

futureearth

Research. Innovation. Sustainability.

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United Nations
Educational, Scientific and
Cultural Organization



International
Science Council



Global Mission & Vision

Our **mission** is to advance research in support of transformations to global sustainability.

Our **vision** is of a sustainable and equitable world for all, where societal decisions are informed by openly-accessible and shared knowledge.



9

**Global
Secretariat
Hubs**

16

**National
and Local
Networks**

27

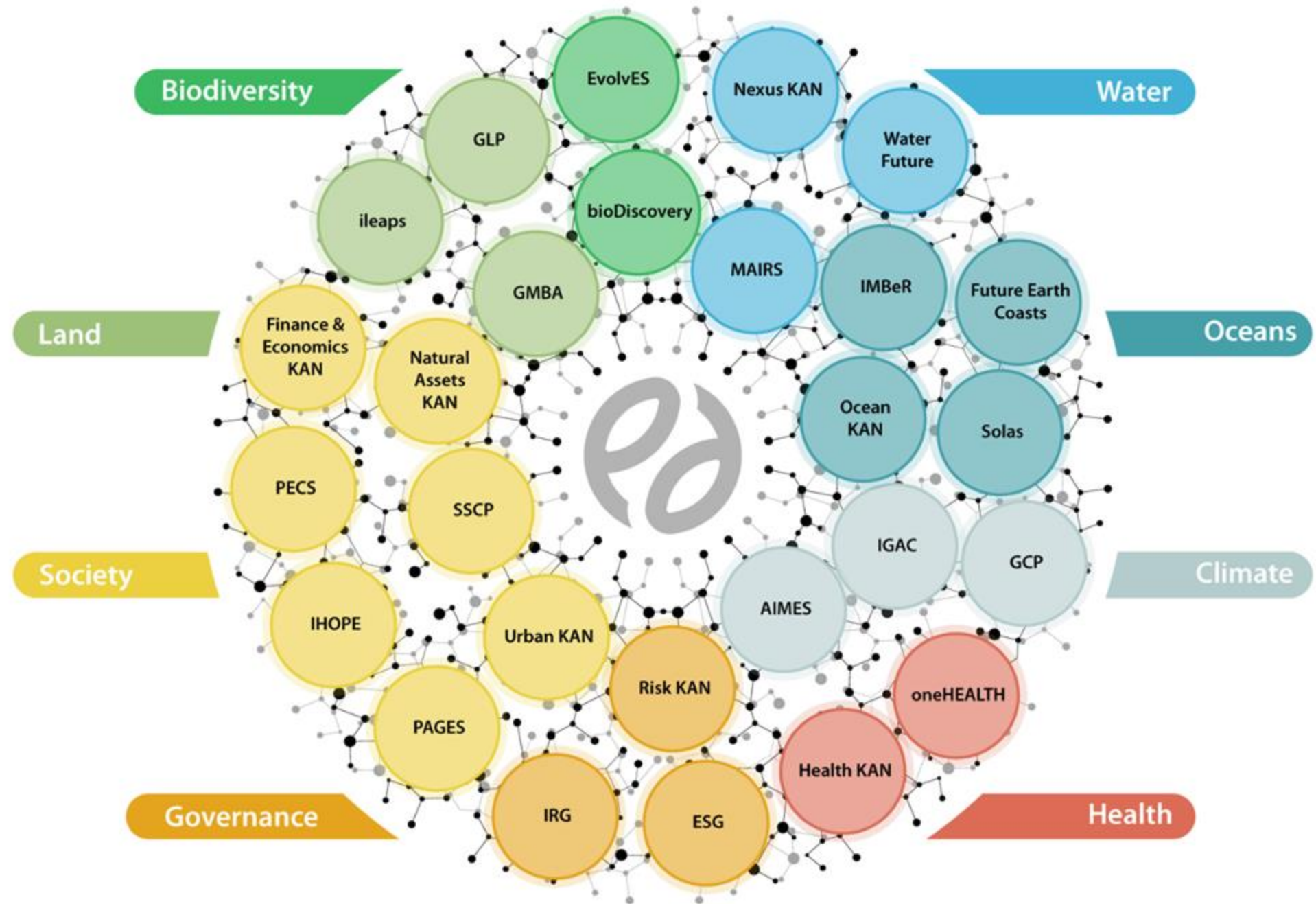
**Global
Research
Networks**

50 000

**People
Involved
Globally**



Global Research Networks



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:** published in *Global Sustainability* until 2023, for 2024/2025 submitting to *One Earth*.
- 2. Policy report:** geared toward climate policy negotiators and general informed public, launched every with UNFCCC since 2017.



<https://10insightsclimate.science/>

10

NEW INSIGHTS IN
CLIMATE SCIENCE



Accepted manuscript

Ten New Insights in Climate Science 2023/2024

Published online by Cambridge University Press: 01 December 2023

Mercedes Bustamante, Joyashree Roy, Daniel Ospina , Ploy Achakulwisut, Anubha Aggarwal, Ana Bastos, Wendy Broadgate, Josep G. Canadell, Edward R. Carr and Deliang Chen 

...Show all authors 

Article


Metrics

Statement from Science at COP28

- A statement from science on fossil fuel phase out.
- 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

