Meeting Summary

NASA Disasters Program at GSFC /UMBC event in collaboration with
ITU/WMO/UNEP FG-AI4NDM
(13-15 March 2024)

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Introduction

On 16 March 2021, three United Nations (UN) agencies—the International Telecommunication Union (ITU), World Meteorological Organization (WMO), and UN Environment (UNEP)—kicked off a focus group dedicated to the systematic evaluation of AI as a tool to enhance resilience to natural hazards and disasters. The main objectives of this focus group were to lay the groundwork for international standards and to support capacity development. Soon after, the lead for UN activities at the National Aeronautics and Space Administration (NASA) contacted the ITU, expressing an interest in contributing. Since then, the Focus Group on AI for Natural Disaster Management (FG-AI4NDM) has greatly benefitted from the active participation of experts from NASA. For example, Mr. Arif Albayrak of the NASA Disasters Program at the Goddard Space Flight Center (GSFC)/University of Maryland Baltimore County (UMBC) and Ms. Allison Craddock of the NASA Jet Propulsion Laboratory/California Institute of Technology serve as co-chairs of the Working Group on Data for AI. In addition, Ms. Allison Craddock and Dr. Attila Komjathy (NASA Jet Propulsion Laboratory/California Institute of Technology) are two co-chairs for the Topic Group on AI for Geodetic Enhancements to Tsunami Monitoring and Detection. Alongside these leadership roles, experts from NASA have directly contributed to workshops and webinars,[1] to technical reports, to scientific literature,[2] and related activities.

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[1] One of the webinars in which NASA experts directly contributed looked at “Fighting Wildfires with AI-powered Insights” (https://www.itu.int/en/ITU-T/webinars/20230419/Pages/default.aspx).

[2] For example:

Kuglitsch, M.M., Cox, J., Luterbacher, J., Jamoussi, B., Xoplaki, E., Thummarukudy, M., Radwan, G.S., Yasukawa, S., **McClain, S.N.**, **Albayrak, A.**, Oehmen, D., Ward, T., 2024. Boost AI systems for disaster warning. *Nature* **631**. (Slated for online publication on 3 October 2024.)

Kuglitsch, M.M., **Albayrak, A.**, Aquino, R., **Craddock, A.**, Edward-Gill, J., Kanwar, R., Koul, A., Ma, J., Marti, A., Menon, M., Pelivan, I., Toreti, A., Venguswamy, R., Ward, T., Xoplaki, E., Rea, A., & Luterbacher, J. Artificial intelligence for disaster risk reduction: Opportunities, challenges, and prospects. *WMO Bulletin* **71**(1) (2022).

Kuglitsch, M.M., **Albayrak, A.**, Luterbacher, J., **Craddock, A.**, Toreti, A., Ma, J., Padrino Vilela, P., Xoplaki, E., Kotani, R., Berod, D., Cox, J., & Pelivan, I. When it comes to Earth observations in AI for disaster risk reduction, is it feast or famine? A topical review. *Environmental Research Letters* **18**, 093004 (2023).

After three years of productive collaboration, which resulted in the completion of the deliverables described in the original terms of reference, the FG-AI4NDM will end its lifetime. However, the UN partners as well as the participants in FG-AI4NDM have agreed that additional work can and should be done in this domain. Furthermore, the deliverables that have been completed will require updates to reflect advances in technology. Thus, it was decided that the FG-AI4NDM should continue its activities through a transition into a new mechanism: a UN Global Initiative, which will enable it to continue and scale up its work.

To mark this transition from focus group to global initiative, to recognize the meaningful contributions of the experts at NASA, and to explore ways to formalize the partnership between NASA and these UN activities, the NASA Disasters Program at GSFC and UMBC generously offered to host a three-day (onsite with online participation) event from 13 to 15 March 2024. The structure, whose components will be described in greater detail below, consisted of a workshop (at UMBC); a meeting to approve the final deliverables of FG-AI4NDM and to discuss the transition into a global initiative (at UMBC); and a day of "parallel events" (including tours and closed meetings).

