WCRP World Climate Research Programme

Working Group on Numerical Experimentation – WGNE

ESMO Earth System Modelling and Observations

40th Session
03-07 November 2025
Beijing, China

WGNE Systematic Error Survey to contribute to the WMO EW4All initiative

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Thanks to CPTEC (I. Costa), ECCC (Ron), IITM (Ankur), INMET (G. Bonatti, H. Oliveira), KMA (Eun-Hee), NCEP (Fanglin), ECMWF (Nils)

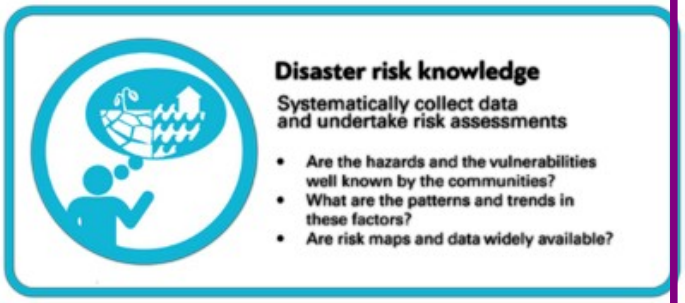
UN Early Warning for All Initiative

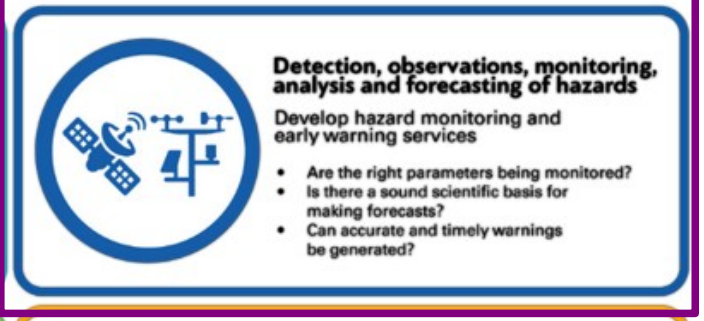
EW4All Initiative

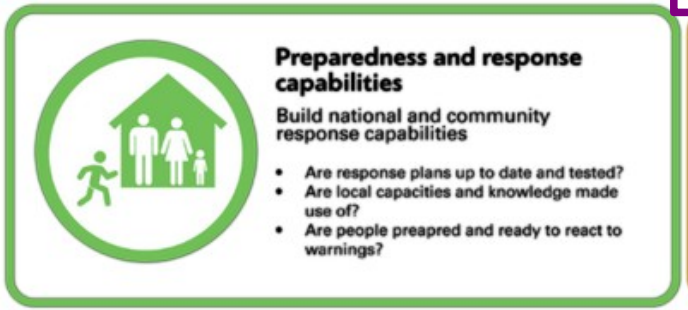
Early Warnings for All

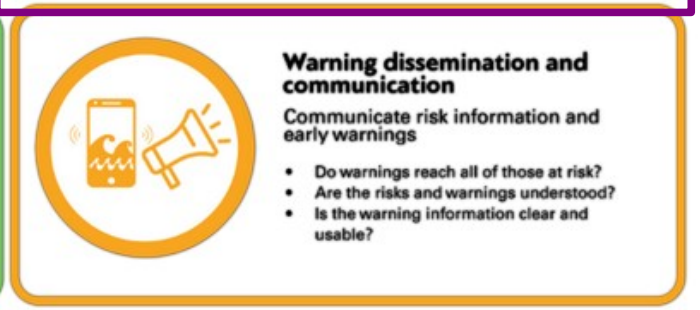
The EW4All initiative is a groundbreaking effort to ensure that everyone on Earth is protected from hazardous weather, water, or climate events through life-saving early warning systems by the end of 2027.

The Early Warnings for All initiative is built around four key pillars:







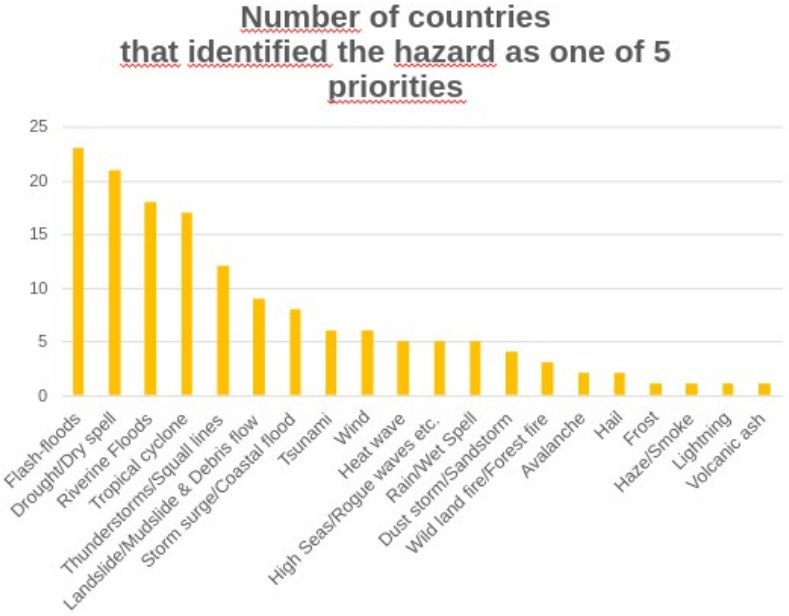


WMO IMO-WMO

EW4All Initiative: Approach to identify priority hazards

For the short-term activities of INFCOM, the six hazards were identified, mainly based on the hazards that were most frequently identified as “priority hazards” by the 30 countries*.

- **Flash-floods**
- **Drought/Dry spell**
- **Riverine Floods**
- **Tropical cyclone**
- **Thunderstorms/Squall lines**
- **Heatwave**



List of hazard types: defined by the implementation plan of the WMO Catalogue of Hazardous Events.

* List of the 30 countries can be found at: https://public.wmo.int/en/media/press-release/early-warnings-all-initiative-scaled-action-ground

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Does your organization forecast one or more of the following hazards?

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Yes
No

Modeling Centres	Flashfloods	Drought-dry spell	Riverine floods	Tropical Cyclones	Thunderstorms / Squall lines	Heatwave
ECCC	No	No	No	Yes	Yes	Yes
ECMWF						
CPTEC						
DWD	Yes	No	No	No	Yes	Yes
IITM	-	Yes	-	Yes	Yes	Yes
INMET	No	Yes	Yes	No	Yes	Yes
KMA	Yes	Yes	Yes	Yes	Yes	Yes
NCEP	Yes	Yes	Yes	Yes	Yes	Yes
Total	4	5	3	5	7	7

What is the timescale for which the hazard forecast is produced? If there is more than one, please indicate each of them

Modeling Centres	Flashfloods
DWD	localized warnings: a few hours ahead; pre-warnings and watches up to five days ahead
KMA	general hazard forecast: 3-5 days
CPTEC	7 days
NCEP	
ECMWF	Short

Modeling Centres	Riverine floods
INMET	one week
KMA	general hazard forecast: 3-5 days
NCEP	one week
ECMWF	Short, medium

What is the timescale for which the hazard forecast is produced? If there is more than one, please indicate each of them

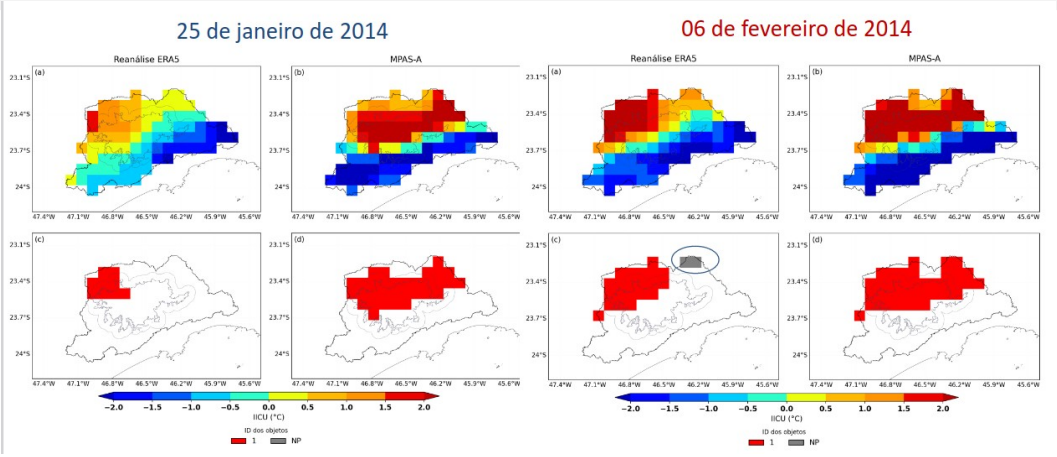
Modeling Centres	Tropical Cyclones
CPTEC	7 days
ECCC ECMWF	Short-range/ Long-Range
IITM	2-4 weeks
KMA	(1) general hazard forecast: 2-3days / (2) hazard warning : flexible. No regul.
NCEP	5 days
Modeling Centres	**Thunderstorms / Squall lines**
CPTEC	7 days
ECCC	Nowcasting/ Short-range/ Long-Range
DWD	localized warnings: a few hours ahead; pre-warnings and watches up to five days ahead
IITM	Nowcasting (Hours)
INMET	1 a 3 horas
KMA	(1) general hazard forecast: 2-3days / (2) hazard warning : flexible. No regul.
NCEP	day 1, 2, 3, 4-8
ECMWF	Short and medium-range

