

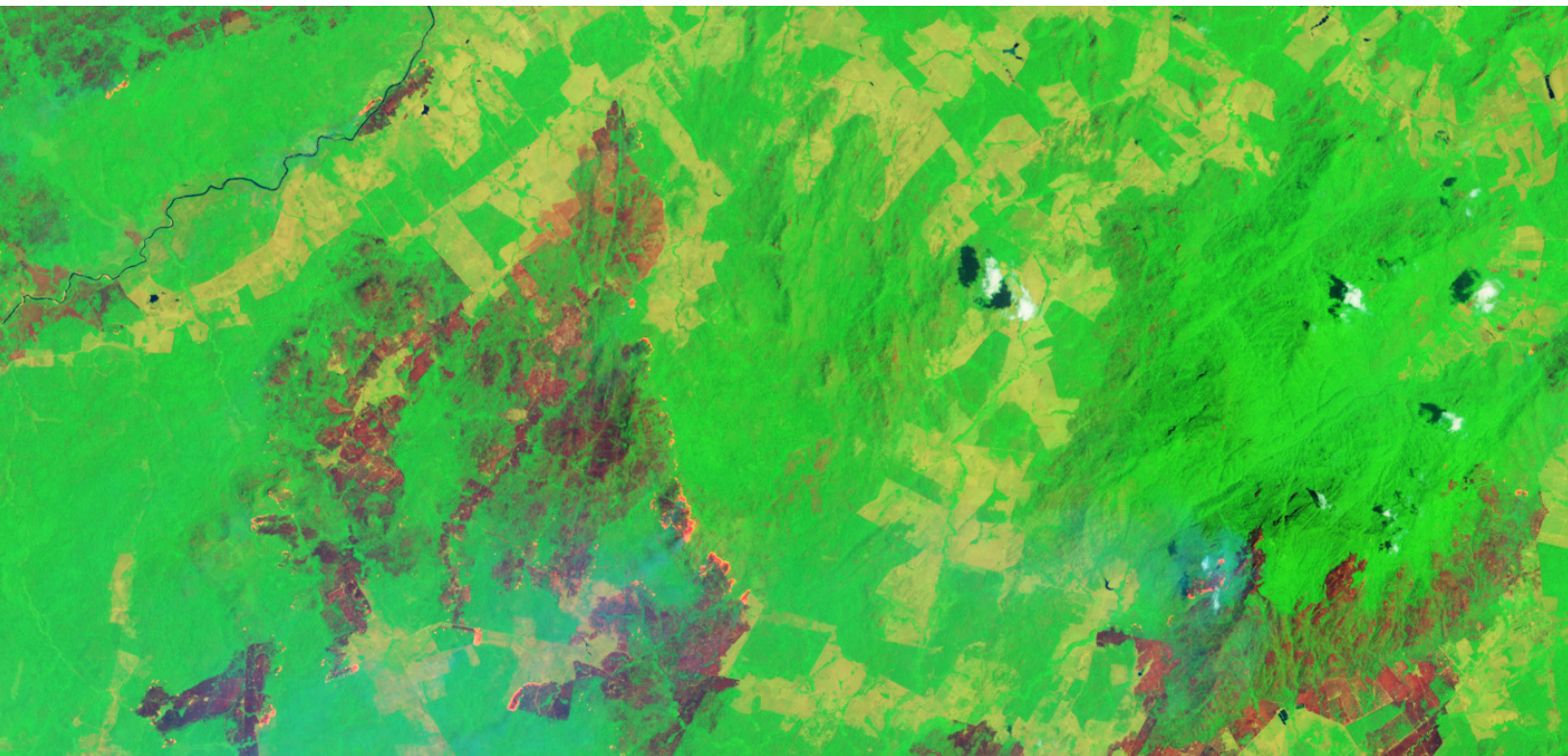


OPENING UP EARTH OBSERVATIONS FOR CLIMATE ADAPTATION

WCRP Report on the ISSI–WCRP Workshop

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Authors

David Khumbanyiwa, Narelle van der Wel
WCRP Secretariat, Geneva, Switzerland

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Executive Summary

Space-based Earth Observations (EO) are fundamental to understanding climate change and supporting climate adaptation efforts across global, regional, and local scales. While EO data are increasingly open and accessible in principle, significant challenges remain in translating these data into usable, equitable, and context-appropriate information for climate adaptation, particularly in vulnerable regions. These challenges include issues of data consistency, scale mismatch, interoperability, institutional capacity, and epistemic injustice.

