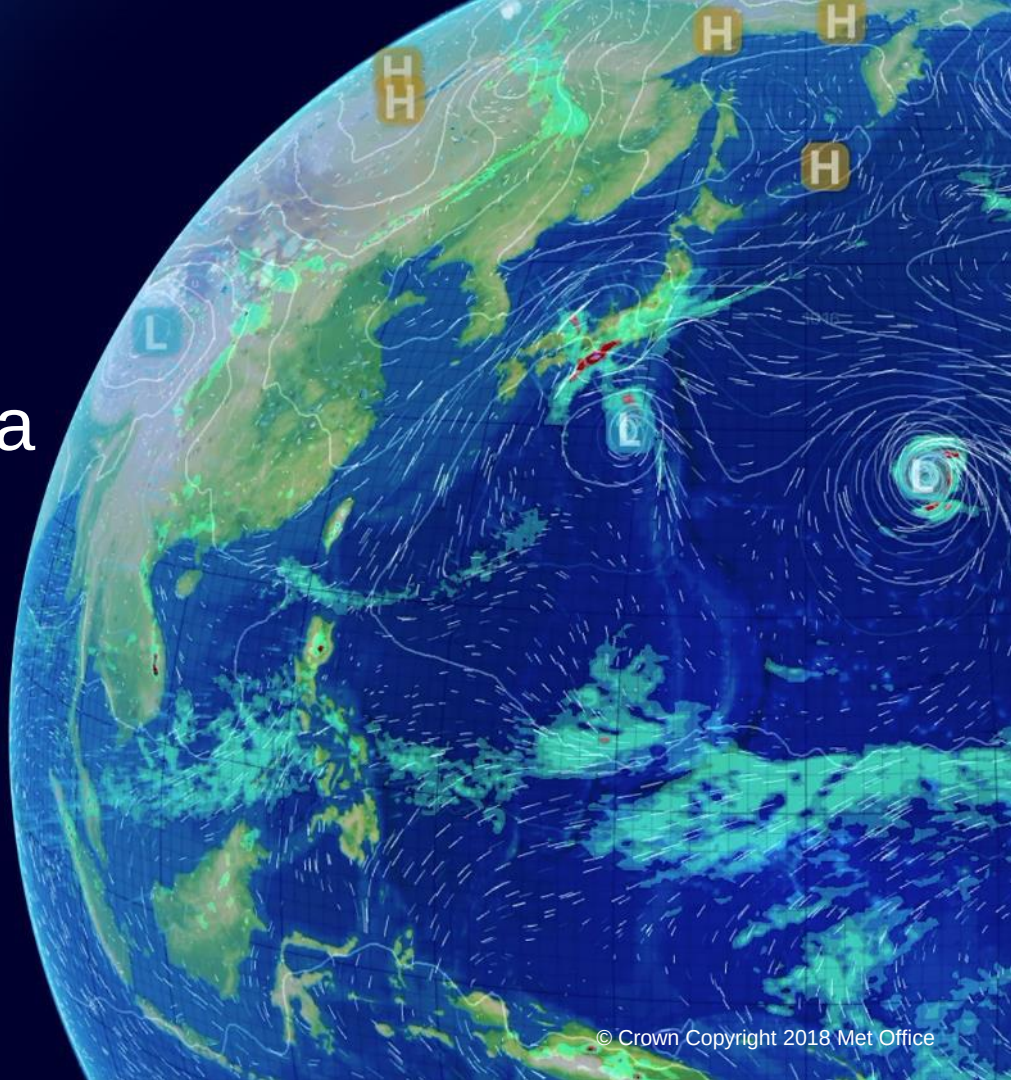
Underpinning science to a climate service: examples from Climate Science for Services Partnership-China (CSSP-China)

Tyrone Dunbar (Met Office)

LST cci Users Workshop June 2020



Climate Science for Service Partnership China

Developing the science needed to build climate services that support climate-resilient economic development and social welfare

