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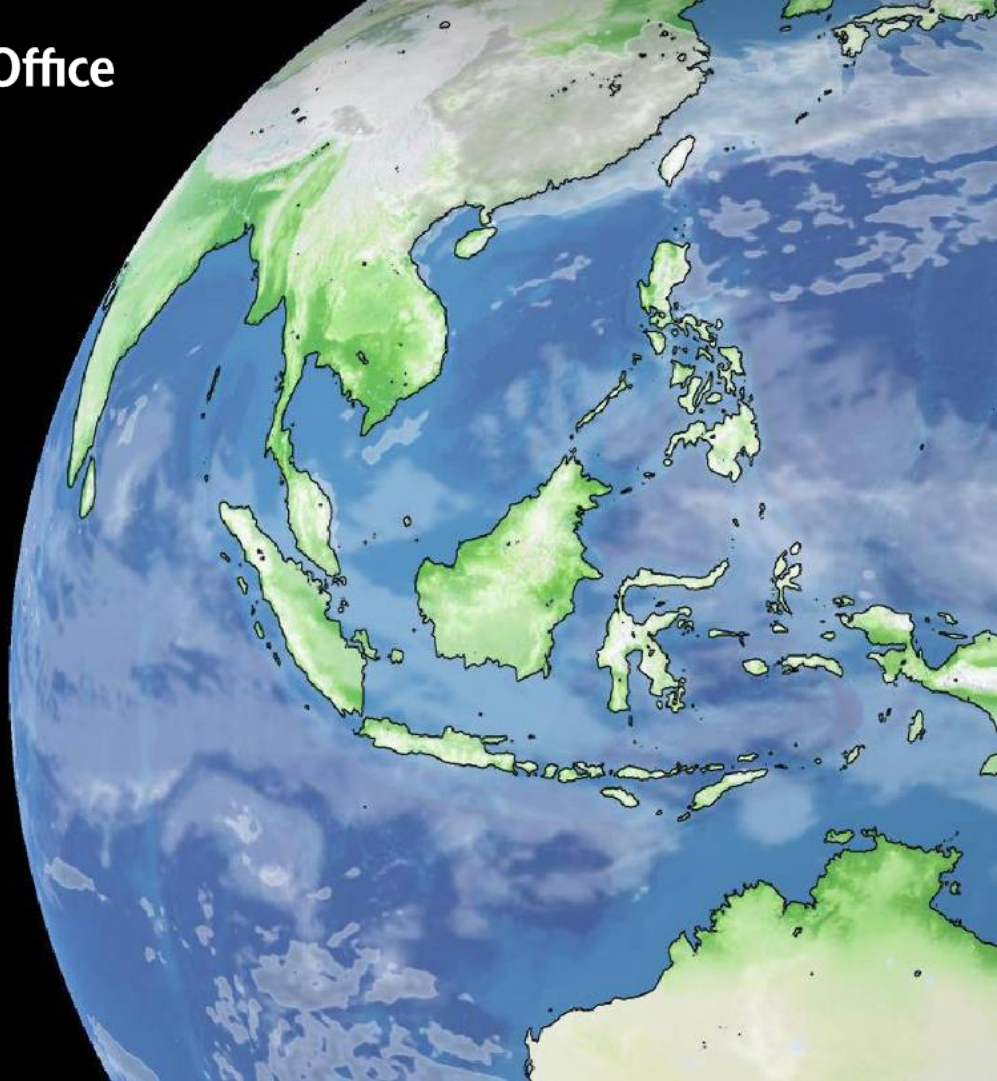
Interpretation of Seasonal Outlooks, Probabilistic Forecasts & Climate Advisories



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Met Office, UK

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SASCOF26 Climate Services User Forum

Contents

Seasonal forecasts versus weather forecasts

!!! Seasonal forecasts are not like weather forecasts !!!

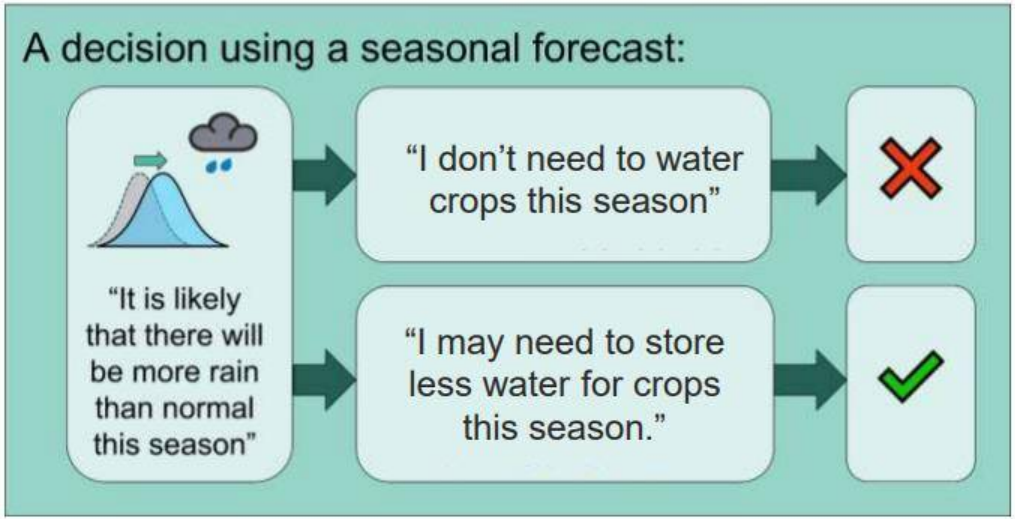
Weather forecasts attempt to predict the weather conditions in the next few hours or several days.

