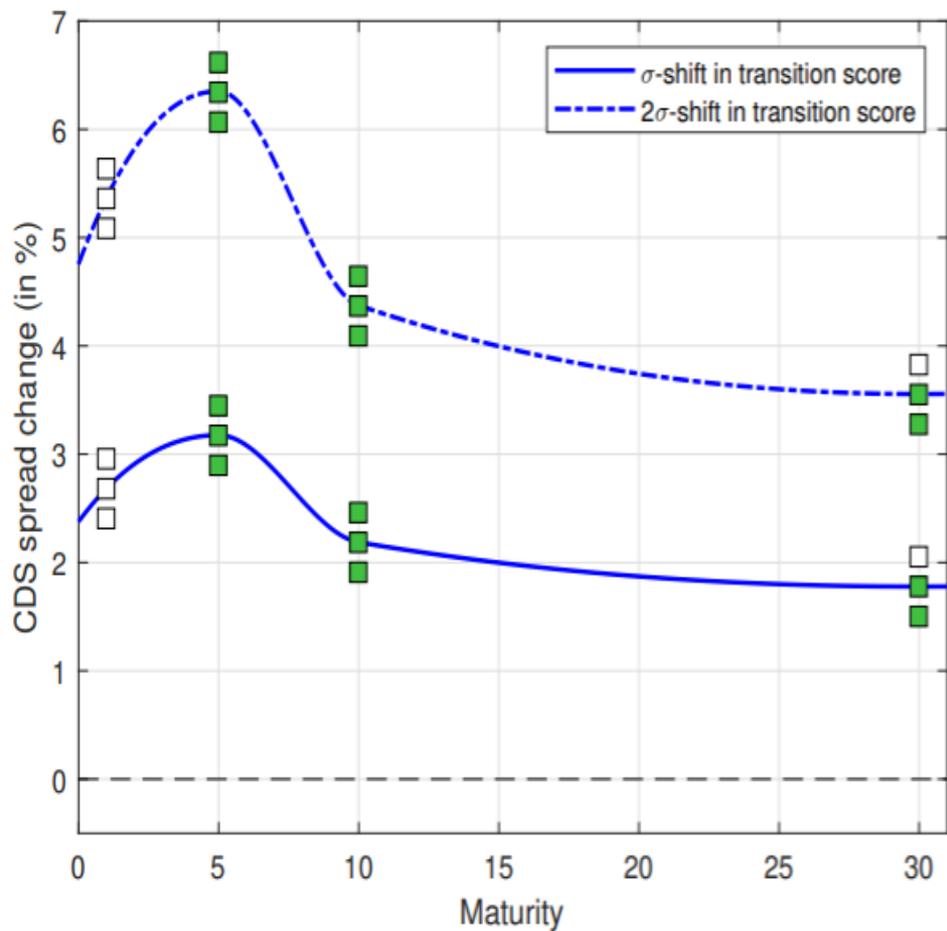


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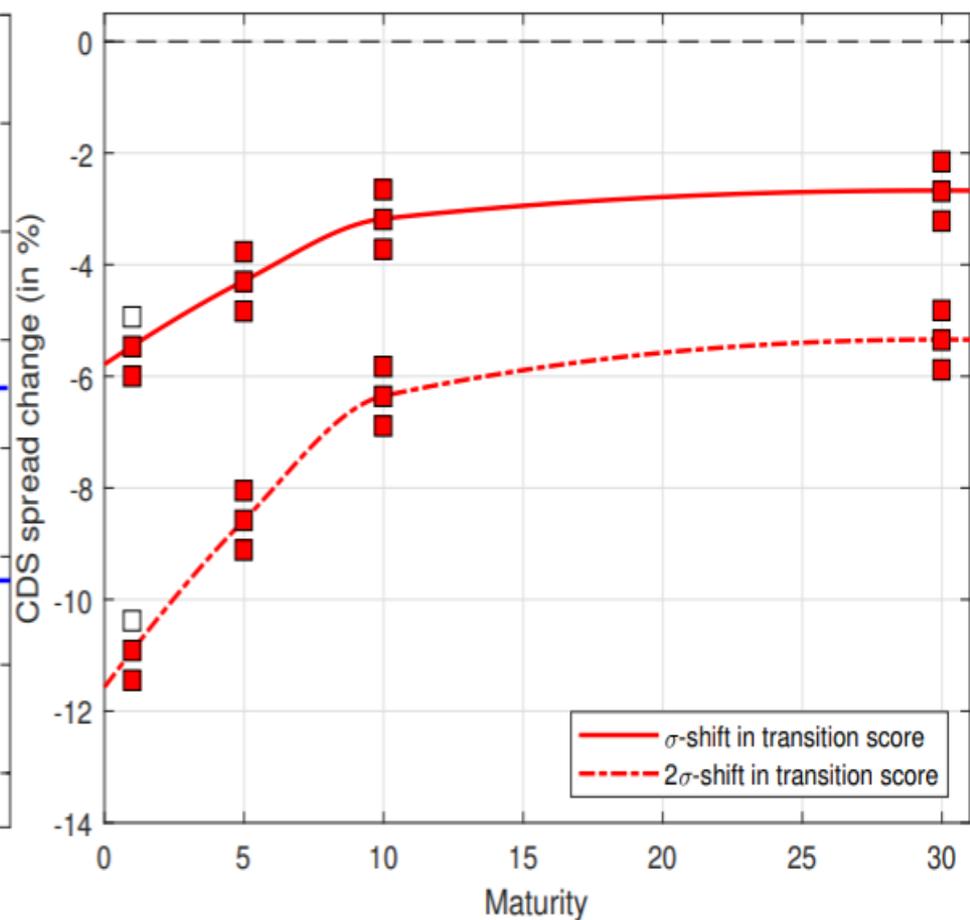
Koelbel J., M. Leippold, J. Rillaerts, Q. Wang (2022). Ask BERT: How Regulatory Disclosure of Transition and Physical Risks Affects the CDS Term Structure, *Journal of Financial Econometrics*.



