Asia-Pacific:
Advancing FAIR data in Advanced Networks

Webinar 25th November 2025

Agenda

Launch of the APAN-CODATA collaboration	
Introducing APAN and CODATA, the MoU background and goals	APAN: Markus Buchhorn, Advisor to the APAN board CODATA: Matti Heikkurinen, Project Portfolio Manager at CODATA
Interoperability approaches and solutions	
APAN working groups and topics	Eric Yen, Cloud WG / ISGC, Academia Sinica Grid Computing Center (ASGC) Taiwan Franz de Leon, Disaster Mitigation WG, Advanced Science and Technology Institute (ASTI), Philippines
CODATA “Making data work” activities and solutions.	Matti Heikkurinen, Project Portfolio Manager at CODATA
Case studies, examples, and future challenges	
Citizen science data for the SDGs in Asia Pacific	Carolynne Hultquist, Director of Geospatial Data Science at the University of Canterbury and Co-chair of the CODATA Task Group on Citizen-Generated Data for the SDGs.
Case studies from the Agriculture, Open and Sharing WGs	Veerachai Tanpipat, Agriculture and Open and Sharing WGs, Hydro-Informatics Institute (HII) and ThaiREN
Open and FAIR air quality data as a foundation for responding to health crises	Núria Castell, Senior Scientist at NILU and co-chair of the CSGP Air Quality CoP
Discussion, next steps	
	Q&A; APAN 61, ISGC other major events

Launch of the APAN-CODATA collaboration

MoU background

APAN and CODATA have had *ad hoc* contacts on working group levels for about a decade

- Workshop talks
- Exchange of project ideas
- Other academic exchange

2025: increased awareness of the need for a framework to benefit from synergies

- Both organisations have grown to a stage where more strategic approach could be sustained
- IDW 2025 being organised in Australia was perhaps also a catalyst

The MoU is a living document

- We have established a starting point
- Webinars like this have an important role in identifying new opportunities for joint activities

MoU Details

Goals

“MoU is to build an effective and mutually beneficial cooperation between the Parties in topics related to data”

Background:
“CODATA and APAN have previously explored their common interests in workshops and dedicated bilateral meetings. These activities have confirmed the parties’ shared interest in supporting a broad range of research and innovation activities, including cross- or trans-disciplinary topics, such as disaster risk reduction and environmental monitoring.

CODATA has actively participated in the work of two APAN working groups:

- Open & Sharing Data WG
- Disaster Mitigation WG

The organisations have also cross-promoted events of interest on an ad hoc basis.”

Complementarity

“Both parties are concerned with advancing the role of research infrastructures: CODATA is primarily concerned with policy issues and the development of technical solutions to implement and advance the FAIR principles, but is not itself an infrastructure provider; APAN is a membership body for NRENs and infrastructure providers who implement such policies and technical solutions.”

APAN in a nutshell: Asia-Pacific Advanced Network

Connecting People, Cultures, Research and Education

Dr Markus Buchhorn
markus@apan.net

Former General Manager.
Board Advisor; Open and Sharing Data WG Co-Chair
eResearch-infrastructure consultant

Asia Pacific Advanced Network
Connecting People, Cultures, Research and Education

National Research and Education Networks…?

- NREN: Parallel internet, sector run, with strong govt linkage
- Freeways for Research and Education, connecting:
  - Universities/Higher Education/K-12
  - Government agencies, cultural institutions (GLAM), hospitals, …
  - Facilities: Telescopes, accelerators, Supercomputers, Cloud, …
- Support the data explosion – PB/s?!?

Asia Pacific Advanced Network

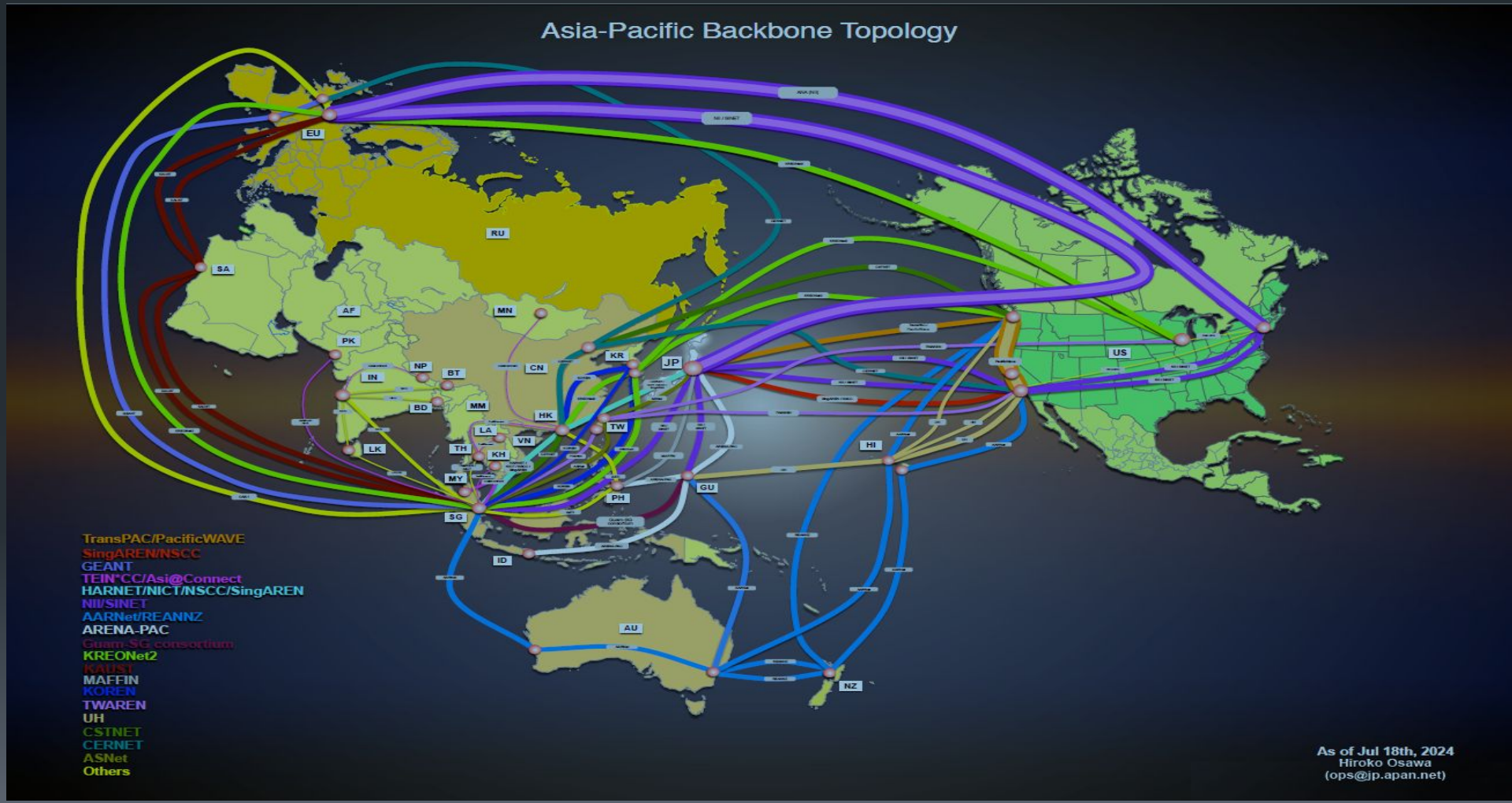
Connecting People, Cultures, Research and Education

The Asia Pacific and APAN

- More than half the world's population
  - Rapidly growing proportion of global R&D
  - Rapidly growing population in education at all levels
  - Strong social pressures around food, health
  - Immense diversity

- APAN: 30-year partnership of NRENs
  - 20+ Economies as primary members, 15+ other partners, etc.

  - Built with both networks and people
  - Built FOR research and education


Asia-Pacific Backbone Topology
EU
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MN
NP
IN
BT
CN
KR
JP
US
BD
MM
HK
TW
LA
VN
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MY
PH
GU
HI
SG
ID
AU
NZ
TransPAC/PacificWAVE
SingAREN/NSCC
GEANT
TEIN*CC/Asi@Connect
HARNET/NICT/NSCC/SingAREN
NII/SINET
AARNet/REANNZ
ARENA-PAC
Guam SG consortium
KREONet2
KAUST
MAFFIN
KOREN
TWAREN
UH
CSTNET
CERNET
ASNet
Others
As of Jul 18th, 2024
Hiroko Osawa
(ops@jp.apan.net)

Asia Pacific Advanced Network
Connecting People, Cultures, Research and Education

Community: focus on users

- Research, Education and Societal Benefits
  - Applications: Agriculture, Earth Systems and Sensing, Culture and Arts, Astronomy, HEP, Bioinformatics, Medicine, Education, Disaster Management (natural, medical, etc.), Health partnerships, …
  - Open and Sharing Data
  - Tech: UC, IPv6, HDTV, AI, Future Int., SDN, IdP Fed., Grid, Cloud, …
- Two major meetings/conference each year
  - *300+ attendees (around 1000 in virtual meetings)*

Asia Pacific Advanced Network

Connecting People, Cultures, Research and Education

Open and Sharing Data WG

- RDM in the Asia Pacific region
- Many technology projects
- Not enough on
  - Awareness, Culture
  - Skills, Capacity
  - Standards, Policies, Maturity
  - Govt engagement
  - *International partners, bodies, …*

Then and now?

- "Towards the Australian Research Data Commons"
  - 2006

- *Towards the Asia-Pacific Research Data Commons…*
  - 2026+

COMMITTEE ON DATA
CODATA
INTERNATIONAL
SCIENCE COUNCIL

International
Science Council

CODATA

Short introduction

Matti Heikkurinen, Project Portfolio Manager, CODATA

https://codata.org/

CODATA in a nutshell

COMMITTEE ON DATA
CODATA
INTERNATIONAL SCIENCE COUNCIL

The **Committee on Data of the International Science Council (CODATA)** is a data-focused membership organisation established in 1966. Our mission is to **connect data and people to advance science and improve our world.**

- CODATA serves a **membership** that includes national data committees, scientific academies, International Scientific Unions and other organisations **(including APAN!)**
- CODATA maintains a **network of expertise** and a **skilled secretariat** to address challenges around data policy, interoperability and reuse of data
- CODATA works with many partners, including
  - UN and intergovernmental agencies (UNESCO, UN Stats, UNEP, UNDRR; OECD; GBIF, BIPM)
  - Technical and standards organisations, data infrastructures.
- CODATA's vision is of a world in which **science is empowered to address universal challenges through the transparent, trustworthy and equitable use of data and information.**

Making Data Work…

WorldFAIR

GOSC Global Open Science Cloud

DDI DATA DOCUMENTATION INITIATIVE

- **Making Data Work for Cross Domain Grand Challenges**
- **WorldFAIR Project and WorldFAIR+**
- Recommendations for the **Cross-Domain Interoperability Framework (CDIF)**
- FAIR Vocabularies with ISUs
- Cross-Domain Case Studies
- Global Open Science Cloud initiative
- Regional Open Science Platforms

Promoting Data Policy

- International Data Policy Committee http://bit.ly/data-policy-committee
- Data Policy in Times of Crisis (UNESCO Open Science Toolkit) https://bit.ly/UNESCO-CODATA-DPTC
- Major policy reports: https://bit.ly/CODATA-Policy-Reports

Data science and AI for science

CODATA – RDA Data Schools

]u[ubiquity press open scholarship

- Data Science Journal: https://datascience.codata.org/
- International Data Week and CODATA Conference series.
- Task Groups and Working Groups.

- CODATA Connect ECR Group
- CODATA-RDA School of Research Data Science.
- Beijing and other training workshops.
- CODATA RDM Terminology

CODATA mission: https://codata.org/about-codata/our-mission/

COMMITTEE ON DATA CODATA INTERNATIONAL SCIENCE COUNCIL

International Science Council

CODATA Task Groups and Working Groups

Task Groups

1. Big Data Curation and Curation Sustainability
2. Open Science Cloud Service XI Metadata TG (OSCs XI metadata TG)
3. Open Tools and Visitation Frameworks for Global Research Assessment Reform (OT-VIRARe)
4. Research Data Quality Management Across the Data Lifecycle
5. Citizen Science for the SDGs
6. DRUM – Digital Representation of Units of Measure
7. FAIR Data for Disaster Risk Research (FAIR-DRR)
8. Geographical Indications Environment & Sustainability (GIES)

See https://codata.org/initiatives/task-groups/

Standing Task Group

1. Task Group on Fundamental Constants

Working Groups

1. Research Data Management Terminology (RDMT)
2. One Geochemistry Working Group
3. GOSC Working Groups

See:

https://codata.org/initiatives/working-groups/

Interested people can contact co-chairs to join TGs and WGs.

CODATA Officers

CODATA President

- **Mercè Crosas**, Director of Computational Social Sciences, Barcelona Super Computing Centre.
- See https://codata.org/about-codata/message-from-president-merce-crosas/

CODATA Officers

- **Richard Hartshorn, Vice President**, Professor of Chemistry, University of Canterbury, New Zealand.
- **Daisy Selematsela, Vice President**, Director of Wits Libraries, South Africa.
- **Christine Kirkpatrick, Secretary General**, Division Director, Research Data Services, San Diego Supercomputer Center
- **Steve McEachern, Treasurer**, Director of the UK Data Service.
- **See** https://codata.org/about-codata/executive-committee/

CODATA Executive Committee 2025 - 2027

Elected Members

- **Jeremy Frey**, Professor of Physical Chemistry, University of Southampton, United Kingdom
- **Leo Lahti**, professor in Data Science at the Department of Computing, University of Turku, Finland.
- **Pam Maras**, Past President IUPsyS, Emerita Professor of Psychology at the University of Greenwich, UK
- **Audrey Masizana**, Senior Lecturer in Computer Science University of Botswana.
- **Lauren Maxwell**, Group leader, Universitätsklinikum Heidelberg, Germany, and Senior Researcher with the Ecraid Foundation in the Netherlands
- **Yasuyuki Minamiyama**, Associate professor in the Center for Social Research and Data Archives at the Institute of Social Science, the University of Tokyo, Japan
- **Mark A Musen**, Stanford Medicine Professor of Biomedical Informatics Research at Stanford University, United States
- **Francisca Oladipo**, Vice-Chancellor and Chief Executive Officer of Thomas Adewumi University, Kwara State, Nigeria
- **Rodrigo Roa**, Executive Director of the Data Observatory foundation, Chile
- **Cyrus Walther**, IUPAP, President of the International Association of Physics Students; ISC Fellow.

Ex Officio Members

- **Lianglin HU**, Deputy Director of the Big Data Department at the Computer Network Information Center (CNIC), Chinese Academy of Sciences (CAS)
- **Narinder Kumar Mehra**, Former Dean and National chair of the All-India Institute of Medical Sciences, New Delhi, India
- **Virginia Murray**, Chair of the UNDRR/ISC Steering Group for Phase 2 update for 2025 of the UNDRR-ISC Hazard Information Profiles

- See https://codata.org/about-codata/executive-committee/

COMMITTEE ON DATA
CODATA
INTERNATIONAL SCIENCE COUNCIL

CODATA Secretariat: Increased Capacity

CODATA Secretariat

- **Radomir Buzek,** Executive assistant.
- **Nina Grau,** Project Officer, RDA Tiger.
- **Arofan Gregory**, Metadata and Technical Expert, 'Making Data Work', WorldFAIR+ initiative and DSWB project.
- **Matti Heikkurinen**, Project Portfolio Manager.
- **Simon Hodson**, Executive Director.
- **Asha Khandelwal**, Programme Assistant: communications, technical platforms and website updates.
- **Laura Molloy**, Senior Research Lead: WorldFAIR and RDA Tiger projects, vocabularies and terminologies, project and research development.
- **Hana Pergl**, Operations Manager: strategic and management activities, membership relations, GOSC.
- **Slava Tykhonov,** Head of Interoperability and AI: Tooling and implementation of CDIF, LLMs for Science
- info@codata.org

Simon Hodson

Arofan Gregory

Laura Molloy

Matti Heikkurinen

Nina Grau

Hana Pergl

CODATA Team on INSPIRE / DSWB / CDIF Projects

- **Jay Greenfield**, Data, Metadata and Systems Expert, Data Science Without Borders (DSWB) and INSPIRE Mental Health (MH) Projects.
- **Dorothy Mailosi**, Research Assistant, DSWB and INSPIRE MH Projects.
- **Letisha Najjemba**, Data base and repository engineer, DSWB.
- **Doug Fils**, Data and Software Craftsman with a focus in semantics, linked data and web architecture, DSWB project.
- **Steve Richard,** preparing CDIF documentation, managing CDIF WG.