Weather Model: “There is a 90% chance of heavy rain between 3 and 4 pm.”

…but seasonal forecasts indicate whether conditions are likely to be wett***er***, dri***er***, warm***er*** or cool***er*** compared to a long-term average (e.g. warmer than *normal* this spring)

Seasonal (Probabilistic) Model:

“There is a **60% chance** of an **above average (wetter)** rainfall season**.”**



What is a seasonal forecast?

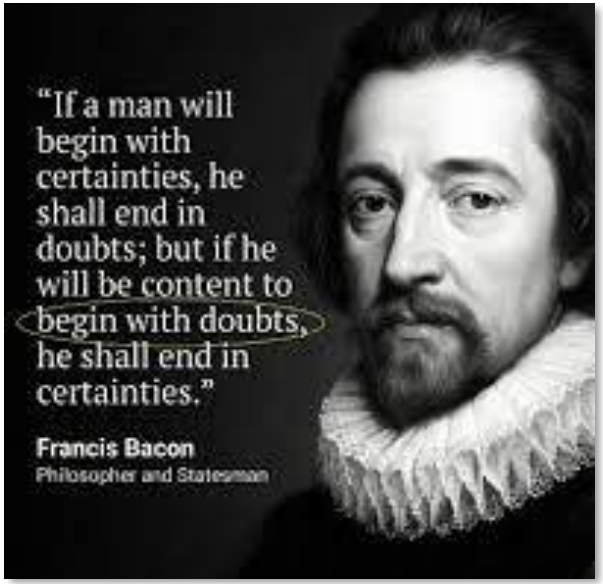
WHAT A SEASONAL FORECAST IS	WHAT A SEASONAL FORECAST IS NOT
Information about average seasonal conditions (e.g. 'October to December rainfall is expected to be normal')	**Information about conditions on day-to-day variations or extreme weather** (e.g. 'The 23rd of November will be wet')
Forecast over a large region (e.g. 'The whole western part of the country may be wetter than normal')	**Forecasts with small-spatial detail** (e.g. 'This village will have a wetter-than-normal seasonal, that village will be drier than normal')
Shifts in probabilities (e.g. 'There is an increased chance of an average seasonal temperature of 25°C)	**Definite information** (e.g. 'The season's average temperature will be 25°C)

IMPORTANT NOTE: Seasonal forecasts **do not necessarily capture extreme events**. A wetter season may still have periods of *very dry*, and a drier season may have days with *high rainfall*.

Why communicate forecast uncertainty?

Will communicating uncertainty just confuse people and prevent them from making decisions, or will it help them make better, more informed decisions?

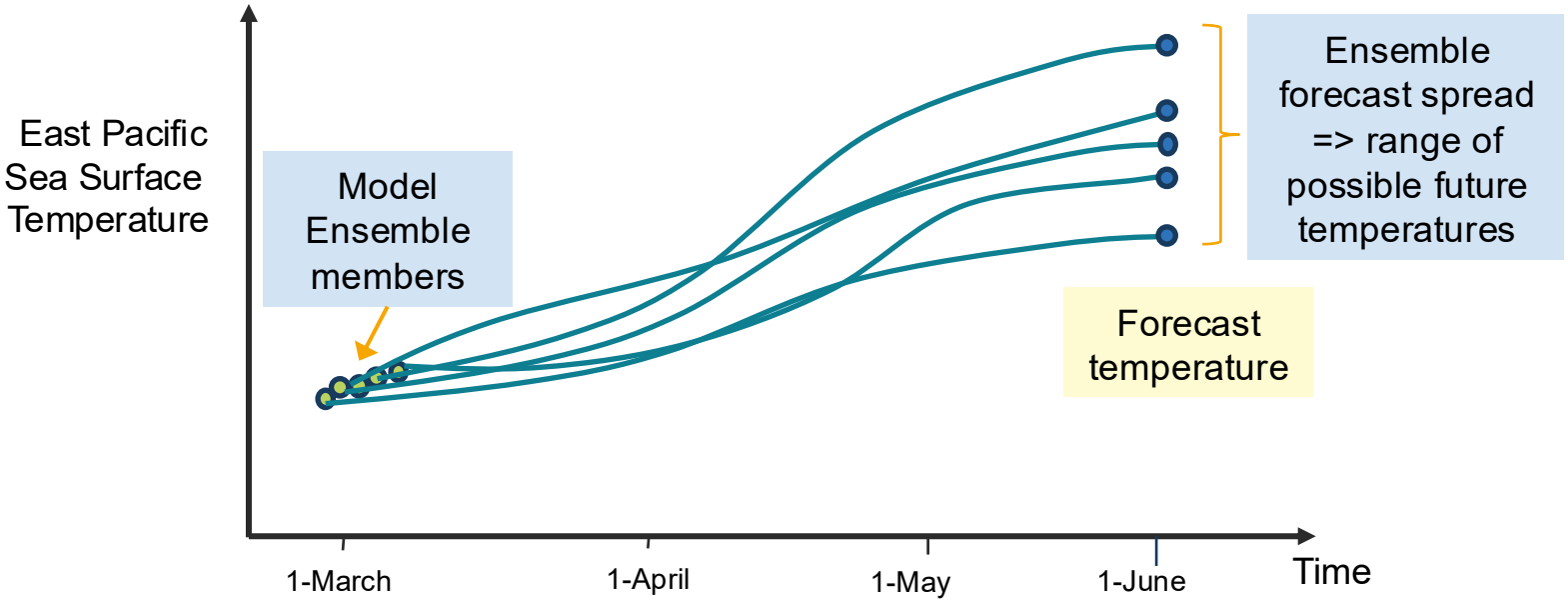
- ✓ Knowledge of forecast uncertainty (= the range of possible futures) assists decision-making
- ✓ Communicating uncertainty helps manage user expectations
- ✓ Communicating uncertainty retains user confidence
- ✓ Forecast uncertainty reflects the chaotic nature of the atmosphere
- ✓ Forecast uncertainty reflects the state of the science



