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National Center of Meteorology

ARTIFICIAL INTELLIGENCE FOR WEATHER PREDICTION

Advances, Challenges & Future Outlook

9-11

SEPTEMBER

NCM, ABU DHABI



Theme A:

Collaboration across private, public and academic sectors

Breakout Group 1 – Opportunities for Partnership

Presenter:

Johannes Schmude



Breakout Room 1 – Opportunities for Partnership

- There is no single opportunity.
 - Opportunities depend on parties, regions and will change over time.
 - E.g.: The difference between an early R&D or a later scaling stage. R&D brings latest innovations from mainstream AI to meteorology. Scaling brings these to more parties.
- Alignment between parties is key. Different parties have different mandates and have to be able to fulfill this.
- Potential benefits to all parties is what creates a partnership; transparency regarding objectives and mandates makes it strong.
- Partnerships existed before AI; yet AI makes partnerships more urgent.



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Breakout Room 1 – How of Partnerships

- AI makes partnerships more urgent.
- Speed is needed rather than structure.
- The general idea: “a light touch” rather than “strong governance”
 - No single incentive would work. Incentives depend on mandates & vision.
 - There is no requirement for the WMO to create additional structures but creating points of engagement would maintain the discussion
 - Incentives can be generated ad-hoc via existing mechanisms.
 - A common principle might be useful.



Theme A:
Collaboration across private, public and academic
sectors

Breakout Group 2 – Data and Infrastructure

Presenter:

Ken Mylne



Breakout Room 2 – Data & Infrastructure

Opportunities and Benefits (1)

- Data is essential, AI is data driven, “data hungry”. AI models will get better as much as we will “feed them” better.
- Open data increases the socio-economic benefits of the efforts invested in collecting the data.
- AI allows to make use of novel, non-traditional data types (such as pictures, video, text, IoT, biased data sources, amateur stations). This is expected to improve results, including in currently data sparse regions. It also enables better impact forecasting.



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Breakout Room 2 – Data & Infrastructure

Opportunities and Benefits (2)

- The existing public infrastructure (including WIGOS, WIS & WIPPS) and WMO`s open data policy provide a great starting point for the development of the need AI data ecosystem.
- Shared infrastructure might be a cost-effective solution for AI training (including: storage, GPUs, data processing, tools).



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Breakout Room 2 – Data & Infrastructure

Challenges and Barriers (1)

- Data policy – not fully open in many countries and typically not open with private sector collected data . Does not allow to unlock the full potential that AI can bring.
- Only limited number of organizations will be able to train (an re-train) on huge data-sets, probably only “Global North”.
- New observations/ data types – which we still do not properly know how to use, classify, assess their added values. Some of which poorly structured. Many lack agreed formats/standards.



Breakout Room 2 – Data & Infrastructure

Challenges and Barriers (2)

- Concerns related to sovereignty may decrease the use of shared infrastructures and/or data sharing.
- Sustainability of observations and prediction systems need to be ensured. This includes not only funding, but also competencies.
- Training is not a one-time effort. Re-training needs to be considered when designing an AI system. That includes not only data and computational power, but also competencies.



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Breakout Room 2 – Data & Infrastructure

Challenges and Barriers (3)

- Loads of open source AI supporting tools are currently developed in fragmented/ineffective way.
- Every thing is happening fast ! There is no time to waste on prolonged regulatory processes. We need to develop agility in the way we move forward. The private sector will not wait if the public sector will stall.



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Breakout Room 2 – Data & Infrastructure

Recommended Actions (1)

- Encourage data sharing by all sectors. Explore incentives & trust building.
- Public sector needs to continue curate and further develop high quality training data-sets, including: re-analysis, satellite records, long records of QC observations.
- The use of new observation/data types needs to be explored and its added value to be assessed.



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Breakout Room 2 – Data & Infrastructure

Recommended Actions (2)

- Explore the possibility of public repositories augmenting the meteorological variables: relevant text, camera images, videos etc.
- Explore ecosystem for centralized AI/ML model training, to support many others.
- “AI-ready” data standards need to be established . Including formats, data identifiers, metadata structures, version control of data, protocols, storage, compression, data meshes. Adhere to FAIR principles.