Strong partnership
Enhanced scientific research
Demonstration climate services

Underpinning Science

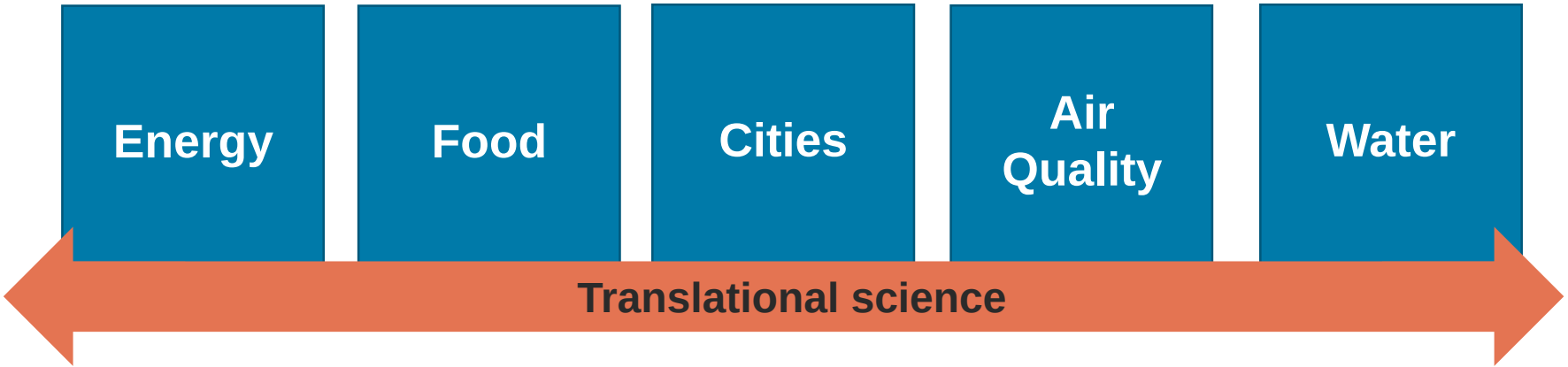
1. Monitoring, attribution and reanalysis
2. Global dynamics of climate variability and change
3. East Asian climate variability and extremes
4. Development of models and climate projection systems

Climate services that support climate-resilient economic development and social welfare