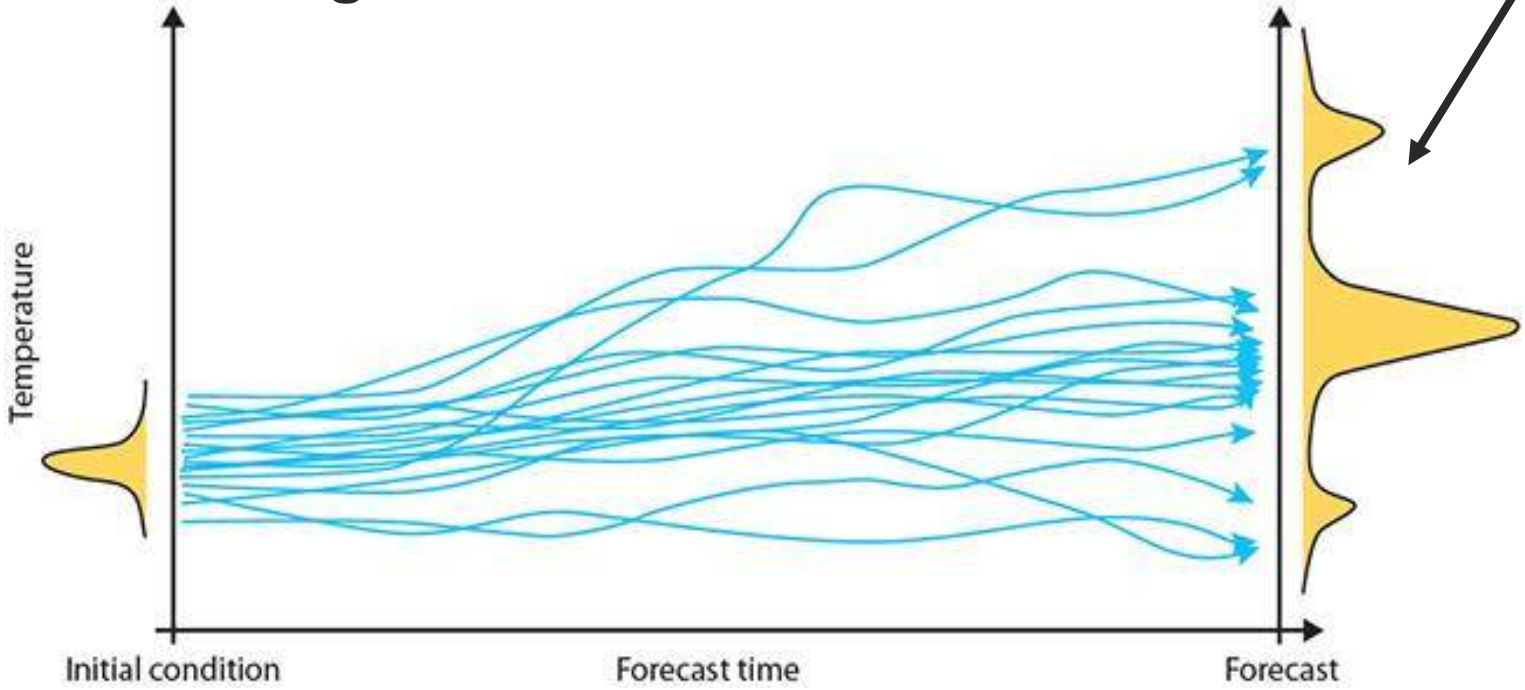
What are probabilistic forecasts?

- **Probability** - likelihood or chance of an event occurring
- **Event** (in seasonal forecasting) – the upcoming season experiencing either above, below or near normal conditions
- **Seasonal (ensemble) prediction system** - dynamical climate model(s) representing atmospheric and oceanic processes, which are run multiple times
- **Ensemble forecast** – range of possible futures, communicated as probabilities, helping us quantify the uncertainty arising from:
  - Inherent complexity of the climate system
  - Model imperfections