Panel A: The Paris effect of transition risk



Panel B: The Trump effect of transition risk





Webersinke, et al: "Climatebert: A pretrained language model for climate-related text."  
Proceedings of the Association for the Advancement of Artificial Intelligence (AAAI) 2022 Symposium *arXiv preprint arXiv:2110.12010*

# ClimateBERT allowed us to ask many relevant questions:

## 1. Are companies cherry-picking in their climate disclosures?

Bingler, J. A., Kraus, M., Leippold, M., & Webersinke, N. (2022). Cheap talk and cherry disclosures. *Finance Research Letters*, 102776

- picking: What climateBert has to say on

corporate climate risk

## 2. Can we pinpoint environmental claims across various texts?

Stammbach, D., N. Webersinke, J. A. Bingler, M. Kraus, and M. Leippold. "Environmental Claim Detection" (ACL Proceedings 2023)

## 3. Words vs Reality: Do claims match actions?

Bingler, J. A., Kraus, M., Leippold, M., & Webersinke, N. (2022). How Cheap Talk in Climate Disclosures relates to Climate In Emissions, and Reputation Risk, GRASFI 2022 Best Paper Prize.

iti atives, Corporate

## 4. Beyond patents: Who's genuinely pioneering in environmental innovation and adaptation?

M. Leippold and T. Yu, (2023), The Green Innovation Premium: Evidence from U.S. Patents and the Stock Market. SFI Research Pa

per No. 23 -21.

## 5. What are the net-zero commitments of companies?

Schimanski Tobias, Hyslop Camilla, Kraus Mathias, Bingler Julia, and Markus Leippold, ClimateBERT Reduction Targets, EMNLP 2023.

- NetZero: Detecting and Assessi

ng Net Zero and

## 6. Can we identify nature-related disclosures in corporate reports?

Schimanski Tobias, Chiara Colesanti - Senni, Glen Gostlow, Jingwei Ni, Tingyu Yu, Markus Leippold (2023), Exploring Nature: Datas Analyzing Nature - Related Disclosures, Under Review.

ts and Models for

# Impact Beyond Writing Academic Papers



Corporate climate disclosures: how do we weed out cheap talkers? | Markus Leippold | TEDxHECParis

## Forbes

FORBES > INNOVATION > SUSTAINABILITY

### Are You Ready For AI-Driven Radical ESG Transparency?

Solitaire Townsend Contributor @  
Entrepreneur, author & sustainability solutionist.

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Apr 30, 2023, 08:18am EDT



AI tools for sustainability and ESG transparency are multiplying before our eyes.

**ChatIPCC** can converse about climate science, using the latest and most authoritative scientific papers as its data input. **ClarityAI** digs around in companies' sustainability data and shares back simple graphics and reports. **GreenwatchAI** compares companies' green claims against their actual carbon emissions. And **ClimateBert** fact checks climate-related claims and can be used by governments to detect greenwashing.

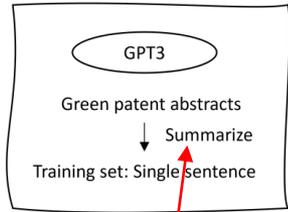
chatReport

# TEDx

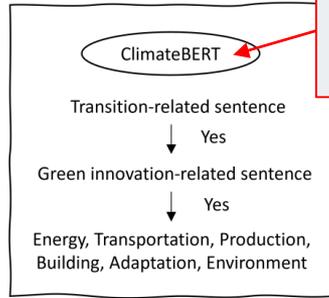
# The Second Generation of Foundation Models

# BERT meets GPT: Green Innovation and Adaptation Premium

M. Leippold and T. Yu, (2023), The Green Innovation Premium: Evidence from U.S. Patents and the Stock Market. SFI Research Paper No. 23 - 21.

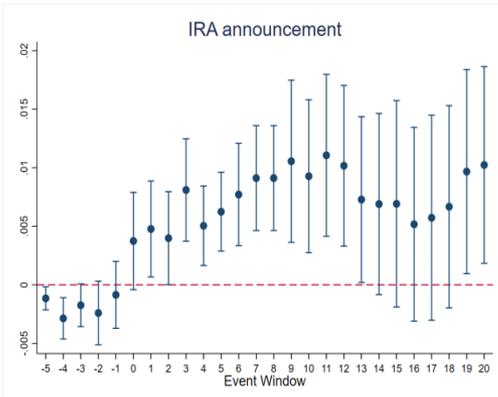
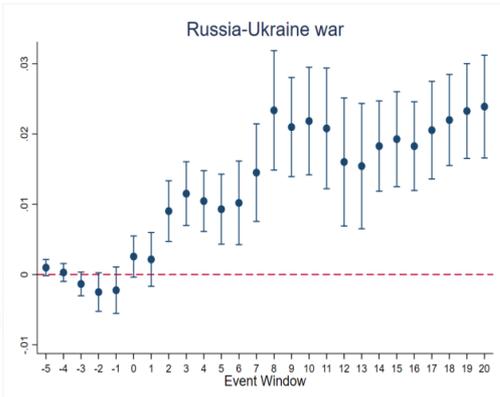
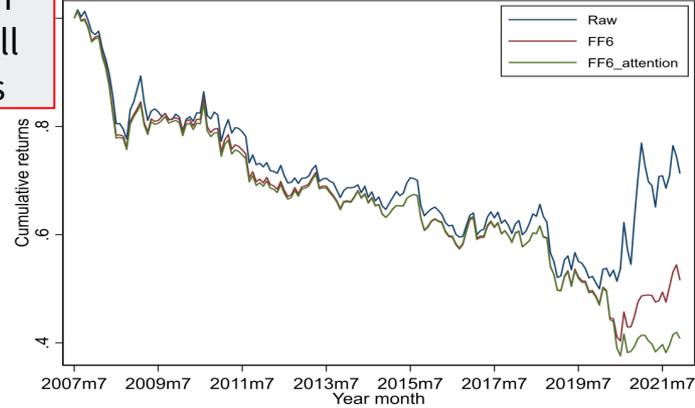


Fine-tune



Attention in earnings call transcripts

Generative AI for abstractive summarization



- Novel firm-level green innovation measure from patent abstracts and earnings calls.
- Green innovation premium of -6% per year.
- Stock market prices green innovation activities beyond the realm of patents.
- Measure can be used for hedging purposes.
- Green innovation measure is tightly linked to future carbon emissions and climate incident involvements.

