



CLIMATE SCIENCE FOR SERVICE PARTNERSHIP CHINA

SEASONAL FORECASTS FOR THE YANGTZE RIVER BASIN



UNDERSTANDING AND WARNING OF EXTREME RAINFALL AND FLOODING

Extreme climatic events, such as intense rainfall and drought, can have serious impacts on society, including the loss of lives and livelihoods. Improving understanding, prediction and advice on extreme events in China is a core theme of CSSP China, and has already generated new advances based on the latest science.

The Yangtze river basin is home to one third of China's population, covers one fifth of the land area, and includes many major cities and economic centres. In addition, the rural land that makes up most of the area is responsible for producing a vast amount of China's agricultural yield.

However, the Yangtze river is affected by monsoon rainfall. The strength of the monsoon, and the time of year when it begins and ends, can have a large impact on livelihoods in the region. Particularly intense or prolonged periods of rainfall can lead to flooding and loss of life. In addition, hydroelectric dams along the river rely on the seasonal rainfall to produce electricity for the major cities of eastern and southern China.

By controlling the river water level, managers of hydroelectric dams are able to alleviate flood and drought impacts and regulate electricity supply. Finding out in advance how much rainfall there will be over the next few months, and particularly for the summer rainy season, is vital to supporting these activities.

What CSSP China is doing

To support climate-smart decision-making, CSSP China is developing the cutting-edge science needed to better understand and forecast extreme events such as flooding and drought in China.

Seasonal prediction of rainfall – understanding the large scale causes

Research by scientists from China and the UK working on CSSP China¹ found that the seasonal forecast system used by the Met Office has significant skill in predicting summer rainfall and natural river flow in the Yangtze river basin. They confirmed that this skill is linked to the model's representation of the El Niño Southern Oscillation, and the way that El Niño in particular affects the monsoon in this part of China. In many cases, an El Niño during the winter season is followed by elevated risk of flooding along the Yangtze river in the following summer. This was the case for the devastating floods of 1998.

The climate system is complex so this pattern is not observed in every year following an El Niño, and in some years, El Niño and La Niña are inactive. There is also fundamentally unpredictable variability in the climate system so the most likely outcome from the seasonal forecast is not guaranteed. Scientists in the CSSP China project are working to ensure the statistical reliability of the risk based forecasts.

Collaborating to develop a prototype climate service

Summer rainfall, 2016

From the beginning of the CSSP China collaboration, managers of the hydroelectric dams in the Yangtze river basin have voiced a clear need for skilful forecasts of rainfall on seasonal timescales, particularly for the summer flood season. In 2015, CSSP China climate scientists recognised that there was a clear opportunity to make an important summer rainfall prediction for the Yangtze river basin for summer 2016, as long range forecasts were suggesting a very large El Niño event was on the way.

A prototype climate service was therefore trialled, with scientists at the Met Office producing a real-time seasonal forecast for the Yangtze river basin throughout the spring and summer of 2016. The forecast was delivered to key decision makers by the China Meteorological Administration and its regional centre, the Wuhan Regional Climate Centre. By working closely with decision makers, the trial helped provide appropriate interpretation of the uncertainty in the forecasts, and assisted robust decision-making. The forecast presented each month gave headline messages for the coming season including probabilities of above average rainfall and river flow. It also included a more detailed description and graphics outlining how the forecasts and their uncertainties relate to conditions in the past.

Associated with the strong El Niño, the early summer precipitation forecasts predicted high likelihood of above-average rainfall in the Yangtze river basin, as well as above-average river flow. Operators of the large hydroelectric dams were able to make more confident decisions to prepare for higher river flow and potentially avoid costs to life, livelihoods and infrastructure.



¹ Li et al. 2016. Skillful seasonal prediction of Yangtze river valley summer rainfall. *Environmental Research Letters*. <http://iopscience.iop.org/article/10.1088/1748-9326/11/9/094002>

What's next?

This prototype climate service is the first of several that are planned in CSSP China to address challenges posed to society by the climate, both in the short and longer term.

Work to evaluate the forecasts and service provided will help understand how to improve future climate services. Scientists continue to engage with decision makers to provide a seasonal forecast that better meets the needs of the people making decisions.

CSSP China is also working to develop climate service prototypes for sectors needing similar information on seasonal timescales, and those making decisions on longer timescales where climate change may begin to have an impact.



UK-China Research Innovation Partnership Fund information

The Weather and Climate Science for Service Partnership Programme – of which CSSP China is a part - comprises projects to develop partnerships harnessing UK scientific expertise to build the basis for strengthening the resilience of vulnerable communities to weather and climate variability, supported by the UK government's Newton Fund.

For more information visit: www.newtonfund.ac.uk and follow via Twitter: @NewtonFund

For more information about CSSP China please visit the Met Office (www.metoffice.gov.uk/research/collaboration/cssp-china), IAP (www.lasg.ac.cn/cssp) or CMA (www.cma.gov.cn/en2014) or contact cssp-china@metoffice.gov.uk

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