This report summarizes the plenary discussions of the ISSI–WCRP Workshop “*Opening up Earth Observations for Climate Adaptation*”, held at the International Space Science Institute (ISSI) in Bern from 8–12 December 2025. The workshop brought together experts from climate science, Earth Observation, adaptation practice, philosophy of science, social sciences, and policy to examine how EO can better serve local adaptation needs within the framework of Open Science. Discussions emphasized the importance of community-defined indicators, integration of local and scientific knowledge, transparency in data governance, and institutional structures that enable sustained and just use of EO for adaptation.

The report documents the workshop rationale, objectives, structure, and key plenary themes. Outcomes from breakout groups are not included, as these are being developed further in forthcoming peer-reviewed publications. Instead, this report provides a consolidated account of the shared understanding and strategic directions articulated during the plenary sessions, contributing to WCRP’s broader efforts to advance actionable climate science.

1. Background and Rationale

Earth Observation systems provide long-term, global, and systematic measurements of the Earth system, forming a cornerstone of climate science. EO data support monitoring of climate variables, detection of trends and extremes, and assessment of impacts relevant to the Sustainable Development Goals (SDGs). In recent years, Open Science initiatives have significantly expanded access to EO data and tools.

However, access alone does not guarantee usability. For climate adaptation—particularly at local scales—users face obstacles related to data availability, continuity, spatial and temporal resolution, interoperability across products, and the translation of observations into decision-relevant information. These challenges are often compounded by institutional, technical, and capacity constraints, especially in regions most exposed to climate risks. As a result, inequities may arise in who can effectively use EO data, contributing to forms of epistemic injustice.

Recognizing these challenges, the International Space Science Institute and the My Climate Risk Lighthouse Activity of the World Climate Research Programme (WCRP) convened this interdisciplinary workshop to critically assess the usability of EO for climate adaptation from a local perspective (see ISSI workshop webpage: [Opening up Earth Observations for Climate Adaptation – Workshop 8–12 December 2025](#)). ISSI hosted the workshop and generously covered local

accommodation and per diem, as well as the travel of several convenors, while WCRP covered the travel of several participants. The workshop aimed to move beyond technical considerations alone, engaging with questions of governance, values, and knowledge integration that shape how EO supports adaptation in practice.

2. Workshop Objectives

The overarching objective of the workshop was to assess how Earth Observations can be better “opened up” to support adequate and just climate adaptation. Specific objectives included:

- Evaluating the usability of EO products for climate adaptation at local and regional scales;
- Identifying technical, institutional, and epistemic barriers to effective EO use;
- Exploring the role of community-defined indicators and local knowledge in shaping adaptation-relevant information;
- Examining approaches to connect global EO data with local decision-making, including causal networks and storyline methodologies;
- Identifying pathways for improving governance, capacity, and collaboration across scientific and practitioner communities;
- Addressing epistemic injustices related to EO for adaptation.

3. Workshop Structure and Participation

The five-day workshop combined plenary sessions, invited presentations, and facilitated discussions. Participants represented a wide range of expertise, including Earth Observation science, climate modeling, adaptation practice, philosophy of science, social sciences, data governance, and international climate institutions. This diversity was central to the workshop’s interdisciplinary approach. The workshop schedule and list of participants are provided in the Appendices.

Plenary sessions provided a shared space to establish common framing, discuss cross-cutting themes, and reflect collectively on challenges and opportunities. Breakout groups were used to explore specific topics in more depth; however, their detailed outcomes are not reported here, as they will inform separate peer-reviewed publications currently under development.