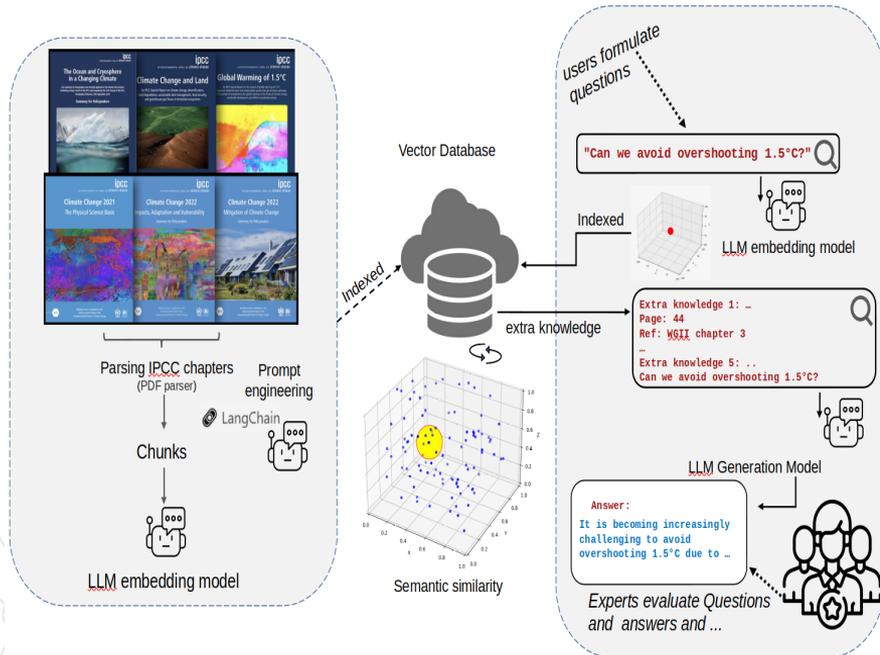




# ChatClimate (f.k.a. ChatIPCC)

## Grounding Large Language Models

Q = "Is it still possible to limit warming to 1.5°C?"



Yes, it is still possible to limit global warming to 1.5°C, but it requires deep, rapid, and sustained reductions of greenhouse gases, including methane, alongside rapid reductions of CO2 emissions to net zero (Page: 31, Reference: IPCC\_AR6\_WGIII\_Chapter03). This would limit the warming contributions from non-CO2 forcing agents as well as from CO2 emissions at low levels. However, the likelihood of limiting warming to 1.5°C with no or limited overshoot has dropped in AR6 compared to the Special Report on Global Warming of 1.5°C (SR1.5) because global GHG emissions have risen since the time SR1.5 was published, leading to higher near-term emissions (2030) and higher cumulative CO2 emissions until the time of net zero (Page: 4, Reference: IPCC\_AR6\_WGIII\_Chapter03). In scenarios limiting warming to 1.5°C with no or limited overshoot, net energy system CO2 emissions fall by 87–97% in 2050 and net CO2 and GHG emissions fall by 35–51% and 38–52% respectively in 2030 (Page: 43, Reference: IPCC\_AR6\_WGIII\_TechnicalSummary). Furthermore, net electricity sector CO2 emissions would need to reach zero globally between 2045 and 2055 (Page: 3, Reference: IPCC\_AR6\_WGIII\_Chapter06). Therefore, while it is technically possible to limit warming to 1.5°C, it requires significant and immediate action to reduce greenhouse gas emissions. (In-house knowledge)

IPCC AR6, WGIII Chapter03, p31, → Limiting warming to 1.5°C (>50%) or to 2°C (>67%) requires deep, rapid, and sustained reductions of other greenhouse gases including methane alongside rapid reductions of CO2 emissions to net zero. This ensures that the warming contributions from non-CO2 forcing agents as well as from CO2 emissions are both limited at low levels. The AR6 WGI estimated remaining carbon budgets until the time of reaching net zero CO2 emissions for a range of warming limits, taking into account historical CO2 emissions and projections of the warming from non-CO2 forcing agents (Box 3.4 in Section 3.3, AR6 WGI Section 5.5).

**Executive Summary**

Warming cannot be limited to well below 2°C without rapid and deep reductions in energy system carbon dioxide (CO2) and greenhouse gas (GHG) emissions. In scenarios limiting warming to 1.5°C (>50%) with no or limited overshoot (2°C (>67%) with action starting in 2020), net energy system CO2 emissions (interquartile range) fall by 87–97% (60–79%) in 2050. In 2030, in scenarios limiting warming to 1.5°C (>50%) with no or limited overshoot, net CO2 and GHG emissions fall by 35–51% and 38–52% respectively. In scenarios limiting warming to 1.5°C (>50%) with no or limited overshoot (2°C (>67%)), net electricity sector CO2 emissions reach zero globally between 2045 and 2055 (2050 and 2080). (high confidence) (6.7)

IPCC AR6, WGIII Chapter06, p3 ←

**TS.5.1 Energy**

A broad-based approach to deploying energy-sector mitigation options can reduce emissions over the next ten years and set the stage for still deeper reductions beyond 2030 (high confidence). There are substantial, cost-effective opportunities to reduce emissions rapidly, including in electricity generation, but near-term reductions will not be sufficient to limit warming to 2°C (>67%) or limit warming to 1.5°C (>50%) with no or limited overshoot. (6.4, 6.6, 6.7)