Global Open Science Cloud, International Programme Office

- **Lili Zhang**, Executive Director.

See: https://codata.org/about-codata/secretariat/

Interoperability approaches and solutions: APAN working groups and topics

Open Data & Open Science Collaboration Platform

Eric Yen

Academia Sinica Grid Computing Centre
(ASGC)
Taiwan

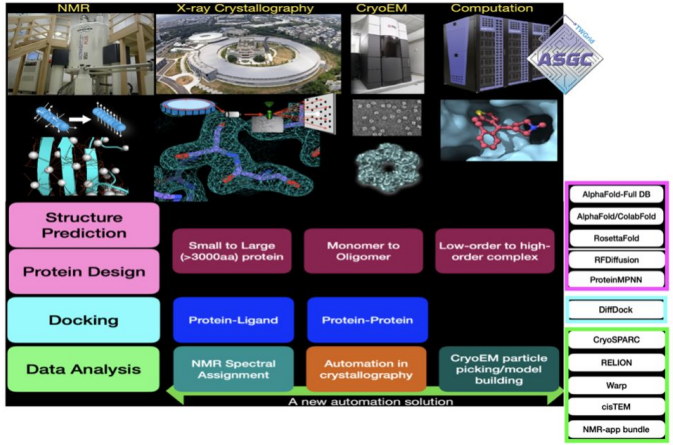
APAN-CODATA Webinar
26 Nov. 2025

APAN Cloud Working Group

- Leveraging Science Cloud for Accelerating Discovery, Innovation and Collaborations
- Working together with APAN WGs: Disaster Mitigation, Agriculture, Open & Sharing Data, Security, Networking, etc.
- Capacity Building
  - Training, case study, experiences of Cloud sites in Asia, trends of ICT, Scientific computing application, etc.
- Chairs: Jongwon Kim (KR)
  - Co-chairs: Eric Yen (ASGC, TW), Hiroki Kashiwazaki (JP)

ASGC Open Science Cloud as the research infrastructure

- ASGC was founded for the deployment and development of WLCG system in 2005.
- Vision: accelerating scientific discovery with growing scientific computing capacity
  - User-oriented, service-based approach
    - Flexible collaboration models and customized services are strategic focus
    - Reliability and efficiency are primary objectives
  - Integrated platform of data, algorithm and computing
  - Federating community, application/service, RI & supporting team



ATLAS EXPERIMENT · CMS · AMS-02 · PHENIX · STAR · CEPC · KAGRA · LIGO · The Electron-Ion Collider

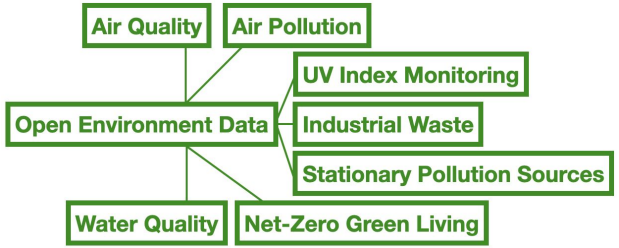
TIDC Taiwan Instrumentation And Detector Consortium (TIDC)

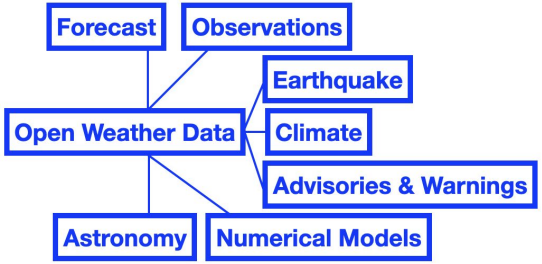
TWGrid ASGC

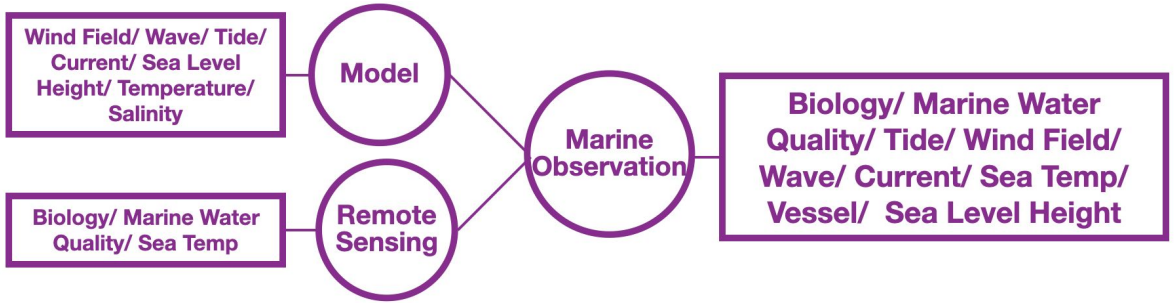
Neutrino/MHEP
Quantum Materials Physics
Physics of Active & Living Matter
Astrophysics
Earth Science
CryoEM
Bioimaging
Drug Discovery
Computational Chemistry
Biodiversity & Ecology

Drivers of Open Data in Academics

- Laws and regulations of the government
- Rules & guidelines of Funding agency
- Rules & guidelines of Home institute
- Collaboration
- Data owner
- Publisher
- As a Product
- Long-term research strategy of a lab
- Access might be limited and schedule of openness might vary

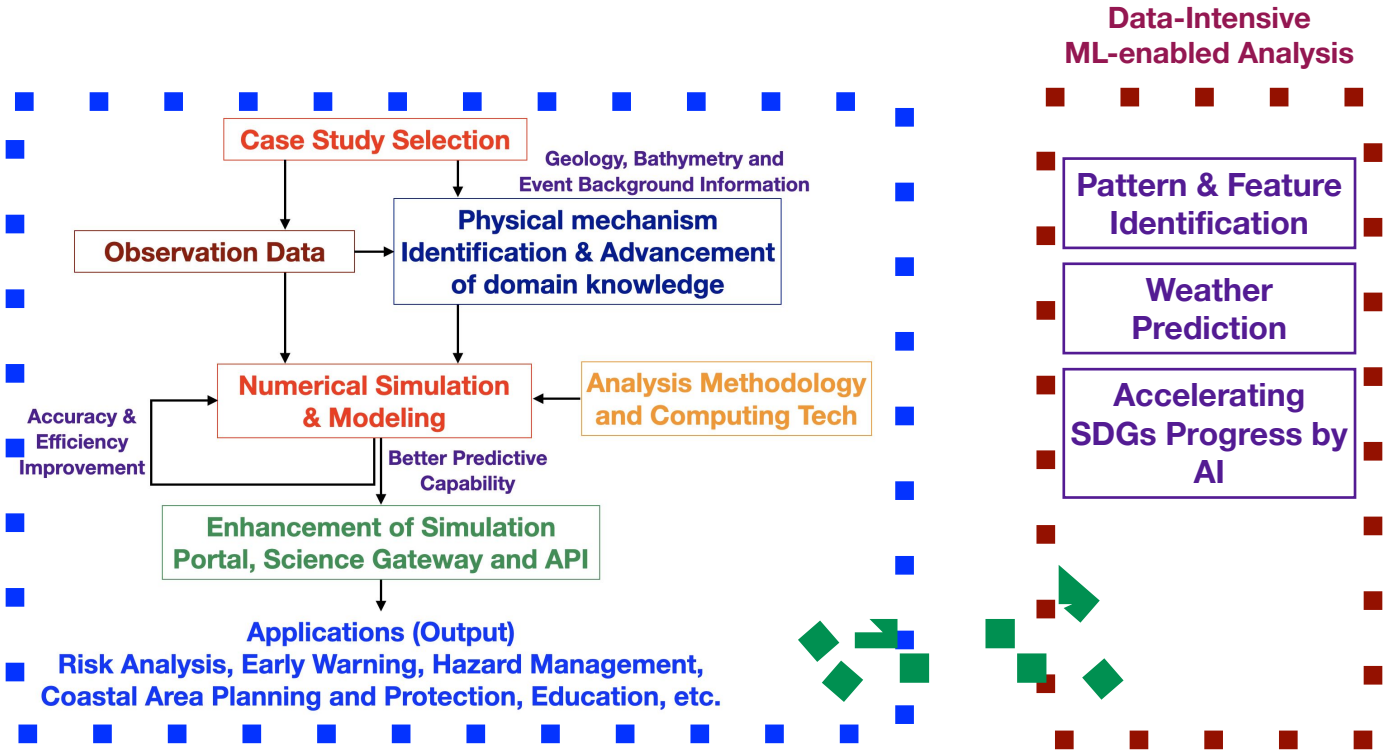


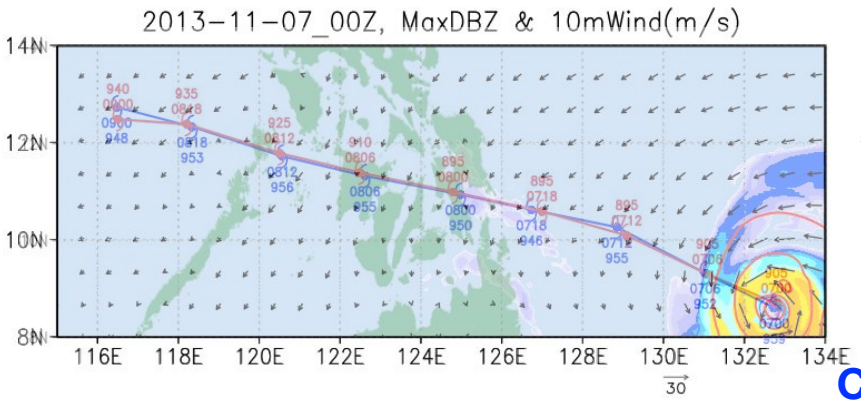




Empowering prediction and Analysis Capabilities

- Deeper understanding to the science behind hazards + Case studies
- >20 case studies of 6 hazard types conducted
- Enabling multi-hazard, multi-scale simulations





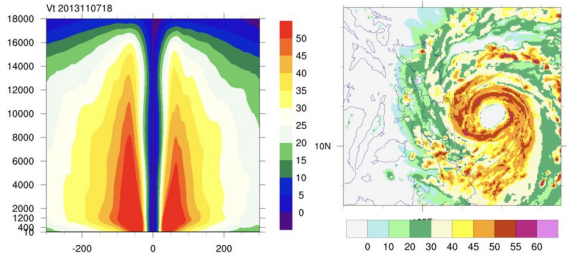
2013 Super Typhoon Haiyan (Yolanda)

Typhoon Life Cycle: November 3rd – 11th

Simulation of impacts from Storm surge caused by super typhoon by combining atmospheric model and oceanic model

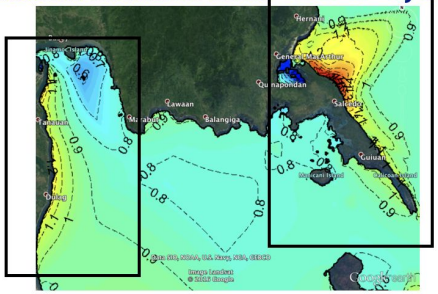
Covering full disaster management workflow, and quantitive analysis at each stage

Improved Vertical Wind Field Structure and Eyewall Contraction for Typhoon Haiyan

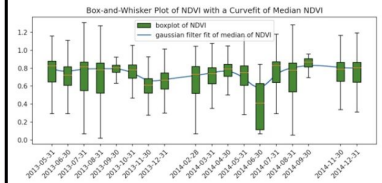


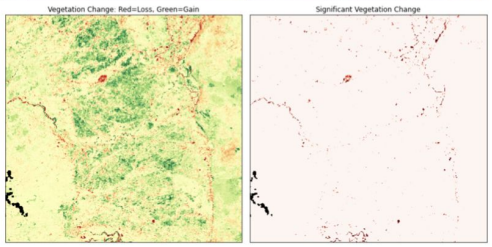
Vegetation change between 2013 and 2020 on Haiyan impacted areas from EODC

Maximum Simulated Storm Tides at Leyte Gulf



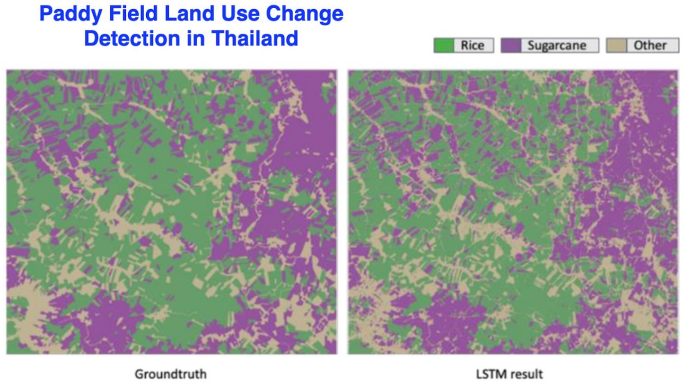
Box-and-Whisker Plot of NDVI from EODC

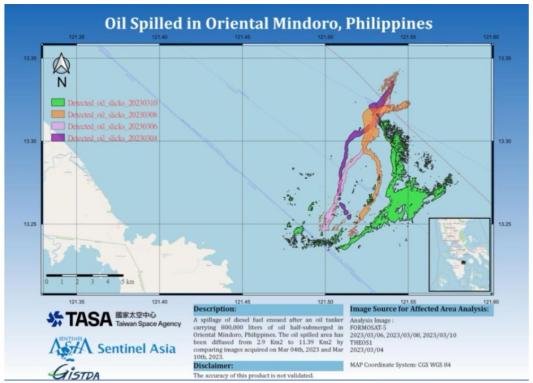


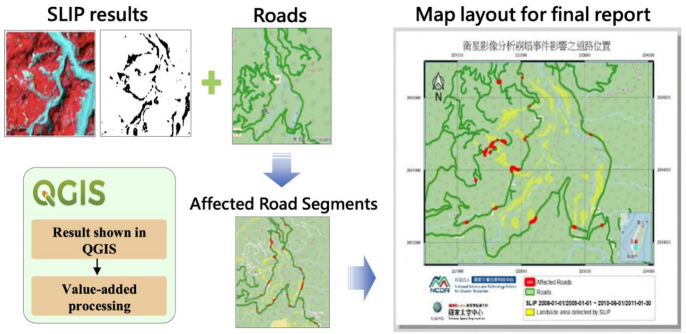


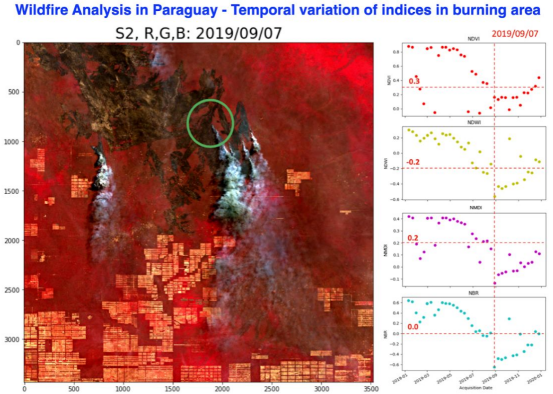
From Earth Observation to Earth Intelligence