Breakout Room 2 – Data & Infrastructure

Recommended Actions (3)

- Observation network tiering guidelines probably need to be developed, including classification of various data sources.
- Future design of WIPPS needs to consider computation close to the data. Possibly, WIPPS centres should in the future consider providing services, not only products.
- Joint cross-sectoral pilot projects for exploration of various issues highly recommended.
- New standards should be co-designed, with private sector engagement.



Theme A:

Collaboration across private, public and academic sectors

Breakout Group 3 – Innovation and Service Co-design

Presenter:

Kenji Takeda



Breakout Room 3 – Opportunities and Benefits Innovation and service co-design

- Agile AI developments may allow a great diversity of applications tailored to specific sectoral needs
- Downscaling / upscaling (gridding)
- Ai processing of sector specific data types
- Automation of labour intensive tasks related to service delivery
 - multilingual products ,
 - Multimedia products (text, infographics, audio and video)
 - dissemination across multiple or specific channels

Breakout Room 3 – Challenges and Barriers

Innovation and service co-design

- Challenges to bring the right expertise on board , including from the final user sector ,
- social science expertise is too often missing in designing / upgrading safety related services for the public and decision makers (EWS)
- Weather/climate intelligence provision to certain sectors maybe a highly competitive activity, hindering open collaboration
- Significant automation of routine production
- Ai literacy of public actors is still limited

Breakout Room 3– Positive actions for Statement Innovation and service co-design

- Collaboration between service providers (both public and private), academia and AI/ML developers is essential to ensure the user-focussed co-development and delivery of services for a range of application areas and user communities and to assure trust, transparency and accountability of those services.
- Huge potential for more probabilistic-based and impact-based forecast and warning service applications based on reanalysis of hazard impact characteristics from previous events to use as proxies for likely evolution of similar future events at any location.
- Essential for WMO to coordinate the acceleration of the development of supporting guidance, knowledge sharing and access to training opportunities, especially for developing countries and Small Island Developing States.



Theme A: Collaboration across private, public and academic sectors **Discussion**

Moderator:
Anthony Rea



Theme B:

Democratising benefits for less-developed countries

Breakout Group 4 – Capacity Development and Skills

Presenter:

Abiola Abayomi Okanlawon



Breakout Room 4 – Opportunities and Benefits

Capacity Development and Skills

- There is a plethora of existing training material
- There are examples of successful capacity development projects that can be used as models
- Regional entities are present and can be leveraged
- Existing peer-support arrangements can be built upon to include AI projects
- There is a focus on corporate social responsibility



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Breakout Room 4 – Challenges and Barriers

Capacity Development and Skills

- Small services find it difficult to free resources for training courses
- There is a lack of local data available to be incorporated into local pilots or training
- People can find it hard to put training into practice after completion, risking losing their skills
- Partners (private, academia, development) lack understanding of local challenges



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Breakout Room 4 – Positive actions for Statement Capacity Development and Skills

- Existing training material should be aggregated, curated and publicized
- WMO should develop AI training in partnership with partners, regional centres and local universities
- Successes should be developed into use cases
- NMHSs need to actively identify talent
- WMO-certified courses should be provided in cooperation with the private sector and academia
- WMO should direct some of its scholarships towards AI
- Public-private partnerships should be pursued



Theme B:
Collaboration across private, public and academic
sectors

Breakout Group 5 – Access and Affordability

Presenter:

Amos Mtoyna



Breakout Room 5 – Opportunities and Benefits

Access and Affordability

- Many new stakeholders taking part in AI for weather service, willing to share models and knowledge as open-source or with permissive licensing
- Many new activities are ongoing by WMO and Members, from which we can learn
- Partnering such as Norway-Malawi partnership, and twinning, including possible financial assistance (e.g., like SOFF/GBON)
- Ability to demonstrate the benefit of open data policy, and the value of observational data in Member countries