IPCC AR6 WGIII Technical Summary, p43, →

Warming cannot be limited to 2°C or 1.5°C without rapid and deep reductions in energy system CO2 and GHG emissions (high confidence). In scenarios limiting warming to 1.5°C (>50%) with no or limited overshoot (likely below 2°C), net energy system CO2 emissions fall by 87–97% (interquartile range 60–79%) in 2050. In 2030, in scenarios limiting warming to 1.5°C with no or limited overshoot, net CO2 and GHG emissions fall by 35–51% and 38–52% respectively. In scenarios limiting warming to 1.5°C with no or limited overshoot (likely below 2°C), net electricity sector CO2 emissions reach zero globally between 2045 and 2055 (2050 and 2080) (high confidence). (6.7)

IPCC AR6, WGIII Chapter03, p4 ←

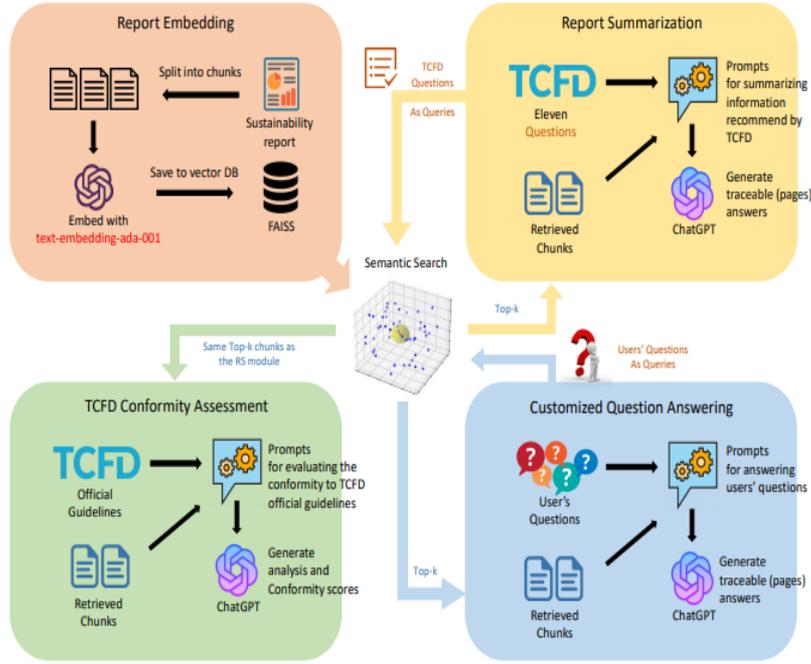
Many pathways in the literature show how to limit global warming compared to pre-industrial times to 2°C (>67%) with no overshoot or to limit warming to 1.5°C (>50%) with no or limited overshoot. The likelihood of limiting warming to 1.5°C with no or limited overshoot has dropped in AR6 compared to the Special Report on Global Warming of 1.5°C (SR1.5) because global GHG emissions have risen since the time SR1.5 was published, leading to higher near-term emissions (2030) and higher cumulative CO2 emissions until the time of net zero (medium confidence). Only a small number of published pathways limit global warming to 1.5°C without overshoot over the course of the 21st century. (3.3, Annex III.II.3)

# From ChatClimate to ChatReport Can Large Language Models shed a light on reporting?



# ChatReport – Analyzing Corporate Sustainability Reports

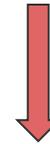
<https://reports.chatclimate.ai/>



TCFD1: "How does the company's board oversee climate related risks and opportunities?"

TCFD2: "What is the role of management in assessing and managing climate - related risks and opportunities?"

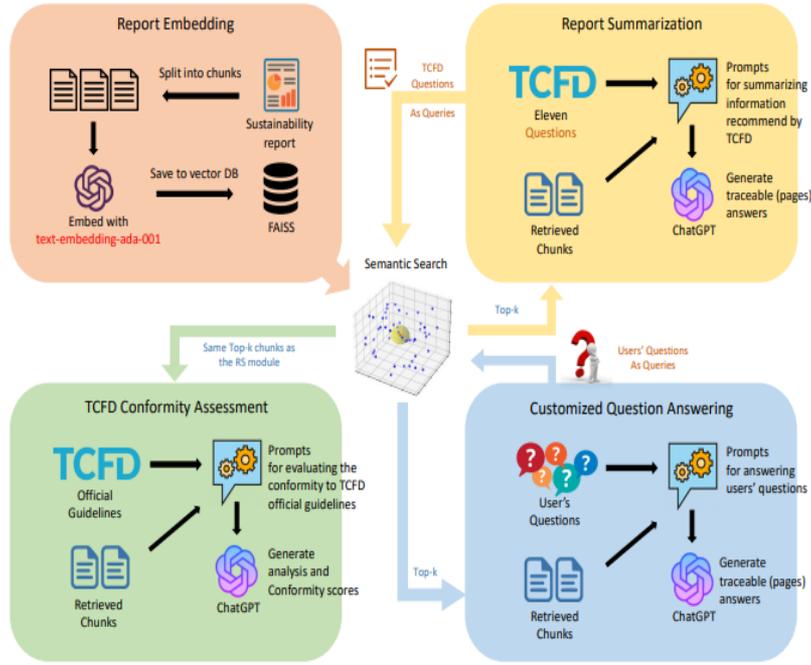
TCFD3: "What are the most relevant climate - related risks and opportunities that the organisation has identified over the short, medium, and long term? Are risks clearly associated with a horizon?"



TCFD11: "What targets does the organisation use to understand/quantify/benchmark climate - related risks and opportunities? How is the organization performing against these targets?"

# ChatReport – Analyzing Corporate Sustainability Reports

<https://reports.chatclimate.ai/>



**A11:** JPMorgan Chase plans to disclose additional detail on its efforts to integrate climate risk into its Firmwide risk management framework in a standalone climate report which it plans to publish later this year. No specific targets were mentioned in the report.