- Gaining actionable insights from every useful heterogeneous data sources, supported by physics-based knowledge
- Open Data Cube + Spatial Temporal Asset Catalog (STAC)
- Case studies from TASA









FAIR Principles for Data, Software, and Computational Workflow

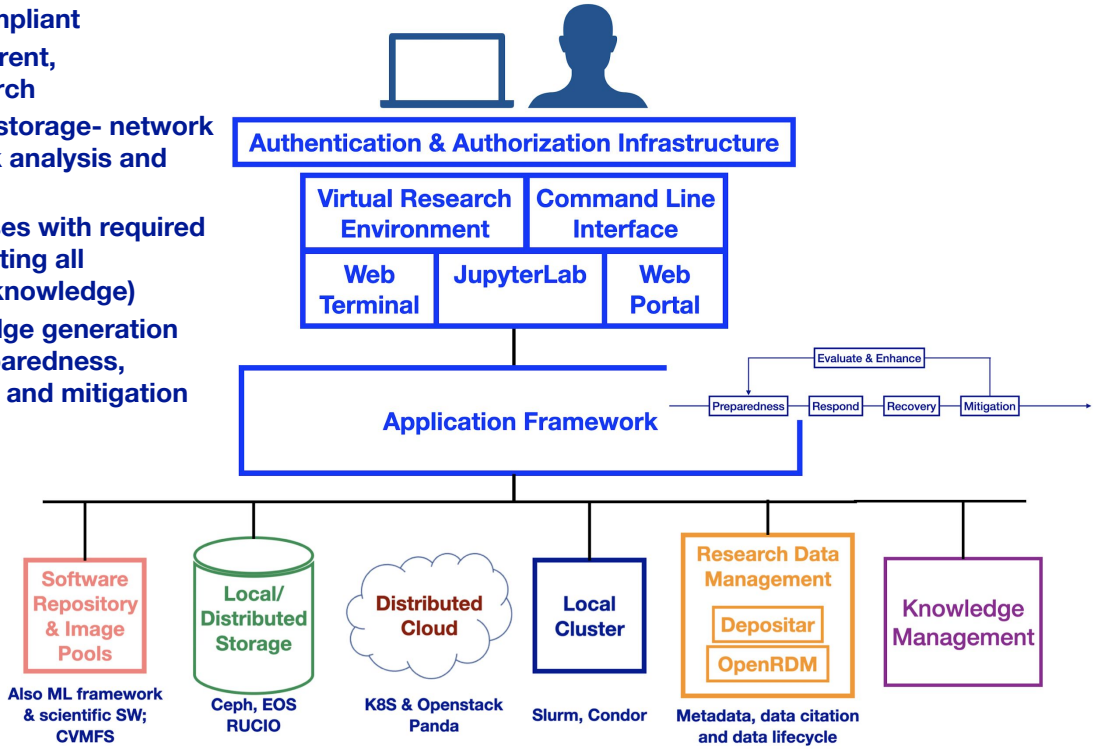
- **FAIR: maximize the value and impact of scientific digital objects**

	Scientific Data	Research Software	Computational Workflow
Findablity	Metadata and unique PID	Repository and registry	Unique PID for multiple objects & rich metadata are registered/ indexed
Accessibility	Open/ controlled access	Open licensing and documentation	retrievable by open/ standard protocol
Interoperability	Standardized format and metadata schemes	Standardization and compatibility	represented by domain-based standard
Reusability	Licensing and documentation	Versioning and documentation of functionality & dependencies	Described with accurate attributes, clear licenses
Definition & Scope		Source code files, algorithms, scripts, computational workflows, and executables	Covering workflow, components, metadata, intermediate data, attributes and provenance run

Source: *Sci Data* 12, 328 (2025). https://doi.org/10.1038/s41597-025-04451-9

Collaboration Research Infrastructure

- User/ Community-oriented design
- Fostering community collaboration
- Federating distributed resources
- FAIR principles compliant
- Facilitating transparent, reproducible research
- Scalable compute-storage- network for quantitative risk analysis and decision making
- Supporting use cases with required services and collecting all input/output (e.g., knowledge)
- Promoting knowledge generation that enhances preparedness, response, recovery and mitigation from disasters



Challenges of the Collaboration Platform

- Reliability and Efficiency for production services
- Sustainability
- Cybersecurity
- Inconsistency of data and services format
- Uptakes of latest version of open data & services
- Taking advantage of fast evolving technologies: earth observation, AI, networking, computing, storage, analytics, etc.
- Sustainable research infrastructure: supporting development and services
- Community Collaborations

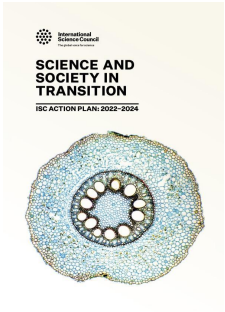
Next Steps

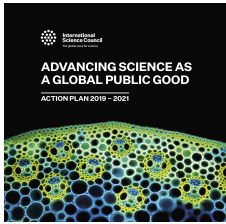
- Strengthen the collaborations
- Capacity building for Asia partners
- Collaboration platforms: APAN, ISGC, CODATA, …
- APAN Meetings
  - 2026: Jan 2026 @BD, Aug @NZ
  - 2027: January @SG, Aug @TW
- ISGC 2026: 16-20 March in Academia Sinica, Taiwan
  - Theme: Trustworthy Infrastructures and AI for Global Open Science – Enabling Data Sovereignty and Secure Research Collaboration
  - Objectives: in-person APAN-CODATA collaboration Meeting ?
  - Possibilities
    - Sessions or a Workshop at ISGC 2026
    - Talks in sessions
  - Environmental Computing Workshop: 4x 90-min sessions
  - https://indico4.twgrid.org/event/64/

Interoperability approaches and solutions: CODATA “Making data work” activities and solutions.

Making Data Work for Cross-Domain Grand Challenges (2018 ->)

- **Premise:** The major, pressing global scientific and human challenges of the 21st century (such as SDGs or DRR) can ONLY be addressed through **research that works across disciplines to understand complex systems**, and which uses a **transdisciplinary approach to turn data into knowledge** and then into action.
- ISC Action Plans entrusted CODATA with an initiative 'Making Data Work for Cross-Domain Grand Challenges': establish a **global (decadal) programme** to address these issues.
- **ISC provided funding support for a Preparatory Phase:**
  - Exploratory workshops with Unions and standards organisations.
  - Developed a case study driven methodology.
  - Established a very strong collaboration with the DDI Alliance.
  - Jointly explored cross-domain interoperability issues at a series of Dagstuhl workshops: https://codata.org/initiatives/decadal-programme2/dagstuhl-workshops/





DDI®
DATA DOCUMENTATION INITIATIVE

WorldFAIR: Global cooperation on FAIR data policy and practice 2022 - 2024

- Advances in FAIR implementation in **cross-domain** scenarios, in 11 specific **disciplines** and **globally**.
- **Global** in approach, because research domains, data and metadata standards and specifications need to be global. Leveraged **CODATA and RDA networks** to achieve this.
- Includes **authoritative international entities** (e.g. IUPAC, OneGeochemistry, GBIF, ODIS); connections with important projects or standards organisations (e.g. NanoCommons, DDI Alliance, OHDSI, TDWG, SalUrbAL).
- Considerable emphasis on **case studies** and the recommendations from these organisations.
- Leveraged links to international standards and scientific organisations, as well as reliable articulations of good (web) practice to make cross-domain recommendations. **Were able to have funded partners outside the European Union.**
- Helps reinforce **bidirectional links between EOSC and global developments**.

WorldFAIR

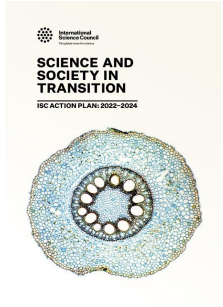
- **Funded by the European Union, HORIZON-WIDERA-2021-ERA-0 — Project: 101058393**

Making Data Work – WorldFAIR – WorldFAIR+

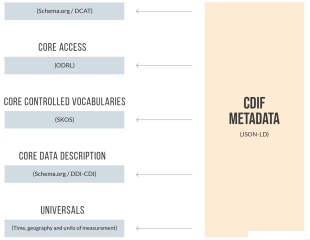
Making Data Work (2018-2022)

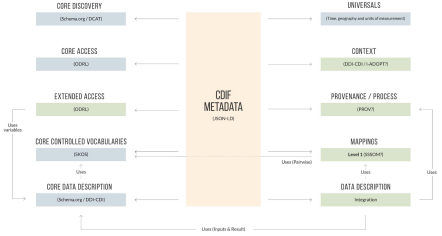
WorldFAIR (2022-2024)

WorldFAIR+ (2024+)



WorldFAIR

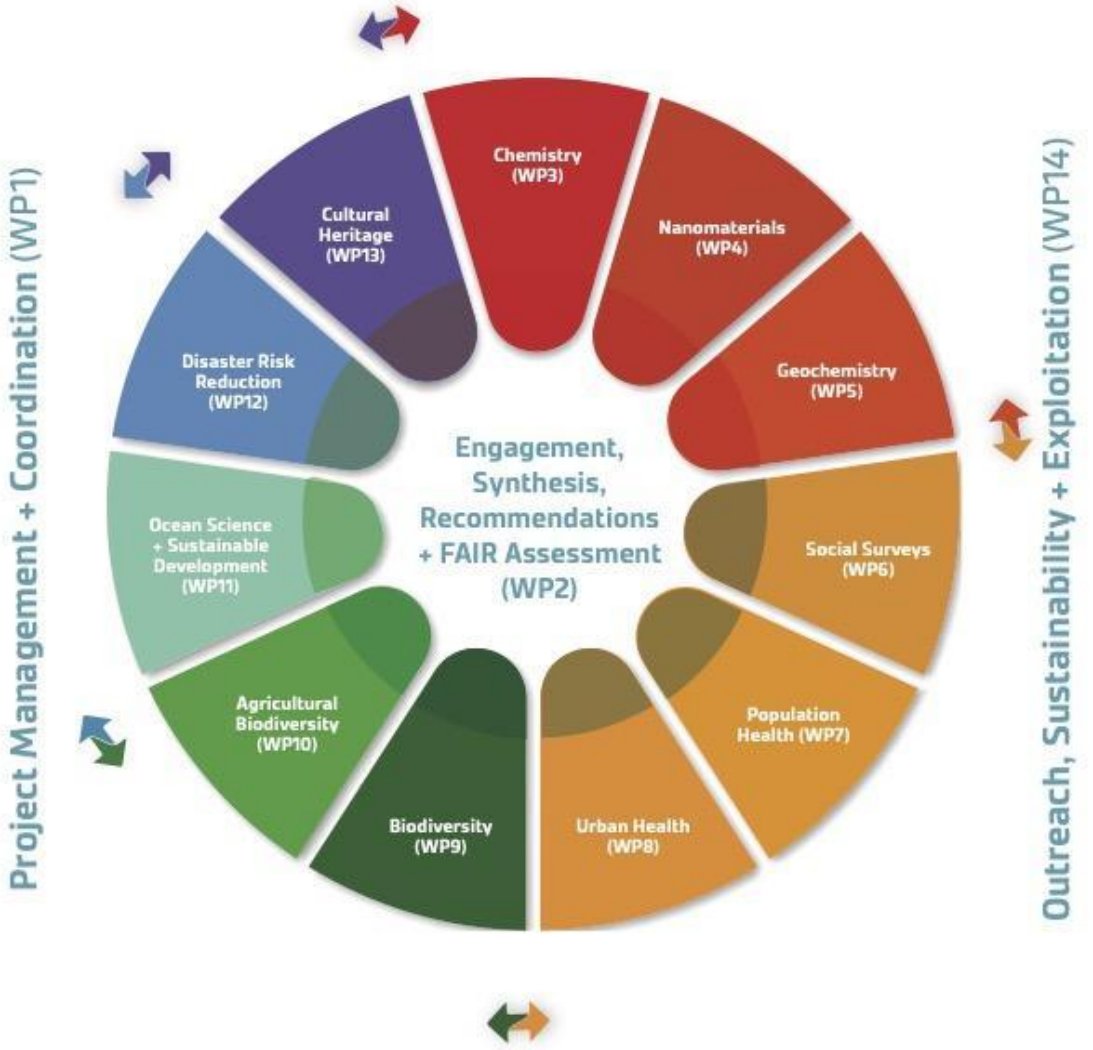




International Data Week 2027, Cape Town, South Africa
20-23 September 2027

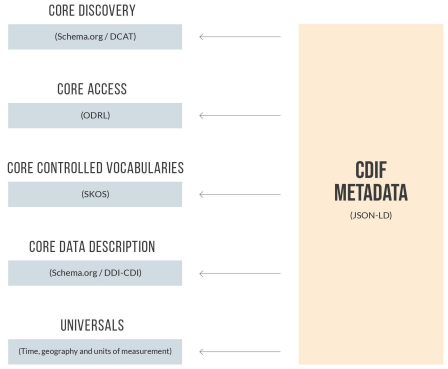
WorldFAIR Case Studies

- **Chemistry** – making IUPAC assets FAIR
- **Nanomaterials** – applying NanoInchi and FAIR recommendations in Nanosafety.
- **Geochemistry** – recommendations for FAIR in geochemistry, particularly vocabularies.
- **Social Surveys Data** – data harmonisation between ESS and AussiESS.
- **Population Health –** INSPIRE - Integration of population surveys with clinical and genomics data for COVID-19 research in eastern and southern Africa.
- **Urban Health** – terminologies and making urban health data FAIR
- **Biodiversity** – improving GBIF data model in collaboration with TDWG - GBIF (Global Biodiversity Information Facility)
- **Agricultural Biodiversity** – pollinator data (KALRO, Embrapa, Meise, HiveTracks)
- **Ocean Science** – Implementing FAIR in the ODIS (Ocean Data and Information System) for the UNESCO Oceans' decade.
- **Disaster Risk Reduction** – recommendations on making DRR data and terminologies FAIR, case studies in Africa and Pacific Islands
- **Cultural Heritage** – recommendations on making cultural heritage data FAIR (particularly digital representation of heritage artefacts)