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



 163

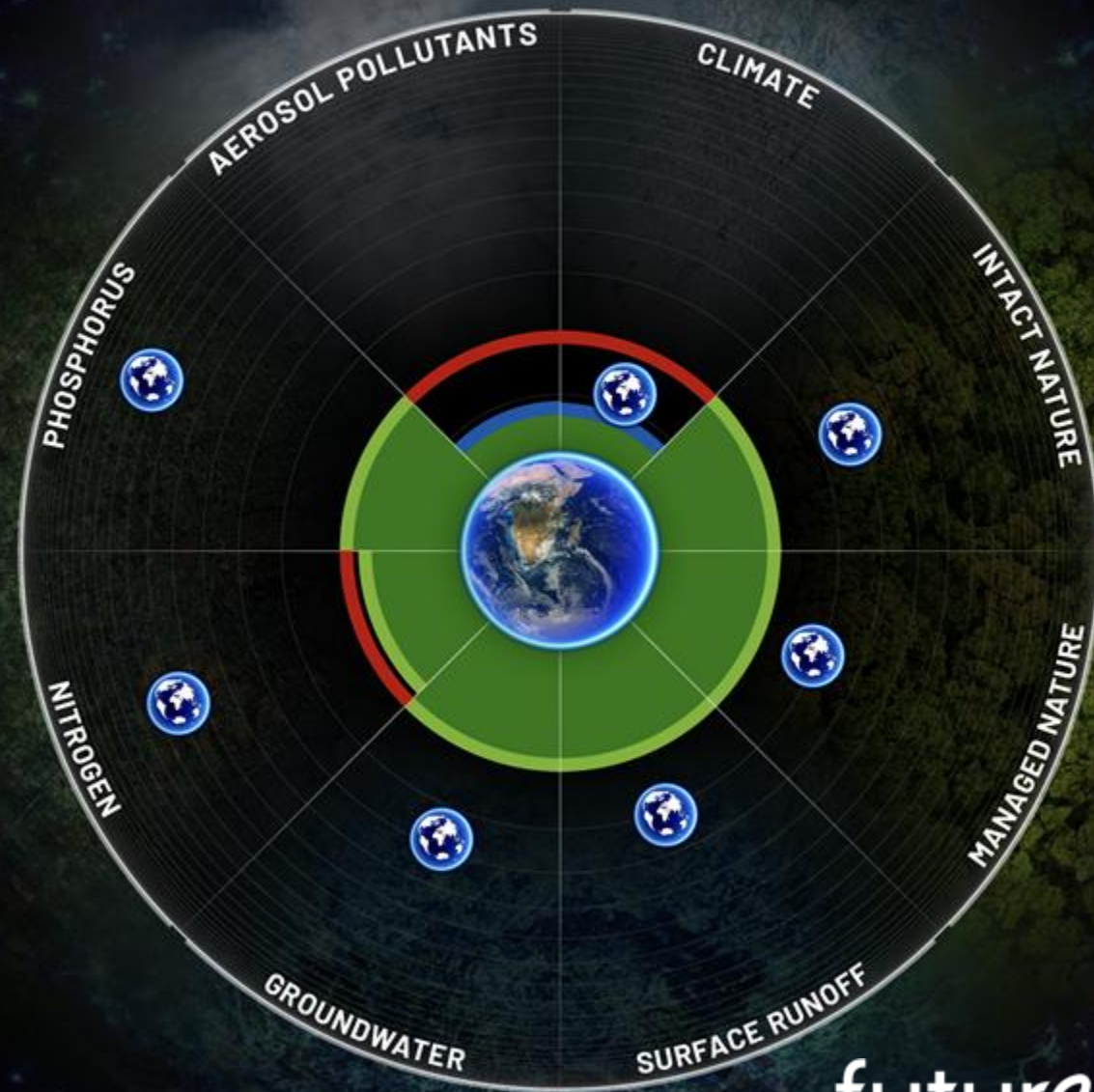


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WCRP
World Climate Research Programme

The Earth Commission

- **Safe & Just Earth System Boundaries quantified (Nature 2023)**
- **20+ peer reviewed papers**
 - To underpin **science-based targets** and guide action by e.g. companies & cities (with Global Commons Alliance)
- **Phase 2 (2024-2026) objectives:**
 - **Transformation pathways** to reach the safe & just corridor
 - **Refine ESBs** and quantify ESBs for Ocean & Novel Entities
 - Tipping Points Modelling Intercomparison Project (**TIPMIP**)



Rockström et al, Nature 2023

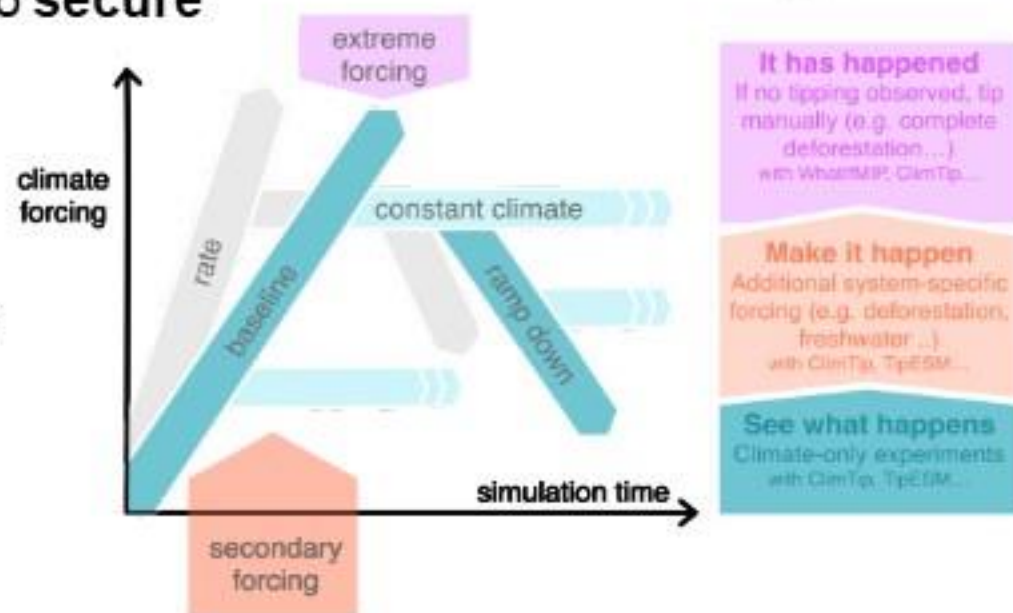
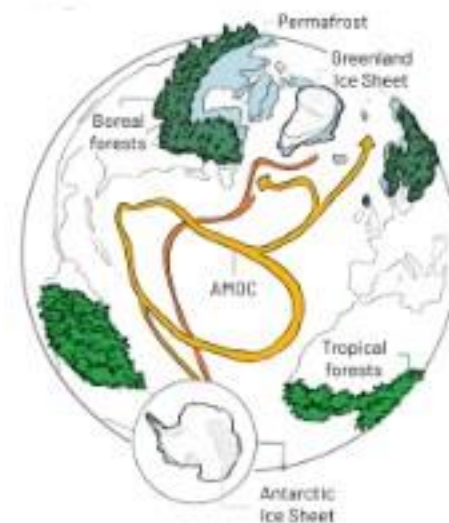
The Tipping Points Modelling Intercomparison Project (TIPMIP)

