



An Introduction to Early Warning Capacities in China Co-development Cloud-based Al-powered

Luo Bing China Meteorological Administration May 2025, Colombo, Siri Lanka



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Customization and Co-development

3 Al powered

Further Cooperation





- Early warning systems are effective measures against climate change, as extreme weather events are on the rise.
- **WMO** leads the monitoring and early warning pillar. Moreover, it partly undertakes and supports the other three pillars, namely risk assessment, information dissemination, and emergency response.





METEOROLOGICAL

We must boost the power of prediction for everyone and build their capacity to act. On this World Meteorological Day, let us recognize the value of early warnings and early action as critical tools to reduce disaster risk and support climate

Pillar 2 lead by WMO

Pillar 3 lead by ITU



Pillar 4 lead by IFRC





CMA continuously attaches value to organizational efforts, forming capabilities and successful practices of Early Warnings for All

Early warnings, precise forecasting and proactive emergency management can significantly reduce disaster losses and casualties



CMAto enhance Early Warning for All co-operation



Agreement to support EW4AII

CMA delegation attended 19th WMO congress to promote Early Warning for All



A delegation of CMA visited Weather Service in Africa



High-level Forum of Belt and Road Early Warning for All in 2023





- 2024 was the warmest year on record, Super Typhoon Yagi hit Hainan island.
- It was the strongest typhoon landfall in China in autumn since 1949, and also the severest one in Vietnam in 30 years, maintaining a super typhoon level for up to 64 hours.







1. Progressive service



 Progressive warning service strategy in advance and timely updating had enabled relevant departments to allocate resources, prepare for and deploy major disaster prevention measures, and urgently evacuate and resettle over 140 thousand people in Haikou City, striving for sufficient time to prepare, respond and take actions.







- Bebinca was the severest typhoon that made landfall in Shanghai in 75 years.
- A week in advance, Shanghai Meteorological Service **released disaster risk early warnings.** Refined forecasting services were provided and were updated in a rolling manner hourly.
- The service pushed hundreds of millions of pieces of warning information to citizens.
- Through early warning, early mobilization, and early action, this megacity with 25 million people achieved zero fatalities.



Early
Warnings1. "Progressive service" mechanismImage: Service Service



- We can issue severe convective weather warnings 43 minutes in advance, predict major weather events 3-4 days ahead, reduce the 24-hour errors of typhoon track forecasts to 62 kilometers, and predict global climate anomalies 6 months ahead. We improve the accuracy of forecast. The warning can reach 98% of the population within 3 to 8 minutes.
- We established a "progressive service" mechanism, continuously reducing forecast uncertainties through rolling updates and impact assessments.







• We incorporated the "warning-action" linkage mechanism into national and local disaster prevention regulations and emergency response procedures across sectors, integrating meteorological warnings into government decision-making, urban operations, and social life.







- Under the World Meteorological Center(Beijing).
- Based on AI ,Cloud technology and open architecture, We build the agility and flexible system. Co-build Early Warning System



1. A Package Solution of Early Warning Service Warnings

Early

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We are committed to providing a package solution of early warning service with a full working process for various disasters.





1. Lightweight Cloud Version



- It requires **no installation or local maintenance**, providing quick and convenient access to early warning capabilities.
- It has an AI-based customized Early Warning Toolbox, and enables "one-stop" rapid response for disasters and impact weather conditions, such as typhoon, heatwave, dust, rainstorm etc..
- It has an Open Development Architecture, component-based.

http://ew4all.wmc-bj.net/





Intelligent Warning Tool Box





Co-Developed Intelligent Warning Tool Box



1. Localized Version



- It is deployed locally, can ingest local observation data, NWP and Al models product .
- Al-based customized Early Warning Toolbox, local monitoring and forecasting algorithms and tools could be integrated and improved very easily.
- It has an Open Development Architecture, enhanced security and timeliness.





Al-based customized Early Warning Toolbox & Urban Multi-Hazard Early Warning Toolbox



- Cloud-based Early Warning System CEWS, AI Empowerment
- Urban Multi-Hazard Early Warning Toolbox, Open Architecture and application have been developed and applied for processive early warning service.





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2. Co-development with Ethiopian Meteorological Institute



We carry out application and customized development for CEWS of Ethiopian Meteorological Institute.