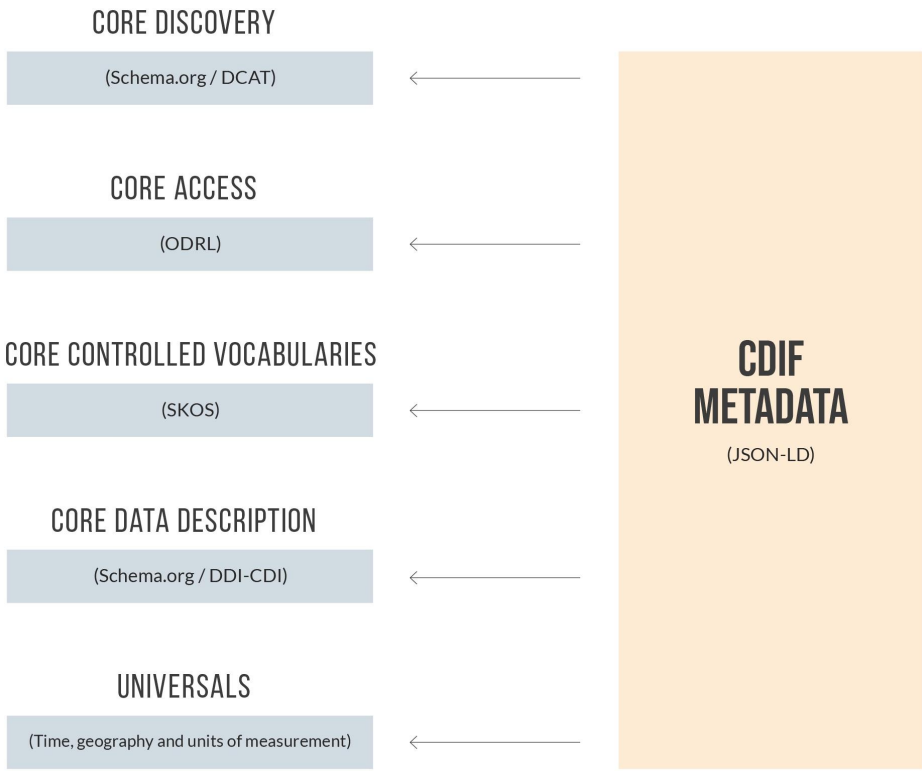
WorldFAIR Outputs

- See WorldFAIR Final Message from Coordinator https://bit.ly/WorldFAIR-Final-Coordinator-Message and https://bit.ly/worldfair-plus
  - **Summary of project, links to key outputs and next steps.**
- Reports, recommendations, guidelines, implementation examples and training materials from 11 Case Studies: https://bit.ly/WorldFAIR-Case-Study-Outputs
  - **So many useful materials for all the subjects covered by WorldFAIR!**
- Experience with FAIR Implementation Profiles (FIPs) https://doi.org/10.5281/zenodo.11236094 and Recommendations for FAIR Assessment https://doi.org/10.5281/zenodo.11242737
  - **Use and further develop FIPs; put the FAIR Implementation Profiles horse in front of the FAIR assessment cart!**
- Policy Recommendations: https://doi.org/10.5281/zenodo.11242702 :
  - **We urgently need to shift from a bibliographic to an engineering approach to data stewardship. We need metadata upflift.**
- Cross-Domain Interoperability Framework: https://doi.org/10.5281/zenodo.11236871 and https://bit.ly/CDIF-Book
  - **Considerable interest shown (over 3000 downloads)**
  - **A practical guide to FAIR implementation! Adopt widely used web standards and use them in line with good practice.**

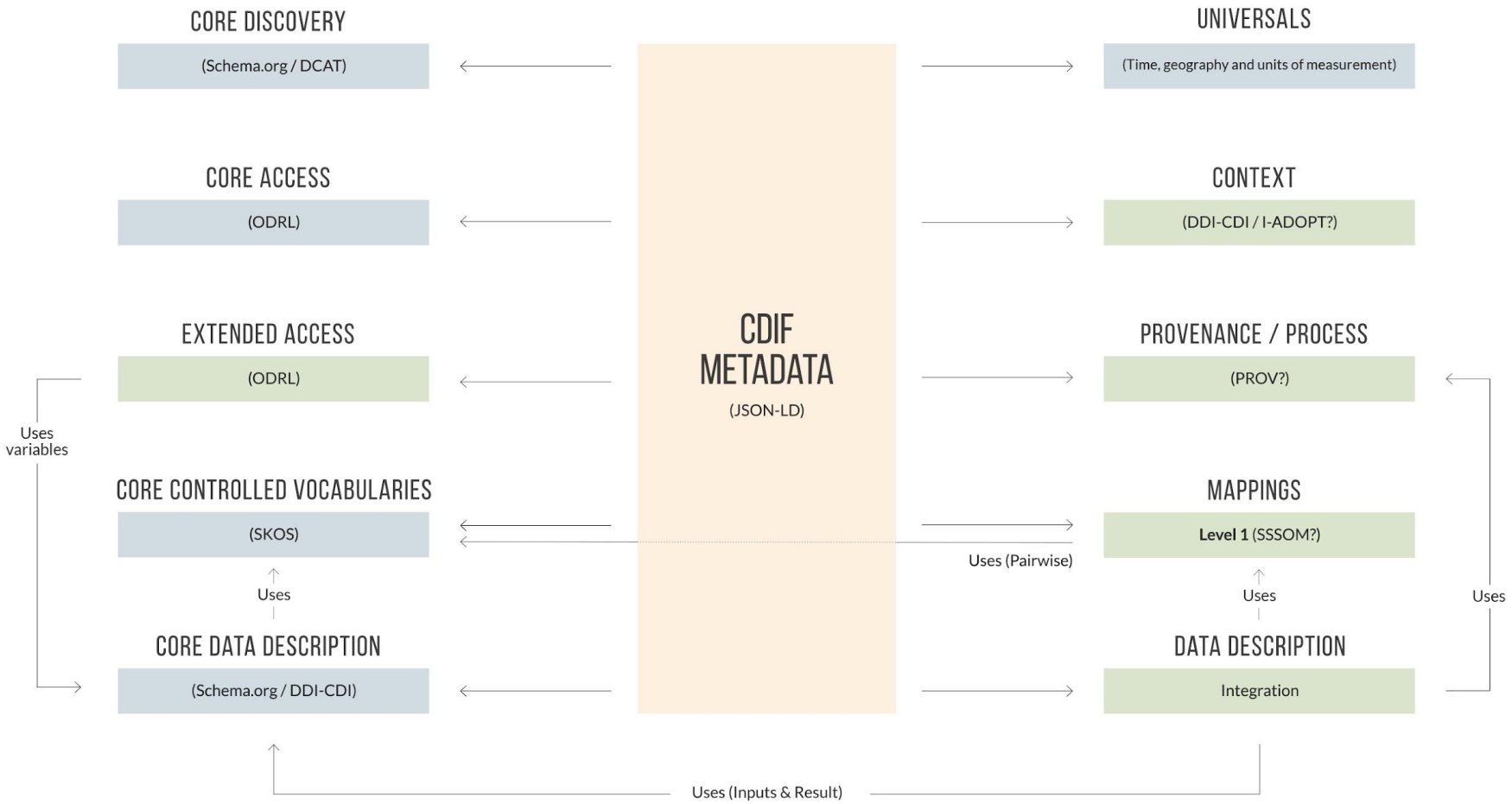


What is CDIF?

- The Cross Domain Interoperability Framework (CDIF) is a set of practical, implementation-level principles designed to improve data management practices within any community and lower the barriers to cross-domain data reuse. CDIF offers standards and methodologies for achieving different levels of interoperability necessary for reusing data across diverse domains. It is built around five core profiles that address the essential functions for implementing cross-domain FAIR principles.
- CDIF was first released in May 2024 as an output of the WorldFAIR project: https://doi.org/10.5281/zenodo.11236871
- The point of reference for CDIF and its component profiles is now the CDIF Book: https://bit.ly/CDIF-Book



CDIF, Next Steps



‘WorldFAIR+’, CDIF Implementation Projects

1. **“Data Science Without Borders”:** Wellcome-funded project. **Population health**, building on WorldFAIR WP07. CDIF implementation. Combining population health / statistical data, clinical outcome data, phylogenetic data, environmental data. Also privacy management, ML/AI to enable federated analysis across four African health research centres (Kenya, Ethiopia, Senegal, Cameroon). Three years. Underway. Africa.
2. **“FAIR Data and Emergencies”:** ISC-funded. **Disaster Risk Reduction (DRR) research.** Applying the WorldFAIR methodology, implementing CDIF components in case studies on earthquake data (Turkey) and flooding / cholera (Malawi). 18 months. Started 1 September 2024. Africa and Turkey.
3. **“CDIF-4-XAS”:** OSCARS cascading grant (EC). Describing **X-ray absorption spectroscopy (XAS)** data with CDIF to enhance interoperability and enable interdisciplinary reuse. Two years. Started 1 October 2024. Europe (Germany and UK, but with global relevance and partners).
4. **“CLIMATE-ADAPT4EOSC”:** Major EC-funded project, FAIR data and innovative services for **climate adaptation**. CDIF implementation for legal, organisational, semantic and technical (LOST) interoperability. Three case studies: urban heat (Greece); oceans / coastal management (Portugal); clay soils / hydrology / built environment / insurance (France). Four years. Started 1 Jan 2025. Europe.
5. **“JUST SAFE”:** EC-funded, linked to CLIMATE-ADAPT. CDIF implementation, particular emphasis on **climate adaptation and citizen science data**, legal and policy recommendations. Four years. Starts 1 May 2025. Europe.
6. **“TOGETHER”:** EC-funded, linked to CLIMATE-ADAPT. CDIF implementation and data integration for disaster risk management. Case studies in Norway (mud-slides), Greece (wildfires), and Spain (flooding). Three years. Starts 1 Oct 2025? Europe.
7. **“FAIR Principles implementation for DDE”:** Implementation of FAIR principles, alignment of IUGS CGI standards with CDIF, for cross-domain research topics and data reuse in **geology**. Three years. Starts April 2025. Funding from IUGS. Global.
8. **“Citizen-Driven Living Labs for Urban Heat Island Mitigation”:** ISC Science Missions project selected for funding. **Transdisciplinary approach to urban heat** in India and SE Asia. CDIF core to data integration for multiple data sources. ISC brokered funding. Starts later 2025.

ClimateAdapt | eosc

3 use cases

Use case #1

Urban heat

- Scales: from the planet to an individual
- Personal data, vulnerable populations
- Translation of Informed consent

Use case #2

Coastal/estuary hazards

- Protecting the environment, supply chains, supply chain workers, food protection,…
- Orthogonal goals?
- Trade secrets, high financial stakes

Use case #3

Shrink-Swell

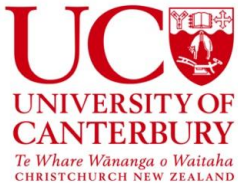
- Survey data
- Pilot: clear processes and regulatory frameworks
- Replicators: data and policy gaps?

Legal and Organisational interoperability issues

- Legal issues
  - Security (critical infrastructure)
  - Privacy (sensitive personal data)
  - Contract law (commercial services)
- Organisational Issues
  - SLAs/OLAs/MoUs
  - Integration of resources across different resource pools (global resources,EOSC, European Common data spaces, national services and municipal/regional solutions): APIs, data standards, new workflows.
- Describing these issues in a semantically coherent and complete manner
  - Using frameworks such as CDIF, DUO,...
  - Shared vocabulary describing how data can be used is essential when changing legal/organisational contexts

Case studies, examples, and future challenges

Citizen science data for the SDGs in Asia Pacific

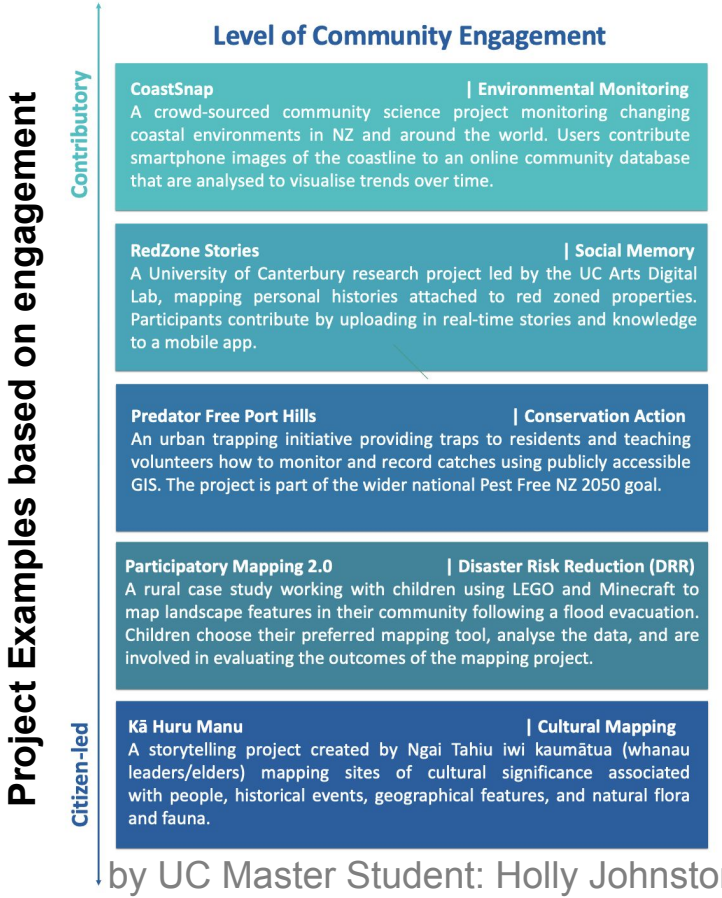


Carolynne Hultquist
carolynne.hultquist@canterbury.ac.nz

Co-chair of the CODATA Task Group on Citizen-Generated Data for the Sustainable Development Goals

https://tinyurl.com/citizengenerated

NZ examples towards active engagement



by UC Master Student: Holly Johnstone

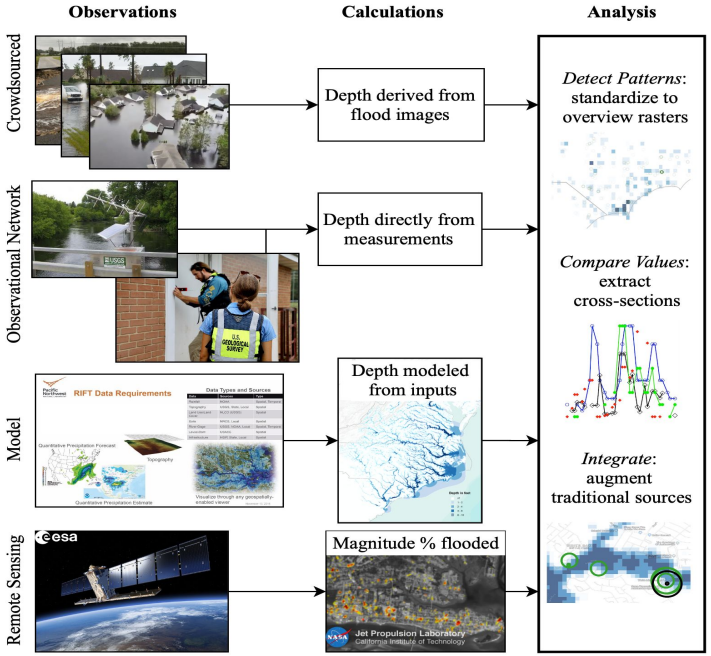
Participation Structure as role of citizen

- contributory, collaborative, co-created – *Bonney 2009*
- contractual and collegial – *Shirk 2012*

Level of Engagement as crowdsourcing (sensors, computing), distributed intelligence (thinking), participatory science (definition or collection), extreme (definition, collection, analysis) – *Haklay 2013*

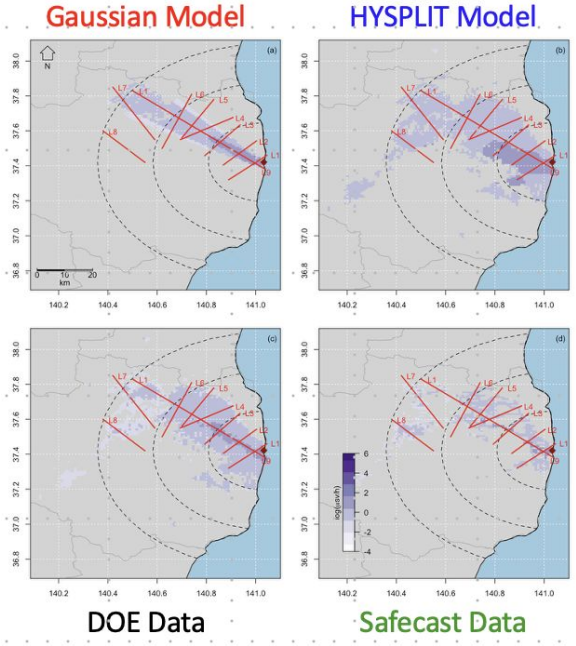
Integration, Validation, Uncertainty

Contributory



Hultquist, C., Cervone, G. (2020). Integration of Crowdsourced Images, USGS Networks, Remote Sensing, and a Model to Assess Flood Depth during Hurricane Florence. Remote Sensing. Vol. 12, No. 5, pp. 834-851.

Citizen-led



Hultquist, C., & Cervone, G. (2019). Comparison of simulated radioactive atmospheric releases to citizen science observations for the Fukushima nuclear accident. *Atmospheric Environment*, *198* (April 2018), 478–488.

