futurearth

Research. Innovation. Sustainability.

Update for WCRP JSC

Wendy Broadgate

Interim Coordinating Director Global Hub Dlrector (Sweden) Future Earth Secretariat













A sustainable and equitable world for all

MISSION: Advance research in support of transformations to global sustainability





environment programme





futurerth Research. Innovation. Sustainability

> Global Secretariat Hubs

National and Local Networks 16

26 Global Research Networks

9

30 000 People Involved Globally



Global Research Networks



THE GREAT ACCELERATION



W.Steffen, W.Broadgate, L.Deutsch, O.Gaffney and C.Ludwig (2015), The Trajectory of the Anthropocene: The Great Acceleration



10 New Insights in Climate Science series

An annual synthesis of **essential recent advances in climate change research**, with high policy relevance.

- **1. Academic synthesis:** Peer-reviewed publication since 2020. Underpins the Policy report.
- **2. Policy report:** Launched at or ahead of UNFCCC COP and shared with Party delegations since 2017. Geared toward negotiators, policymakers, and general informed public.
- 3. Translation and events in Japanese, French & Spanish.

Developed by a group of over **80 experts**, with input from more than 250 climate change researchers.









https://10insightsclimate.science/

10 New Insights in Climate Science 2024

- 1. Methane levels are surging. Enforceable policies for emission reductions are essential.
- 2. Reductions in air pollution have implications for mitigation and adaptation given complex **aerosol-climate interactions**.
- 3. Increasing heat is making more of the planet **uninhabitable**.
- 4. Climate extremes are harming maternal and reproductive well-being.
- 5. Concerns about **ENSO** and **AMOC** with an increasingly warm ocean.
- 6. Biocultural diversity can bolster the Amazon's resilience against climate change.
- **7. Critical infrastructure** is increasingly exposed to climate hazards, with risk of cascading disruption across interconnected networks.
- 8. New frameworks for **climate-resilient development in cities** provide decision-makers with ideas for unlocking co-benefits.
- 9. Closing governance gaps in the **energy transition minerals** global value chain is crucial for a just and equitable energy transition.

10. Public's acceptance of climate policies crucially depends on perceptions of fairness











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Revi Cite th intights' scan (28 doi.org/

NEW INSIGHTS IN CLIMATE SCIENCE

Review

doi.org/10.1017/sus.2023.25

Ten new insights in climate science 2024

Roberto Schaeffer, 1 E. Lisa F. Schipper, 2 Daniel Ospina, 3.* Paula Mirazo, 4.* Ane Alencar, 9 Mehmaz Anvari, 6.7 Paulo Artaxo,⁶ Mehmet Efe Biresselioglu,⁹ Tanja Blome,¹⁰ Melanie Boeckmann,¹¹ Ebba Brink,¹² Wendy Broadgate,³ Mercedes Bustamante,13 Wenju Cal,14.16 Josep G. Canadell,16 Roberto Cardinale,17 Maria Paz Chidichimo,19 Peter Ditlevsen,²⁰ Ursula Eicker,²¹ Sarah Feron,²² Mahelet G. Fikru,²³ Sabine Fuss,^{24,85} Amadou T. Gaye,²⁶ Örjan Gustafsson,27 Niklas Harring,28 Cheng He,39 Sophie Hebden,3,30 Adrian Heilemann,7 Marina Hirota,31 Nandakumar Janardhanan, 32 Sirkku Juhola, 33 Tae Yong Jung, 34 Jiang Kejun, 36 Siir Kilkis, 36 Nilushi Kumarasinghe, 37, 86

(Author list continued on next page)







10 New Insights in Climate Science 2025



- 1. Understanding the **record-breaking warmth** of 2023 and 2024
- 2. Sea surface warming and marine heatwaves in a changing climate
- 3. Observed changes in **land carbon sinks**, with an emphasis on the weakening Northern Hemisphere sink
- 4. Self-reinforcing feedback loops between **biodiversity loss** and climate change
- 5. The global rise of **dengue** under warming scenarios
- 6. Climate-induced global income and labour productivity losses
- 7. Accelerating global groundwater depletion due to climate pressures
- 8. Underestimation of carbon dioxide removal (CDR) needs
- 9. Methodological limitations and future prospects of carbon markets
- **10. Policy mixes** that can effectively drive emissions reductions

Report launch plan: October

2025 Editorial board experts from WCRP: Ana Bastos, Pierre Friedlingstein, Regina Rodrigues, Roberto Sanchez-Rodriguez

Statement from Science at COP28

- "We Need Net Zero Carbon Dioxide Emissions by 2050".
- Over 1000 signatories.
- Mentioned in New York Times
- Co-convened between Future Earth and WCRP.