Updates:

- **Formed domain leadership groups** for the six TIPMIP domains;
- Hosted a series of in-person and online community and domain meetings, including the W.E. Heraeus Seminar “Towards TIPMIP” in Nov. '23 and TIPMIP meeting at EGU.
- **Converged on an Earth system modeling protocol** with other domain protocols actively in development;
- Leveraged the initial Earth Commission seed funding to **secure additional external funding.**

Forthcoming:

- **Now hiring!:** Data Scientist/Manager;
- TIPMIP General Assembly in North America (Dec. 2024, details to follow).
- Stay in touch: www.tipmip.org or tipmip@pik-potsdam.de



Tipping Points Discussion Series



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 2024

Recent events

- Accelerating Transformation with Positive Food System Tipping Points
- Soils
- Communicating Tipping Points
- Sea Ice
- Early Warning Signals

Next: 19 June 14:30-16:00 *Climate Tipping Interactions and Cascades.*

Future Earth Assembly



- **Mechanism for recommendations to Governing Council (WCRP is a member)**
- **Assembly Meeting 12-13 June 2024 to co-design the foundations for Future Earth's post 2025 research agenda**
- Convening our networks in an Open Science Conference: would WCRP be interested to explore hosting a true joint OSC with Future Earth? In what time horizon?



The International Global Atmospheric Chemistry Project



Mission Statement: Advancing atmospheric chemistry towards a sustainable world

Advancing Knowledge

Through activities like:

Tropospheric Ozone Assessment Report (TOAR-II).
Global Emissions Initiative (GEIA)
Air Pollution in the Arctic: Climate, Environment and Societies (PACES)
Allin Wayra: Small sensors for Atmospheric Science
Analysis of emissions using Observations (AMIGO)
Atmospheric Composition and the Asian Monsoon (ACAM)
Biomass Burning Uncertainty: ReactionS, Emissions, and Dynamics (BBURNED)
Chemistry-Climate Model Initiative (CCMI)
Monitoring, Analysis, and Prediction of Air Quality (MAP-AQ)
The Cryosphere and Atmospheric Chemistry (CATCH)

** Many activities co-sponsored and we welcome this!

Fostering Community and Building Capacity

Through major events like:

Biennial Science Conferences, co-sponsored by iCACGP
Workshops, conferences, and summer schools planned by Activities and Working Groups
Through regional working groups like:
African Group on Atmospheric Sciences (ANGA)
Americas Working Group
China Working Group
Japan National Committee
Monsoon Asian and Oceania Networking Group (MANGO)
IGAC Southern Hemisphere working group
Through early career research activities like:
The Early Career Scientific Steering Committee and related activities
Biennial Early Career Short Course and early Career events during conferences

Thanks to our project office sponsors, NSF, NASA, & NOAA

Engaging community and society

Through communications

Website
Social media
Mailing list
Newsletter

Through new activities and working groups

IGAC is open to proposals of new activities and working groups, especially co-sponsored activities.

Engaging society is a newer facet of IGAC, we welcome collaboration on this front.

Examples of recent and planned outcomes from IGAC:

Tropospheric ozone database and special journal issue.
Summer school on satellite data usage.
Review paper on atmospheric chemistry issues specific to the Southern Hemisphere
Review paper on low-cost sensor usage and health applications in Asia
35th year celebration special journal issue on IGAC
Database of atmospheric chemistry datasets (metadata and links only, not data hosting).

PAGES

Coordinating paleoscience for a sustainable future

Marie-France Loutre – Executive Director



中国科学院
CHINESE ACADEMY OF SCIENCES

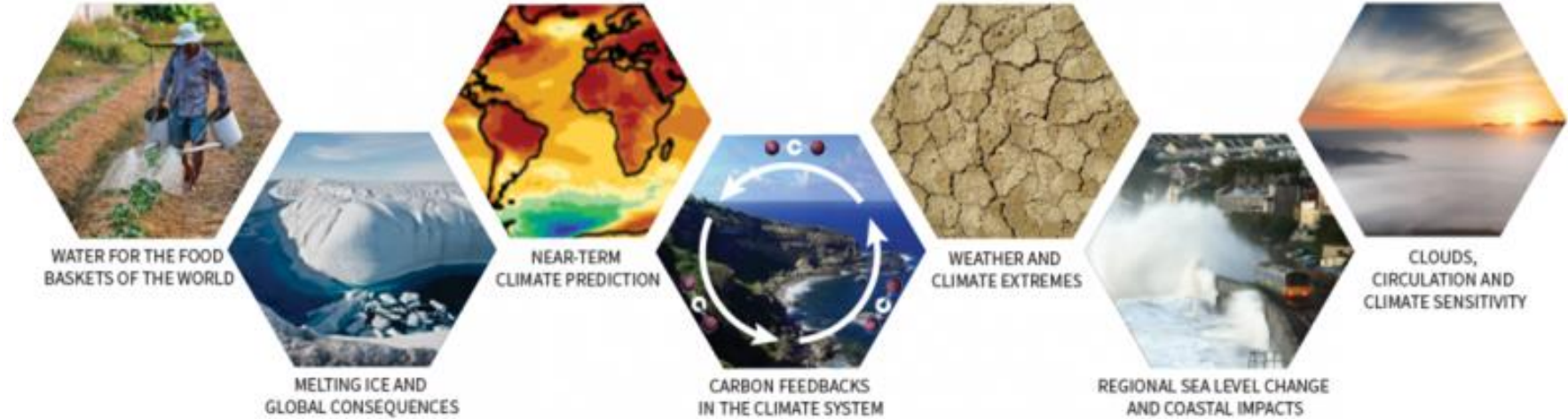


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WCRP
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Research Programme