5. Climate services

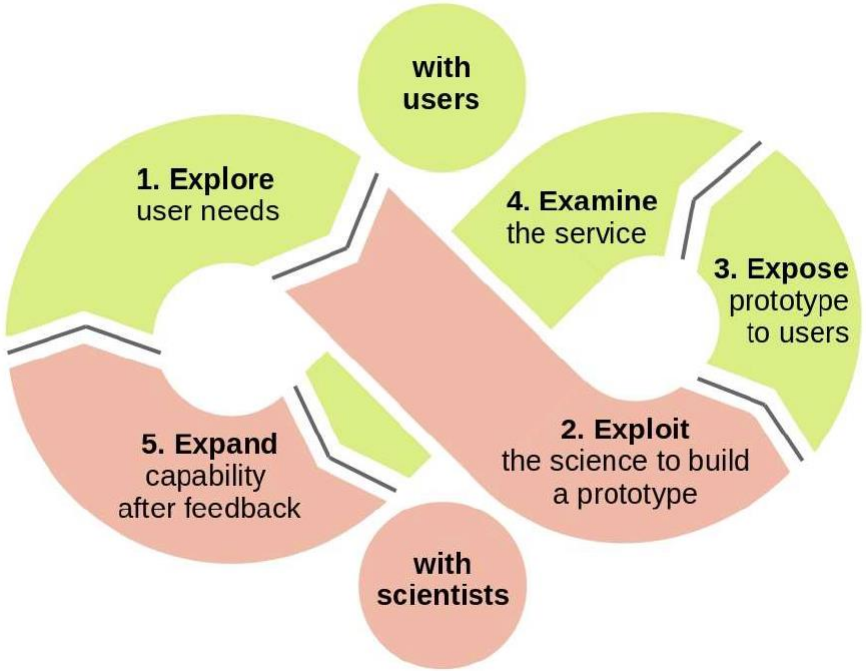
WP5 - Climate Services

Developing applied science and prototype climate services for priority sectors



Climate Service development

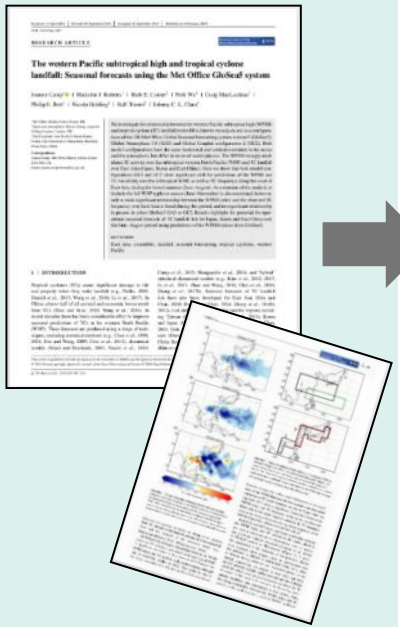
1. **Explore**: Understand user needs
2. **Exploit**: Develop a prototype to meet the user needs utilizing current capability
3. **Expose**: Provide and explain information through user engagement
4. **Examine**: Evaluate the service assessing its usefulness and its shortcomings
5. **Expand**: Feed back requirements into underpinning science and prototype improvements.



From: Hewitt et al., 2020. The Process and Benefits of Developing Prototype Climate Services – Examples in China. *Accepted, Journal of Meteorological Research.*

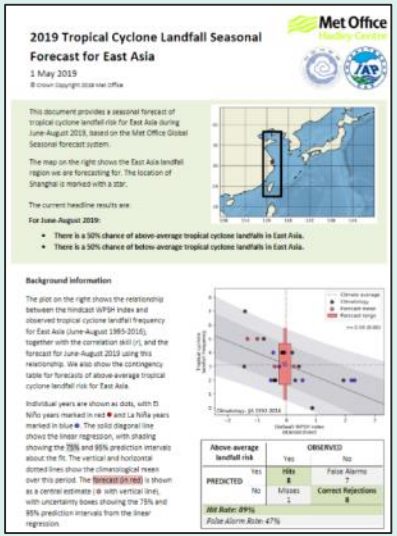
Seasonal forecast for tropical cyclone landfall risk

Research



Jo Camp et al. February 2019

Prototype Forecast



Issued May 2019

User Engagement Visit

Shenzhen & Beijing, June 2019

What did we learn?

Longer lead time desirable

Above/below normal forecast not useful

Desire for guidance when faced with multiple sources of information

Jo Camp and Tim Mitchell

Seasonal forecast for tropical cyclone landfall risk

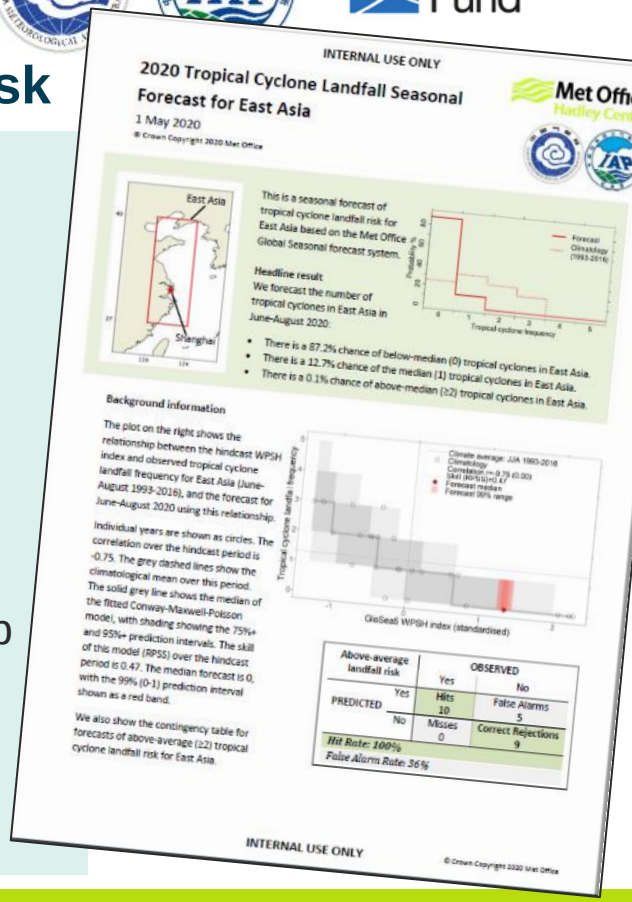
Changes for 2020 based on user engagement