It's Big Oil vs. Science at the U.N. Climate Summit

163

As negotiators work to agree on a final text, attention has turned to a fundamental question: Will the talks call for a phaseout of fossil fuels?

Share full article







Earth Commission



- Established 2019
- Quantify **safe and just boundaries** for a stable, resilient planet
- Underpins action via sciencebased targets
- Transformation pathways







Earth Commission

- Safe & Just Boundaries quantified (Nature 2023)
- Safe & just corridor defined (Lancet Planetary Health 2024) - A dignified life for all within the boundaries
- 20+ peer reviewed papers
- Phase 2 (2024-2026) objectives:
 - Refine the boundaries and quantify Ocean & Novel Entities boundaries
 - Earth system budgets
 - Transformation Pathways







The Tipping Point Modelling Intercomparison Project

Led by: Ricarda Winkelmann Donovan Dennis Jonathan Donges Sina Loriani

In collaboration with: The TIPMIP community









Tipping Points Modelling Intercomparison Project (TIPMIP) is an international modelling intercomparison aimed at addressing the critical knowledge gaps regarding tipping dynamics in the Earth system. TIPMIP and its community will will work towards a multi-model assessment of the associated likelihoods and biophysical impacts of crossing critical thresholds (tipping points) in the Earth system.





Progress 2024-25

- Engaged with **250+ scientists, stakeholders, and policy-makers** at in-person meetings in Europe, North America, and Asia
- Collaborations with EU Horizon projects (TipESM, ClimTIP, OptimESM) and WhatifMIP
- Overarching project framing protocol, experimental protocols for TIPMIP-OCEAN domain
- Co-authored an EU Policy Brief on Earth system tipping risks for Europe
- Second annual TIPMIP General Assembly 2025 in Baltimore, Maryland
- Co-convened sessions at AGU and EGU
- **TIPMIP Framework paper** (Winkelmann et al., submitted) for peer review
- Secured long-term, open-access **data storage** for model outputs/results



Tipping Points Discussion Series









World Climate **Research Programme**

Tipping Points Discussion Series

Take part in the new scientific discussion about looming abrupt changes in the Earth system. This new webinar series invites scientists interested in tipping elements and the broader public to attend.

1 SEPTEMBER 2021 - 31 DECEMBER 2025

Previous events in 2025

- The AMOC Tipping Point: Impacts on Climate and Extreme Events (March)
- **Tipping Points Across Scales:** Complexity in Social and Ecological Systems (Jan)

Next: 21 May 13:00-14:30 AMOC Shifts: Scientific Insights & Policy Implications.



MODEL INTERCOMPARISONS

CALMIP - Calibrated Land Model Intercomparison Project a

> info and workshop (April 2025) recordings available: <u>https://aimesproject.org/category/events/</u>

- AerohistMIP (Scoping with **PAGES** and **IGAC**)
- Endorsement of TIPMIP

CONFERENCES

3rd Annual Dynamic Vegetation Modeling and Observations Conference, April 2025

ASSESSMENTS

- Modeling the climate-biodiversity-society nexus
- High-impact climate events, tipping points, and irreversible regional impacts (With WCRP Safe Landing Climates High Risk Lighthouse Activity)

Governing Council 2025



GC Co-chairs: Maria Uhle (US NSF), Xuemei Bai (AUS, Urban KAN, Earth Commission) Assembly co-chairs: Kristie Ebi (US), Cornelia Krug (DE)

Early Career Researchers





Giovanni Avila-Flores

UNIVERSITY OF BAIA.