&

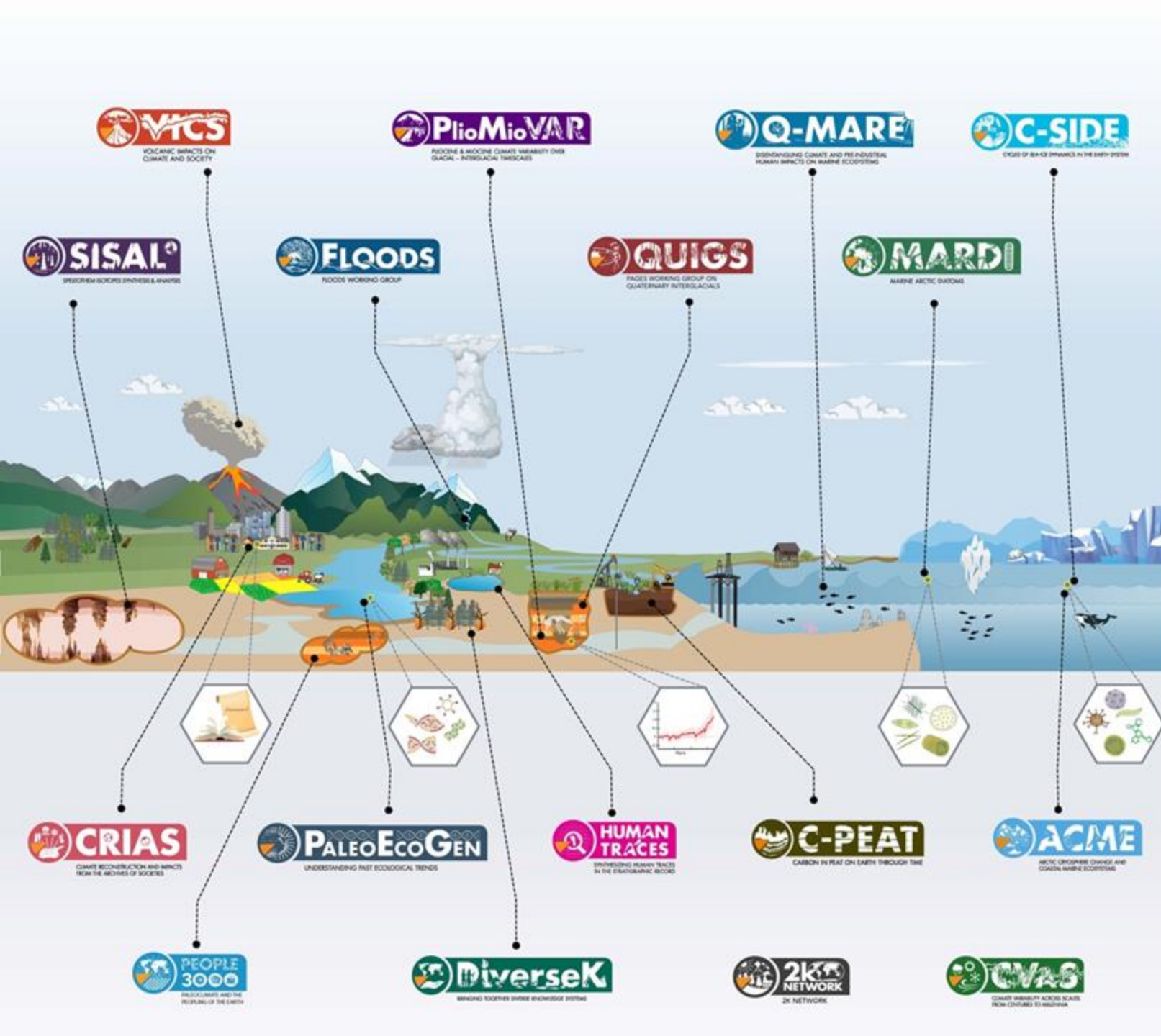
Common grand challenges & questions, today ...



...and in the past.

We need **collaborative opportunities** to enhance climate and paleoclimate!





PAGES
WCRP
collaboration



Rif





Surface Ocean – Lower Atmosphere Study (SOLAS)

International research programme officially launched in 2004 to understand the key biogeochemical-physical interactions and feedbacks between ocean and atmosphere and impact on climate regulation and global change