To support the onsite participation of experts from least developed countries, small island developing states, as well as female and young researchers, an International Union for Geodesy and Geophysics (IUGG) Travel Grant (Special Call - IYBSSD2022) was acquired with the support of IAMAS and IAG. The financial statement can be found in Appendix C.

Workshop on Resilience to Natural Hazards through AI Solutions (13 March 2024)

During its tenure, the FG-AI4NDM organized a series of workshops. These were an important vehicle for learning and sharing: highlighting innovative ways that AI is being used to support disaster management, challenges and opportunities when using AI for research or in operations, and stakeholder perspectives. Keeping with this tradition, a workshop on "Resilience to Natural Hazards through AI Solutions" was convened on 13 March 2024 (Fig. 1). Dr. Shanna McClain (NASA Disasters Program), Mr. Arif Albayrak (NASA Disasters Program), Dr. Robert Emberson (NASA Disasters Program), and Dr. Monique Kuglitsch (chair of FG-AI4NDM) worked together to organize the workshop program.

Figure 1. The workshop banner was designed by Mr. Jacob Reed at NASA GSFC and was circulated by NASA and the UN partners.

In total, about 230 participants (ca. 80 onsite and 150 online; Fig. 2) joined the workshop. The agenda, which can be found online,[3] began with welcoming addresses by representatives from the co-hosting organizations: Dr. Karl Steiner highlighted the exciting research and athletic achievements of UMBC and Dr. Robert Emberson introduced ongoing activities within the NASA Disasters Program. This was followed by keynote presentations introducing the FG-AI4NDM and alluding to its transition into a global initiative (by Dr. Monique Kuglitsch), demonstrating relevant activities across UNEP (by Ms. Sally Radwan), showing applications of geodesy in hazard monitoring (by Prof. Benedikt Soja[4]), and reviewing technology assessments by the U.S. Government Accountability Office (by Mr. Brian Bothwell).

The next session, which was moderated by Mr. Dan Joseph from the Red Cross, had presentations that showed how AI is being used operationally to support disaster management—to fill the gaps in radar observations, to monitor disasters and their impacts from remote sensing imagery, and to address accessibility gaps in weather information. These were provided by experts at (e.g.,) MIT Lincoln Lab, National Weather Service, and U.S. Department of Agriculture. During the ensuing discussion, a recurring theme was keeping technology “human-centric” and interacting with end users throughout AI development and operational use.

After a brief intermission, the final session was moderated by Mr. Lorenzo Nava, a young researcher at the University of Padova (Italy) working on AI-based landslide detection. Here, presentations showed how AI is being used in a research context: to classify imagery, to transform disaster risk reduction progresses, and to support disaster management through versatile foundational models. This featured presentations by (e.g.,) experts from UMBC, NASA GSFC, and Texas A&M. After a lively discussion, Mr. Arif Albayrak provided closing remarks. A link to reach a recording of the workshop can be found in the footnotes.[5]

[3] The workshop agenda.
[4] An expert within the IAG.
[5] Link to watch the workshop.