Uncertainty in probabilistic seasonal forecasting



Uncertainty in probabilistic seasonal forecasting



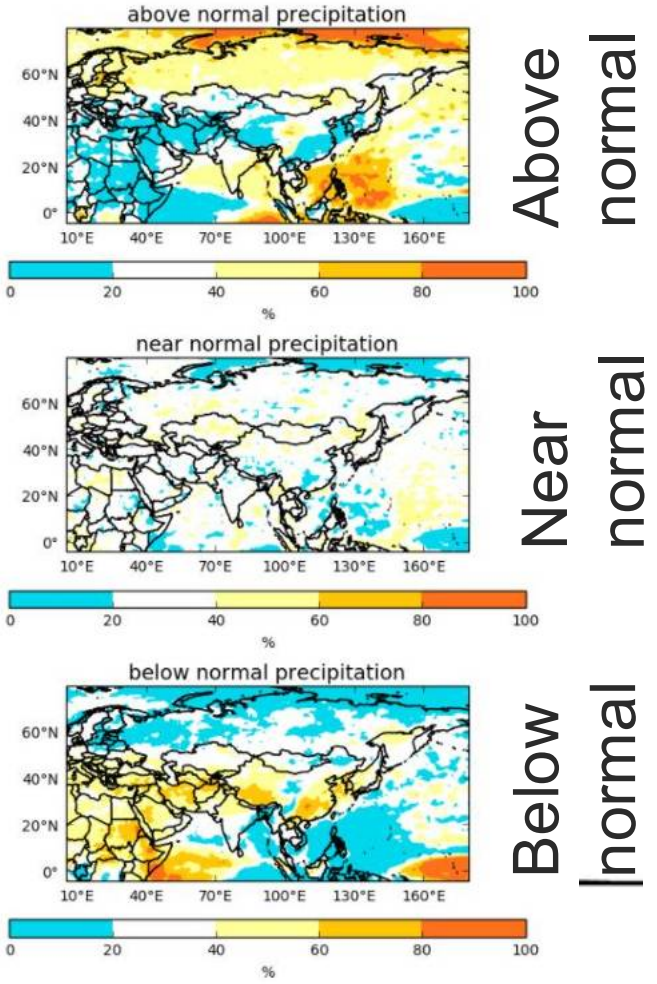
From ECMWF

Probability distribution

The ensembles of forecasts together should describe the range of possible scenarios and their likelihood of occurrence

Communicating ensemble forecast spread – use of terciles

- Terciles are a way of grouping of data into three equally likely categories, each which have a baseline probability of **33.3% (1/3)** which is determined by **climatological data**.
- Tercile-based seasonal forecasts indicate the probability of forecast data falling into one of these categories: **Below normal**, **near normal** and **above normal**.
- Probabilities are calculated from the number of ensemble members that predict values to be in one of the three categories **based of the model climate distribution**.
- Terciles are not based on fixed values, they vary with location and season based on the local climatology



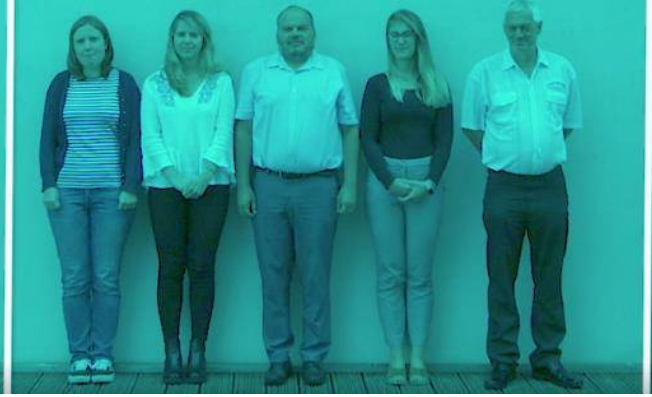
Tercile demonstration

Tercile grouping

below average
1/3 or 33%

near average
1/3 or 33%

above average
1/3 or 33%



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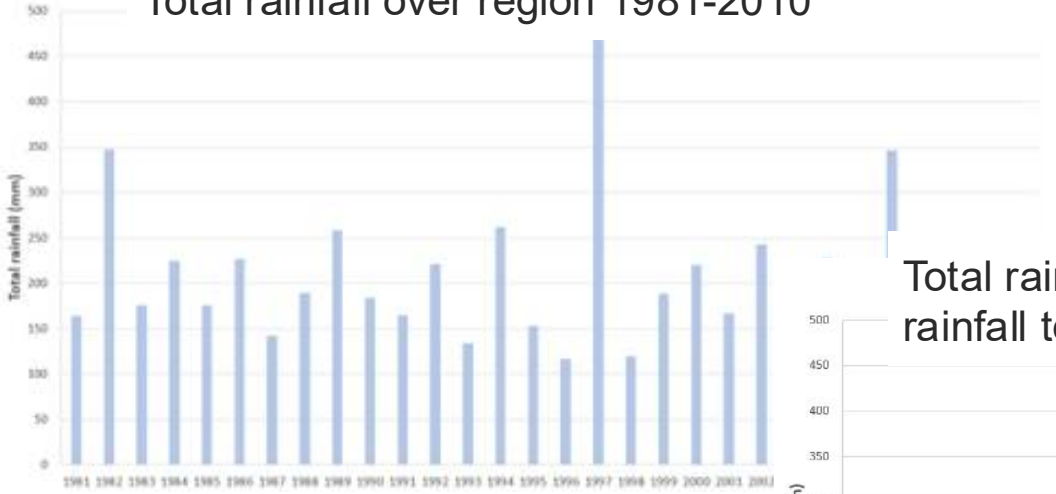
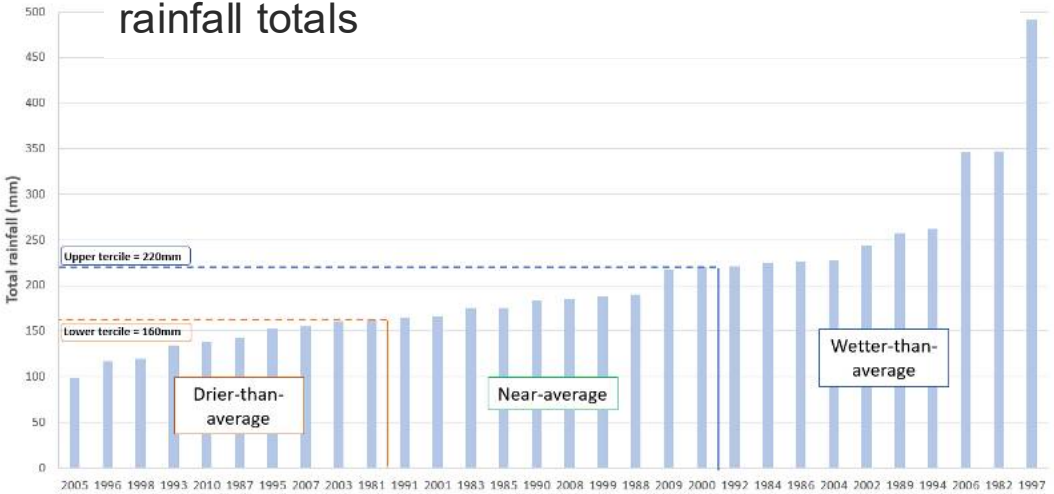
Total rainfall over region 1981-2010