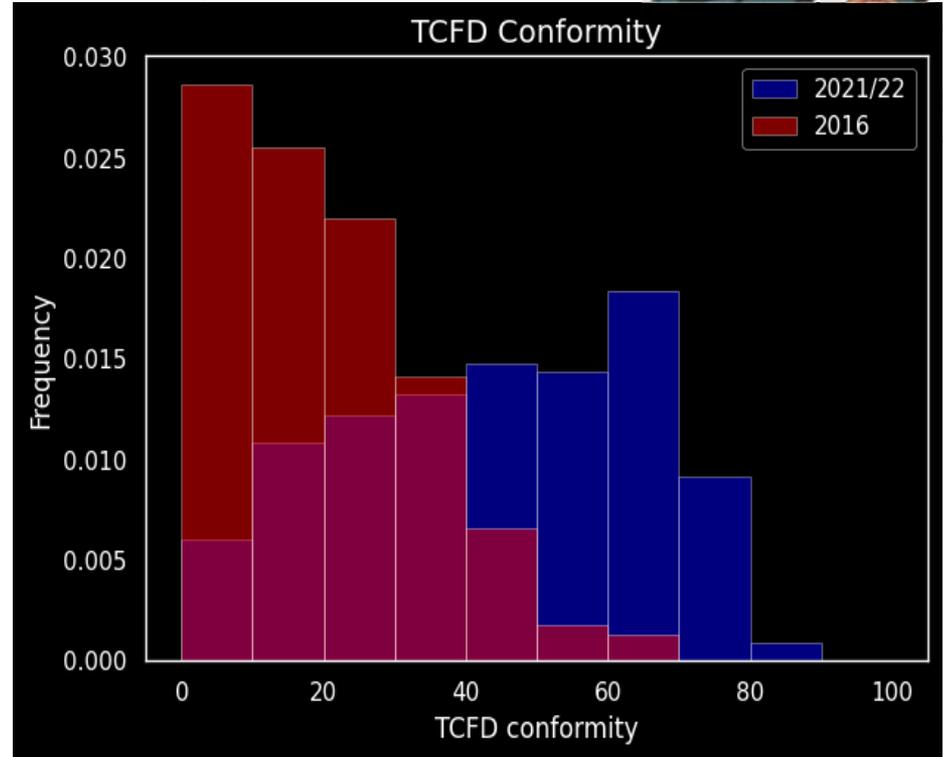
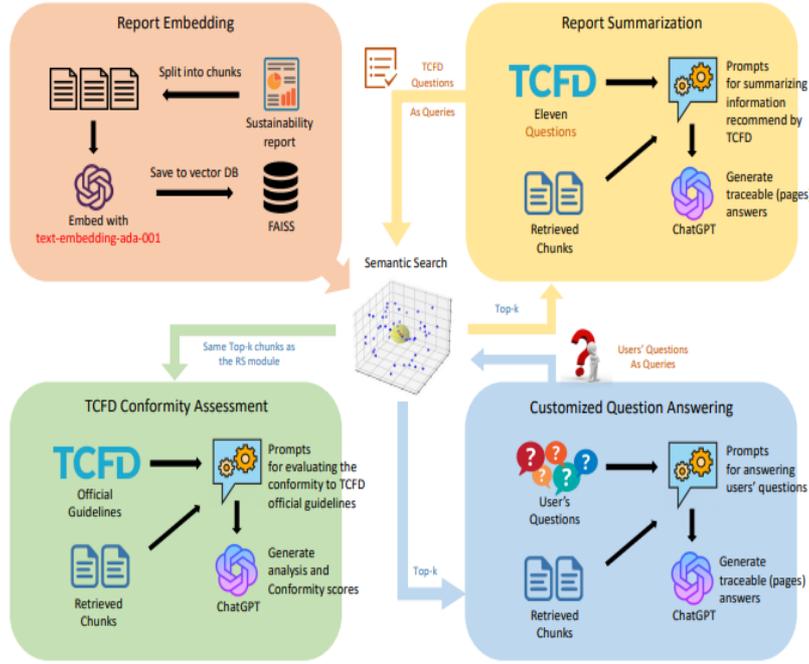
**Analysis11:** The sustainability report provides limited information on the targets used by the organization to manage climate - related risks and opportunities and performance against targets. While the report mentions the development of relevant policies and standards, it does not provide specific details on the key climate related targets, time frames, base year, or key performance indicators used to assess progress against targets. The report also lacks information on the methodologies used to calculate targets and measures. While the report mentions the establishment of a robust governance process for tracking progress, it does not provide specific details on the process. Overall, the report does not meet the TCFD guidelines for high quality disclosure pertaining to the TCFD recommendation point.

**Score11: 20**

# ChatReport – Analyzing Corporate Sustainability Reports

<https://reports.chatclimate.ai/>

“I analyzed 11,000 Corporate Sustainability Reports over the weekend”



# Beyond Climate: Exploring Nature

Schimanski Tobias, Chiara Colesanti  
Nature - Related Disclosures, Under Review.

- Senni, Glen Gostlow, Jingwei Ni, Tingyu Yu, Markus Leippold (2023), Exploring Nature: Dataset