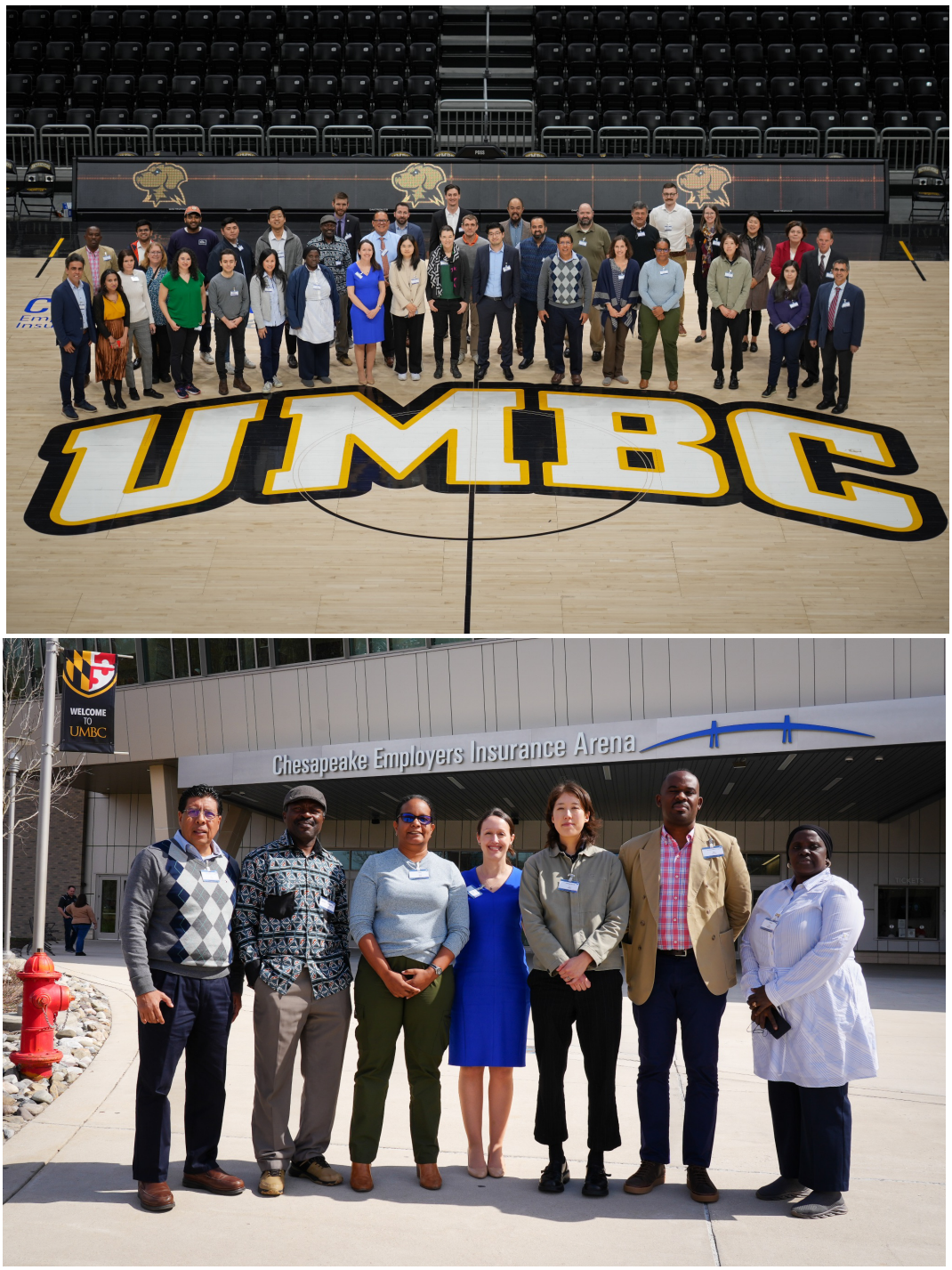

Figure 2. (top) Onsite participants gathered on the basketball court at UMBC for the workshop. (bottom) Through an IUGG Travel Grant, it was possible to support the onsite participation for seven experts from institutes in Africa and the Caribbean region, as well as young and female experts. They are shown alongside the FG-AI4NDM chair (picture credits: Jesse Cruz, WMO).

Final meeting of FG-AI4NDM and call for UN Global Initiative (14 March 2024)

The final meeting of FG-AI4NDM (14 March 2024) was moderated by the chair, Dr. Monique Kuglitsch, and had ca. 150 participants in total (onsite and online). It began with highlights from the workshop and opening remarks from representatives of the three UN partner organizations: the Director of the ITU Standardization Bureau, Mr. Seizo Onoe; the Director of Science and Innovation of WMO, Prof. Juerg Luterbacher (one of the FG-AI4NDM vice chairs); and the Chief Digital Officer of UNEP, Ms. Sally Radwan. After approval of the proposed agenda (as shown in Appendix A), incoming correspondences ("liaison statements") were reviewed and acknowledged. This was followed by a presentation about the history and future of the FG-AI4NDM, which culminated in an official proposal to transition the FG-AI4NDM into a UN Global Initiative on *Resilience to Natural Hazards through AI Solutions* (*Resolutions*).