Trend towards Active Engagement

Citizen science

‘the participation of people from outside professional organisations in gathering or analysing scientific data’

- Hicks et al., 2019

Revolution in citizen data

‘Data generated by people, for people’

Citizen-generated data

Environmental stewardship

Empowering communities

Collaborative science

Data gaps

Decision making

Copenhagen Framework: Sufficient and meaningful participation of citizens: strives for the highest degree and quality

Data data everywhere, but not a drop to drink

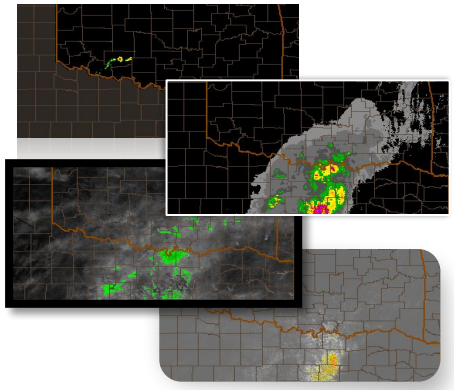
- We are often faced with a deluge of data, but the time, place, and specifics needed for decision making may not be apparent.
  - Hazard products often require tailoring to needs.
  - SDG data needs are extensive - 231 indicators with underlying data required to perform broad, consistent, and longitudinally reliable monitoring.
- Data are often lacking in areas with underrepresented groups and low services.
- Community engagement can provide not just raw data, but insights from local knowledge and active progress on goals.

https://tinyurl.com/citizengenerated

Tailoring hazard products

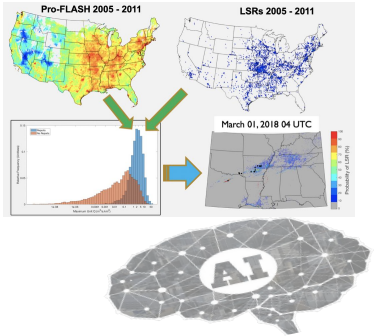
Advancing flash flood forecasting with FLASH to produce impact-based probabilistic warnings (NOAA JTTI) – Humberto Vergara

MRMS-FLASH Suite of Products



FLASH

Expert evaluation
- National scientists
- Humanitarian actors



Training with Historical Reports

Vulnerability Layers

Citizen contributions to reports and mapping of vulnerable areas

Probability of Flash Flood Impact

Citizen local knowledge evaluation
– expected hazard areas?
– who is left out of impact?
– what actions would help?

Mission Statement - CODATA Task Group for Citizen-Generated Data for the SDGs

Communities are in a unique position to provide local data on global challenges. Abundant literature shows that citizens can contribute high-quality data. **We aim to demonstrate and encourage practices that facilitate the inclusion of citizen data in the official monitoring of the SDGs and other policies at local, national, and global levels**. Community participation in the design and analysis of research provides unique local perspectives that are essential to building a society that is more inclusive, resilient, and connected to science.

Select Collaborators - CODATA Task Group for Citizen-Generated Data for the SDGs

Peter Elias

Co-chair, Prof. UniLag, CSA Africa

Haoyi Chen

UNSD Coordinator Inter-Secretariat Working Group on Household Surveys

Maryam Rabiee

Head SDGs Today Sustainable Development Solutions Network (SDSN)

Adenike Shonowo

PhD Glasgow, IDEAMAPS & YouthMappers

Elaine Faustman

Professor UW, health & risk communication

Caren Cooper

Professor NCSU, established *Citizen Science: Theory and Practice* journal

Finn Danielsen

Nordic Foundation, community-based natural resource management

Mariana Varese

Wildlife Conservation Society, Director Amazon Landscapes & Citizen Science

Muki Haklay

Professor UCL, Extreme Citizen Science (ExCiteS) bottom-up approaches

Dilek Fraisl

Managing Director, CSGP & IIASA Austria

Prior Work of Task Group

- Promote proper data stewardship practices:
  Bowser, A., Cooper, C., De Sherbinin, A., Wiggins, A., Brenton, P., Chuang, T. R., Faustman, E., Haklay, M., & Meloche, M. (2020). Still in need of norms: The state of the data in citizen science. Citizen Science: Theory and Practice, 5(1), [18]. https://doi.org/10.5334/CSTP.303

Special Collection:
Contributions of Citizen Science to the SDGs and International Development Frameworks
CITIZEN SCIENCE: THEORY AND PRACTICE ubiquity press open scholarship

- Citizen data practices and their use for the SDGs:
  de Sherbinin A, Bowser A, Chuang T-R, Cooper C, Danielsen F, Edmunds R, Elias P, Faustman E, Hultquist C, Mondardini R, Popescu I, Shonowo A and Sivakumar K (2021) The Critical Importance of Citizen Science Data. Front. Clim. 3:650760.
- How To Guides on SDG Indicators:
  - SDG 3: Good Health and Wellbeing, indicator 3.1.1 Maternal mortality ratio
  - SDG 11: Sustainable Cities and Communities, indicator 11.6.1 Proportion of municipal solid waste collected and managed in controlled facilities out of total municipal waste generated, by cities
  - SDG 15: Life on Land, indicator 15.5.1 Red List Index
  - SDG 13: Climate Action, indicator 13.1.2 Number of countries that adopt and implement national disaster risk reduction strategies in line with the Sendai Framework for Disaster Risk Reduction 2015-2030

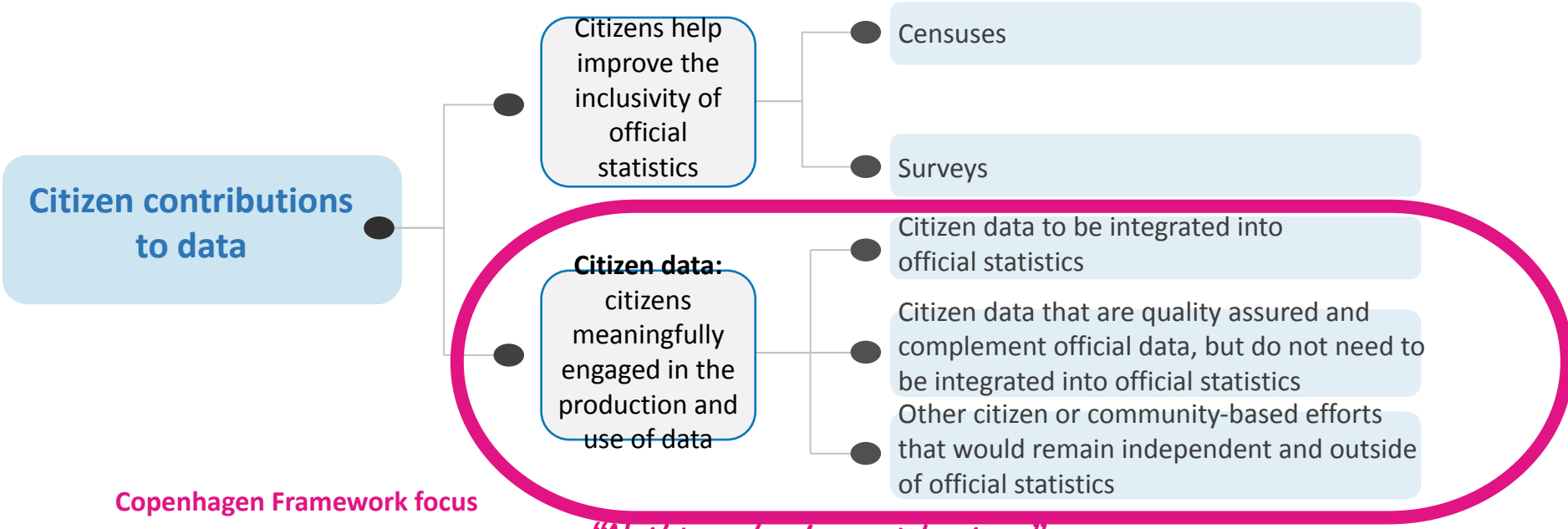
Activities of Task Group

- **Development of Copenhagen Framework** with United Nations Statistics Division (UNSD) on characteristics, quality, ethics, and sustainment of citizen-generated data to encourage uptake of citizen-generated data.

- **Development of standards** for citizen-generated data:
  - CDIF on FAIR/CARE for citizen-generated data
  - Citizen Science Global Partnership (CSGP) on citizen-generated global air quality monitoring

https://tinyurl.com/citizengenerated

Development of Copenhagen Framework with UNSD



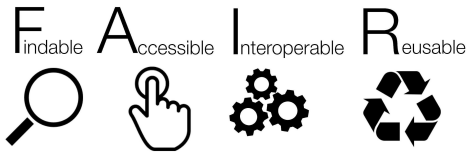
"Nothing about us, without us."

https://unstats.un.org/UNSDWebsite/citizen-data/

Collaborative on Citizen Data

Development of standards for citizen-generated data

- Cross-Domain Interoperability Framework (CDIF) citizen science extension on FAIR/CARE of CODATA WorldFAIR+
- Partnership with CSGP for citizen science integration in global air quality monitoring
- Facilitate global air quality data for SDG target 11.6.2: *Annual mean levels of fine particulate matter (e.g., PM2.5 and PM10) in cities (population weighted)*
- Set agreed upon standards and aim for community agreement to formalize data integration for key metrics



Wilkinson, Mons, et al., The FAIR Guiding Principles for scientific data management and stewardship, Scientific Data, http://dx.doi.org/10.1038/sdata.2016.18

How can we collaborate?

- Do you have an example of a citizen engaged project that could be highlighted as a case study?
  - Any level of engagement, both top-down or bottom-up welcomed
  - We'd appreciate your suggestions

- Keen to contribute?

https://tinyurl.com/citizengenerated

- Reach out in general: I'm excited to engage

carolynne.hultquist@canterbury.ac.nz

Agriculture and Open & Sharing Data Toward Open Science WGs

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+6681-620-4953

APAN

สมาคมเครือข่ายไทยเพื่อการศึกษาวิจัย ThaiREN

UniNet

HII Hydro – Informatics Institute

Agriculture Working Group (AgWG)

It aims to accelerate state-of-the-art agricultural and rural information research, utilizing the APAN network and technology. It also promotes research, education, and services projects in agricultural fields and rural areas attempts to bridge institutes, agencies, and start up new collaborations.

The economic development and the increase of the population in AP demand expansion of the farmland, which is creating loss of other ecologically viable lands, resource degradation, and desertification. *This leads to the importance and growth of cooperative research to develop mutually sustainable agriculture in this region.* In addition, changing and inclement climatic conditions in the region are strongly affecting our Agricultural systems.

Agriculture Working Group (AgWG)

Therefore, it is necessary to address and cooperate while we respect diversity in various countries. We, APAN AgWG, believe and are proud that, those issues can be addressed with technology and the applications of the Internet/Digital World in our region. However, we never forget in our mind the challenges in overcoming the region's digital divides.

As the balance of food supply and demand is now inevitably under the strategy and control power of the world trading mechanism, it is almost meaningless to solve the crisis within a country. *Only international sharing and cooperation for sustainable food productivity based on information sharing and mutual understanding can bring the solution.*

Open and Sharing Data (OSDWG) toward Open Science

With the fundamental problems of open data and data sharing which are huge obstacles to many researchers and research communities, it is therefore in need to bring those issues and pain point to the table for the APAN community to discuss and find out possible solutions together through APAN connections.

In this WG, good practices will be shared, & obstacles/standards will be presented and discussed toward feasible suggestions and solutions. Of course, those issues are not easy to solve, but toward sustainable development, climate change mitigation, adaptation, and resilience, we need to overcome those and find a common ground together to open as possible and to close as necessary.

Open and Sharing Data (OSDWG) toward Open Science

Open and sharing data are difficult to handle for many researchers and communities across the Asia-Pacific region, technically, culturally, and politically. The APAN community is the pre-eminent forum in our region to engage the research community. The OSDWG seeks *"To improve research data sharing and reduce information access pain by increasing the informatics and/or data sharing culture among researchers within APAN toward Open Science."* *We have a great concern about "The Gabage in Gabage Out"!!!*

Disseminating practices from regional initiatives that take into account the cultural contexts of each nation would offer valuable case studies and good practices. The concept of 'Cultural Change' serves as a fundamental component for collective progress.

HONG KONG APAN60

APAN61

DHAKA, 26-30 JANUARY 2026

Open and FAIR air quality data as a foundation for responding to health crises

Nuria Castell, ncb@nilu.no

Asia-Pacific: Advancing FAIR data in Advanced Networks

Webinar, 26th November 2025

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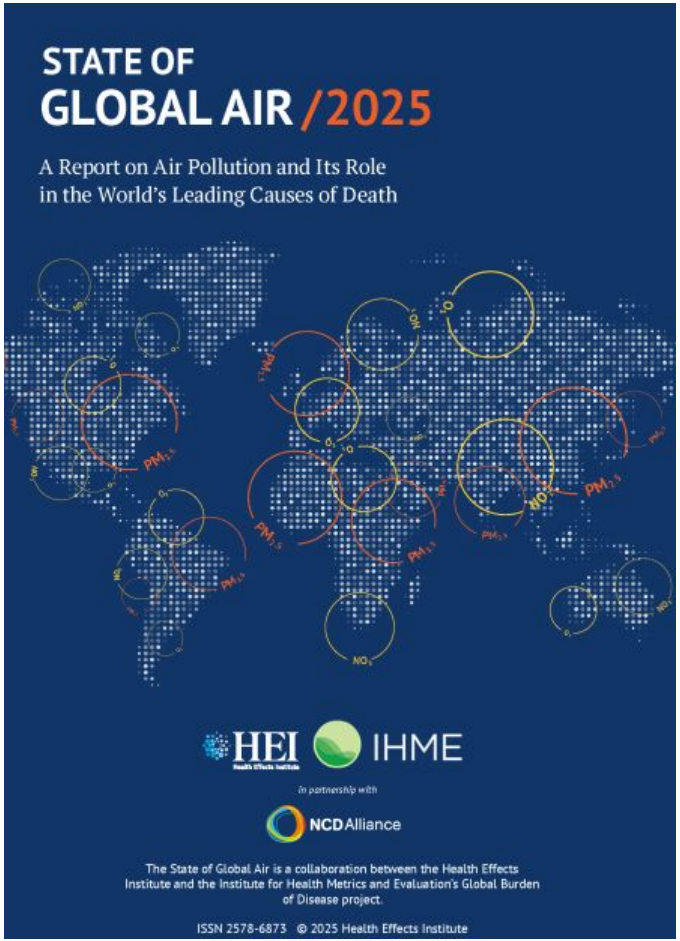

More than 36% of the world's population is exposed to levels of PM2.5 pollution above the least stringent interim target, set at 35 µg/m3 by the WHO.