ts and Models for Analyzing

Domain	Model	F1-Score (std.)	Accuracy (std.)	Precision (std.)	Recall (std.)
Water	EnvironmentalBERT	0.9447 (0.0137)	0.9591 (0.0104)	0.9413 (0.0166)	0.9486 (0.0134)
	ClimateBERT	<b>0.9510 (0.0113)</b>	<b>0.9636 (0.0088)</b>	0.9470 (0.0165)	<b>0.9555 (0.0074)</b>
	RoBERTa	0.9455 (0.0086)	0.9600 (0.0065)	<b>0.9452 (0.0140)</b>	0.9478 (0.0110)
	DistilRoBERTa	0.9498 (0.0116)	0.9627 (0.0087)	0.9445 (0.0149)	0.9552 (0.0130)
Forest	EnvironmentalBERT	<b>0.9537 (0.0092)</b>	<b>0.9700 (0.0061)</b>	<b>0.9509 (0.0111)</b>	0.9567 (0.0103)
	ClimateBERT	0.9534 (0.0046)	0.9695 (0.0034)	0.9479 (0.0132)	<b>0.9598 (0.0080)</b>
	RoBERTa	0.9478 (0.0048)	0.9664 (0.0025)	0.9470 (0.0076)	0.9494 (0.0141)
	DistilRoBERTa	0.9529 (0.0065)	0.9695 (0.0041)	0.9509 (0.0099)	0.9556 (0.0132)
Biodiversity	EnvironmentalBERT	<b>0.9276 (0.0191)</b>	<b>0.9582 (0.0105)</b>	<b>0.9285 (0.0176)</b>	<b>0.9278 (0.0267)</b>
	ClimateBERT	0.9249 (0.0134)	0.9564 (0.0074)	0.9242 (0.0153)	0.9267 (0.0220)
	RoBERTa	0.9246 (0.0154)	0.9564 (0.0083)	0.9243 (0.0116)	0.9256 (0.0236)
	DistilRoBERTa	0.9229 (0.0203)	0.9545 (0.0118)	0.9158 (0.0202)	0.9307 (0.0212)
Nature	EnvironmentalBERT	<b>0.9419 (0.0081)</b>	<b>0.9423 (0.0080)</b>	<b>0.9444 (0.0070)</b>	<b>0.9409 (0.0085)</b>
	ClimateBERT	0.9350 (0.0046)	0.9355 (0.0044)	0.9380 (0.0035)	0.9339 (0.0051)
	RoBERTa	0.9397 (0.0026)	0.9400 (0.0026)	0.9418 (0.0028)	0.9386 (0.0027)
	DistilRoBERTa	0.9355 (0.0072)	0.9359 (0.0071)	0.9381 (0.0066)	0.9345 (0.0075)



Keywords	F1-score	Accuracy	Precision	Recall
on biodiversity label	0.6303	0.8427	0.7623	0.5373
on nature label	0.6100	0.6978	0.4498	0.9472

Giglio, S.; Kuchler, T.; Stroebel, J.; and Zeng, X. 2023. Biodiversity Risk. Technical report, National Bureau of Economic Research.

# Conclusion



Our mission is to  
organize the *relevant*  
information and make it  
*decision-* accessible  
and *useful.*



# Ongoing Projects

# Project Pipeline: ChatEnergy



UNECE

SUSTAINABLE DEVELOPMENT GOALS

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Our work

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## UNECE and partners to develop AI-powered platform to help build resilient energy systems

[SDGs](#) [Climate Change](#) [Sustainable Development](#) [Sustainable Energy](#)

18 September 2023

**Geneva, 18 September, 2023**

To meet the objectives of the Paris agreement, energy systems will need to undergo a profound transformation and become fully resilient, finding the right balance between the three pillars of resiliency (as defined in UNECE's publication ["Building Resilient Energy Systems"](#)): energy security, affordability and environmental sustainability.



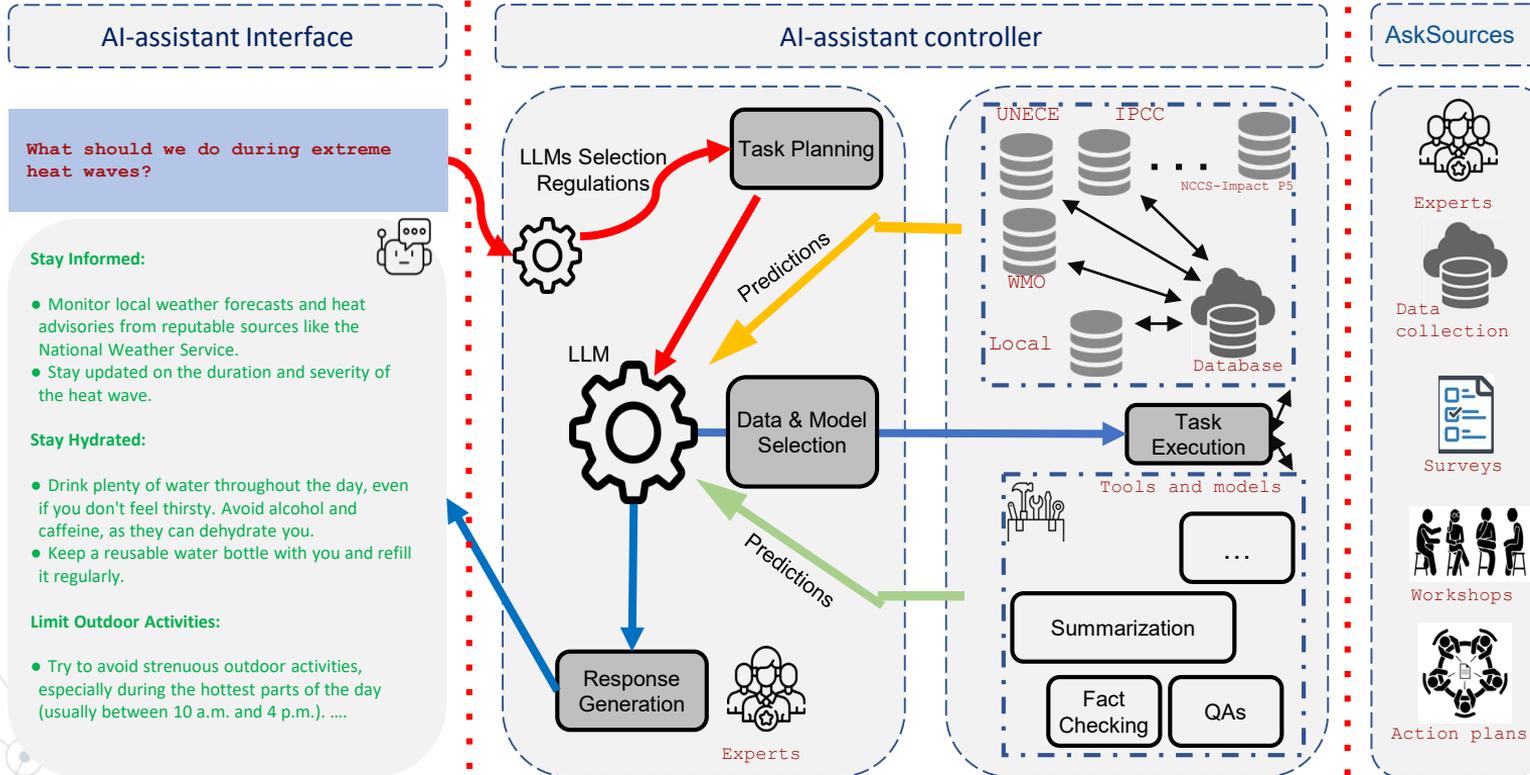
To ease this process and facilitate policy decision-making towards this complex endeavor, UNECE and other organizations, including the European Investment Bank, the International Atomic Energy Agency, the International Energy Agency, the International Telecommunication Union, the Organization for Security and Cooperation in Europe, the World Meteorological Organization, and the World Bank have provided knowledge input for an AI-powered platform that will offer a real-time interactive compendium of information and data resources on the resilience of energy systems. This work will be performed in collaboration with a team from the University of Zürich led by Professor Markus Leippold.