Total rainfall over region 1981-2010, sorted by rainfall totals



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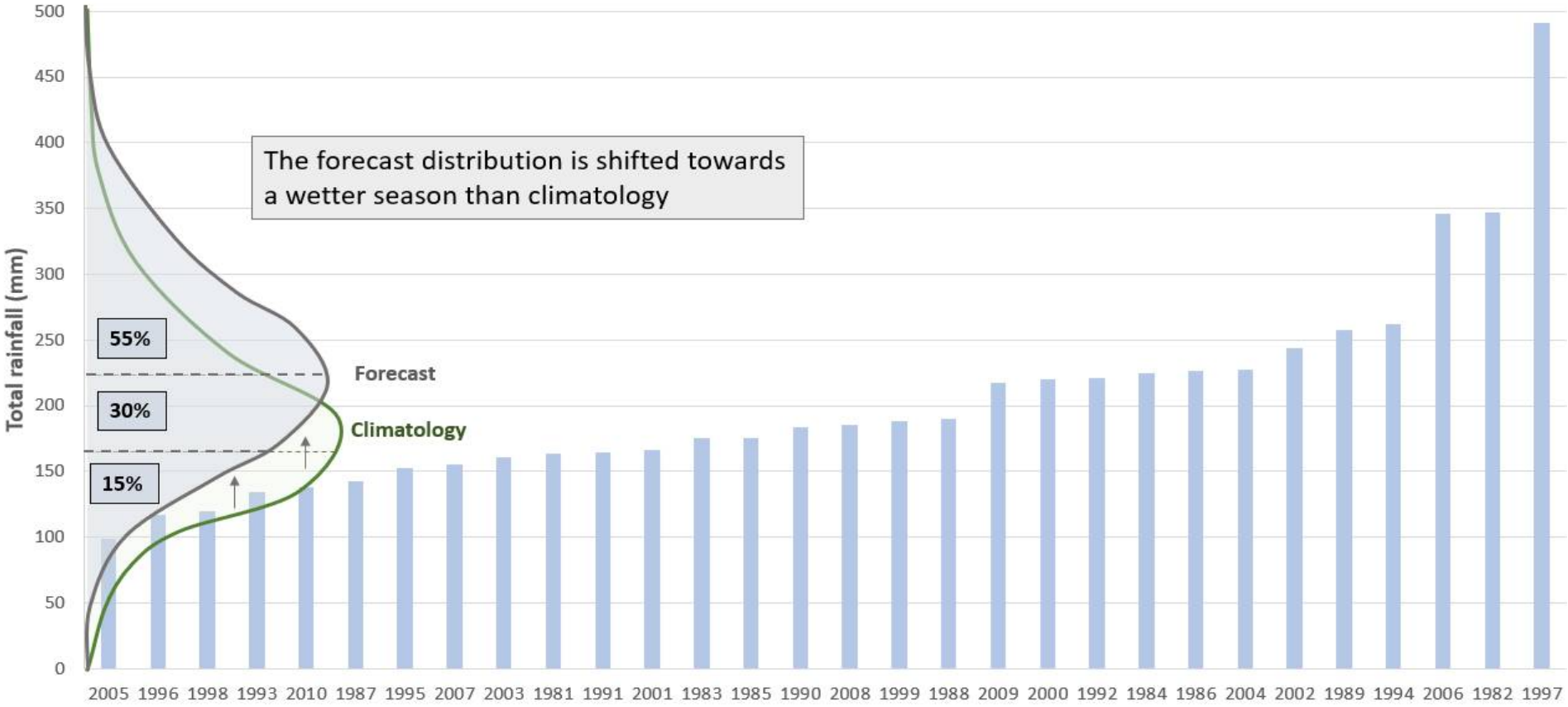