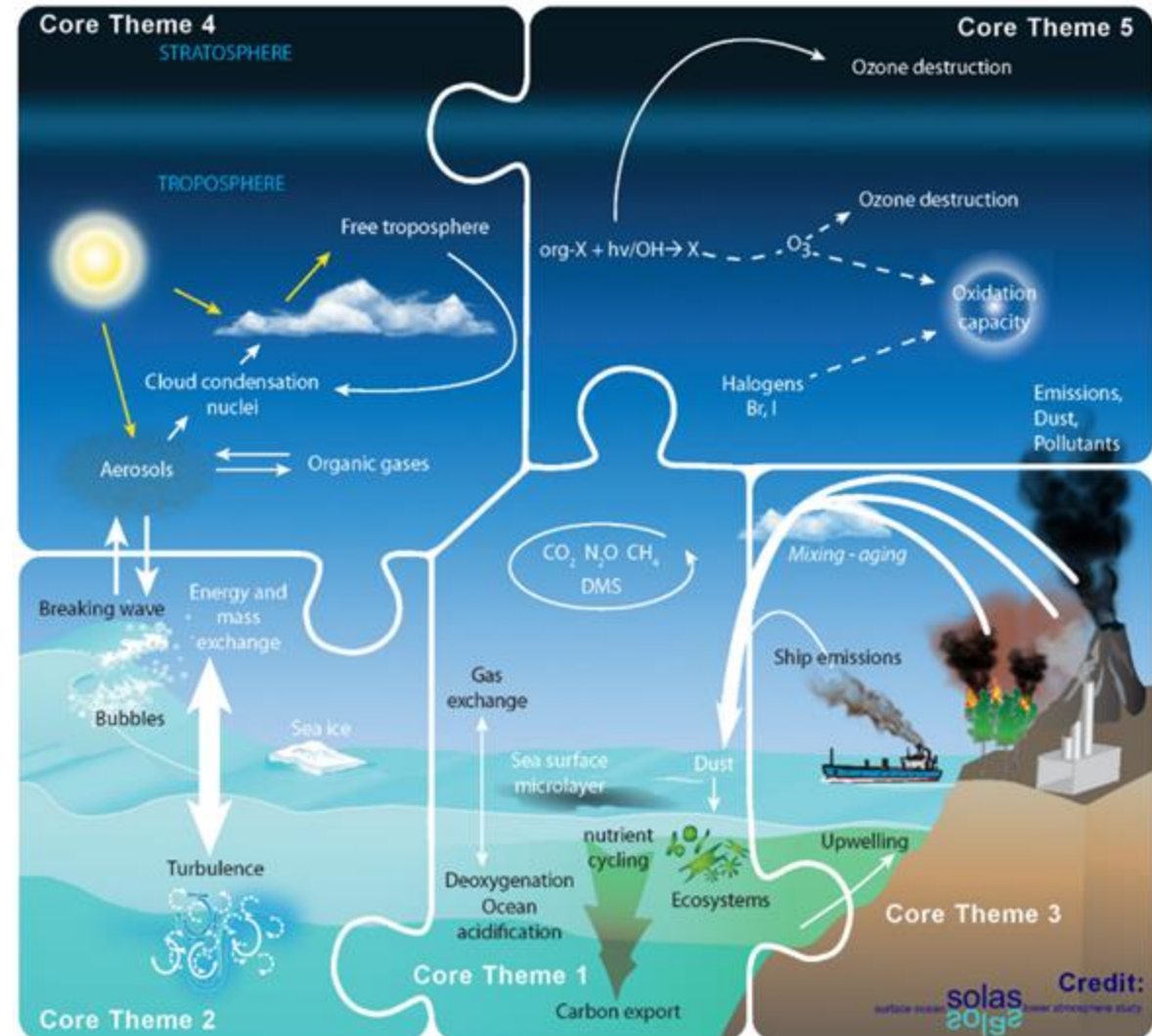
Core Themes

1. Greenhouse gases and the oceans, including ocean acidification
2. Air-sea interface and fluxes of mass and energy
3. Atmospheric deposition and ocean biogeochemistry
4. Interconnections between aerosols, clouds, and marine ecosystems
5. Ocean control of atmospheric chemistry

Cross-Cutting Themes

- Regional studies - upwelling systems, polar oceans, Indian Ocean
- Climate intervention: environmental efficacy and impacts
- Science & Society: ship emissions, blue carbon