Figure 3. Representatives from the three UN partner organizations: (far right) the Director of the ITU Standardization Bureau, Mr. Seizo Onoe; (center right) the Director of Science and Innovation of WMO, Prof. Juerg Luterbacher; and (far left) the Chief Digital Officer of UNEP, Ms. Sally Radwan, joined (center left) Dr. Monique Kuglitsch to propose the launch of the Global Initiative *Resolutions* (picture credit: Jesse Cruz, WMO).

The next discussions related to use case proposals. These covered topics as widespread as AI-based precipitation nowcasting (by the Korea Meteorological Administration), quality control of hydrometeorological data for climate forecasting (by Environment and Climate Change

Canada), damage assessment in satellite imagery (from Johns Hopkins University), and an integrated holographic management map for safety and crisis events (from Ithaca S.r.l. and LINKS Foundation). All ten proposals that were presented and discussed were deemed suitable for further analysis by the meeting.

Following a brief recess for lunch, the meeting reconvened and the final deliverables for FG-AI4NDM–a technical report on AI for modeling, a technical report summarizing educational activities for capacity sharing, and a document describing a large language model (LLM)-based tool–were also presented, discussed, and adopted. The final agenda items related to the creation of three new organizational groups: a topic group to cluster climate-related use cases, a working group dedicated to exploring climate-relevant topics, and a working group to support implementation activities through which standards can be deployed and (as needed) further refined. The former two groups were created in response to ongoing efforts to more closely work with the United Nations Framework Convention on Climate Change (UNFCCC). The latter group (on implementation) was created to directly contribute to the *Early Warning for All Initiative* (*EW4All*) and, in parallel, to test FG-AI4NDM standards through operational deployment.

Parallel Events including Tours and Closed Meetings (15 March 2024)

On the third day of the event, most of the onsite participants were treated to a guided tour of the UMBC campus with bus transfer to the NASA GSFC visitor center. In parallel, members of the FG-AI4NDM management were invited to the NASA GSFC campus for closed meetings and a guided tour. From FG-AI4NDM, Dr. Monique Kuglitsch (chair), Prof. Juerg Luterbacher (vice chair), Dr. Elena Xoplaki (vice chair), Dr. Andrea Toreti (Working Group on Modeling for AI co-chair), Ms. Mythili Menon (advisor and secretariat), and Mr. Jesse Cruz (WMO communications) were in attendance. From NASA GSFC, Dr. Dalia Kirschbaum, Dr. Paul Newman, Mr. Michael M. Little, Dr. Mark Carroll, Dr. Helen Amos, Mr. Arif Albayrak, Dr. Robert Emberson, and Ms. Rachel Soobitsky participated.

Per the agenda, which was prepared by Dr. Robert Emberson (see Appendix B), Dr. Dalia Kirschbaum opened the meeting by introducing the Earth Sciences Division and highlighting activities that innovate, integrate information, and inform. This included slides showing vertical cross sections of tropical cyclones in satellite imagery, research on the cascading effects of natural hazards (e.g., Cholera outbreaks in Haiti following the earthquake), and a project using MODIS data for near-real-time fire detection. Dr. Kirschbaum also emphasized the role of international partnerships in accelerating science.

This was followed by a presentation by Dr. Robert Emberson on the NASA Disasters Program. It demonstrated how models can provide actionable information. One example demonstrated how near-time satellite observations of volcanic ash are being used to assist aircraft, and another example showed how synthetic aperture radar were used to provide proxy maps during the Hawaii wildfires.