Has your organization been working on improving the modeled hazard? If so, please provide a reference paper

Modeling Centres	Tropical cyclones
CPTEC	Convection and cold pool parametrizations (Freitas et al., 2024)
ECMWF	Majumdar et al., (MWR, QJRMS), Magnusson et al. (2024, in review), Polichtchouk et al. (2024 in review)

Verification methods used to assess the hazard forecasts

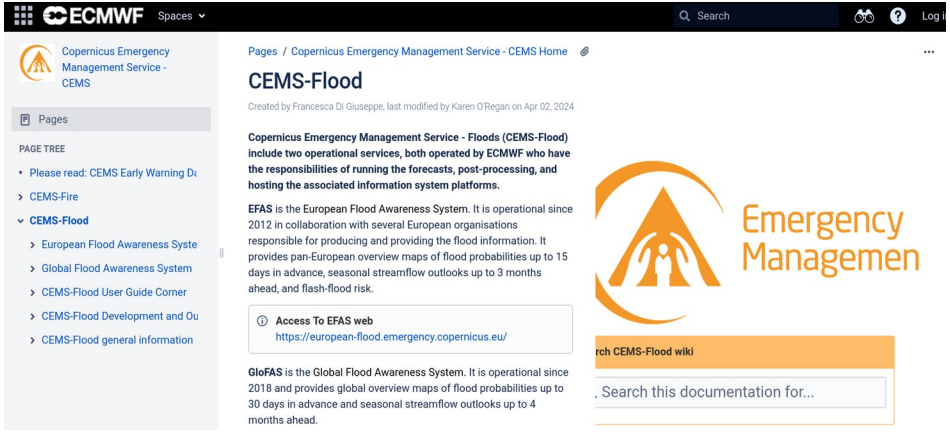
CPTEC - Spatial verification of heat waves (Araújo, Frassoni, Sapucci 2025 in review)



	25/01/2014	06/02/2014
ACC	0,71	0,81
BIAS	3,55	1,61
POD	0,89	0,96
FAR	0,75	0,40

Araújo PhD thesis, 2025

ECMWF -



Modeling system used to forecast the hazard

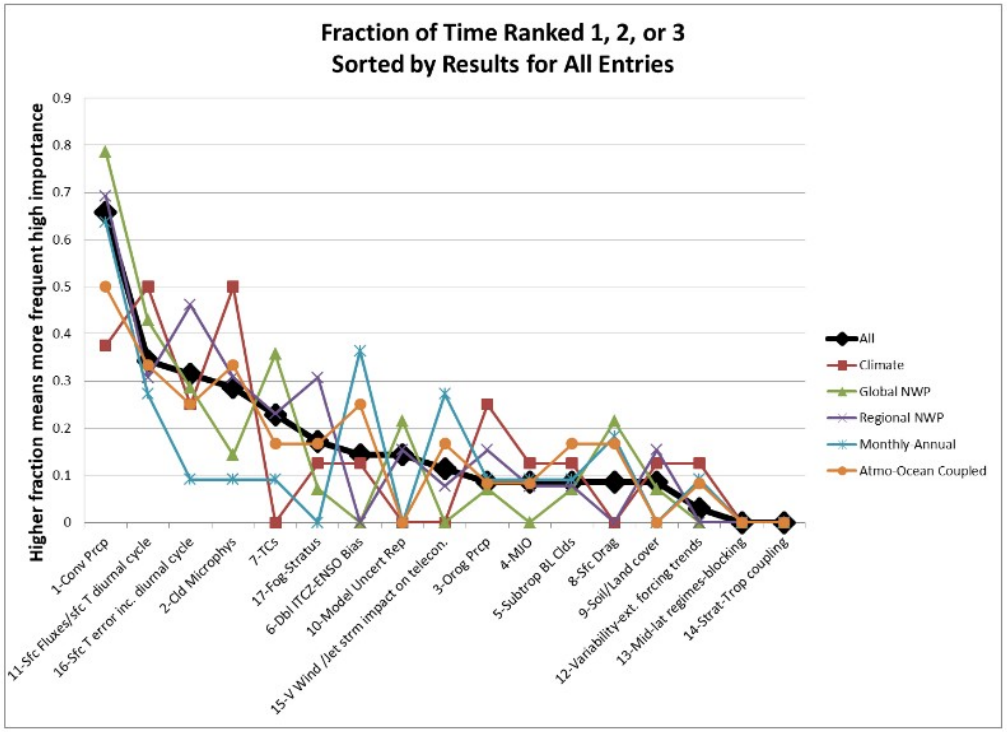
	Riverine floods - ECMWF	
	Global	**Regional**
Prediction timescale	NWP	NWP
Type of modeling system	Probabilistic	Probabilistic