Science Plan 2015-2025

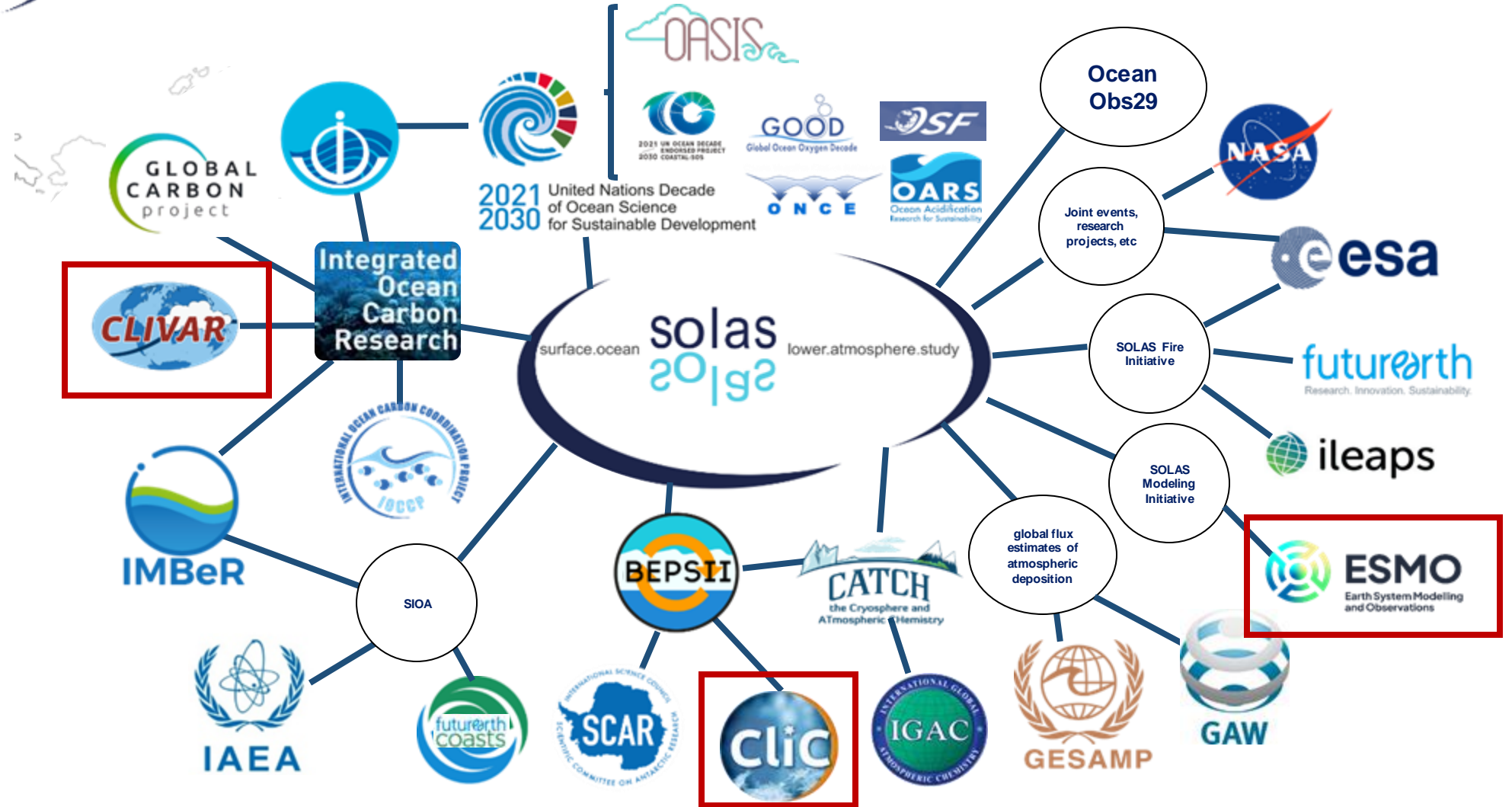


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Surface Ocean – Lower Atmosphere Study (SOLAS) Global Network