4. Summary of Plenary Sessions

Day 1: Framing EO, Open Science, and Climate Adaptation

The opening plenary sessions established the motivation for the workshop, emphasizing the critical role of EO in documenting climate change and informing adaptation. Discussions highlighted that while EO data are inherently global, adaptation decisions are local, creating a persistent scale gap. Participants underscored that Open Science must encompass not only data access, but also transparency, interpretability, capacity, and inclusivity.

A recurring theme was the concept of epistemic injustice—situations in which certain communities are disadvantaged in producing, accessing, or using knowledge. Participants noted that EO systems and standards are often shaped by global priorities that may not align with local adaptation needs, reinforcing existing inequities.

Day 2: From Observations to Usable Information

Plenary discussions on Day 2 focused on the transformation of EO data into information that is actionable for adaptation. Participants examined challenges related to data consistency, reanalysis products, and the integration of multiple data sources. The importance of uncertainty communication and transparency in methodological choices was emphasized.

The role of community-defined indicators emerged as a key topic, highlighting the need for indicators that reflect locally relevant thresholds, impacts, and priorities. Participants stressed that EO should be viewed as one line of evidence among many, complementing in situ observations, local knowledge, and socio-economic information.

Day 3: Storylines, Knowledge Integration, and Case-Based Learning

Day 3 plenaries explored approaches for linking climate science and adaptation decision-making through storyline methodologies and causal frameworks. These approaches were discussed as tools for integrating diverse knowledge sources, including scientific understanding and traditional or experiential knowledge.

Case-based perspectives were highlighted as a way to ground abstract concepts in real-world contexts. Participants discussed how case studies can reveal gaps in data availability, mismatches between EO products and user needs, and opportunities for co-production and validation with local stakeholders.

Day 4: Values, Institutions, and Capacity for Adaptation

Plenary discussions on Day 4 emphasized the institutional and ethical dimensions of using EO for adaptation. Participants reflected on how values shape decisions about what is observed, how data are shared, and which adaptation outcomes are prioritized.

Capacity building was discussed not only in terms of individual skills, but also institutional capacity, long-term mentorship, and infrastructure. Participants noted that effective use of EO requires sustained support structures and two-way knowledge exchange between data producers and users.

Day 5: Synthesis and Pathways Forward

The final day focused on synthesizing insights and outlining pathways for future work. Plenary discussions addressed how workshop themes would feed into two planned peer-reviewed

papers: one focused on challenges and opportunities in EO for adaptation, and a second proposing paths forward.

Participants discussed target audiences, including space agencies, WCRP, IPCC, and adaptation-focused communities, emphasizing the need for clear framing and accessible communication. The importance of careful and responsible use of AI tools in supporting writing and synthesis was also highlighted.

5. Links to Future Outputs

The workshop discussions are informing the development of two peer-reviewed publications that will explore specific themes in greater depth, including openness, indicators, case studies, and institutional structures. These publications will build on breakout group work and are intended to complement this report.

6. Conclusions

The ISSI–WCRP workshop highlighted both the promise and the limitations of Earth Observations for climate adaptation. While EO data are essential for understanding climate risks, their effective use for adaptation depends on more than technical advances alone. Addressing issues of usability, equity, governance, and capacity is critical to ensuring that EO supports adaptation in ways that are just, inclusive, and decision-relevant.

By bringing together diverse expertise and perspectives, the workshop contributed to a shared understanding of how EO can be better aligned with local adaptation needs within an Open Science framework. The insights summarized in this report support WCRP’s mission to advance climate science for society and provide a foundation for continued collaboration and research.