The first presentation on behalf of FG-AI4NDM, by Dr. Elena Xoplaki, introduced the concept behind the *Mediterranean and pan-European forecast and Early Warning System against Natural Hazards* (*MedEWSa*). This WMO-coordinated and European Union (Horizon Europe)-funded project is exploring the potential of AI for decision support systems, multi-hazard and impact-based forecasts, risk transfer solutions, and societal support in key regions around the extended Mediterranean basin. One of the study sites (Ethiopia) is also an *EW4All* priority country

(Fig. 4). The MedEWSa project has been designed in a way that allows upscaling of its approaches and architectures, enabling adaptation and implementation in different areas on Earth. Through this project, *Resolutions* will be able to test the performance of FG-AI4NDM standards under different settings and to further refine them as needed.

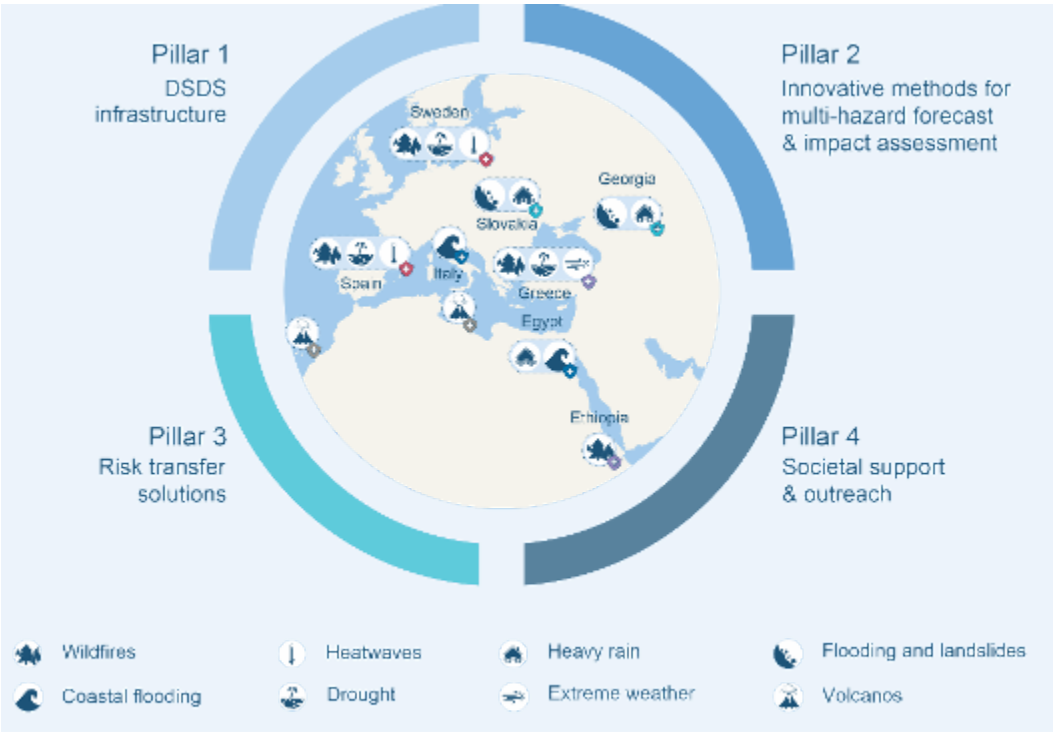

Figure 4. A map showing the study sites, hazards, and pillars of the MedEWSa project.

This was followed by a presentation by Mr. Seizo Onoe, which described the standardization activities at the ITU, including *Bridging the Standardization Gap*.[6] Mr. Onoe demonstrated the regional inequalities in communication infrastructure and adoption of new technologies (using the 5G as an example). He also showed how BSG aims to help member states—including developing countries—contribute to standardization processes and implement international standards from the ITU.

In the following presentation, which was given by Dr. Andrea Toreti, the emphasis returned to natural hazards. Dr. Toreti showed how the European Commission is addressing droughts; providing drought indicators to facilitate data interpretation, creating a Drought Risk Atlas, and related tools (Fig. 5).