Integrated Ocean Carbon Research

2021 2030 United Nations Decade of Ocean Science for Sustainable Development



Ocean Obs29



Joint events, research projects, etc



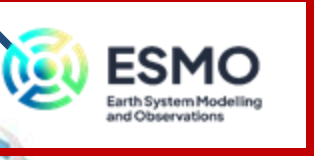
SOLAS Fire Initiative



SOLAS Modeling Initiative



global flux estimates of atmospheric deposition



SIOA



Ocean Obs29



Joint events, research projects, etc



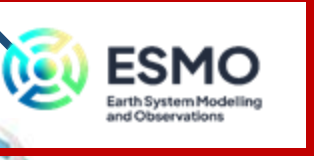
SOLAS Fire Initiative



SOLAS Modeling Initiative



global flux estimates of atmospheric deposition



SIOA



Ocean Obs29



Joint events, research projects, etc



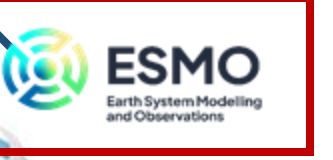
SOLAS Fire Initiative



SOLAS Modeling Initiative

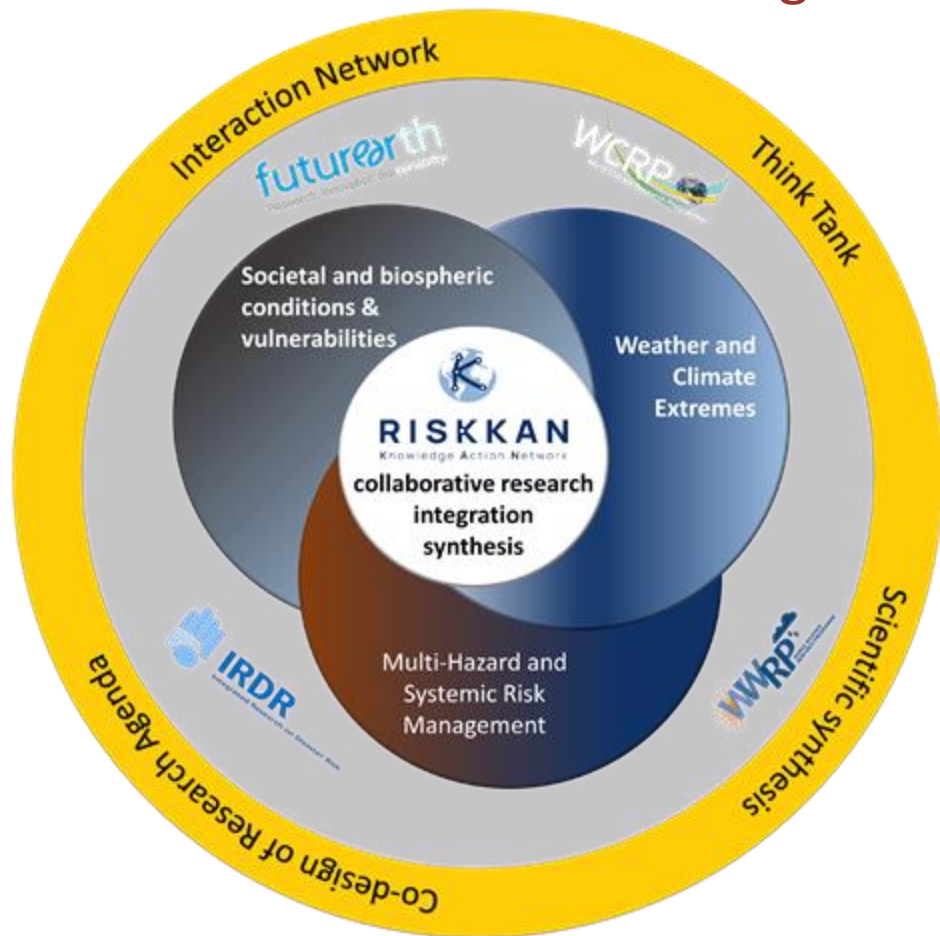


global flux estimates of atmospheric deposition



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

Risk KAN Working Groups

Compound Events and Impacts

Colin Raymond, Kai Kornhuber
Mona Hemmati, Cassandra Rogers


Webpage

Document 

Past4future

Lara Mani, Arindam Chakraborty, Evaristus

Iorkohol

Document 


Early Warning

Brian Golding, Faith Taylor
Marleen de Ruiter, Robert Sakic Trogrlic

Document 


Ecosystem -based approaches to DRR

Takehito Yoshida

Document 

Low elevated coastal zones and cities

Qian Ye

Document 


Critical infrastructures

Patricia Romero-Lankao
Alexander Fekete

Document 

Metabolic Risk on Islands

Simron Singh

Document 


Systemic risks and global governance

Sirkku Juhola, Gordon McBean
Reinhard Mechler

Document 

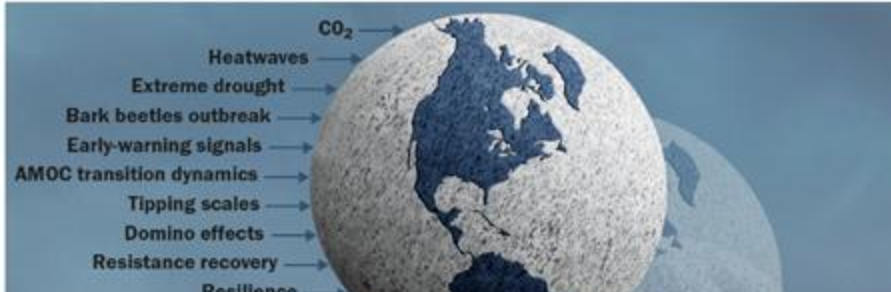
Climate Risk Modeling and Management

Alessio Ciullo
Jana Sillmann

Document 

Recent Activities

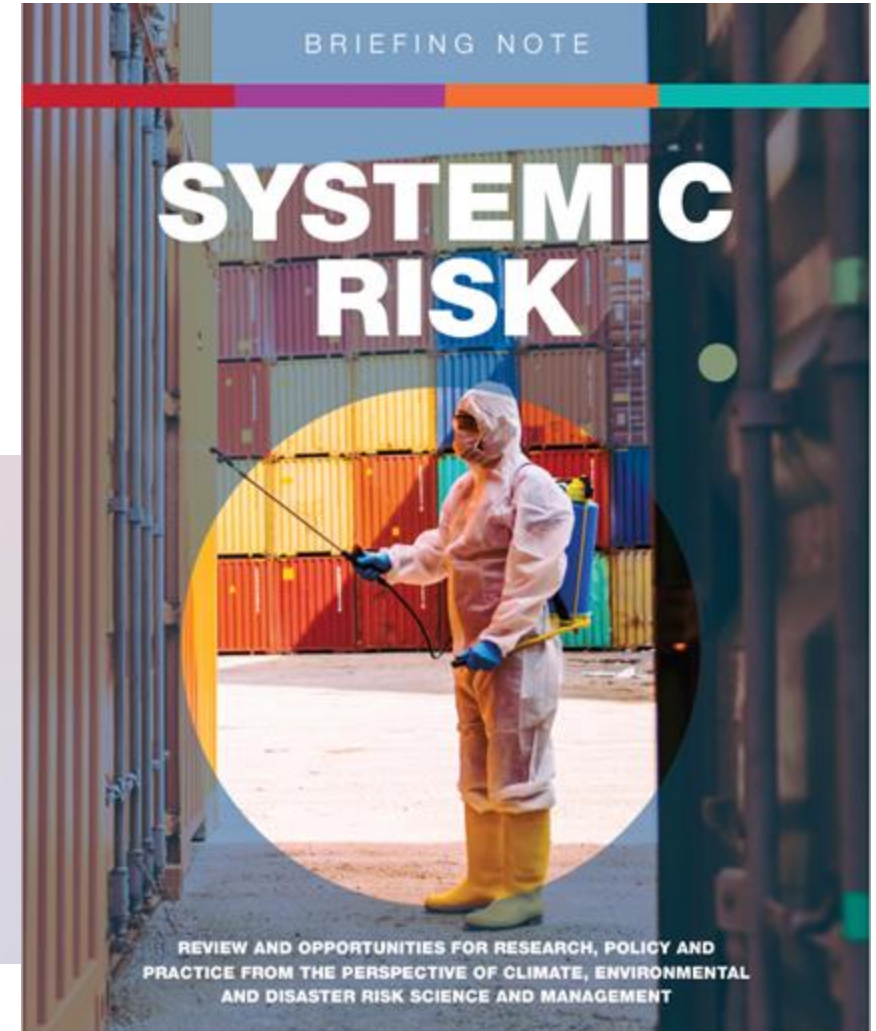
Focus on Earth System Resilience and Tipping Behavior



3rd International Conference

Natural Hazards and Risks in a Changing World

Addressing Compound and Multi-
Hazard Risk

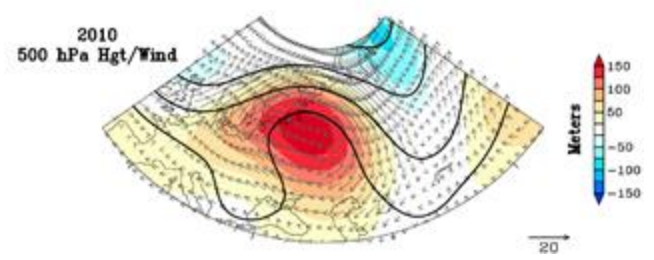


Main Foci: Systemic risk, Early Warning of complex risk

AI for Climate Impact Risk mitigation: Early Warning



MAX PLANCK INSTITUTE FOR BIOGEOCHEMISTRY



Dole et al. (2011) Geophys. Res. Let.



c) ground-truth output



d) physics-informed GAN (ours)