Appendices

Appendix A: Workshop Programme Schedule

Time	Session	Speakers / Panellists	Chair / Notes
Monday, 8 December 2025 14:00–15:15	Plenary Session 1: Introductions and Scene-Setting	Mike Rast (Introduction to ISSI) Convener Introductions Ana Durán-Quesada (Workshop Objectives) Regina Rodrigues (My Climate Risk framework) Tour de table: motivations	Chair: Narelle van der Wel
15:15–15:45	Coffee Break		
15:45–17:00	Scene-setting talks & Plenary Discussion (20 min each incl. Q&A)	Sarah Connors (Outcomes from recent ISSI Forum on EO for Climate Adaptation) Aïda Diongue-Niang (IPCC and GCOS perspective) Ted Shepherd (Storylines and conditional attribution)	Chair: Michaela Hegglin
18:00	Welcome Reception - Hallerstrasse 6, 1st floor		
Tuesday, 9 December 2025 9:00–10:30	Plenary Session 2: Challenges in EO Usability (Panel Discussion, 5 min opening)	Cromwel Lukorito Elinah Kuya Carlo Buontempo Chris Merchant Johanna Nalau	Chair: Claudia Notarnicola Topics: - Impacts of data scarcity - Calibration/ validation gaps in data-poor regions - Data consistency and epistemic injustice

			<ul style="list-style-type: none"> - Identification and communication of uncertainties - Utilization of different risk attitudes and preferences in adaptation
10:30–11:00	Coffee Break		
11:00–11:30	Paper 1 Brainstorming / Guidance in Plenary	Patricia Nying'uro Mason Majszak	Paper 1 Objective: <ul style="list-style-type: none"> - Introduction: EO's adaptation relevance - Core sections: CIDs, storylines, case studies
11:30–13:00	Breakout Groups: Paper 1 Content Development	See chair and rapporteur assignments	Participants work in groups on assigned sections
13:00–14:30	Lunch		
14:30–15:45	Plenary: Breakout Group Presentations	Rapporteurs	Chair: Pier Luigi Vidale
15:45–16:15	Coffee Break		
16:15–17:30	Plenary: Case Study Presentations on EO Use	Patricia Nying'uro (Heat extremes) Paola Arias (Rainfall extremes) Julienne Stroeve (Ice- loss narratives)	Chair: Sophie Hebden
Wednesday, 10 December 2025 9:00–10:30	Plenary Session 3: Philosophy & EO Intersections (Panel Discussion, 5 min opening)	Vincent Lam Julie Jebeile Anna Sörensson Douglas Maraun	Chair: Rodrigo Estevez Topics: <ul style="list-style-type: none"> - Calibration gaps as epistemic injustice - Storylines and epistemic injustice - Beyond data access: Open Science limitations - Entanglement of epistemic and ethical

			(& justice) issues Discussion Questions: - How do case studies illustrate Fricker/Lionelli frameworks? - What philosophical tools resolve issues highlighted in Paper 1 obstacles? - Do we need a political philosophy of (adaptation) science?
10:30–11:00	Coffee Break		
11:00–11:30	Paper 2 Brainstorming / Guidance in Plenary	Patricia Nying'uro Mason Majszak	Paper 2 Objective: - Introduction: Epistemic gaps in EO - Core sections: Justice-driven solutions (e.g., co-production, calibration equity)
11:30–13:00	Breakout Groups: Paper 2 Content Development	See chair and rapporteur assignments	Participants work in groups on assigned sections
13:00–14:30	Lunch		
14:30–15:45	Plenary: Breakout Group Presentations	Rapporteurs	Chair: Sarah Kimani
15:45–16:15	Break		
16:15–17:15	Plenary Session 4: Epistemic Injustice (Scene-setting talks 20 min incl. Q&A)	David Ludwig (Knowledge system diversity) Greg Lusk (Values in science, policy focus)	Chair: Heather Maseko-Msyale Discussion Questions: - Credibility deficits and bias in local EO testimony (Indigenous vs formal) - Normative

