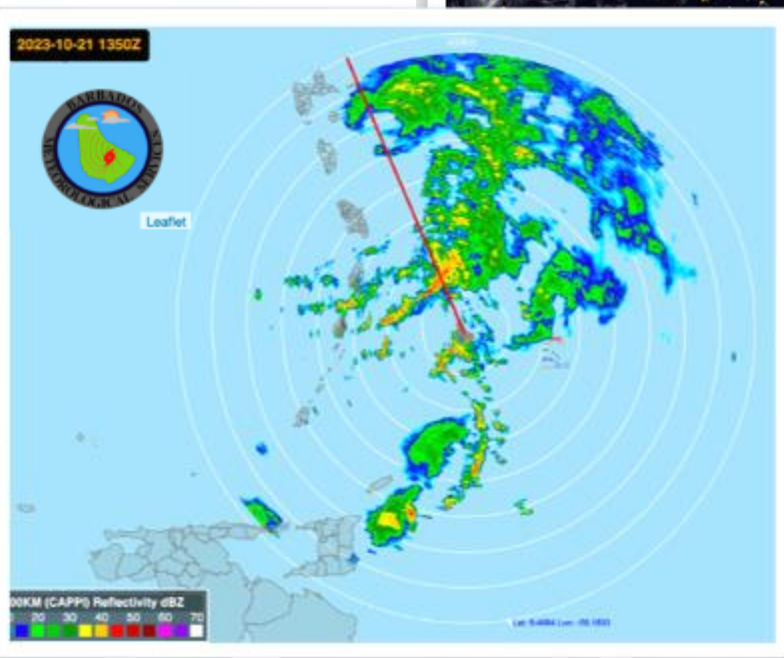
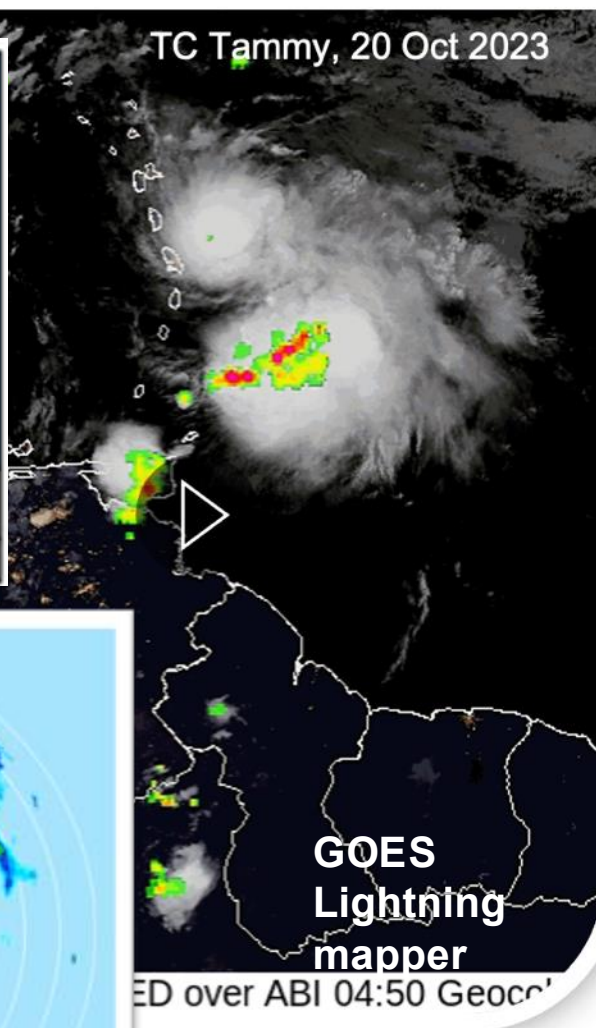




