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Communicating uncertainty in climate and extreme weather forecasting

Briefing Note

A briefing on research from the Climate Science for Service Partnership (CSSP) China for decision-makers in China No. 04

The language of climate science can be a barrier to the take-up of valuable research, regardless of its importance and relevance. Even among climate scientists speaking the same language, differing definitions of common terminology can be an obstacle, leading to glossaries accompanying some reports. Bring in a completely different language – such as Mandarin – and a structurally different decision-making process for and by users, and the challenge expands.

However, it a challenge that Climate Science for Service Partnership (CSSP) China has approached in the same way as all its joint climate research – collaboratively.

Deterministic v probabilistic forecasts

Research into communicating uncertainty in climate information for China, (Andrea Taylor et al), led by the University of Leeds, conducted interviews with climate scientists and potential users from China and the UK, covering the hydropower, water, urban, agriculture, aviation, commercial and academic sectors.

Discussions on how best to communicate climate services (such as seasonal forecasts which are presented as A4 documents) to high-level decision-makers in China found a strong preference for deterministic information (such as a prediction of an actual temperature or amount of rainfall), which was echoed by potential new users. While some experienced users said they welcomed probabilistic information (encompassing the uncertainty around projected information), deterministic information was seen as highly important for maintaining credibility and engaging decision-makers at the highest levels.

Furthermore, while current users expressed an overall preference for receiving probabilistic forecast information, the level of probability they required was often unrealistically high, for instance above 80%. They were less inclined to engage with probabilities lower than 60%, which were deemed to lack credibility.

This desire for forecasts to be linked to extremes or user-defined thresholds, rather than historical averages, was expressed throughout the interviews with current and potential users of seasonal forecasts.

A new glossary of commonly mis-translated climate terms

English is widely used as the common language of science around the world but to encourage the take-up of science from the CSSP China project within China, many of the resources produced have been translated in Mandarin. Translating the idiosyncrasies of frequently-used climate terms has been challenging as has a lack of terms in the language to express uncertainty in climate forecasts and projections.

CSSP China has taken steps towards addressing the recommendations overleaf:

- **Arup's climate risk tool for infrastructure, produced as part of CSSP China, includes a glossary of climate terms.**
- **The Met Office and the Institute for Environmental Analytics have compiled a glossary of the most commonly confused translations, published on the VIEWpoint website. This is a working document to which further comments and suggestions can be added.**
  www.viewpoint-cssp.org/glossary

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Produced by VIEWpoint, a CSSP China project from the Institute for Environmental Analytics, highlighting research and improving the uptake of climate services developed in the partnership, through accessible resources.

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Implications

Managing user expectations of what climate science can feasibly provide is crucial, especially if tailoring climate information products to decision-relevant thresholds or seasonal extremes, where high probabilities of exceedance may be rare.

For both Chinese and UK experts, there is a need to balance what users want against what can be reasonably provided, for instance a probabilistic threshold of 80% would very rarely be reached in seasonal forecasting.

The participants recognised a trade-off between providing detailed explanations and overloading users with information, as well as a need to tailor this information to a diverse range of users.

Although this research found a belief among the participants that probabilistic information should be communicated, opinions on how to do this varied. This could be addressed through training in uncertainty in forecasting for end-users, for intermediaries advising decision-makers as well as for decision-makers themselves, but also for climate scientists who are communicating probabilistic information to them.

Enhance	Intensify, increase	增强 或 增加	某气候或天气系统增强或某测量值增加
Ensemble	A collection of comparable datasets that reflect variations within the bounds of one or more sources of uncertainty, and that when averaged can provide a more robust estimate of underlying behaviour.	集合	针对某一变量，综合采用不同数据源进行估计，从而提升估计值的可靠性
Error	Difference from exact true number	误差	测量结果偏离真值的程度
Exceedance	For any threshold, x, the probability that during the year the random variable in question, X, will exceed some x; exceedance probability = P = [X>x]	超越（概率）	变量X超过临界值x的概率
Excess	Exceeding a prescribed or desirable amount.	超值	超过临界值的数量
Exposure	The presence of people, livelihoods,species or ecosystems, nvironmental functions,services, and resources, infrastructure, or economic,social, or cultural assets in places and settings that could be adversely affected.	暴露	人员、生计、种群、生态环境、服务、资源、基础设施，以及经济、社会和文化财产处于可能被灾害破坏的状态

An English-Mandarin glossary of commonly misunderstood or mis-translated climate terms is featured on the VIEWpoint CSSP China website at www.viewpoint-cssp.org/glossary

Recommendations

- Take into account that end-users of climate information **may** not always be final decision makers, but rather technicians and analysts who advise them.
- Work towards providing information for user-relevant thresholds and extremes (rather than being above/below the historical averages), subject to the underlying forecasting science being able to support this.
- Keep explanations, justifying forecasts, for example, concise. Long technical descriptions are unlikely to be directly consulted.
- Include decision-relevant advisory statements.
- Use summary boxes at the top of the first page of seasonal forecasts, written in plain language, to highlight the most important information – the headline message.
- Developing Chinese terminologies to be able to talk about different aspects of uncertainty and products that enable academic users to integrate uncertainties into their work, will assist improved climate communication.
- Specific training for climate scientists, users and decision-makers could help address a perception that adherence to procedures and hierarchy within the delivery processes may have an importance that goes above and beyond the information itself.

Further reading:

Andrea Louise TAYLOR, Sam GRAINGER, Suraje DESSAI, Yim Ling SIU & Marta BRUNO SOARES (2021) Communicating Uncertainty in Climate Information for China: Recommendations and Lessons Learned for Climate Services
http://jmr.cmsjournal.net/article/doi/10.1007/s13351-021-0118-y

Blog by Andrea Taylor: https://cdr.leeds.ac.uk/news/andrea-taylor-communicating-uncertainty-in-climate-information-in-china/

In 2018 the IPCC (Intergovernmental Panel on Climate Change) published a glossary of terms used in the context of its report 'Special report: Global warming of 1.5°C'
https://www.ipcc.ch/sr15/chapter/glossary/

By Sally Stevens, with thanks to Andrea Taylor