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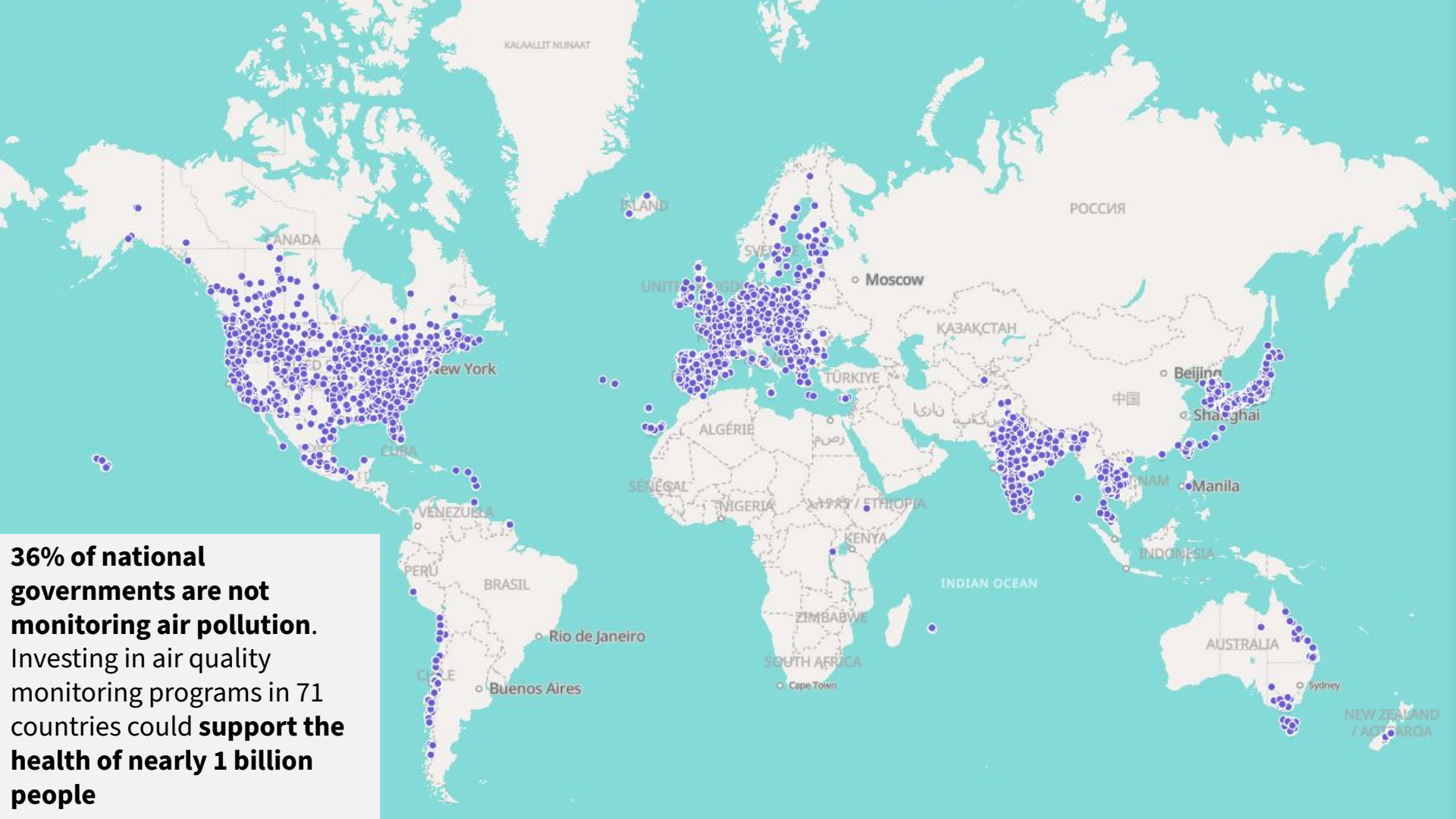
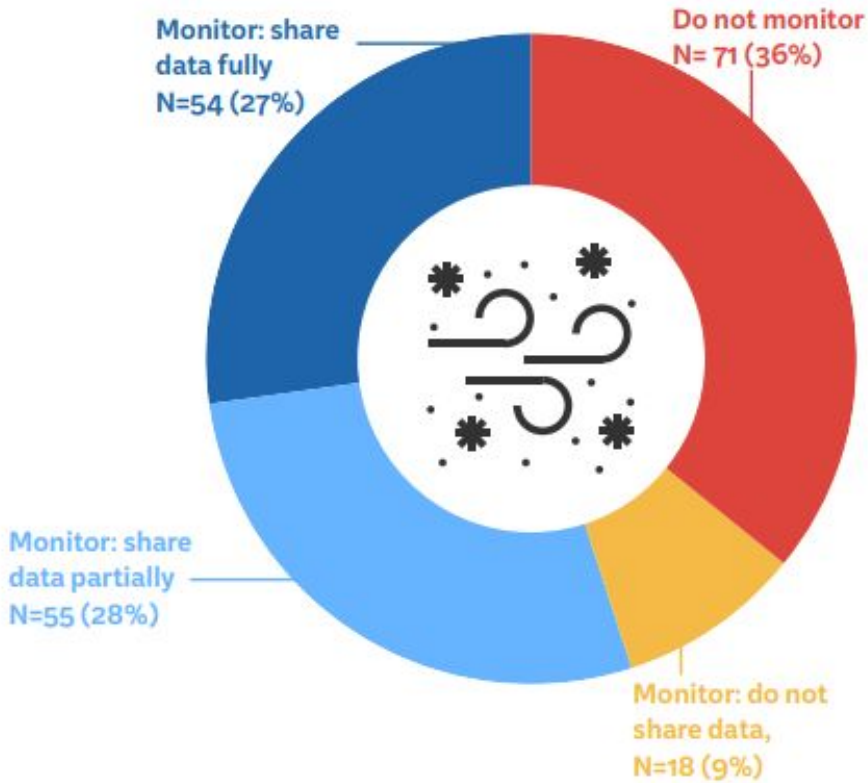


36% of national governments are not monitoring air pollution. Investing in air quality monitoring programs in 71 countries could **support the health of nearly 1 billion people**

Only a little over half of the world's governments publicly share air quality data. A few more generate data, but do not share.

Greater data transparency would benefit billions of people.



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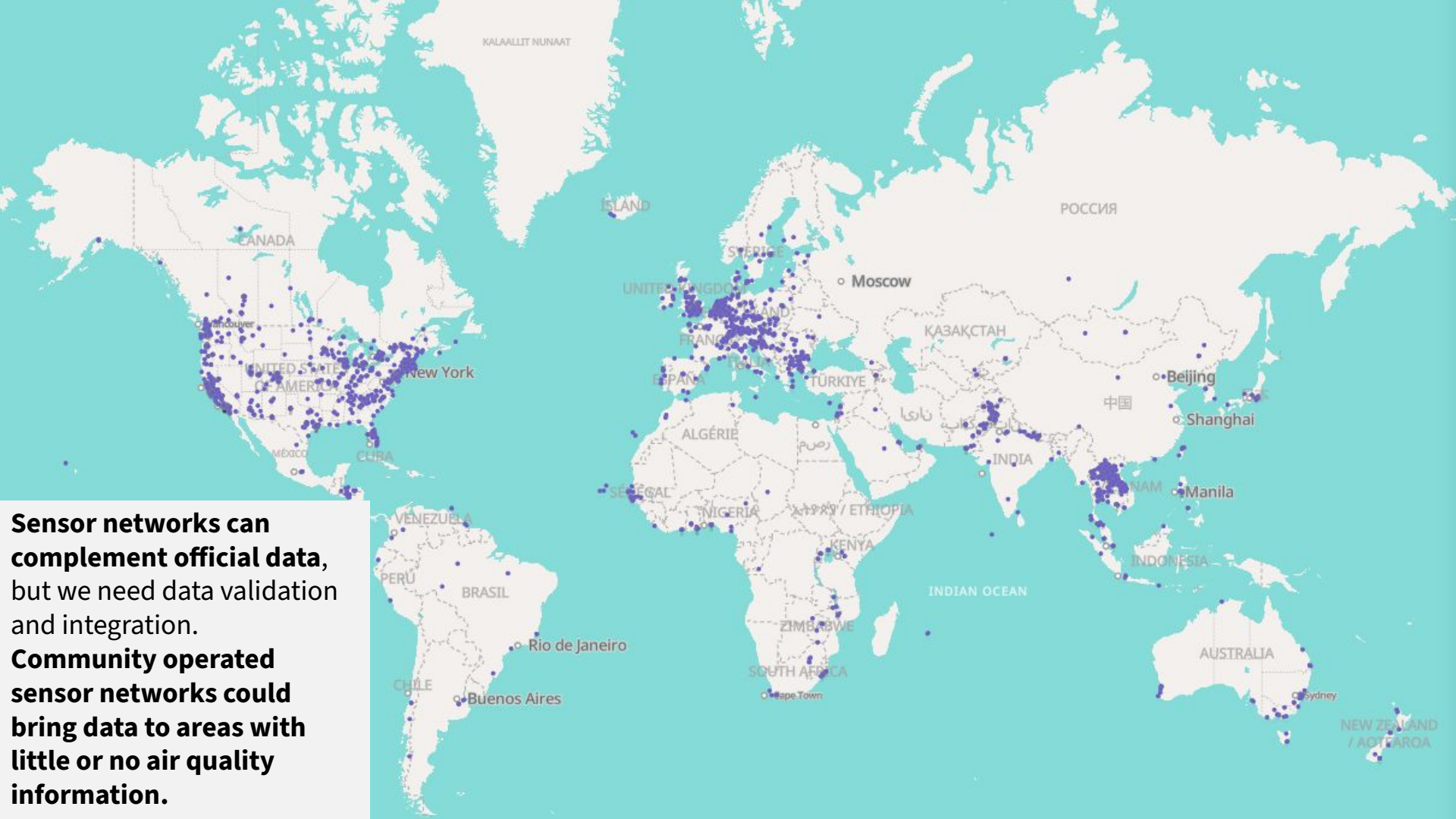
Open+Air+Quality+Data-The+Global+Landscape+2024.pdf



Sensor networks can complement official data, but we need data validation and integration.

Community operated sensor networks could bring data to areas with little or no air quality information.

Citizen Science and Air Quality. CSAQ CoP.

*"**Citizen science has the power to close one of the world's most urgent data gaps in addressing global air quality challenges**. Scientists can collaboratively empower communities to measure their own environment by providing them with the skills and knowledge to develop agency in creating impactful, local solutions."* — Dr Bridie Schultz, Director, teachSTEM Ltd.

*"**Citizen science doesn't replace official air quality monitoring; it multiplies its impact**. High-agency local actors are often better positioned to spot what formal systems can miss. And, in the best scenarios, when these community efforts can join forces with institutional ones, the results can be faster, fairer, and more effective."* — Christa Hasenkopf, EPIC Chicago.

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Open hardware, Open data, Open science

We value owning our air quality data and freely sharing

Much of the power of air quality data gathered by scientists, researchers, and community members comes from the ability of those who create the data to share that data as they see fit.

We support **“open-ready” air quality sensing** equipment that:

- Grants ownership of air quality data to the purchaser of the equipment, and therefore;
- Legally allows the purchaser to share data publicly on a platform of their choice.

ORGANIZATION	A. DATA OWNERSHIP*	B. DATA SHARING*	C. COMPLIANCE WITH EPIC AIR QUALITY FUND OPEN DATA CRITERIA
	Do consumers own the data? Consumers must own the data in order to be able to share it freely (at no cost) and publicly downstream of themselves.	*Can a consumer share data beyond the organization platform, publicly with a CC-BY-4.0 (or more permissive) license?*	*Does it meet the selection criteria for the EPIC Air Quality Fund Application of open data sharing, as defined by columns A and B? Note: Compliance with the Fund's open data criteria **does not** mean endorsement by the Fund or represent a partnership.*
AirGradient	YES *Refer to their terms and conditions*	YES *Refer to their terms and conditions*	YES
AirScan	YES *Refer to their data policies*	YES *Refer to their data policies*	YES
Airveda	YES *This information was provided directly to us by the company.*	YES *This information was provided directly to us by the company.*	YES
AirQo	AirQo co-owns the data with consumers *This information was provided directly to us by the company.*	YES *This information was provided directly to us by the company.*	YES
airgoon	YES	YES	YES

About 20 sensor vendors (Fall 2024)

Guidance-for-EPIC-AQ-Applicants - Google Docs

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airgradient

Indoor Monitor | Outdoor Monitor | Documentation | Perspectives | Support | Map | Shop

TRACK YOUR AIR. WE'LL SUPPORT A COMMUNITY THAT CAN'T.

Buy One, We Gift One

When you purchase an AirGradient monitor with the link below, **AirGradient will donate a second monitor** to a community with little or no access to air quality data. You'll be able to follow both your sensor and the community's sensor online – building understanding and connection.

If you wish, you can add an **optional donation** at checkout. 100% of this goes to *shipping*, *customs clearance*, and *local onboarding* for the community placement. Working with the Citizen Science Global Partnership (CSGP) and the Citizen Science for Air Quality Community of Practice (CSAQ CoP, LinkedIn Group), donated sensors go to trusted local partners who publish data openly and use it for awareness and action.

Learn More About the Monitor

Time-limited: This campaign runs in **December 2025** only.

How it works

Simple steps to turn personal monitoring into shared impact.

Buy one, we donate one

You purchase a monitor; we donate a second to a community.

Match with a community

With CSGP/CSAQ CoP we prioritise LMIC partners with limited access to data.

Optional extra gift

Help cover shipping, customs, and onboarding for community hosts.

Transparent delivery

We share where sensors go, when installed, and link to live data.

Seventh session of the United Nations Environment Assembly (UNEA-7)

Focus on Low and Middle Income Countries and Disadvantaged Communities

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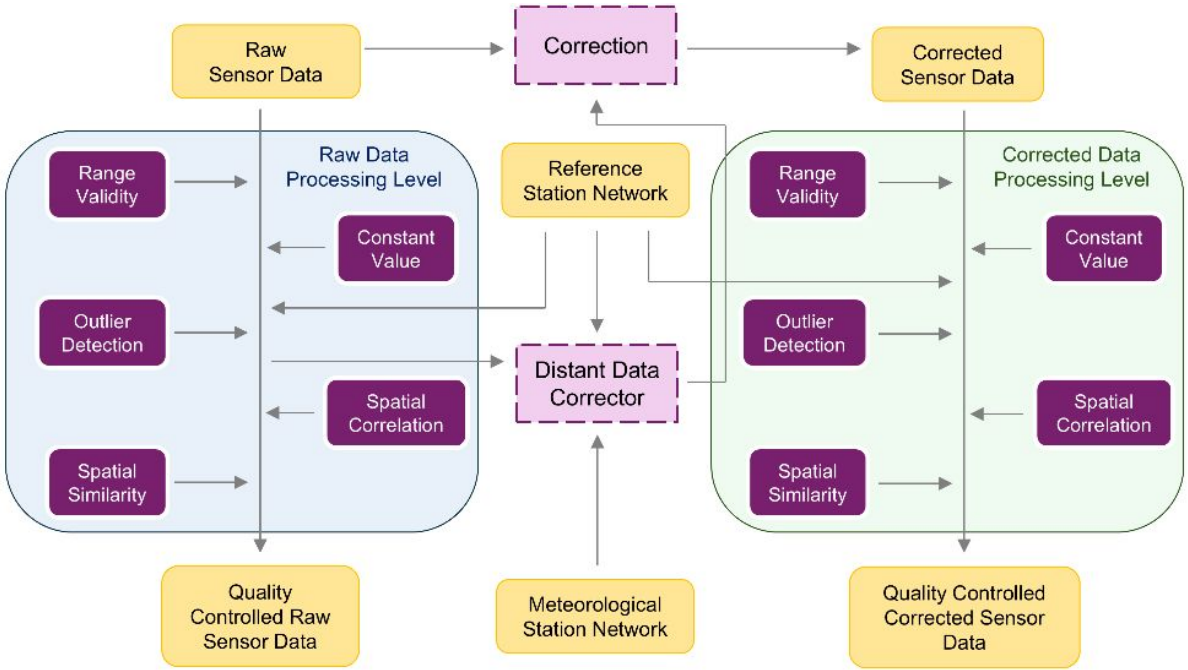
Data of Known Quality



FILTER: A framework to unify and flag sensor-based outdoor/static $PM_{2.5}$ data

Includes **two Processing levels** ("raw" and "corrected") with five Quality Controls steps within each level

Output: Provides flags for all tests and labels data as "high quality", "good quality", or "other quality", providing guidance to the

Hassani, A., Salamalikis, V., Schneider, P., Stebel, K., and Castell, N.: A scalable framework for harmonizing, standardization, and correcting crowd-sourced low-cost sensor PM2.5 data across Europe, Journal of Environmental Management, 380, 125100, https://doi.org/10.1016/j.jenvman.2025.125100, 2025.