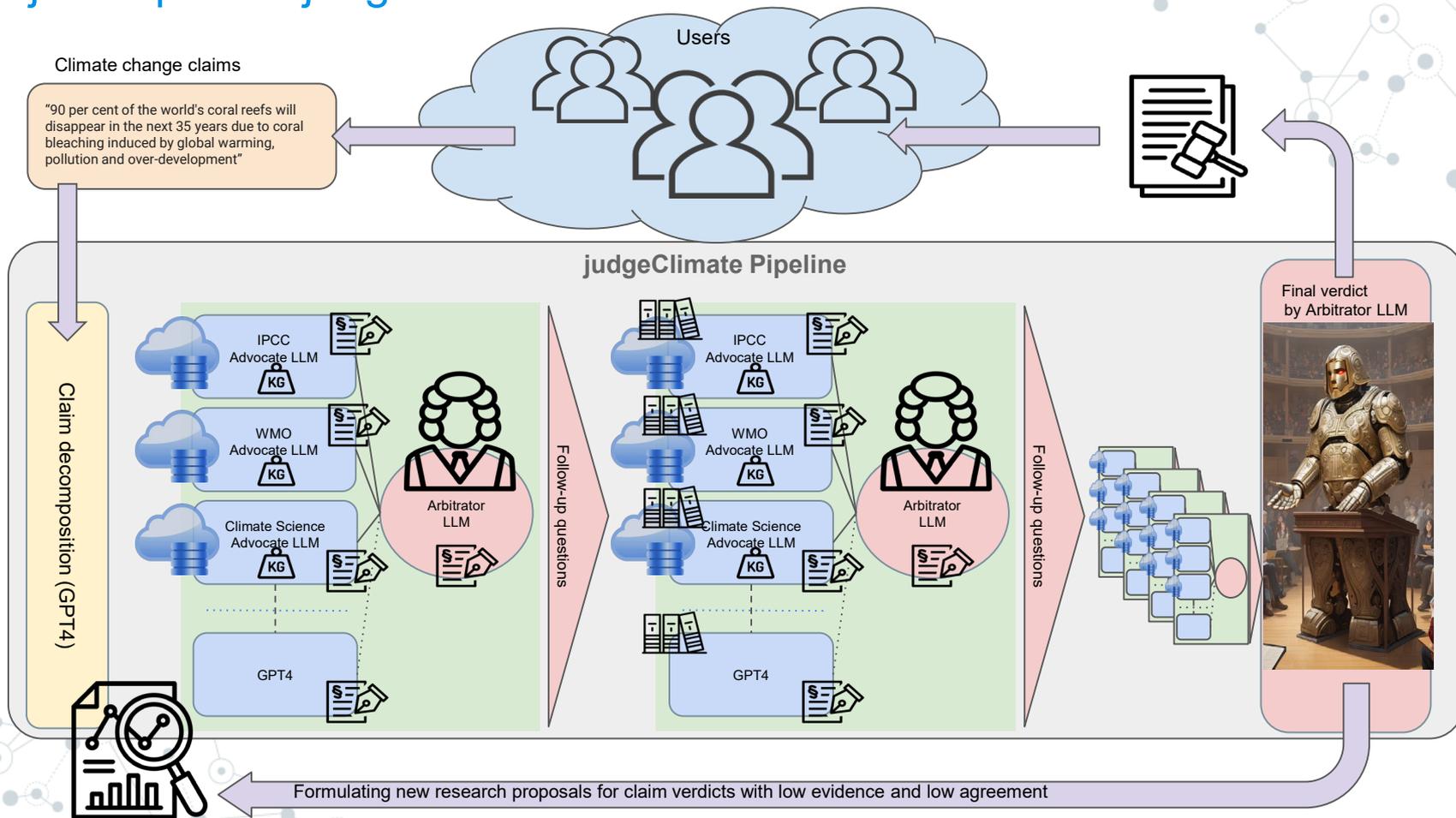
# Project Pipeline: Early Warning Systems for All