- Developed to fit with CMA's seasonal typhoon process
- Forecast region reduced to cover East China coastline
- Headline forecast given as below-median, median, or above median

Scientific developments in 2020

- Updated statistical distribution used for regression relationship improves predictive skill
- Skill assessed using Ranked Probability Skill Score

Details in Mitchell and Camp 2020 (submitted)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2020 Tropical Cyclone Landfall Seasonal Forecast for East Asia

1 May 2020

East Asia

Shanghai

This is a seasonal forecast of tropical cyclone landfall risk for East Asia based on the Met Office Global Seasonal forecast system.

Headline result

We forecast the number of tropical cyclones in East Asia in June-August 2020:

- There is a 87.2% chance of below-median (0) tropical cyclones in East Asia.
- There is a 12.7% chance of the median (1) tropical cyclones in East Asia.
- There is a 0.1% chance of above-median (≥2) tropical cyclones in East Asia.

Background information

The plot on the right shows the relationship between the hindcast WPSH index and observed tropical cyclone landfall frequency for East Asia (June-August 1993-2016), and the forecast for June-August 2020 using this relationship.

Individual years are shown as circles. The correlation over the hindcast period is -0.75. The grey dashed lines show the climatological mean over this period. The solid grey line shows the median of the fitted Conway-Maxwell-Poisson model, with shading showing the 75%+ and 95%+ prediction intervals. The skill of this model (RPSS) over the hindcast period is 0.47. The median forecast is 0, with the 99% (0-1) prediction interval shown as a red band.

We also show the contingency table for forecasts of above-average (≥2) tropical cyclone landfall risk for East Asia.

Tropical cyclone landfall frequency

GloSeaS WPSH index (standardised)

Above-average landfall risk		OBSERVED	
		Yes	No
PREDICTED	Yes	Hits 10	False Alarms 5
	No	Misses 0	Correct Rejections 9

Hit Rate: 100%

False Alarm Rate: 36%

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Jo Camp and Tim Mitchell

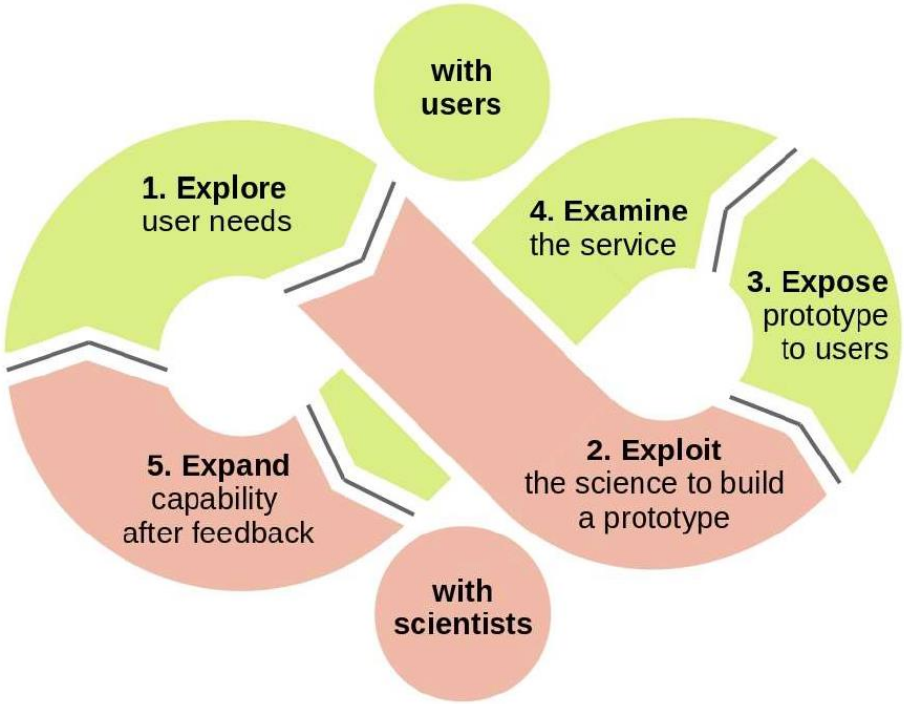
Identifying users for food security research