To end the meeting, Dr. Monique Kuglitsch provided an overview of the accomplishments of the FG-AI4NDM and proposed goals for *Resolutions*. In simple terms, these are: (1) to branch out, (2) to build on, and (3) to scale up. Specifically, it aims to add new use cases (e.g., during the meeting on 14 March 2024, 10 new use cases were identified and adopted) and expand the scope to include new hazards and complementary technologies. In parallel, it will update the technical reports and do deep dives on topics of interest (e.g., the Working Group on AI for

[6] https://www.itu.int/bsg/

Modeling is currently investigating the potential of explainable AI in disaster management). To scale up impact, it will use implementation projects to see how standards perform in practice and revise them as needed. Through carefully selecting study sites for these implementation projects (as demonstrated by *MedEWSa*), it can directly contribute to the *EW4All*. Furthermore, through educational materials and capacity sharing, it will ensure the sustainability of these projects.

Figure 5. Highlights from the closed meetings at NASA GSFC. (top left) Dr. Dalia Kirschbaum presented some of the innovative research happening in her division. (top right) Dr. Monique Kuglitsch introduced the FG-AI4NDM. (middle left) Dr. Elena Xoplaki discussed the concept behind the EU-funded and WMO-coordinated MedEWSa project. (middle right) Mr. Seizo Onoe introduced standardization activities at the ITU including the BSG. (bottom left) Mr. Arif Albayrak–who helped organize this event–contributed to important discussions. (bottom right) Dr. Helen

Amos explained some of the challenges when using and preparing data tailored for impact studies (picture credit: Jesse Cruz, WMO).

Following the closed meetings, a tour of the NASA GSFC facilities (Fig. 6) was provided to the visitors. Highlights included a visit to the spacecraft and integration complex (including views of the centrifuge and the end-to-end testing rooms), the space science and mission operations (of great relevance for our experts working on space weather), and to the quantum communications lab (of particular interest to our ITU colleagues!). The visitors were highly impressed and very grateful for this experience.

Figure 6. Representatives of the FG-AI4NDM were provided a guided tour of the NASA GSFC facilities (picture credit: tour guide at NASA GSFC).

Appendix A. Agenda of the meeting on 14 March 2024.
Organized by Ms. Mythili Menon and Dr. Monique Kuglitsch (ITU/WMO/UNEP FG-AI4NDM)

INTERNATIONAL TELECOMMUNICATION UNION

TELECOMMUNICATION STANDARDIZATION SECTOR

STUDY PERIOD 2022-2024

FG-AI4NDM-I-249R2

Focus Group on AI for Natural Disaster Management

Original: English

WG(s):	N/A	Catonsville, 13-15 March 2024

INPUT DOCUMENT

Source:	FG-AI4NDM Chair
Title:	Draft Agenda for the twelfth meeting of the Focus Group on AI for Natural Disaster Management (FG-AI4NDM)

Contact:	Monique Kuglitsch Fraunhofer HHI Germany	Email: monique.kuglitsch@hhi.fraunhofer.de

Abstract: This document contains a draft agenda for the twelfth meeting of the ITU/WMO/UNEP Focus Group on AI for Natural Disaster Management (FG-AI4NDM) on 13-15 March 2024.

13 March 2024		
Time	**Agenda Item**	**Doc No.**
09:30-16:45	ITU/WMO/UNEP Workshop on "Resilience to Natural Hazards through AI Solutions"	
14 March 2024		

09:30-09:50	**FG-AI4NDM opening plenary** · Opening Remarks: Seizo Onoe, TSB Director · Opening Remarks: WMO · Opening Remarks: UN Environment · Approval of agenda [This Document]	
09:50-10:00	**Incoming Liaison Statement(s) and Other documents** · LS/i on Autonomous Networks deliverables from ITU-T FG-AN [from FG-AN] · LS/i on Invitation to provide inputs to the "Machine learning standardization roadmap" [from JCA-ML] · LS/i on Invitation to provide inputs to the "Glossary of terms and definitions for machine learning" [from JCA-ML]	FGAI4NDM-I-235 FGAI4NDM-I-250 FGAI4NDM-I-251
10:00-10:30	**Way forward for NDM** · Monique Kuglitsch, FG-AI4NDM Chair - FG-AI4NDM Final Report (from March 2021 to March 2024)	FGAI4NDM-I-256

