# Convection-permitting modelling improves simulated precipitation over Tibetan Plateau

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A glance at Himalayas Mountains, the highest mountains of the Tibetan Plateau. Credit: ZHANG Qi

The Tibetan Plateau (TP) is the highest and most extensive highland in the world. The thermal and mechanical forces of the TP play an essential role in influencing the global climate, and precipitation is one of its most important water cycle components.

However, accurately simulating precipitation over the TP is a long-standing worldwide challenge. The deep convection parameterization has been regarded has the largest source of model uncertainty in simulating precipitation.

Convection-permitting models (CPMs), with horizontal-grid spacing of less than five km, are constructed to partially resolve (rather than parameterize) convective heat and moisture transport. They offer a path towards fundamental advances in our understanding of factors influencing clouds and precipitation, and have become important tools for climate research.

Recently, under the Climate Science for Service Partnership China (CSSP China) and Convection-Permitting Third Pole (CPTP), researchers from the Institute of Atmospheric Physics (IAP) of the Chinese Academy of Sciences, Chinese Academy of Meteorological Sciences of China Meteorological Administration and the UK Met Office have jointly investigated the added value of a CPM in simulating precipitation characteristics over the TP, and explained possible reasons for excessive precipitation over the TP in the mesoscale convection-parameterized models.

Their results showed that two mesoscale models (MSMs) had notable wet biases over the TP and could overestimate the summer precipitation by more than 4.0 mm per day in some parts of the central and eastern TP.

Moreover, both MSMs had more frequent light rainfall, and increasing horizontal resolution of the MSMs alone did not reduce the excessive precipitation. Further investigation revealed that the MSMs had a spurious early-afternoon rainfall peak, which could be linked to a strong dependence on convective available potential energy (CAPE) that dominates the wet biases.

"Herein, we highlight that the sensitivity of CAPE to surface temperatures may cause the MSMs to have a spurious hydrological response to surface warming. Users of climate projections should be aware of this potential model uncertainty when investigating future hydrological changes over the TP," said Dr. LI Puxi, the paper's lead author, a researcher from the Chinese Academy of Meteorological Sciences.

By comparison, the CPM removes the spurious afternoon rainfall and thus significantly reduces the wet bias simulated by the MSMs. "The CPM also better depicts the precipitation frequency and intensity, and is therefore a promising tool for dynamic downscaling over the TP," Dr. Kalli FURTADO, the second author of the study, added.

This work was recently published in the *Quarterly Journal of the Royal Meteorological Society*.

**More information:** Puxi Li et al. Convection?permitting modeling improves simulated precipitation over the central and eastern Tibetan Plateau, *Quarterly Journal of the Royal Meteorological Society* (2020). DOI: 10.1002/qj.3921

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