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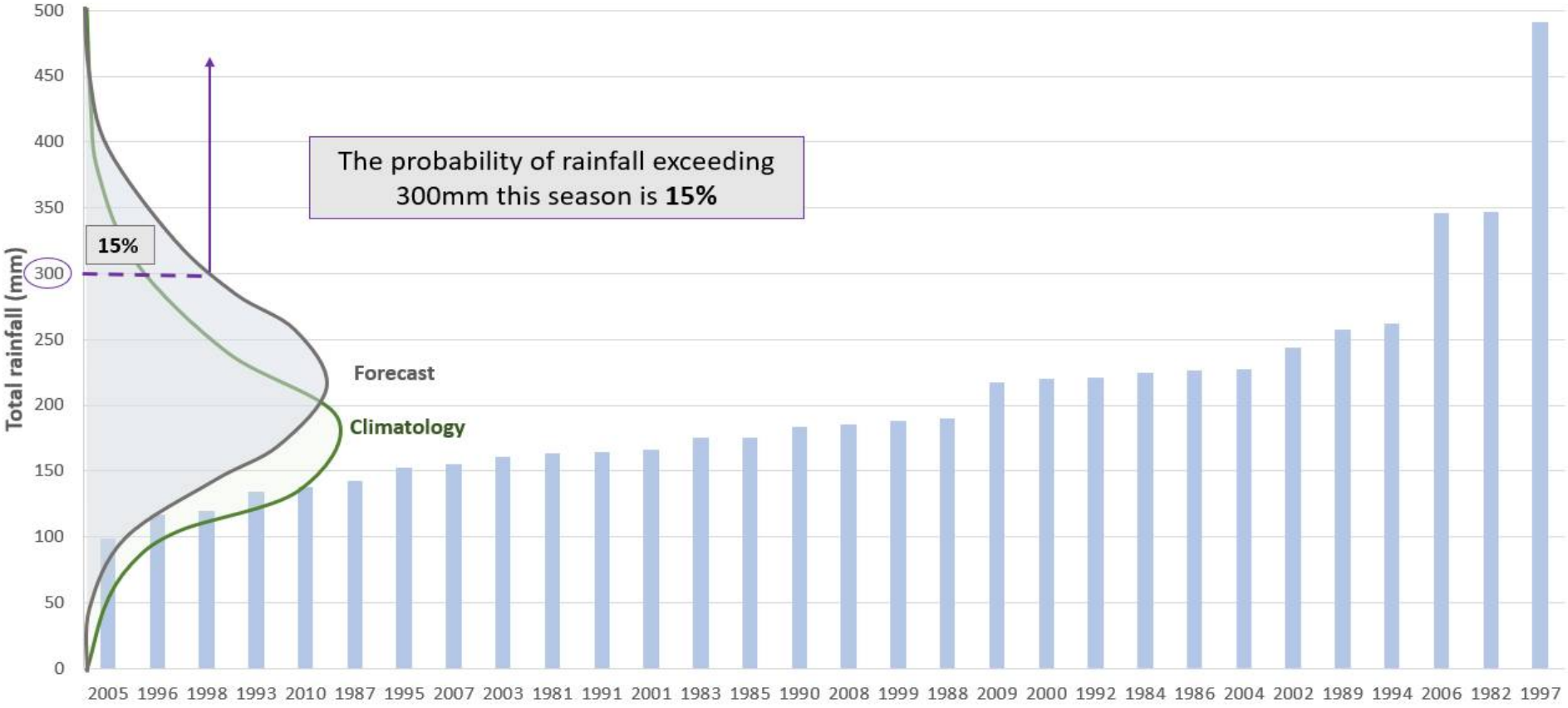
Total rainfall over region 1981-2010, sorted by rainfall totals



Generating probability forecasts from the ensemble using terciles

- The estimated forecast probability of an event is the proportion of the ensemble members that predict the event.
- Say that there were 10 ensemble members in the seasonal forecast …
- Seasonal outlook: the seasonal is likely (50% probability) to be wetter than normal.
- But remember that there is still a 20% likelihood of a near-normal seasonal conditions and a 20% chance of a drier than normal season

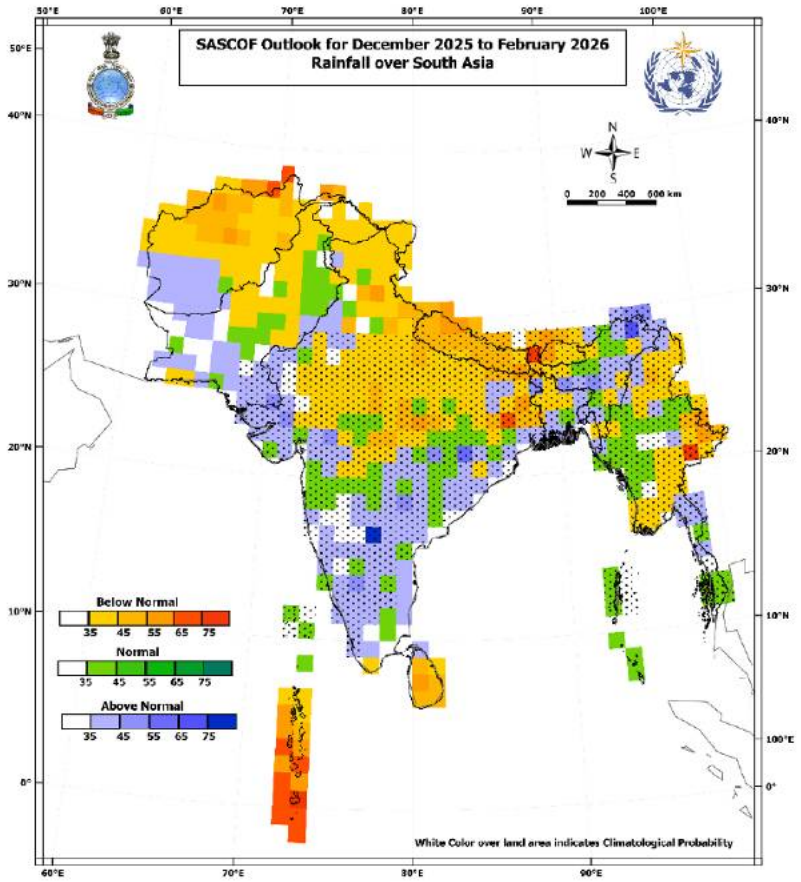
Category	No. Members that predict category	Fraction of total ensemble members	Forecast probability of event
Above (upper tercile)	5	5/10	50%
Average (middle tercile)	3	3/10	30%
Below (lower tercile)	2	2/10	20%

Interpreting probability forecasts

- If a seasonal forecast (using terciles) suggests either a higher (>33%) or lower (<33%) probability, this means the likelihood of the event occurring is **different from usual** (33% in the baseline climate)

- Considering the Dec-Feb 2026 SASCOF Outlook as an example:

- The likelihood of below-normal rainfall is enhanced in some regions (parts of Pakistan, Afghanistan, northern India, Nepal, Maldives and Sri Lanka)
- The likelihood of above-normal rainfall is enhanced in other regions (southern India, parts of Afghanistan and Pakistan)
- Elsewhere rainfall is likely to be normal
- **This does not imply that there is <u>no</u> likelihood of other events occurring**



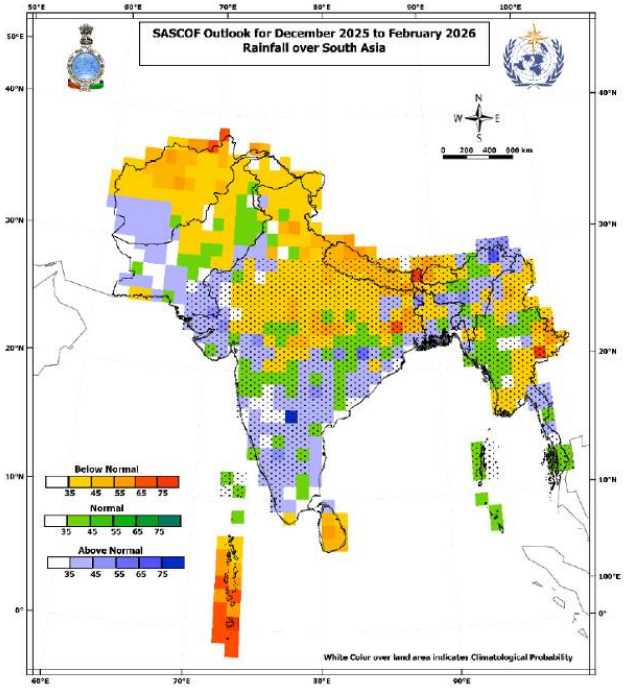
Why do probabilistic forecasts matter?

Seasonal forecasts are designed to shift you from reactive crisis response to *proactive* planning, but the signal is **probabilistic**, not certain.

- **Range of Possible Outcomes** - probabilistic forecasts provide a range of outcomes, help to define the “uncertainty”.
- **Decision-Making Support** - these forecasts help decision-makers plan for *multiple scenarios*, improving risk management and resilience.
- **Sector-Specific Applications** - agriculture, water, and health sectors can use probabilistic forecasts to prepare for variable conditions and reduce impacts.
- **Transforming Uncertainty into Action** - integrating probabilistic thinking allows proactive strategies that safeguard communities and infrastructure.

From seasonal forecasts to climate advisories

From predicting what the seasonal climate will be…

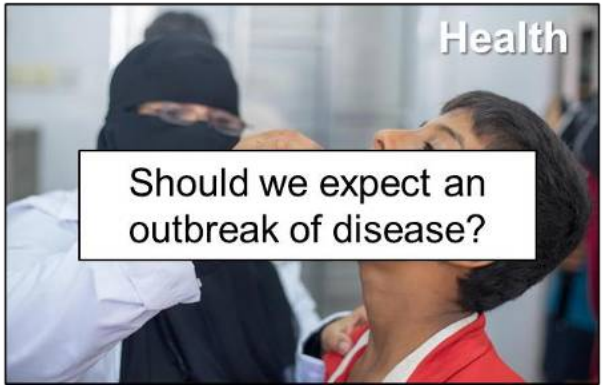


…informing what the seasonal climate may do…

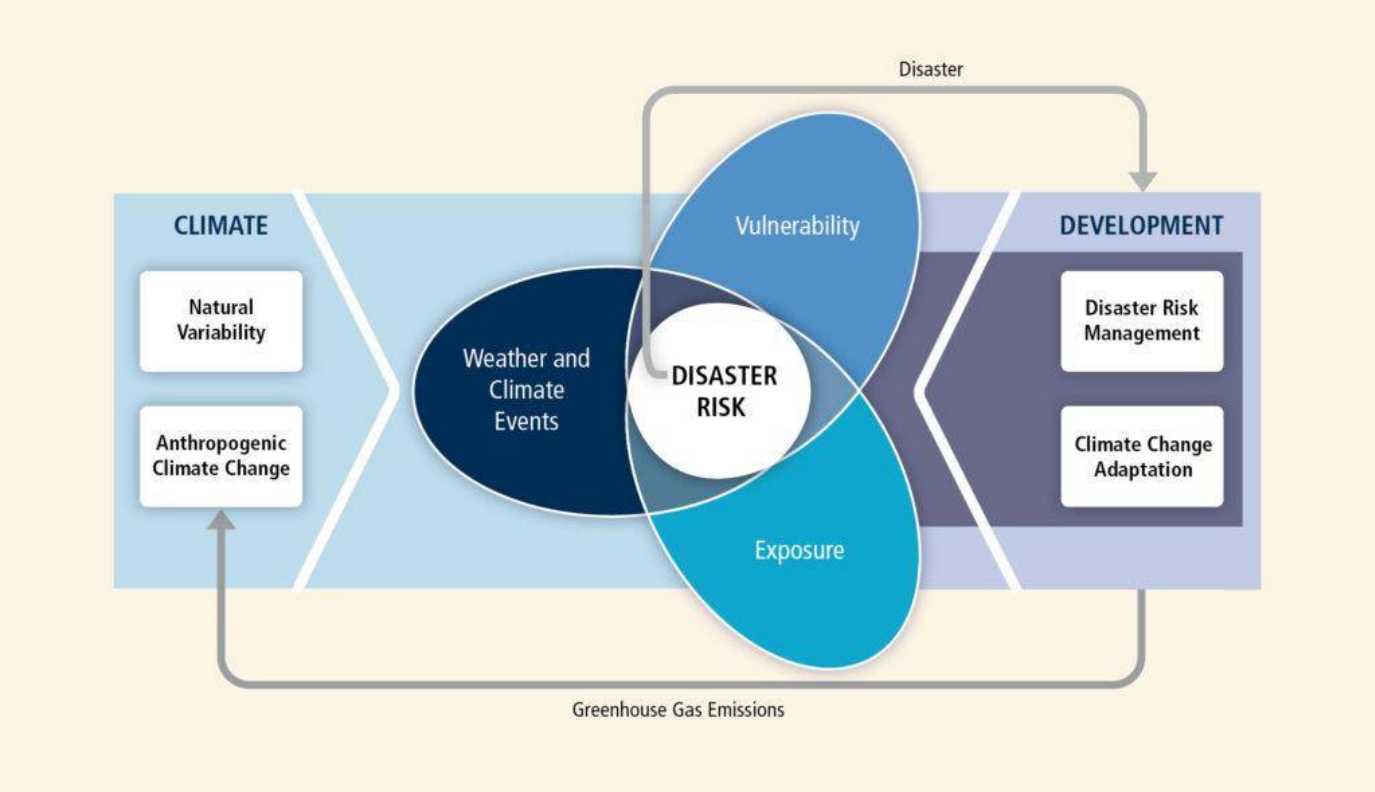
…information on what impacts the season might bring.