Next steps

Are the responses still valid? Is there a need to keep updating?

Considering to have a continuous update ...

Next steps



Identify which of the highest-ranked systematic errors impact extreme events forecasts

- Update the WGNE Systematic errors questionnaire with a revision
- Update the questions to include extreme events
- Capturing changes over time
- Share the survey among major and NMHS's (RB collab)

Modeling system used to forecast the hazard

Interested to contribute? Email me!

Thanks!

What is the timescale for which the hazard forecast is produced? If there is more than one, please indicate each of them

Modeling Centres	Drought-dry spell
CPTEC	3 months
IITM	2-4 weeks
INMET	3-5 months
KMA	(1) general hazard forecast: 2-3 days / (2) hazard warning : flexible. No regul.
NCEP	seasonal

Modeling Centres	Heatwave
CPTEC	7 days / 4 weeks
ECCC	Short-range / Long-Range
DWD	1-2 weeks
IITM	2-4 weeks
INMET	5 a 7 dias
KMA	(1) general hazard forecast: 2-3days / (2) hazard warning : flexible. No regul.
NCEP	day 6-10, day 8-14, week 3-4

Has your organization been working on improving the modeled hazard? If so, please provide a reference paper

Modeling Centres	Thunderstorms / Squall lines
ECCC	A Convection Parameterization for Low-CAPE Environments. Monthly Weather Review, 148(12), 4917-4941
DWD	**Regional scale:** development of the SINFONY system (www.dwd.de/sinfony), providing seamless probabilistic forecasts for precipiation, radar reflectivity and convective cell objects from 0-12 h lead time. It uses Nowcasting ensemble methods (reflectivity, precipitation, convective cell objects) to bridge the quality gap between the most recent observation and the most recent (but usually "old" in terms of init time) NWP-model. To make this NWP-model as recent as possible, we developed a new regional ICON Rapid Update Cycle with hourly forecast inits (ready 35' after the nominal init time), with advanced 2-moment cloud microphysics and improved assimilation of radar- and all-sky VIS and IR satellite data. This ICON-RUC is operational since July 2024. **Global scale:** improvements of the ensemble data assimilation system, use of more and more satellite data, tuning of model physics, new diagnostics like the Lightning Potential Index.
IITM	Mohan et al., (2021), Evaluating different lightning parameterization schemes to simulate lightning flash counts over Maharashtra, India, *Atmospheric Research*, 255: 105532, June 2021, DOI:10.1016/j.atmosres.2021.105532, 1-22 Gayatri et al., (2022), Evaluation and Usefulness of Lightning Forecasts Made with Lightning Parameterization Schemes Coupled with the WRF Model, Weather and Forecasting, 37, May 2022, DOI:10.1175/WAF-D-21-0080.1, 709–726
CPTEC	Convection and cold pool parametrizations (Freitas et al., 2024)
KMA	Yes (no paper)

Is there any other high-impact weather, climate, or environmental hazard relevant to your location that is not listed?

DWD - Aviation forecasts: volcanic ash, turbulence Nuclear accidents: global dispersion modeling

ECCC - Winter-season hazards: blizzard, snowfall, freezing rain, wind chill etc

IITM - Cold waves, heavy rainfall events

KMA – Strong winds, cold waves, high sea waves