LECTURER AUTONOMOUS

Timothy Balag'kutu LECTURER UNIVERSITY OF

PROFESSIONAL STUDIES

Regional, National, Subnational Committees / Structures / Entities

Joon Kim

Xiaoyu Fang

CO-EXECUTIVE DIRECTOR

ICOMMUNICATION &

Xuemei Bai URBAN KNOWLEDGE ACTION

RETWORK STEERING.

Global Research Networks (GRP or KAN)

Ariane de Bremond

EXECUTIVE DIRECTOR

INTERNATIONAL.

Experts from Low and Middle Income Countries



Jean Pierre Ometto

Global Secretariat Hubs Boards and Funders



INTERNATIONAL ACTIVITIES.

Maria Uhlo





Deliang Chen ALCOST BOUSS CHAM PROGRAM INTERFORMENTS.

PROFESSOR OF PARTMENT.

Gordon McBean PROFESSOREMENTES WESTERN UNIVERSITY



Taikan Okl

SPECIAL ADVISOR TO THE PRESIDENT PROFESSOR, 7H.

Wendy Steele VICE, CHAIR FUTURE EARTH CO-CHARLFUTURE EANTH KOREA NATIONAL. AUSTRALIA STEERING.



Lucas Enrico



Yulia Sugandi

RESEARCHER THE.

EDUCATOR AND



Sharachchandra Lele

DISTINGUISHED FELLOW CENTRE FOR ENVIRONMENT.





Prudence Makhura

Stéphane Blanc

NRF EXECUTIVE DIRECTOR INTERNATIONAL GRANTS AN

HESEARCHER/PROFESSOR NATIONAL SCIENTIFIC AND.

Urban KAN

- <u>ESA-FE</u> funded case studies on climate change and cities in LMICs.
- Development of Urban KAN research agenda complete. Relevant manuscripts submitted to the Journal Global Sustainability.
- Organization of Urban KAN webinars initiated. At least three webinars have been planned for in 2025. Tentative topics include:
 - Nature-based solutions, nature & peace, and urban recovery. (Lead: Dr. Kensuke Fukushi)
 - Post-disaster resilience planning. (Lead: Zeenat Niazi)
- Always open to opportunities to join webinars with other entities







UNIVERSITÄT BERN







Coordinating paleoscience for a sustainable future

SHARE

Marie-France Loutre – Executive Director

WCRP

World Climate Research Programme

&

PAGES

Common grand challenges & questions, today ...





PACES WCRP collaboration

Risk KAN

(Knowledge Action Network on Emergent Risks and Extreme Events)

Goal: To serve as open platform for scientific communities from across science disciplines and engineering working on extreme events, disaster risk reduction and governance to exchange information, knowledge and data and engage in collaborative research activities.

- To engage with societal actors to co-create new knowledge for effectively reducing disaster risks...
- To stimulate groundbreaking and solution-oriented scientific research for risk reduction process...

To address systemic, complex and cascading risks by synthesis of various scientific approaches and products...

Institute for Advanced Sustainability Studies

ERL Focus Issue co-lead by Risk KAN co-chair Jana Sillmann "Focus on Earth System Resilience and Tipping Behavior - Environmental Research Letters – IOPscience Nature commentary: Reichstein, M., Riede, F., Frank, D. (2021). More floods, fires and cyclones — plan for domino effects on sustainability goals. Nature, 592, 347-349. doi:10.1038/d41586-021-00927-x

Briefing note: Sillmann, et al.S. 2022. ISC-UNDRR-RISK KAN Briefing note on systemic risk, Paris, France, International Science Council, doi: 10.24948/2022.01 (March 10, 2022)

Golding, B. (edit.) 2022 https://doi.org/10.1007/97 8-3-030-98989-7

Knowledge Action Network on Emergent Risks and Extreme Events

Reducing Disaster Risks under Environmental Change

Objectives

- to build global knowledge on emergent risks and disaster risk reduction under global environmental and societal change
- to address systemic, complex and cascading risks by synthesis of various scientific approaches and products
- to provide an open platform for scientific
 communities across disciplines working on extreme
 events, systemic risks, DRR and governance to
 exchange information, knowledge and data