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Quality Control	Plausible Values	Interpretation of Flags
Range Validity	Integer ∈ {0,1}	0: Out of range 1: Within the range
Constant Value	Integer ∈ {0,1,2}	0: Number of measurements in the window < 6 hours 1: Range ≤ 0.1 and number of measurements in the window ≥ 6 2: Range > 0.1 and number of measurements in the window ≥ 6
Outlier Detection	Integer ∈ {0,1,2,3}	0: Number of measurements in the window < 90 hours 1: Outlier, solely based on the sensor of interest data Not enough neighbors (either station or sensor) are found in the vicinity, meaning at least one within a radius of 3 km or at least 2 up to 30 km 2: Outlier, considering the neighbors 3: Not an outlier
Spatial Correlation	Integer ∈ {0,1,2,3}	0: The sensor of interest’s data coverage in the window is < 90 hours 1: Not enough neighbors (either station or sensor) are found in the vicinity, meaning at least 1 with ≥ 90 hours paired measurements in the window up to 3 km or at least 2 with ≥ 90 hours paired measurements in the window up to 30 km 2: Correlation test with nearest neighbors is not satisfied. The sensor might be faulty or inaccurate, but the lack of correlation might be due to spatial variability 3: Correlated with neighbors Not having enough neighbors takes priority over lack of data coverage
Spatial Similarity	Integer ∈ {0,1,2,3}	0: The sensor of interest’s data coverage in the window is < 90 hours 1: Not enough stations are found in the vicinity, meaning at least 1 with ≥ 90 hours paired measurements in the window up to 30 km 2: Spatial similarity test with nearest references is not satisfied. The sensor might be faulty or inaccurate, but the lack of similarity might be due to spatial variability 3: Spatially similar to nearest references

Hassani, A., Salamalikis, V., Schneider, P., Stebel, K., and Castell, N.: A scalable framework for harmonizing, standardization, and correcting crowd-sourced low-cost sensor PM2.5 data across Europe, Journal of Environmental Management, 380, 125100, https://doi.org/10.1016/j.jenvman.2025.125100, 2025.

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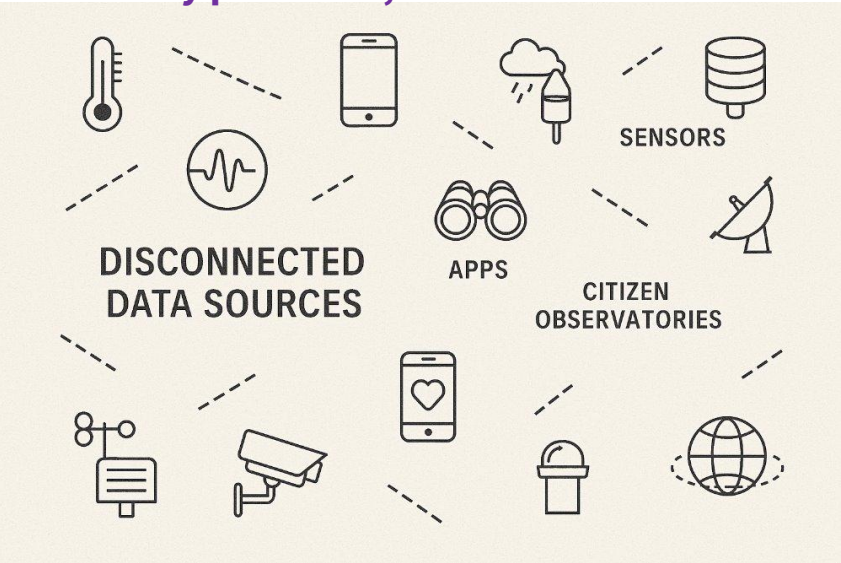
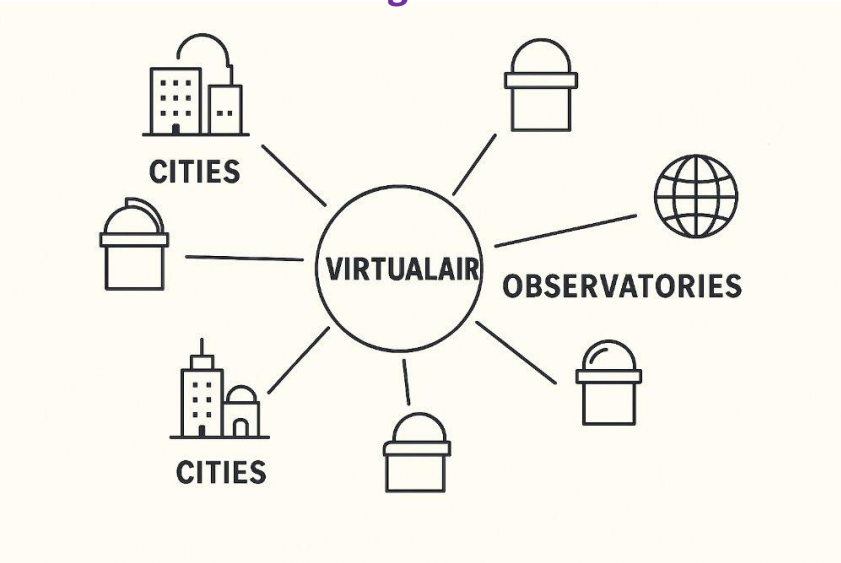
Data integration: FAIR Standards & Global Platforms

«Too many platforms, too little connection»



"Citizen science projects collect valuable environmental data, but data lives on many different platforms. ***Hard to know where it is and how to access it****"- Mirjam F. Fredriksen, NILU*

«Connecting the dots»



A **proxy API** using **OGC SensorThings** standard that let's you query multiple observatories from one endpoint and **keeps track of the data's origin**.

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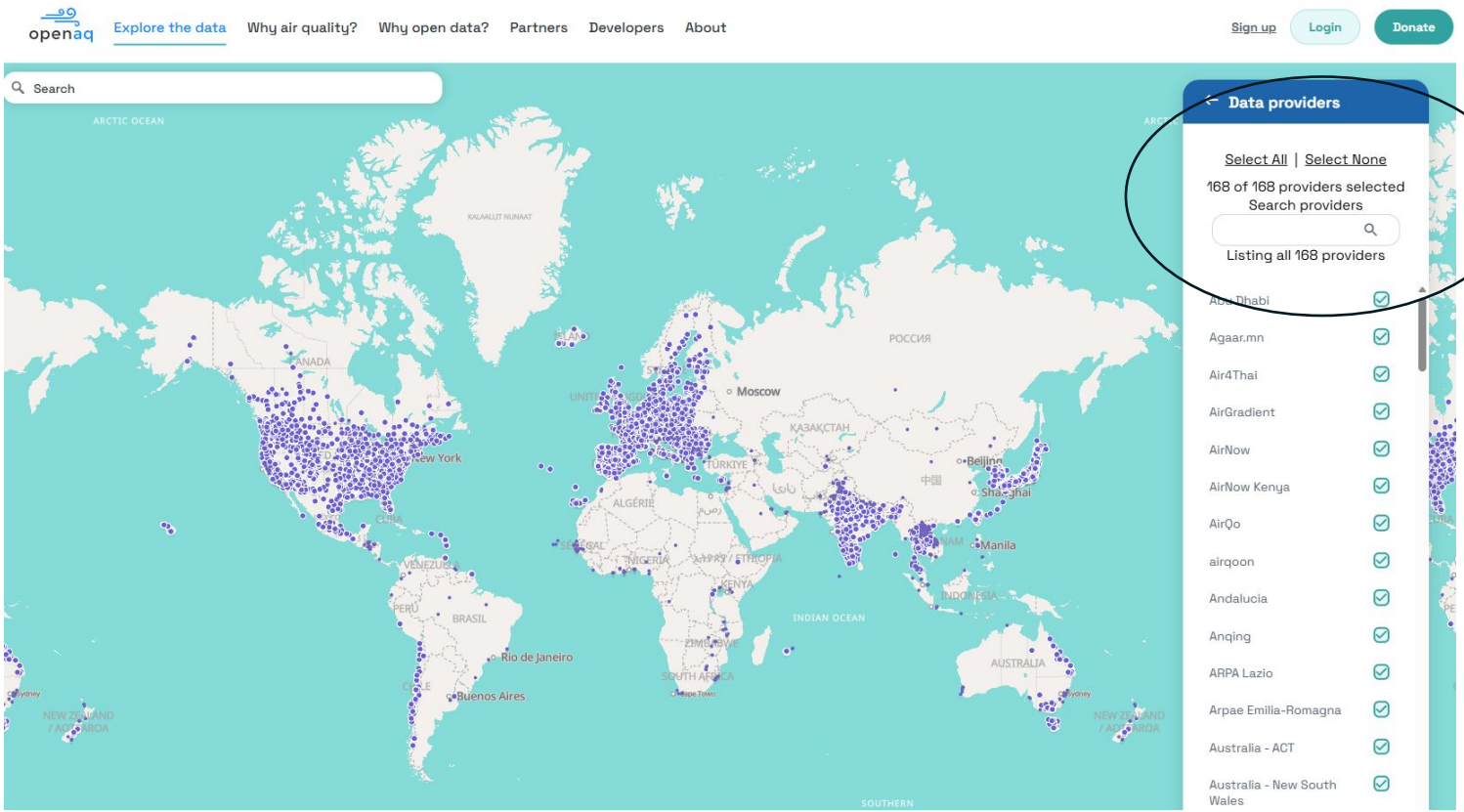

OpenAQ integrates air quality data from 168 sources. Lots of manual work to achieve that.
Still missing proper attribution to the communities collecting the data information on data quality due to lack of proper metadata.

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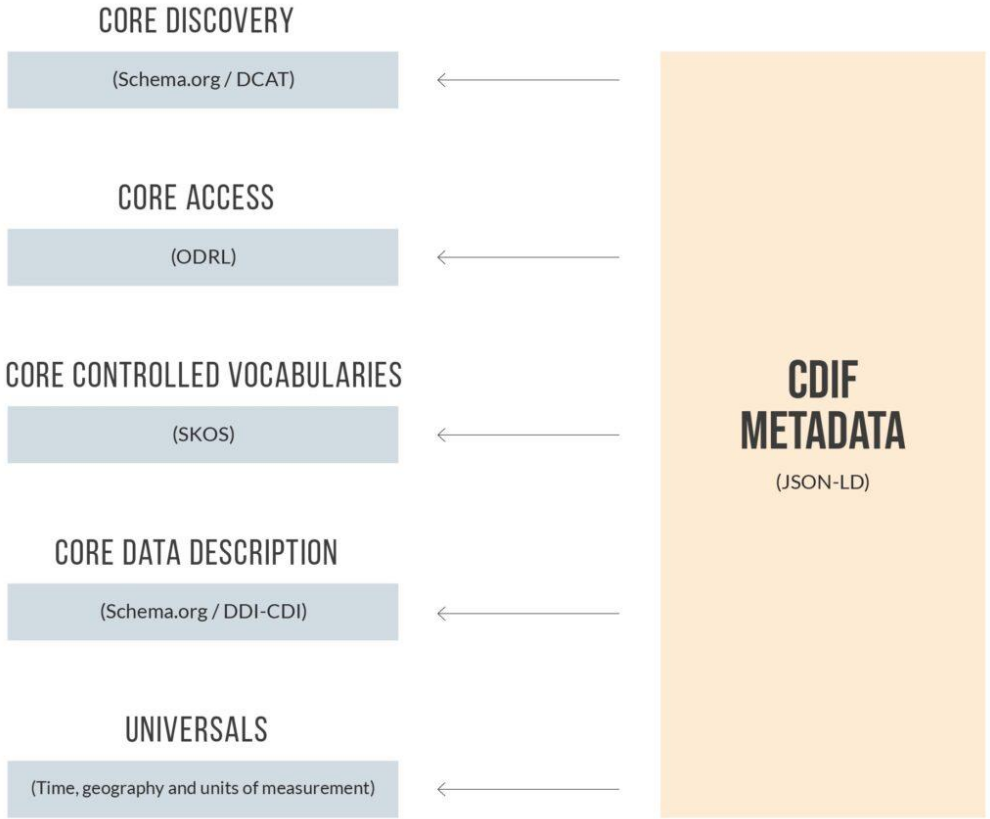
COMMITTEE ON DATA
CODATA
INTERNATIONAL SCIENCE COUNCIL

CDIF
Cross-Domain Interoperability Framework



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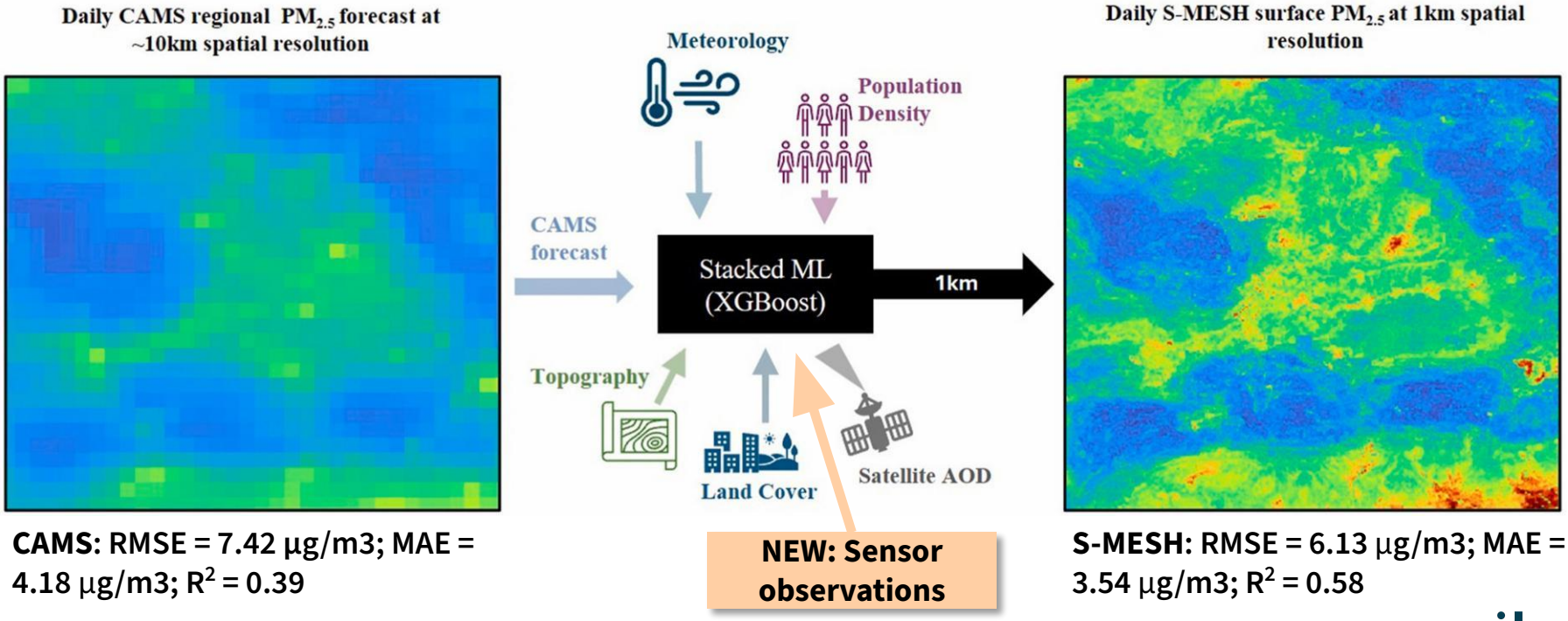
S-MESH: Synergy of Earth Observation and Machine Learning for Air Quality Monitoring in Europe

Simultaneous bias correction and downscaling of the CAMS regional ensemble



CAMS: RMSE = 7.42 µg/m3; MAE = 4.18 µg/m3; R^2 = 0.39

NEW: Sensor observations

S-MESH: RMSE = 6.13 µg/m3; MAE = 3.54 µg/m3; R^2 = 0.58

Shetty, S., Hamer, P. D., Stebel, K., Kylling, A., Hassani, A., Berntsen, T. K., & Schneider, P. (2025). Daily high-resolution surface $PM_{2.5}$ estimation over Europe by ML-based downscaling of the CAMS regional forecast. Environmental Research, 264, 120363.