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Breakout Room 5 – Challenges and Barriers

Access and Affordability

- Difference in the availability of data --- which also affects data-driven prediction
- Use of data-driven models may lead to mis-understanding by governments (ending up with less investment)
- ML trainings consume computational resources
- Many activities ongoing --- difficult to catch up
- Limited opportunities to train staff



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Breakout Room 5 – Positive actions for Statement Access and Affordability (1/2)

- Partnering/twinning such as Norway-Malawi partnership, could be enhanced to countries in need (as a peer advisor).
- Demonstration of the value of data in fine-tuning of AI models in the regional/national/local scales (socioeconomic impacts, e.g., life and property, and economy) to encourage Governments to invest on observations, while utilizing satellite observations especially in data-sparse areas
- Mechanism to collect/share good practices to follow successful cases --- e.g., regular webinar on AI integration stories to raise awareness and to enhance new connections
- World Meteorological Centres / Regional Specialized Meteorological Centres are encouraged to embrace AI/ML in training programs.



Breakout Room 5 – Positive actions for Statement Access and Affordability (2/2)

- Creating a simple guide for AI implementation --- to avoid illusion/misunderstanding by governments
- To enhance involvement of the private sector --- affiliations of the private sector, including to be part of the HMEI, which has a Code of Ethics with WMO
- To enhance motivation --- to make an own-branded model of NMHSs (to gain ownership and avoid misunderstanding)
- Focus --- Instead of having giant models but rather focusing on concerned local climate / phenomena



Theme B:

Collaboration across private, public and academic sectors

Breakout Group 6 – Tailored Benefits and Local Impact

Presenter:

Daniel Muller



Breakout Room 6 – Tailored Benefits and Local Impact



- **Initial phase – discussion of three framing questions (3x10m)**
- **Phase 2 – Opportunities and benefits (15m)**
- **Phase 3 – Challenges and barriers (15m)**
- **Phase 4 – Finalising the outputs (15m)**
- As a group, consider how the benefits might be achieved, and how the barriers could be overcome, through positive actions to be taken by the different actors
- As a final step, consider how this might be framed as one or two dot points that could be included in the conference statement

Breakout Room 6 – Guiding questions

Tailored Benefits and Local Impact

- What concrete benefits of AI can be realised quickly in vulnerable contexts (e.g. SIDS, LDCs)?
- How can AI tools be adapted to reflect local realities (languages, hazards, user needs)?
- What are examples where AI has directly supported resilience, food security, or disaster preparedness?



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Breakout Room 6 – Opportunities and Benefits Tailored Benefits and Local Impact

- Enable local organizations to independently use AI forecasting tools
- Downscaling the available information (e.g. satellite data, global NWP products) to local scale
- Encourage local users to enrich and utilize the local data especially observation
- AI-based Tropical Cyclone forecast products with better quality and improved latency
- Help decision-makers to discover and manage weather risks (AI-based decision-making tools)
- Expand the opportunity to utilize more data (e.g. unused traditional and non-traditional data) with AI



Breakout Room 6 – Challenges and Barriers Tailored Benefits and Local Impact

- AI related capacity and human resources
 - Lack of awareness of existing AI tools and technical guidance
- Lack of access to historical data
- Resistance to the new technologies
- Budget/Funds to support the development of tools, infrastructure and human capacity
- Who takes actions? (Funding models)



Breakout Room 6 – Positive actions for Statement Tailored Benefits and Local Impact

- Understand the local needs to identify specific problems to be solved
- Open more data to the community to attract private sector and academia
- Explore non-traditional data
- Encourage collaboration aimed at democratizing the AI forecasting tools
- Raise the awareness of downscaling tools
- Investigate LLM to identify and manage the weather risks
- Review the available local data and develop a plan to populate and archive the data for AI-ready.
- Assess the impact, benefit and risks of the emerging AI-based information and technologies from local user's viewpoint.



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Theme B: Collaboration across private, public and academic sectors **Discussion**

Moderator:
Anthony Rea



Breakouts

Open Discussion

Moderator:

Anthony Rea