			frameworks (Fricker, Leonelli) - Context & intersectionality (local, regional, global + vulnerabilities) - Co-production of knowledge, SDG-aligned calibration equity, IPCC pathways aligned to policy choices (WGIII centred) - Alignment of epistemic and social justice
19:00	Workshop Dinner – Rosengarten, Alter Aargauerstalden 31b		
Thursday, 11 December 2025 09:00–09:30	Plenary: Recap	–	Convenors
09:30–11:00	Breakout Groups: Paper 1 Writing	Group A–E (assigned sections)	–
11:00–11:30	Coffee Break		
11:30–12:45	Plenary: Breakout group presentations	–	Christina Greene
12:45–14:15	Lunch		
14:15–15:45	Breakout Groups: Paper 2 Writing	Group A–E (assigned sections)	–
15:45–16:15	Coffee Break		
16:15–17:30	Plenary: Breakout group presentations	–	Stefan Brönnimann

Friday, 12 December 2025 9:00–10:30	Plenary: Bridge the Two Papers & Synthesis	All participants	Discussion: - Clarify handoff points - Review challenges & gaps for Paper 1 - Solidify “topics/tools” for Paper 2
10:30–11:00	Coffee Break		
11:00–13:00	Breakout Groups: Paper Writing	Paper 1 & Paper 2 sections	Participants work on assigned sections
13:00–14:30	Lunch		
14:30–16:00	Final Plenary: Closing Remarks & Next Steps	All participants	Wrap-up, assign tasks, set deadlines

Appendix B: List of Participants

Workshop Convenors

- Ana Maria Duran Quesada (University of Costa Rica, Costa Rica)
- Laura Garcia Portela (Erasmus University of Rotterdam, Netherlands)
- Vincent Lam (University of Bern, Switzerland)
- Mason Majszak (New York University, USA)
- Patricia Nying'uro (Kenya Meteorological Department, Kenya)
- Ted Shepherd (University of Reading, UK)
- Julienne Stroeve (University of Manitoba, Canada)
- Narelle van der Wel (WCRP Secretariat, Geneva, Switzerland)
- Michael Rast (ISSI, Bern, Switzerland)

Other Workshop Participants

Name	Institution	Country
Paola Arias	University of Antioquia	Colombia
Stefan Brönnimann	University of Bern	Switzerland
Carlo Buontempo	ECMWF	Germany
Sarah Connors	ESA	UK
Aïda Diongue-Niang	ANACIM	Senegal
Rodrigo Estevez	University of Santo Tomás	Chile
Franck Ghomsi	University of Manitoba	Canada
Christina Greene	University of Arizona	USA
Sophie Hebden	ESA	UK
Michaela Hegglin	Forschungszentrum Jülich	Germany
Julie Jebeile	University of Bern	Switzerland
Glenn Hunt	Mountain Research Institute	Switzerland
David Khumbanyiwa	WCRP Secretariat	Switzerland

Name	Institution	Country
Sarah Kimani	Kenya Meteorological Department	Kenya
Gabriel Kpaka	Forschungszentrum Jülich	Germany
Eleanor Kuya	Norwegian Meteorological Institute	Norway
David Ludwig	Wageningen University	Netherlands
Cromwel Lukorito	University of Nairobi	Kenya
Greg Lusk	University of Durham	UK
Douglas Maraun	University of Graz	Austria
Heather Maseko-Msyale	UNFCCC	Germany
Alexandrine Massot	GEO Mountains Secretariat	Switzerland
Chris Merchant	University of Reading	UK
Johanna Nalau	Griffith University	Australia
Claudia Notarnicola	EURAC Research	Italy
Anna Sörensson	University of Buenos Aires / CONICET	Argentina
Milica Tomic	University of Belgrade	Serbia
Pier Luigi Vidale	University of Reading	UK
Ying Wang	UNEP	Kenya
Jennifer Lukovich (Remote)	University of Manitoba	Canada

Appendix C: Workshop Group Photo



Figure C1. Participants of the ISSI–WCRP Workshop “*Opening up Earth Observations for Climate Adaptation*”,

Bern, Switzerland, 8–12 December 2025.

Photo courtesy of the International Space Science Institute (ISSI).