10:30-12:30	**Contributions – Use-cases** · AI nowcasting model in Korea Meteorological Administration and its applications for natural disaster management *(Korea Meteorological Administration)* · Improved real-time rainfall observation for developing countries using AI-based merging of data from commercial microwave links and geostationary satellites *(Karlsruhe Institute of Technology (KIT))* · Anomaly Detection: Quality Control using Machine Learning *(Environment and Climate Change Canada, Meteorological Service of Canada (ECCC/MSC))* · ML-based post-processing increases the usability of continental hydro-climate services to local conditions *(Swedish Meteorological and Hydrological Institute (SMHI)* · AI for Eathquakes Disaster Management *(Astroteq)* Rapid and Large-scale Ground Failure and Building Damage Assessment using Deep Causal Bayesian Networks and InSAR Imagery Products in the 2023 Mw 7.8 Kahramanmaras, Türkiye Earthquake Sequence *(Johns Hopkins University)* · Early tsunami and earthquake warning based on the estimation of magnitude and epicentre with a single station *(University of Chile)* · Deep Learning for Globally Distributed Sentinel-1 SAR-based Rapid Landslide Detection *(University of Padova)*	FGAI4NDM-I-236 FGAI4NDM-I-244-R1 FGAI4NDM-I-240-R1 FGAI4NDM-I-241-R1 FGAI4NDM-I-246 FGAI4NDM-I-239 FGAI4NDM-I-237 FGAI4NDM-I-242-R1 FGAI4NDM-I-253 FGAI4NDM-I-254-R1 FGAI4NDM-I-257-R1

	· Intelligent Data Solution for Disaster Risk Reduction *(CivicDataLab)* · OVERWATCH: Integrated holographic management map for safety and crisis events *(Ithaca S.r.l., LINKS Foundation)* · Food security indicator: locusts' prediction *(SISTEMA)*	
12:30-14:00	*Lunch*	

14:00-15:00	**Contributions – Deliverables** · FG-AI4NDM Modeling *(Fraunhofer HHI, European Commission)* · Educational materials and complementary activities to support capacity building *(WMO, Fraunhofer HHI, UNEP)* · Submission to FG-AI4NDM: Tooling Group Results *(WS-Tools)*	FGAI4NDM-I-248 FGAI4NDM-I-238 FGAI4NDM-I-252
15:00-16:00	**Contributions – Other Inputs** · The introduction of WMO AI for nowcasting pilot project *(WMO)* · Introduction to the MedEWSa project *(WMO)* · Generative AI and Quantum Machine Learning for NDM *(IBM Corporation)* · Draft scope for proposed Working Group on Operational Implementation · Draft scope for proposed Topic Group on AI for Climate Applications · Draft scope for proposed Working Group on AI for Climate Applications	FGAI4NDM-I-245 FGAI4NDM-I-255 FGAI4NDM-I-247-R1 FGAI4NDM-I-243 FGAI4NDM-I-258 FGAI4NDM-I-259
16:00-16:30	**Outgoing Liaison Statements**	

16:30-17:00	¾ **Next steps** ¾ **AOB** ¾ **FG-AI4NDM management team** Chair: Monique Kuglitsch, Fraunhofer HHI, Germany Vice-Chair(s): · Elena Xoplaki, Justus Liebig University Giessen · Jürg Luterbacher, World Meteorological Organization (WMO) · Muralee Thummarukudy, UNCCD · Srinivas Chaganti, Department of Telecommunications, India · Rakiya Abdullahi Babamaaji, National Space Research and Development Agency, Nigeria · Yan Chuan Wang, China Telecommunications Corporation	
17:00	**Close of the meeting**	
15 March 2024		
	Visit to the NASA Visitor Centre	

NOTE: The timings indicated are the local time in Baltimore. The meeting may end earlier based on the advancement of the agenda

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Appendix B. Agenda of the closed meeting on 15 March 2024.
Organized by Dr. Robert Emberson, NASA GSFC.