- Infographic developed for engagement with potential users in China
- Physical visit cancelled, currently exploring remote engagement methods

Stacey New and Jennifer Weeks

Final thoughts…

- What are the most important decisions the user is making?
- Many users distrust models and put too much faith in observations
- Context is a very powerful communication tool – how would the service have helped with previous events?
- Early engagement is vital



Food Security in CSSP China

Prototype climate service

What are the benefits of this research?

Building resilience to extreme weather

Providing information on the most up-to-date risk of extreme weather events will help communities build climate resilient agriculture and food systems.

Strategies for increasing crop yield

Using adaptation strategies to optimise yield, such as crop rotation.

Developing crop warning systems

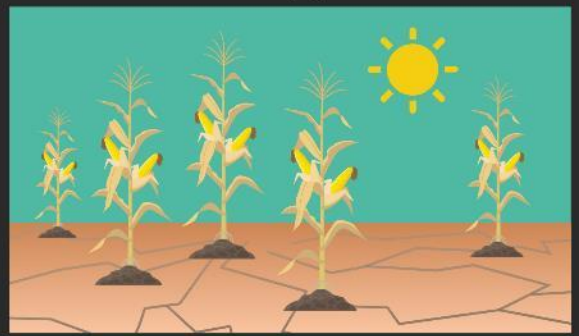
Developing tools to help users better anticipate potential damage to crops.

Food Security in CSSP China

Prototype climate service

What does our latest research show?

Current risks to crop production



Research has shown there is a 5% chance per year of a larger area drought than any previous event, and roughly a 6% chance per decade of simultaneous maize crop failure in China and the USA.

Predicting unfavourable conditions

Research has identified a link between sea surface temperature patterns in different oceans and yield of maize across North and North-east China. This has potential to provide advance warnings of unfavourable conditions for growing crops.

Where and how crops are affected

Research can help to understand and quantify factors affecting agricultural yield. This is performed through the analysis of water use and crop health indicators.

Food Security in CSSP China

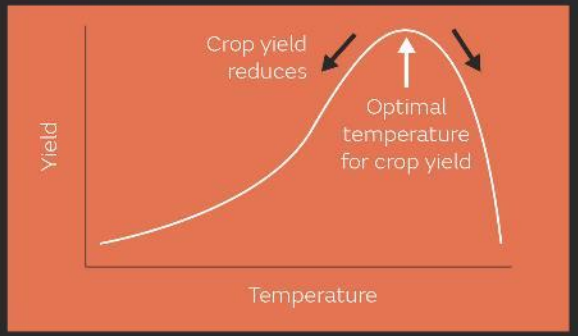
Prototype climate service

What research is being done?

Modelling extreme weather events

Using the latest climate models to simulate the most extreme weather events that are physically plausible (the UNSEEN* method).

Crop response to extreme weather



Using observations and models to understand how crops are affected by changes in temperature and rainfall.

Satellite mapping of crop risks

Using images from the Copernicus Sentinel satellite database, which can be used to monitor crop stress and impact on yield.