WORLD METEOROLOGICAL ORGANIZATION



# Project Pipeline: judgeClimate





University of  
Zurich<sup>UZH</sup>

# Research Output

# Team contributions (since 2020)

1. Bingler, J. A., Kraus, M., Leippold, M., & Webersinke, N. (2022). Cheap talk and cherry has to say on corporate climate risk disclosures. Finance Research Letters, 102776 - picking: What climateBert
2. Koelbel J., M. Leippold, J. Rillaerts, Q. Wang (2022). Ask BERT: How Regulatory Disclosure of Transition and Physical Risks Affects the CDS Term Structure, Journal of Financial Econometrics.
1. Stambach, D., N. Webersinke, J. A. Bingler, M. Kraus, and M. Leippold. "Environmental Claim Detection" (ACL Proceedings 2023)
1. Vaghefi, S., Muccione, V., Huggel, C., Khashehchi, H., and Leippold, M. (2022). ClimateGPT2: A Dataset and Adaptive Domain Pre - trained Language Models for Climate Change Related Tasks (NeurIPS, Climate Change AI 2022)
1. Hershovich, D., Webersinke, N., Kraus, M., Bingler, J.A. and Leippold, M., (2022). Towards Climate Awareness in NLP Research (EMNLP 2022)
1. M. Leippold and T. Yu, (2023), The Green Innovation Premium: Evidence from U.S. Patents and the Stock Market. Swiss Finance Institute Research Paper No. 23 - 21.
1. Bingler, J. A., Kraus, M., Leippold, M., & Webersinke, N. (2022). How Cheap Talk in Climate Disclosures relates to Climate Initiatives, Corporate Emissions, and Reputation Risk, GRASFI 2022 Best Paper Prize.
1. Deng, Ming and Leippold, Markus and Wagner, Alexander F. and Wang, Qian, War and Policy: Investor Expectations on the Net - Zero Transition (May 10, 2023). Swiss Finance Institute Research Paper No. 22 - 29, <http://dx.doi.org/10.2139/ssrn.4080181>
1. Ni, Jingwei and Jin, Zhijing and Wang, Qian and Sachan, Mrinmaya and Leippold, Markus, When Does Aggregating Multiple Skills with Multi - Task Learning Work? A Case Study in Financial NLP (ACL Proceedings, 2023), <http://dx.doi.org/10.2139/ssrn.4456653>
2. Vaghefi, Saeid and Wang, Qian and Muccione, Veruska and Ni, Jingwei and Kraus, Mathias and Bingler, Julia and Schimanski, Tobias and Colesanti Senni, Chiara and Webersinke, Nicolas and Huggel, Christian and Leippold, Markus, ChatClimate: Grounding Conversational AI in Climate Science (April 11, 2023). <http://dx.doi.org/10.2139/ssrn.4414628>

# Team contributions (since 2020, cont.)

11. Filippini, Massimo and Leippold, Markus and Wekhof, Tobias, Sustainable Finance Literacy and the Determinants of Sustainable Investing (December 30, 2021). Swiss Finance Institute Research Paper No. 22 - 02, Available at SSRN:  
<https://ssrn.com/abstract=3997285> or <http://dx.doi.org/10.2139/ssrn.3997285>
12. Hain, Linda Isabella and Kölbl, Julian and Leippold, Markus, Bounding the Impact of Hazard Interdependence on Climate Risk (April 20, 2023). Swiss Finance Institute Research Paper No. 23 - 26, Available at SSRN:  
<https://ssrn.com/abstract=4428724> or <http://dx.doi.org/10.2139/ssrn.4428724>
13. Hain, Linda Isabella and Kölbl, Julian and Leippold, Markus, Let's Get Physical: Comparing Metrics of Physical Climate Risk (April 19, 2021). Available at SSRN: <https://ssrn.com/abstract=3829831> or <http://dx.doi.org/10.2139/ssrn.3829831>
14. Hoepner, Andreas G. F. and Klausmann, Johannes and Leippold, Markus and Rillaerts, Jordy, Beyond Climate: The Impact of Biodiversity, Water, and Pollution on the CDS Term Structure (February 8, 2023). Swiss Finance Institute Research Paper No. 23 - 10, Michael J. Brennan Irish Finance Working Paper Series Research Paper No. 23 - 4,  
<http://dx.doi.org/10.2139/ssrn.4351633>
15. Kraus, Mathias and Bingler, Julia and Leippold, Markus and Schimanski, Tobias and Colesanti Senni, Chiara and Stambach, Dominik and Vaghefi, Saeid and Webersinke, Nicolas, Enhancing Large Language Models with Climate Resources (April 1, 2023). Available at SSRN: <https://ssrn.com/abstract=4407205> or <http://dx.doi.org/10.2139/ssrn.4407205>
16. Ni, Jingwei and Bingler, Julia and Colesanti Senni, Chiara and Kraus, Mathias and Gostlow, Glen and Schimanski, Tobias and Stambach, Dominik and Vaghefi, Saeid and Wang, Qian and Webersinke, Nicolas and Wekhof, Tobias and Yu, Tingyu and Leippold, Markus, Paradigm Shift in Sustainability Disclosure Analysis: Empowering Stakeholders with Chatreport, a Language Model - Based Tool (June 12, 2023). Available at SSRN: <https://ssrn.com/abstract=>
17. Webersinke, Nicolas and Kraus, Mathias and Bingler, Julia and Leippold, Markus, CLIMATEBERT: A Pretrained Language Model for Climate - Related Text (AAAI Proceedings, 2022). <http://dx.doi.org/10.2139/ssrn.4229146>
18. Diggelmann, T., Boyd - Graber, J., Bulian, J., Ciaramita, M. and Leippold, M., 2020. Climate - fever: A dataset for verification of real - world climate claims. Neurips 2020, ClimateChange AI Workshop, arXiv preprint arXiv:2012.00614.

# Team contributions (since 2020, cont.)

19. Varini, F.S., Boyd - Graber, J., Ciaramita, M. and Leippold, M., 2020. ClimaText: A dataset for climate change topic detection. Neurips 2020, ClimateChange AI Workshop, arXiv preprint arXiv:2012.00483.
20. Mishra, Rahul and Gupta, Dhruv and Leippold, Markus, Generating Fact Checking Summaries for Web Claims (October 16, 2020). EMNLP W - NUT 2020 : Conference on Empirical Methods in Natural Language Processing (EMNLP Proceedings), Available at SSRN: <https://ssrn.com/abstract=3713376>
21. Mishra, Rahul and Yadav, Piyush and Calizzano, Remi and Leippold, Markus, MuSeM: Detecting Incongruent News Headlines using Mutual Attentive Semantic Matching (October 11, 2020). IEEE 2020 International Conference on Machine Learning and Applications (ICMLA Proceedings), Available at SSRN: <https://ssrn.com/abstract=3709244>
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