TC Tammy, 20 Oct 2023



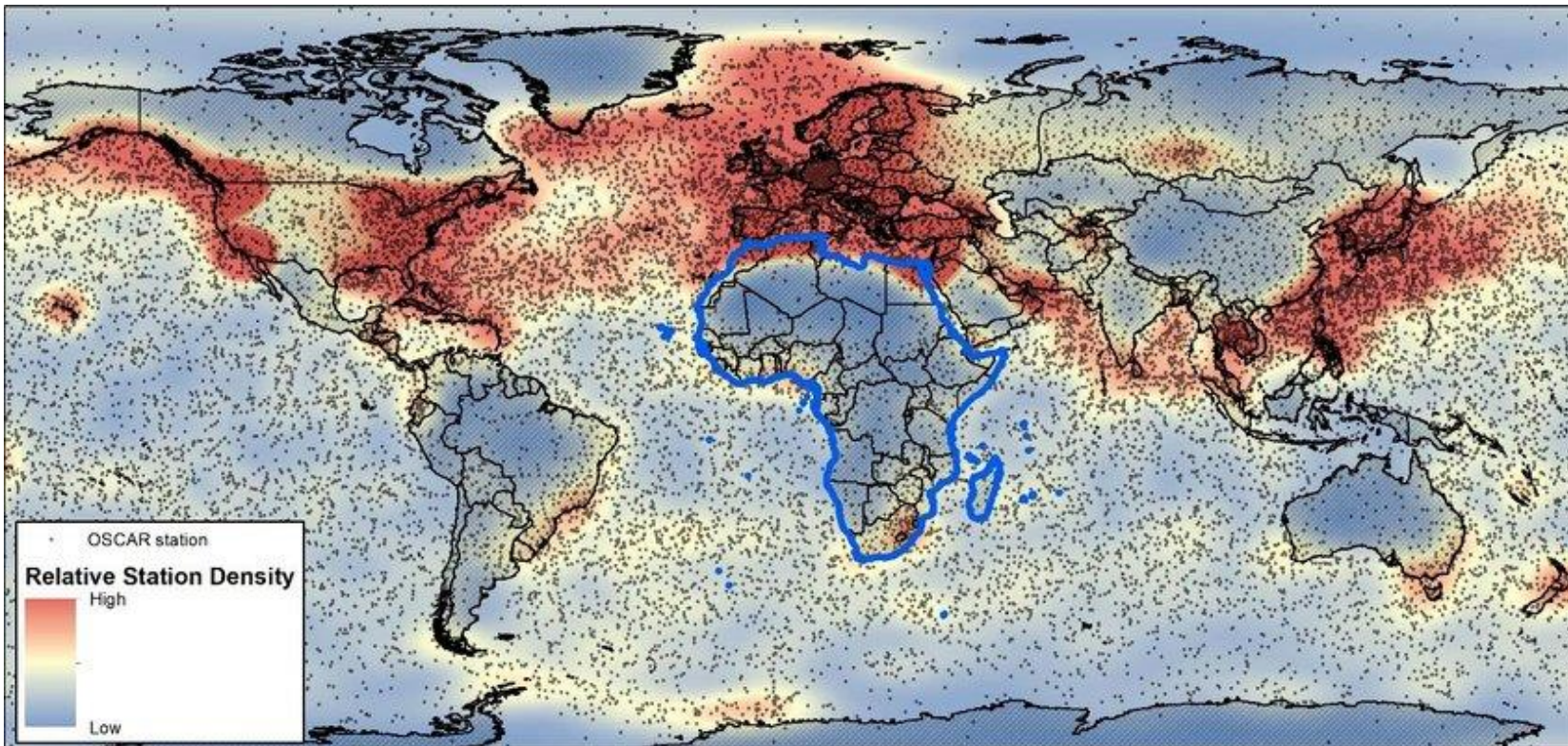
WMO, Sixth High-Level Session
Open Consultative Platform (OCP-HL-6)

Public-Private Engagement on Artificial Intelligence (AI)

Dr Arlene Laing
Permanent Representative
British Caribbean Territories (BCT) with WMO
Caribbean Meteorological Organization



Training Data Limitations in Tropics



Worldwide distribution of stations in the Observing Systems Capability Analysis and Review tool (OSCAR) (WMO, April 2018)

- Data-sparse regions
- Depend on satellite remote-sensing and Reanalysis (large-scale)
- What is optimal for small-island scale?

Webinar Series: Machine Learning (ML)/Artificial Intelligence (AI) in Weather Prediction

WMO RA IV - Research and Earth System Modeling

2024 Thursday July 18th, 14h00-16h00 UTC
08h00-10h00 Costa Rica; 10h00-12h00 Barbados;
09h00-11h00 Perú

English/Spanish interpretation

> 250 participants

Serie de Webinars: Machine Learning (ML)/ Inteligencia Artificial (IA) en Predicción del Tiempo

OMM AR IV - Investigación y modelización del sistema terrestre

Dr. Arlene Laing
WMO RA IV Focal Point on Research and Earth System Modeling (FP-RM)

PR of the British Caribbean Territories with WMO and
Coordinating Director
Caribbean Meteorological Organization
(www.cmo.org.tt)



Dr. Veronique Bouchet
Chair of the WMO Research Board Task Team on AI

DG - Canadian Centre for Meteorological and
Environmental Prediction (CCMEP), ECCC



Dr. Paul Roebber
Distinguished Prof. University of Wisconsin - Milwaukee

Program Director, Bachelor of Science in Data
Analytics and Master of Science in Data Science
Director and Founder, Innovative Weather
CIRA Senior Research Associate



Dr. Mark DeMaria
CIRA/CSU Senior Research Scientist, Colorado State University
American Meteorological Society (AMS) Fellow



Dr. Fernando Pech
Researcher and professor from Superior Technological Institute of Los Rios, Tabasco, Mexico

Member of the Topic Group AI for Flood Monitoring
and Detection at the
International Telecommunication Union (ITU).