…which informs the users' response.

Sectoral Applications

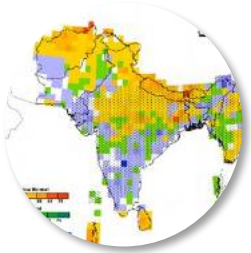


From hazard understanding to risk management



From seasonal forecast to anticipatory action

Hazard + Exposure & Vulnerability = Risk ⇨ Informed decision-making ⇨ Reduced risk



Forecast

Sector sensitivities

Potential sector impacts

Anticipatory adaptation actions

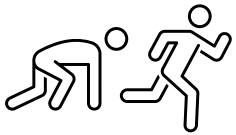
Increased resilience

From probability to decision: three fast tools

No-regrets actions: e.g. resilient crops, pre-position aid.

"Are **beneficial under most forecast outcomes.** Are **low-cost**, **low-risk**, and **alignment-friendly** with existing plans. Do **not depend on high forecast skill.** Improve resilience **even if the forecast does not fully materialise.**"

Cost–loss logic: "If the cost of preparing is less than the expected loss if the event happens, act when probability exceeds your cost/loss threshold."



Ready–Set–Go triggers: agree simple thresholds (e.g., "Go if ≥50% above-normal" or "Go if ≥30% chance of exceeding 300 mm").

UK Winter (Health, Energy & Transport)

Map says: "**70% below-normal** temperature for DJF in the UK."

Meaning: Colder conditions more likely. Perhaps more frequent cold snaps with ice and/or snow.

Actions:

- Prepare "warm centres" for the vulnerable.
- If **P≥60% for < 4 degrees for > 10 days**, *pre-position grit and gritting lorries.*
- Maintenance of power lines and purchase of wholesale energy early.

Farming Advisory

Map says: "**60% above-normal** rainfall for OND in your county; **PoE≥40% for ≥300 mm**; **onset window** earlier by ~1 week."

Meaning: More/larger rainfall events are *more likely than usual*.

Actions:

- Check drainage around fields.
- If **PoE≥30% for ≥400 mm**, *advise raised beds* for flood-prone plots; *prioritise short-cycle, flood-tolerant varieties*.
- Use onset early warning to **stage seed distribution** (don't plant all at once).

Vector-borne Disease

Map says: Above-normal rainfall 55%; **onset earlier**; **dry-spell max short** (fewer long gaps).

Meaning: Standing water likely to persist in populated areas → increased **mosquito breeding** and **contamination** risk.

Actions:

- **Trigger:** If ≥50% above-normal, pre-position **Rapid Diagnostic Tests**, larvicide, and cholera kits in hotspots; run **media hygiene PSAs** two weeks pre-onset.
- Conduct **school/community clean-ups** targeting drains/containers.

Communicating probabilistic seasonal forecasts

Communicate uncertainties and limitations

Embrace uncertainties. Emphasise probabilities.

Use language highlighting **chances** rather than certainties to improve trust, understanding and decision-making.

Use different communication approaches

Use visual aids, consistent wording, **annotated** maps, to **simplify** complex forecast information.

Different people take in information in different ways.

Choose communication routes that **match your audience**

Frame the risk

Put the hazard information into context. Combine forecast probabilities with user information (exposure & vulnerability) to provide **practical advice** encouraging preparedness and timely actions.

This is best done through co-production

Mind your language

Use language to ensure the message is clear, consistent, and accessible.

Be mindful of using over-technical language. Wording might mean one thing to you, but something different to someone else.

Summary

- In the face of the fundamental limits on predictability and the chaotic nature of the atmosphere, probabilistic forecasts offers users a much more complete picture of possible forecast outcomes, allowing assessment of risks and uncertainties

- Seasonal forecasts are designed to shift you from reactive crisis response to *proactive* planning, but the signal is **probabilistic**, not certain.

- Combining the forecast information with understanding of sector sensitivities can allow climate-sensitive sectors to strategically prepare for the upcoming season (**hazard+vulnerability+exposure=risk**) improving risk management and resilience.

- **Seasonal forecasts are essential** in anticipatory action, because they are the **link** between **long term climate change**, and our day-to-day **weather and extremes** – allowing for early warning and preparedness.

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Thank you!