VIEWpoint 新观点

Investigating TPV Tracking: Comparison Between Modern and Conventional Methods

Tibetan Plateau (Image credit: Unsplash.com)

Explainer

An explainer on research from the Climate Science for Service Partnership (CSSP) China for decision-makers in China // No. 03

Summary

A few Tibetan Plateau Vortices (TPVs) are storms which can cause heavy rainfall and catastrophic flooding over the Yangtze River Basin. TPVs are often identified too late to issue effective warnings, therefore, reliable tracking and detection methods are needed. As part of CSSP China, automated TPV tracking methods are investigated in comparison with manual tracking method to understand the evolution process of TPVs and their impact.

Why?

TPVs are one type of weather systems originating over the Tibetan Plateau during the extended summer season (April–September). Some TPVs can "move off" the plateau to the east and cause heavy rainfall, leading to catastrophic flooding in the Yangtze River Basin (home to one third of China's population). For instance, a series of TPV-triggered heavy rainfalls in mid-June 2008 (Chen et al., 2015) forced 1.3 million in South China to evacuate and caused an economic loss of more than 10 billion RMB (MCA of China, 2008). Therefore, accurate prediction of TPV tracks has been a key concern of Chinese researchers for decades.

Currently, it is difficult to identify and track TPVs, especially at the early phase of their lifecycle. This difficulty is mainly due to lack of observational data over the west Tibetan Plateau, where TPVs originate. TPVs are often identified too late to issue effective warnings and to take precautionary action against flooding events; hence reliable and swift detection and tracking methods are in urgent need.

How?

Current tracking methods include manual and automated tracking: the former relies on case-by-case observation-based analysis by experts while the latter makes use of climate model outputs.

A thorough comparison between manual and automated tracking was carried out as part of the CSSP China program and revealed that the automated method can identify TPVs further west at their crucial earlier stages compared with manual tracking (Curio et al., 2018).

In addition, along with global climate model outputs, automated tracking can benefit the understanding of the spatial distribution and annual cycle of TPVs. Using automated tracking, Curio et al (2019) found TPV-associated precipitation can account for up to 40% of the total precipitation in Sichuan Province in July, confirming that TPVs can have a strong influence on the precipitation downstream of the Plateau.

What now?

Compared to manual methods, automated tracking is more objective and reproducible; moreover allowing an earlier detection of TPVs. There is potential for automated method to be incorporated in NWP-based workflows to improve the forecast skill of TPVs and to increase the lead time in TPV-related flood warnings. Meanwhile, the experience and in-depth knowledge of TPVs acquired from the skill of conventional manual methods can inform and refine automated methods to improve automated TPV tracking.

This work is the first time the TPV events have been examined a high-resolution global climate model, helping deepen the knowledge of the mechanisms and patterns of TPVs, and thus their impacts can be better understood and predicted.

References:

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