Risk-KAN Working groups

www.risk-kan.org

ENVIRONMENTAL RESEARCH LETTERS

Recent Activities

Focus on Earth System Resilience and Tipping Behavior

Heatwaves Extreme drought Bark beetles outbreak Early-warning signals AMOC transition dynamics Tipping scales Domino effects Resistance recovery

3rd International Conference Natural Hazards and Risks in a Changing World

Addressing Compound and Multi-Hazard Risk

REVIEW AND OPPORTUNITIES FOR RESEARCH, POLICY AND PRACTICE FROM THE PERSPECTIVE OF CLIMATE, ENVIRONMENTAL AND DISASTER RISK SCIENCE AND MANAGEMENT

BRIEFING NOTE

Al for Climate Impact Risk mitigation: Early Warning

Reichstein, Benson, Camps-Valls, Vinuesa et al. "Early warning of complex climate risk with integrated artificial intelligence", 2024, Nature Sust. in review; figure modified from Brian Golding et al. (2021)

Co-Designing Peer-to-Peer Sharing of Indigenous Knowledge *www.tinyurl.com/pacifaran*

The integrated Land Ecosystem Atmosphere Processes Study

iLEAPS focusses on land-atmosphere systems that include important feedbacks between atmospheric chemistry & vegetation that have an impact on society and on the Earth system.

Future priorities:

- Global change (including surface fluxes)
- Air pollution
- Novel entities
- Land use
- New measurements & data analysis
- Community and collaboration

Atmosphere Level 3: Cloud, serosol, caldant and boundary-layer processe Water/Energy Cycles Level 1: evapo-transpiration, sensible heat, solar radiation **Carbon** Cycle Nitrogen Cycle Level 1: CO. Level 2: N.O. reactive N. Level 2: CO, VOCs, particles particles, ozone Oross Cuttle Arid/Semi-arid Cold regions Natur evel 3: Ecological, Level 3. Foologie velvelogical and cartopy Institution and canopy Land ecosystems

Global Sustainability

cambridge.org/sus

Intelligence Briefing

Cite this article: Haymon G of of (2024), museafth into land atmosphere interactions, supports the sustainable development agenda. Bladed Sustainablery 7, e12; 1-5. https://doi.org/10.1017/sur.2024.3

https://doi.org/10.1017/sus.2024.3

Research into land atmosphere interactions supports the sustainable development agenda

Garry Hayman¹, Benjamin Poulter², Sachin D. Ghude¹, Eleanor Biyth¹, Vinayak Sinha⁴, Sally Archibald⁵, Kirsti Ashworth⁶, Victoria Barlow⁴, Silvano Fares⁷, Gregor Feig^{6,9}, Tetsuya Hiyama¹⁰, Jiming Jin¹¹, Sirkku Juhola¹², Meehye Lee¹³, Sebastian Leuzinger⁴⁴, Miguel D. Mahecha^{15,16}, Xianhong Meng¹⁷, David Odee^{16,19}, Germma Purser²⁰, Hisashi Sato²¹, Pallavi Saxena²², Valiyaveetii S. Semeena¹, Allison Steiner²³, Xuemei Wang²⁴ and Stefan Wolff^{23,26}

UK Centre for Ecology & Hydrology

futurerth

The integrated Land Ecosystem Atmosphere Processes Study

Activities

- Holding webinars, workshops and conferences
- Convening conference sessions (EGU, SRI)
- Setting future priorities
- Developing tools and methods
- ECR networks

Collaborations & initiatives

- GEWEX: iLEAPS on GLASS panel
- <u>GEWEX & AIMES</u>: Land surface modelling forum
- <u>Mountain Research Institute</u>: (a) C-cycle measurements in cold/elevated regions; (b) ECVs
- ESA (AIMES, GLP): EO for land surface modelling
- <u>IGAC</u>: TOAR, air pollution
- SOLAS, IGAC, AIMES & PAGES: Wildfires & biomass burning
- <u>FE Finance & Economics</u>: Biodiversity & Green Finance

futurørth

NOVEL SPATIOTEMPORAL MEASUREMENTS OF URBAN AIR COMPOSITION AND SOURCE FINGERPRINTING

Pawel Misztal Assistant Professor Air Quality "Sniffer" Lab Civil, Architectural and Environmental Engineering University of Texas at Austin

x more reactive towards

©TEXAS