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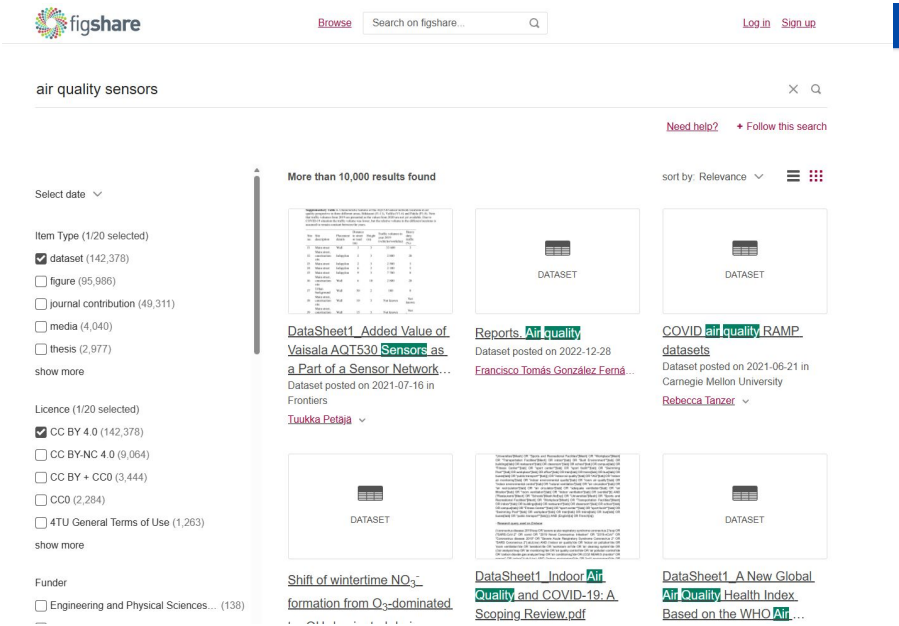
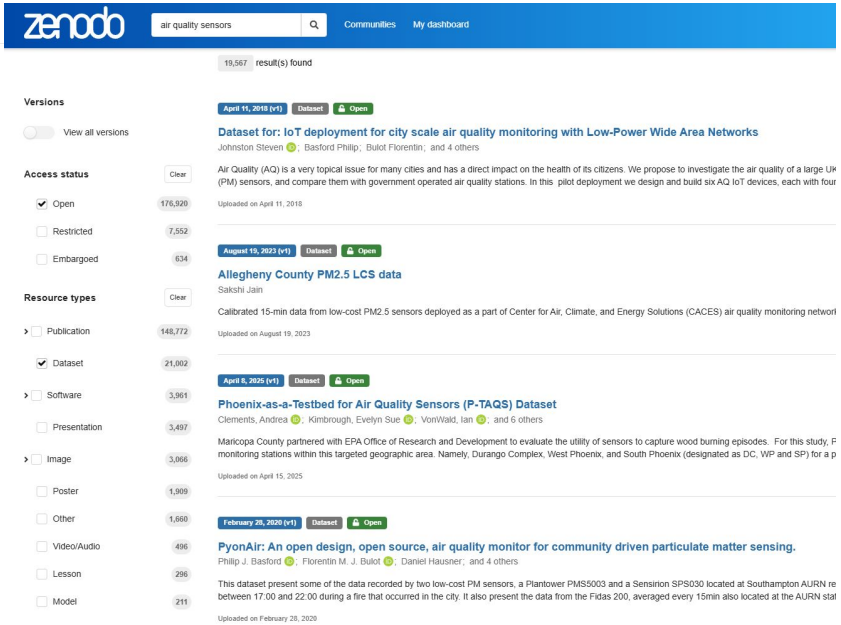
Data legacy: Validated data repositories





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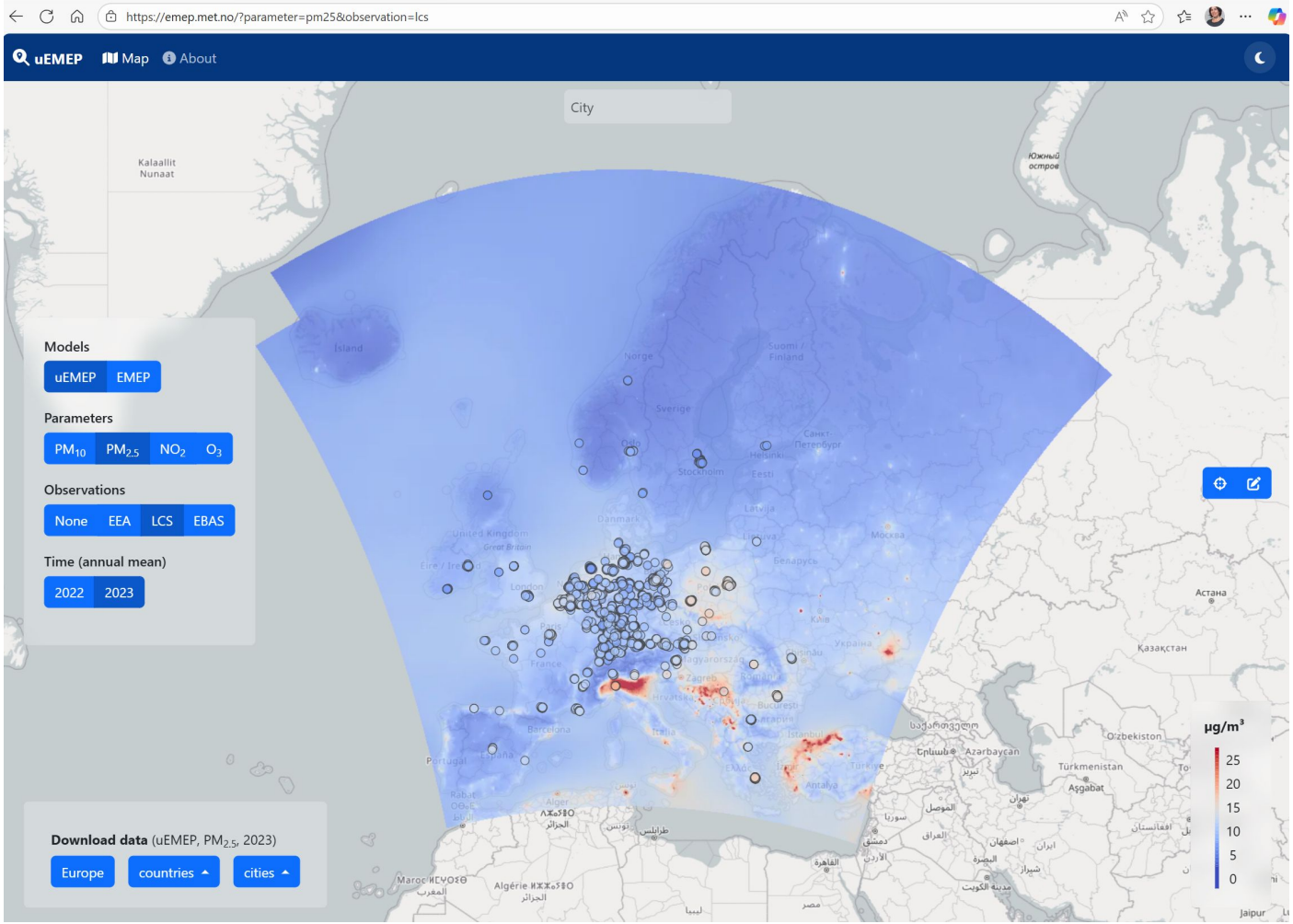

Validated data repositories used for EMEP & uEMEP model validation

Meteorologisk institutt

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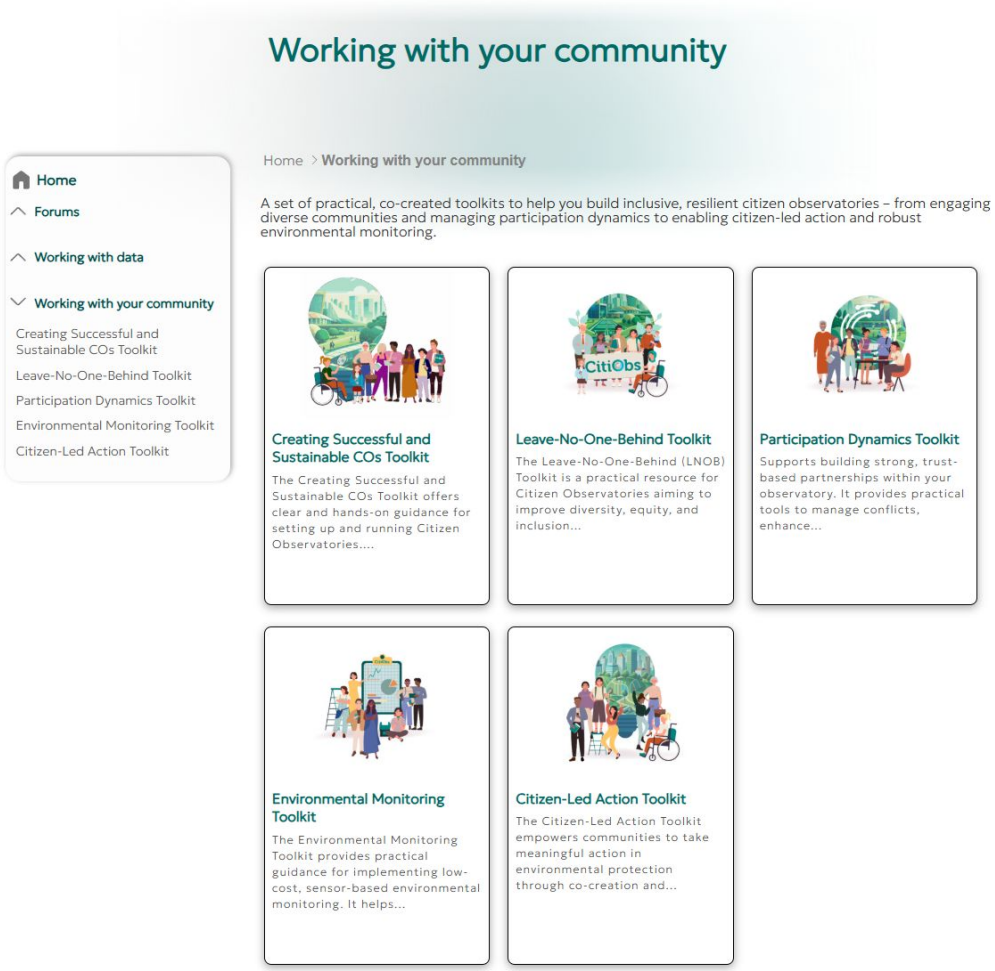

Not only data, we work with people and communities.

Open Science resources to build inclusive, resilent communities, accesible from GitHub.

Open contribution: «pull request»

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Join CSAQ!

Nuria Castell, ncb@nilu.no

Join the Air Quality CoP (Scan the QR code)
E-mail: csgp_aq@list.nilu.no
Website CSGP: https://citizenscienceglobal.org/
LinkedIn CSAQ CoP: Citizen Science Global Partnership Air Quality CoP

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Discussion, next steps

Summary

Common themes

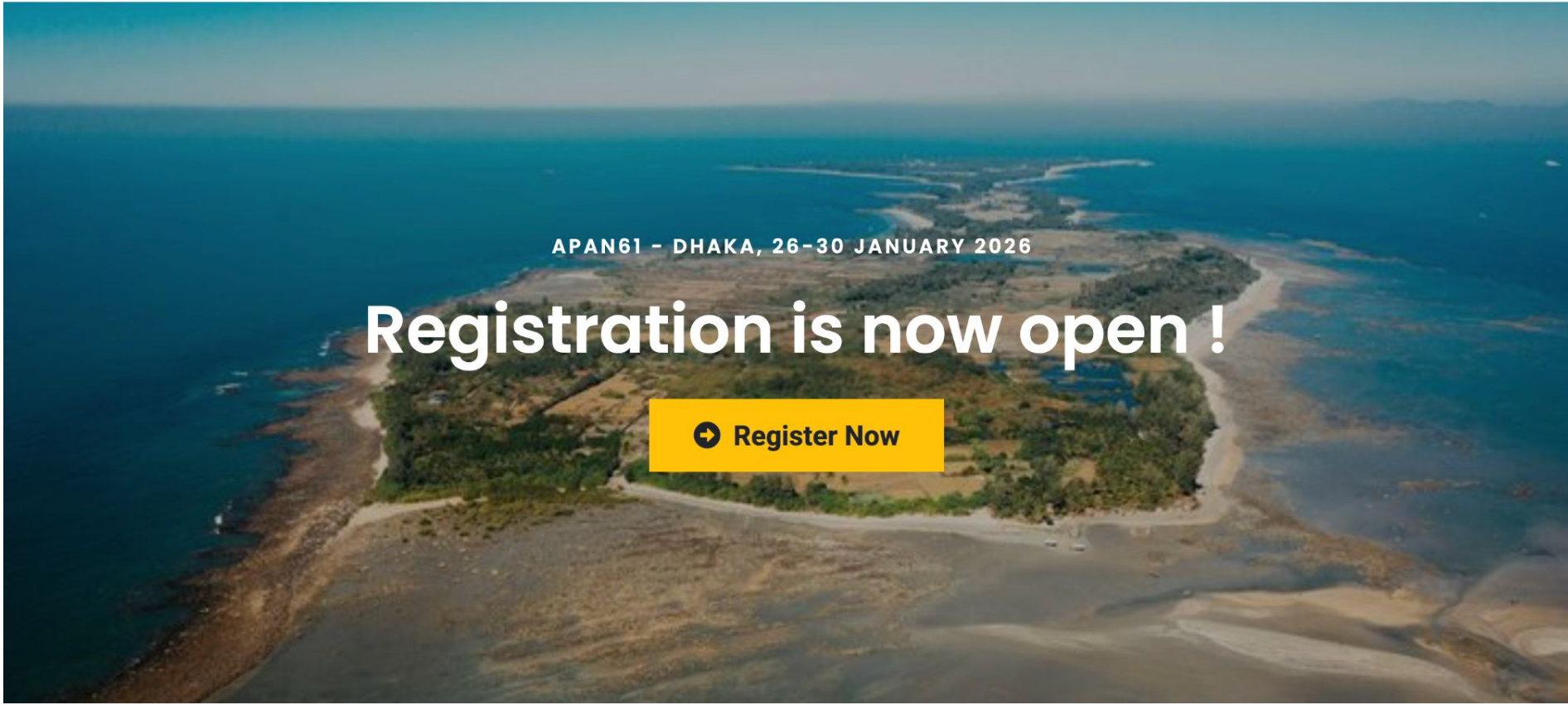
- Human connections and networks (in addition to technical infrastructure and standards)
- Multi-/Inter/trans-disciplinary approach
- Academic research into impact
- Data deluge - data gaps - data quality
- Disaster Risk Reduction/Preparation/Response

New topics?

- Beyond national/regional (this might qualify as a common theme)
- Data - and everything surrounding it
  - Software, workflows, computing platforms, networks, services…
  - Legal issues
  - Sustainability/legacy
- Citizen Science
  - Complementarity with other datasets
  - Active engagement
  - Forums: CODATA TG, potential RDA Interest group
- CARE principles (Collective benefit, Authority to control, Responsibility, Ethics), c.f. Copenhagen Framework?

Approaches to consider

- Future webinars, event participation - collect ideas of topis, events
- Building CODATA-NREN links (and link with projects)
- Funding? For infrastructure (from technical to social)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