Online meeting with EMI to discuss the requirements of CEWS



The PR of CMA and his delegation visited EMI to strengthen cooperation



A delegation of CMA visited EMI to demonstrate the cloud-based early warning system



Co-development team of CEWS had discussion meetings in CMA

Early Warnings Jall

2. Co-development with Ethiopian Meteorological Institute



CEWS Customized version for EMI

 Experts from both sides made use of global data and models to jointly design and develop applications that are adapted to the local area.



ETHIOPIAN METEOROLOGICAL INSTITUTE









CMA dispatched experts to collaborate in offering meteorological services for the 17th Pacific Games.

Tailored CEWS for SIMS integrates monitoring, forecasting and early warning functions, laying a technical foundation for further improving disaster warning capabilities.

9 sets of customized early warning system **equipment** have been delivered to SIMS.





Early

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PR of SIMS visited CMA to communicate about the early warning system

Co-development team of CEWS had a discussion meeting in CMA



At the request of SIMS, CMA dispatched experts to cooperate in providing meteorological services to support the 17th Pacific Games

The impact-based
forecast model uses the
local classification of
rainfall, and blue and
yellow rainstorm
warnings were issued
on the platform.

Early Warnings

٥All

 In February 2025, meteorologists from both sides worked together on the early warning of the tropical cyclone "Alfred".



CEWS Customized for SIMS

Table for the Classification of Rainfall (mm)				
Grade	Lead time			
	3h	6h	12h	24h
Heavy rain	8-19.9	10-24.9	15-29.9	25-49.9
Rainstorm	20-29.9	25-49.9	30-69.9	50-99.9
Heavy Rainstorm	30-49.9	50-99.9	70-139.9	100-249.9
Very heavy Rainstorm	≥50	≥100	≥140	≥250



Since January 17, 2025, the toolbox has been gradually promoted for use in 12 countries and regions, including 4 in Asia, 4 in Africa, and 4 in Oceania.



We have received **positive feedback** from 12 countries and regions, and they have also put forward suggestions for improvement and expectations.





- In 2024, NAMEM and SMS engaged in a joint discussion regarding the urban multi hazard early warning toolbox, with a particular focus on the local requirements and scenarios in Mongolia.
- There was also a specialized exchange with the NAMEM Aviation Meteorological Center, during which the progress on dust storm warning technology was discussed.
- Since 2025, NAMEM has been conducting trials of the toolbox, yielding good results. It has proposed incorporating user - relevant local information and optimizing interactive tools such as profile charts, time - series charts, and sounding charts in line with local usage habits.
- NAMEM plans to introduce more tools, monitoring and forecasting products for high-impact weather conditions like wind shear, icing, turbulence, wildfires, and dust.







discussion and exchange with NAMEM team

urban multi-hazard early warning toolbx



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• With just 30 lines of code, the system can deploy AI models such as Fengshun, Fenglei, Fengqin, Fuxi, Pangu, and AIFS, as well as your own AI models, enabling multi-model integrated forecasting and application.









- It provides AI-generated early warning content and intelligent analysis through large language models(LLM).
- CMA is developing its own large language model "Fenghe" on DeepSeek .









LLM, Al agents for applications (Deepseek)



Al prediction model and Downscaling (Fengshun, Fenglei, Fengqin, Fuxi, Pangu)



Customized, Open sources for AI



Progressive warning



2024-11-27-00:00,AI algorithm recognizes the strong convective weather in Sri Lanka, the precipitation center intensity exceeding 20 millimeters per hour. (FY-2H)

Early Warnings 3. Al-weather Serves many fields : Aviation, Railway, Navigation, etc. () Image: Serve state of the serves many fields in the serve state of the s

- Al-weather and cloud technology support co-research on applications in different fields.
- By leveraging a cloud platform and integrating both global and local data, more algorithms are introduced to realize professional meteorological service applications. This enables the provision of early warning services to a wider range of government departments and industries.





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- We have an open mechanism for collaborative research and development.
- This mechanism supports us in forming joint expert teams to develop **customized** early warning system and toolboxes, **AI** model and applications, satellite applications, among others.



http://ew4all.wmc-bj.net/



China Weather : Al agent



AIGC program AI weather-"Good Night Weather"



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Thank you!

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