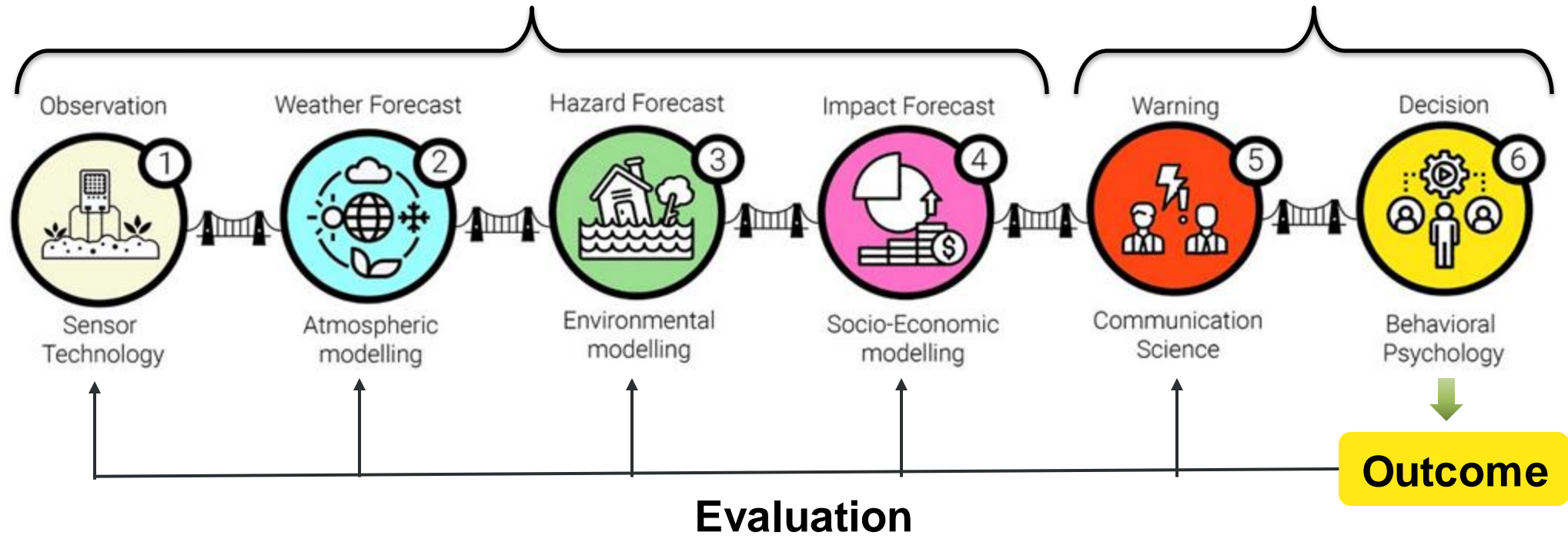
Lütjens et al. (2021)



Fig. 6: Simplified example of interactivity of the AI-based system.

~ Prediction tasks

~ Information tasks

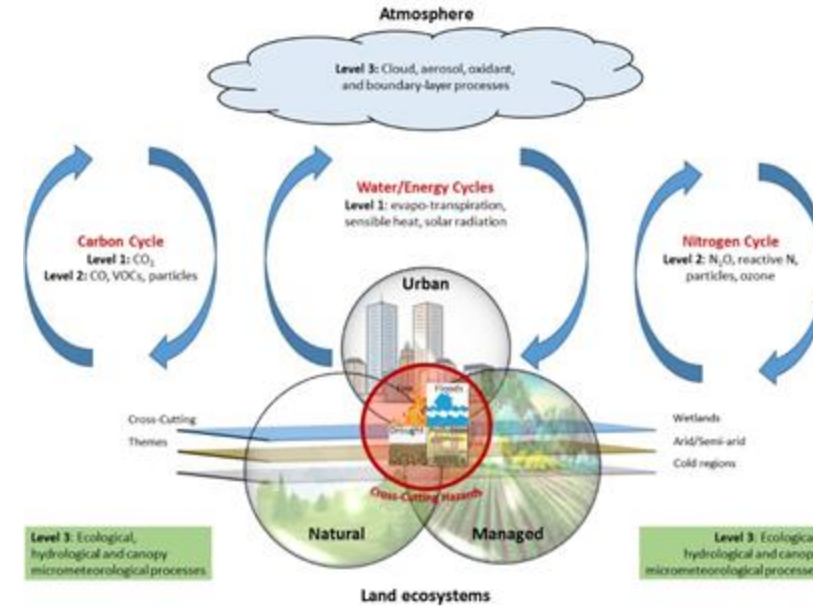


Reichstein, Benson, Camps-Valls, Vinuesa et al. "Early warning of complex climate risk with integrated artificial intelligence", 2024, Nature Sust. in review; figure modified from Brian Golding et al. (2021)

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

Global Sustainability

cambridge.org/sus

Intelligence Briefing

Cite this article: Hayman G et al. (2024). Research into land atmosphere interactions supports the sustainable development agenda. *Global Sustainability* 7, e12, 1–9. <https://doi.org/10.1017/sus.2024.3>

Research into land atmosphere interactions supports the sustainable development agenda

Garry Hayman¹, Benjamin Poulter², Sachin D. Ghude³, Eleanor Blyth¹, Vinayak Sinha⁴, Sally Archibald⁵, Kirsti Ashworth⁶, Victoria Barlow¹, Silvano Fares⁷, Gregor Feig^{8,9}, Tetsuya Hiyama¹⁰, Jiming Jin¹¹, Sirkku Juhola¹², Meehye Lee¹³, Sebastian Leuzinger¹⁴, Miguel D. Mahecha^{15,16}, Xianhong Meng¹⁷, David Odee^{18,19}, Gemma Purser²⁰, Hisashi Sato²¹, Pallavi Saxena²², Valiyaveetil S. Semeena¹, Allison Steiner²³, Xuemei Wang²⁴ and Stefan Wolff^{25,26}

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

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



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