Takeaways from 2024 RA IV Webinar on ML/AI in Weather Prediction

AI Weather Prediction Models (AI-WP), in general

- Perform as well or better than traditional NWP [at a fraction of computational cost](#)
- [Possibility to democratize access to weather forecast models](#) (Open source code for AI/ML systems from private sector; packages developed by ECMWF to install and run AI systems)

Tropical Cyclone forecasting

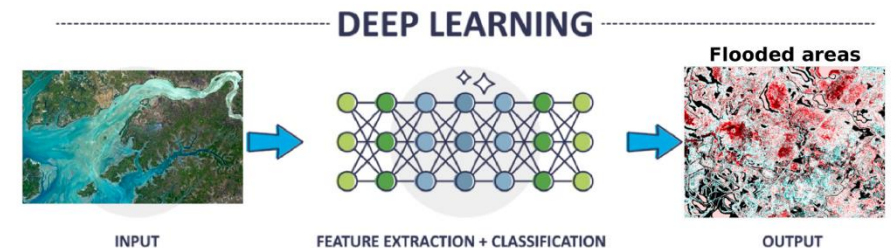
- Simple Machine Learning models used successfully to forecast Tropical Cyclones for many decades
- AI-WP models show great promise for Tropical Cyclone forecasting
 - [Comparable or better track forecasts](#) than best operational models
- [Challenges with accurate intensity forecasts](#) may require new training set and loss function

Physics & Predictability

- Do [AI-WP models capture the underlying physics](#)?
- [Can AI-WP simulate the butterfly effect](#), the limited atmospheric predictability?

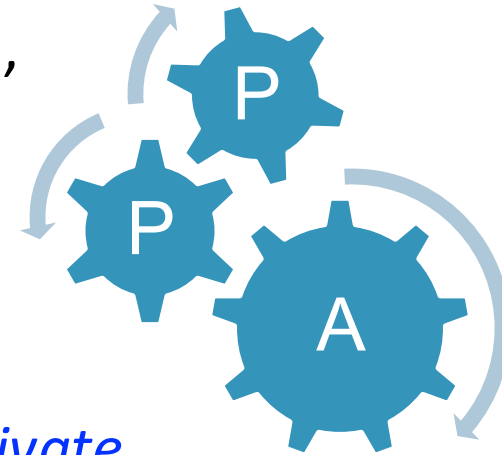
AI, Satellite Imagery and Natural Hazard Management

- Remote sensing & Deep Learning: [Ideal for monitoring and mapping floods](#)



Open Principle

- Why should AI-based Earth System Prediction (AI-ESP) systems be open, transparent and traceable and what is the willingness of the public and private sectors to engage in a shared, open research [and operational] platform for AI-ESP?



Meteorology – Global Interdependence, Openness benefits all

Tradition of collaboration, e.g., technology transition from academia to private sector. Access to open data has unleashed innovation in private sector.

- How can we ensure that the AI-ESPs are trained on open, high-quality data and will all the training data be accessible both to public and private sector?

WMO Infrastructure – WIGOS, WIS, WIPPS

How we evaluate forecast skill really matters in all forecast assessment.

*Need expertise of **WMO and Co-sponsored Research** bodies to ensure appropriate evaluation of AI Prediction, **Operationally-meaningful metrics.***

Small National Meteorological and Hydrological Services

- How will AI help small NMHSs / developing countries, rather than jeopardize their activities / mandate?

*Lower computational cost of AI models -
Democratize access and capacity for operational
weather forecast modelling*

*If AI models can learn to assimilate observations
directly, then reanalysis at small-island scale could
be made with AI and used to train prediction
models*

Capacity Building Workshop on Numerical Weather Prediction to improve operational readiness

5-9 August 2024, Port of Spain, Trinidad

Training on operationalizing high-resolution NWP at National Meteorological Services

Antigua and Barbuda, Barbados, Belize, British Virgin Islands, Dominica, Grenada, Jamaica, Saint Lucia, St Kitts and Nevis, St Vincent & Grenadines, Trinidad and Tobago, and Turks and Caicos Islands, CIMH, UWI-St Augustine, Sint Maarten, Costa Rica, University of Costa Rica



**Need WMO partners, like ECMWF, to train and
build AI-ESP capacity**

**Already done for existing NWP, could build on
those capacity development efforts**

Roles and Single Authoritative Voice of NMHSs

- In your opinion, how do you see the roles of National Meteorological and Hydrological Services in the future?