Attendees (GSFC):
Dalia Kirschbaum, Paul Newman, Ian Adams, Mike Little, Mark Carroll, Helen Amos

Attendees (Disasters):
Shanna McClain, Arif Albayrak, Robert Emberson, Rachel Soobitsky (as FN escort)

Attendees (ITU / UN):
Monique Kuglitsch (Focus Group Chair); Seizo Onoe (ITU Director); Juerg Luterbacher (WMO Chief Scientist); Andrea Toreti (JRC); Eleni Xoplaki (Justus-Liebig-University of Giessen); Mythili Menon (ITU)

Run of show:
09:00– Arif / Robert / Rachel to meet visitors at GSFC badging office
09:15-09:45 – Arrival at B33, introductions (Robert to bring coffee) – B33, Room E125
09:45-10:45 – NASA 101s (B33, E125)

- GSFC Earth Sci 101
- GMAO High level
- Disasters 101 (can be covered by Disasters personnel)
- AIST connections

10:45-11:45: ITU / WMO briefings (B33, E125)

- EW4All: objectives, status, and the role of MedEWSa. (Juerg & Elena)
- Bridging the Standardization Gap. (Seizo Onoe)
- Drought Observatory, EC Drought task force. (Andrea)
- Global Initiative: objectives, status, and future engagement of NASA - partner. (Monique)

11:45-12:15: Discussion, consideration of future actions
12:15-13:15: Lunch – B21 / B1 / B33 canteen possible
13:15-15:30: GSFC Tour (for those available):

- 13:15/13:30 – 14:00 - Spacecraft and Integration Complex
- 14:15-14:45 - Space Science and Mission Ops (relevant for Space Weather)
- 15:00-15:30 – Quantum Communications Lab

15:30: Departure

Appendix C. Financial Statement Related to IUGG Grant

Budget status	23.09.2024
IUGG	P.30080.1.01

	CHF		
Revenue	11.435,98	Invoice 610043907 - Payment received 15.12.2	
Expenses			
Travel - FG-AI4NDM, Catsonville, USA, 13-15 March 2024			
BABB Renee Janelle	904,81	TA 2097-2024	Flight only
Mark CODLING	485,26	TA 2083-2024	Flight only
Raul AQUINO	774,13	TA 2082-2024	Flight only
Edouard Henri TONNANG	1.342,34	TA 2081-2024	Flight only
Eri STERN	1.981,30	TA 2084-2024	Flight + DSA
RAKIYA BABA-MA'AJI	2.850,85	TA 2080-2024	Flight + DSA
Total Travel	8.338,69		
Bank charges	199,30		
Total Expenses	8.537,99		
Balance	2.897,99		

Oronde Lambert [Flight only] - Participated remotely

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Union Internationale des
Télécommun. -Librairie-

IBAN: CH83 0024 0240 FP10 0889 0
As of: 15.12.2022

Details of transaction

Account information

Ccy.	Number/Amt.	Description/IBAN/BIC	Category/Account no.	Duration
USD		UBS Business Current Account CH83 0024 0240 FP10 0889 0 / UBSWCHZH80A	CH83 0024 0240 FP10 0889 0	

Booking				Valued in USD
Dates		Description	Transaction no.	Booking amount
Trade date	16.12.2022	Payment	ZD81350ZD9634940	12'000.00
Booking				
Value date	16.12.2022			
Receipt of order	16.12.2022			

Details

INT. UNION OF GEODESY + GEOPHYSICS
C/O TECHNICAL UNIVERSITY OF
CENTRIFUGEVEJ 356
DK-2800 KGS. LYNGBY
PAYMENT OF IUGG GRANT TO ITU FOCUS
GROUP ON AI FOR NATURAL DISASTER
MANAGEMENT, USD 12,000
INVOICE: 610043907
Amount entered USD 12'000.00