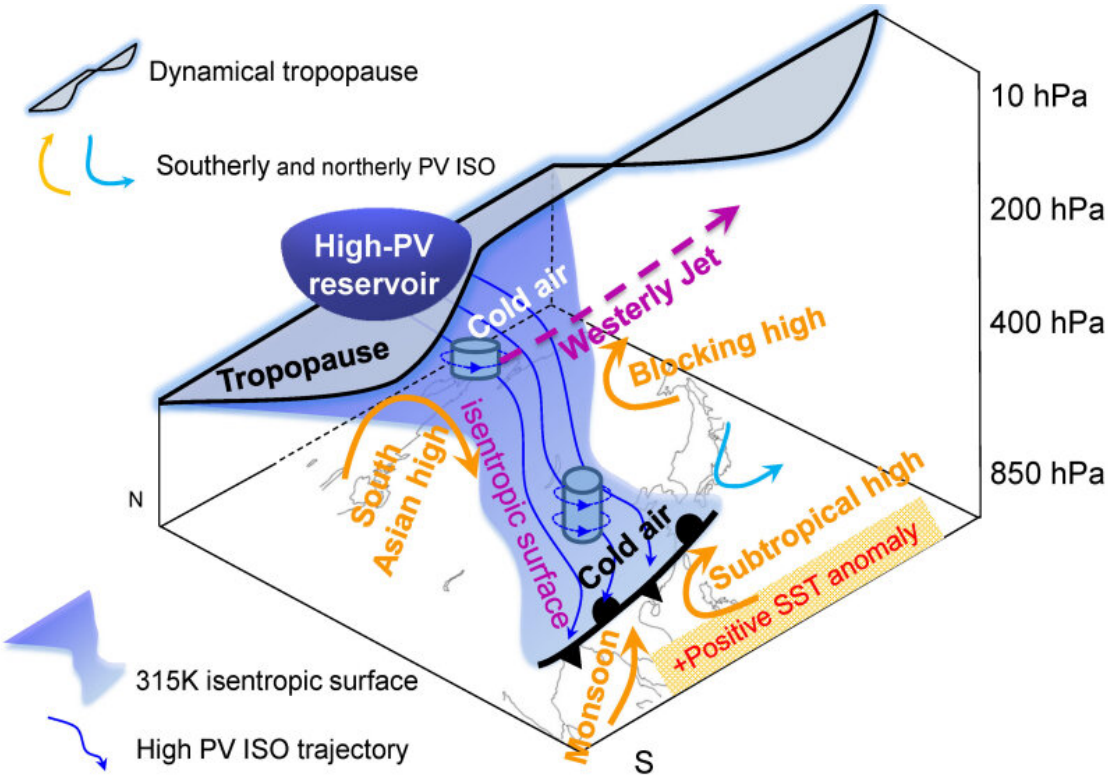
Scientists look into tropopause to find early signals of persistent strong rainfall

September 16 2020, by Li Yuan



Schematic illustration of precursor signal and synoptic system configuration along isentropic surface for persistent strong precipitation events in South China. Credit: ZHAO Liang

The flooding season had just ended in China. Persistent strong precipitation events in many regions of China resulted in severe flooding

disasters in the just passed summer of 2020. It is of great significance to capture precursor signals of persistent strong precipitation events.

To find the signal, Prof. Xiao Ziniu and his team from The State Key Laboratory of Numerical Modeling for Atmospheric Sciences and Geophysical Fluid Dynamics (LASG), Institute of Atmospheric Physics (IAP) of the Chinese Academy of Sciences, and their collaborators used a powerful analysis tool—the intraseasonal oscillation (ISO) of isentropic potential vorticity (PV) - to track precursors near the tropopause preceding persistent strong precipitation in South China.

The results were published on Sept. 2 in *Climate Dynamics*.

The researchers found that the early signals leading to persistent heavy rainfall in South China originate from two regions: the Arctic region and the tropical monsoon region.

"Twenty days before the peak rainfall, the western Tibetan Plateau and the northern side of the East Asian westerly jet near the tropopause are two transit points for the anomalous potential vorticity to strengthen and change propagating direction," said Zhao Liang, the first author of the study. Zhao is a senior engineer with LASG.

It is very critical for prediction to find the special early configuration of synoptic systems for the occurrence of persistent heavy rainfall events.

"We find that when the anomaly low pressure is surrounded by three anomaly high pressure systems, including South Asia high, Okhotsk Sea blocking high and the western Pacific subtropical high, this special situation is often responsible for the following persistent heavy rainfall in South China," said Prof. Xiao.

According to this study, 10 days before the peak rainfall, the joint action

of the South Asia high and the Okhotsk Sea blocking high compresses the anomaly cold air between the two highs, and forms a narrow and steady cold air transport channel on the inclined isentropic surface. It enables the cold air to a lower latitude and continually meet with the warm and moist air in South China brought by the anomaly strong subtropical high, forming a persistent heavy precipitation.

"Our finding provides a new potential factor for the prediction of regional persistent heavy rainfall," said Prof. Xiao.

More information: Liang Zhao et al. Extratropical extended-range precursors near the tropopause preceding persistent strong precipitation in South China: a climatology, *Climate Dynamics* (2020). DOI: 10.1007/s00382-020-05437-6

Provided by Chinese Academy of Sciences