Trusted source of information, mission for safety, public good, answer to governments

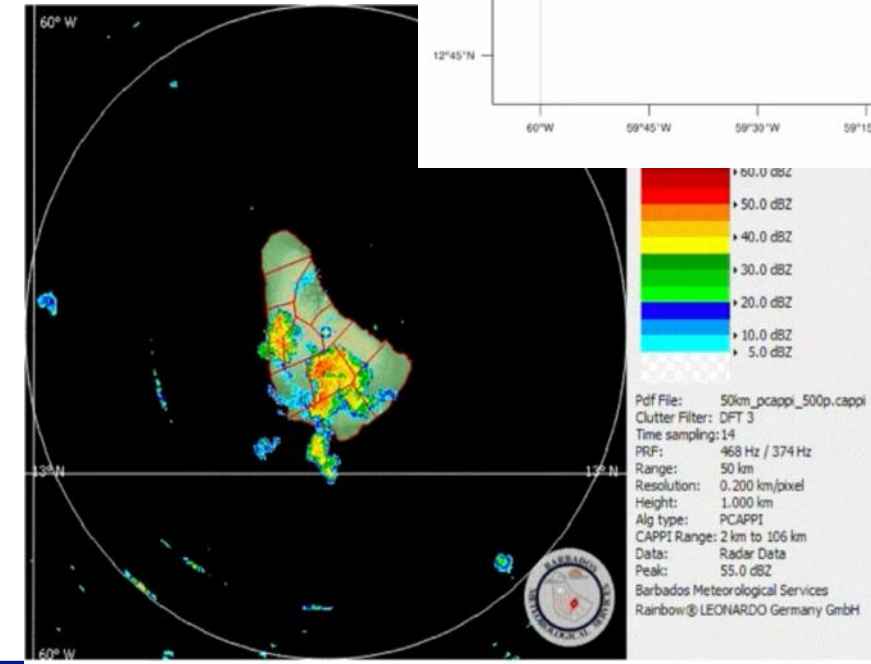
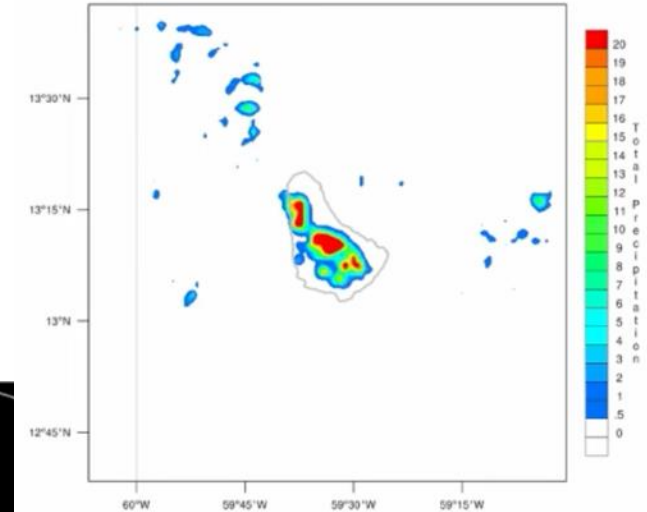
Can the products of private companies be trusted as the main course of forecasts?

Providing greater value for high impact events, outside of limited data sources used to train AI.

REAL-TIME WRF test title

Init: 2024-10-02_00:00:00
Valid: 2024-10-02_15:00:00

Precipitation Tendency from 2024-10-02_12:00:00 to 2024-10-02_15:00:00



Roles and Single Authoritative Voice of NMHSs

- What will be the roles that you envision for public and private entities?

Private entities are more agile, better resourced, but, rely on body of data from public sector. Optimally, should be partners in development and deployment of AI-ESP.

- How can AI-based systems serve to support authoritative extreme weather warnings services provided for the protection life and property

Tropical Cyclone Track Forecasting – Similar or better track forecasts to physics-based models support early warnings.

NMHSs - Use AI to mine hazards catalogues to improve forecast guidance and understanding of specific hazard risks

Remote sensing and AI – supports early warnings

