

Influence of Strong Tropical Volcanic Eruptions on Daily Temperature and Precipitation Extremes

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Background

- Studies on the attribution of extreme climate events have become increasingly more common since the turn of the century, attracting a great deal of interest within and outside the scientific community.
- Much attention has been paid to examining the impacts of humans on climate extremes. However, how climate extremes respond to volcanism, particularly strong tropical volcanic eruptions (SVEs), has received less attention and needs to be studied.

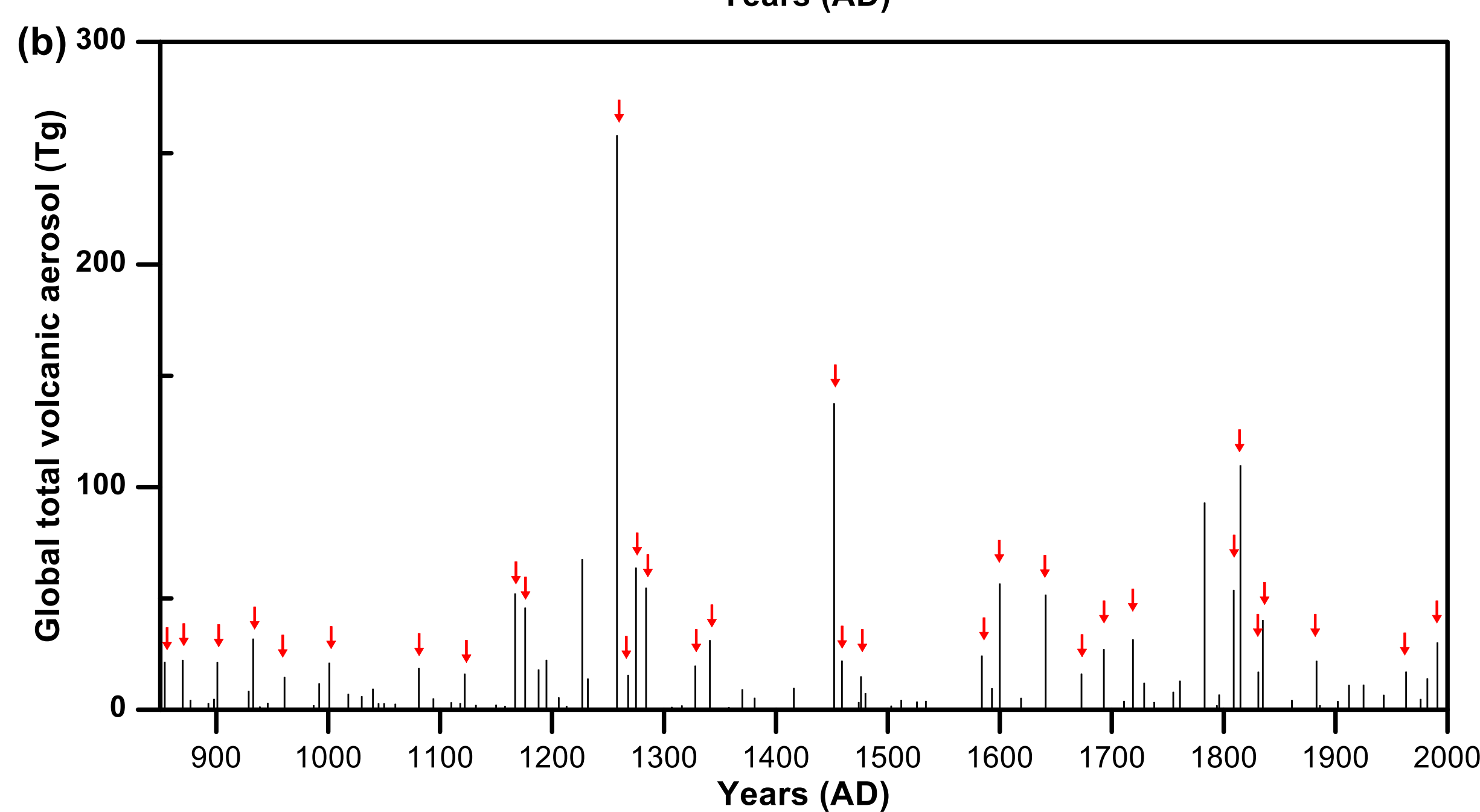
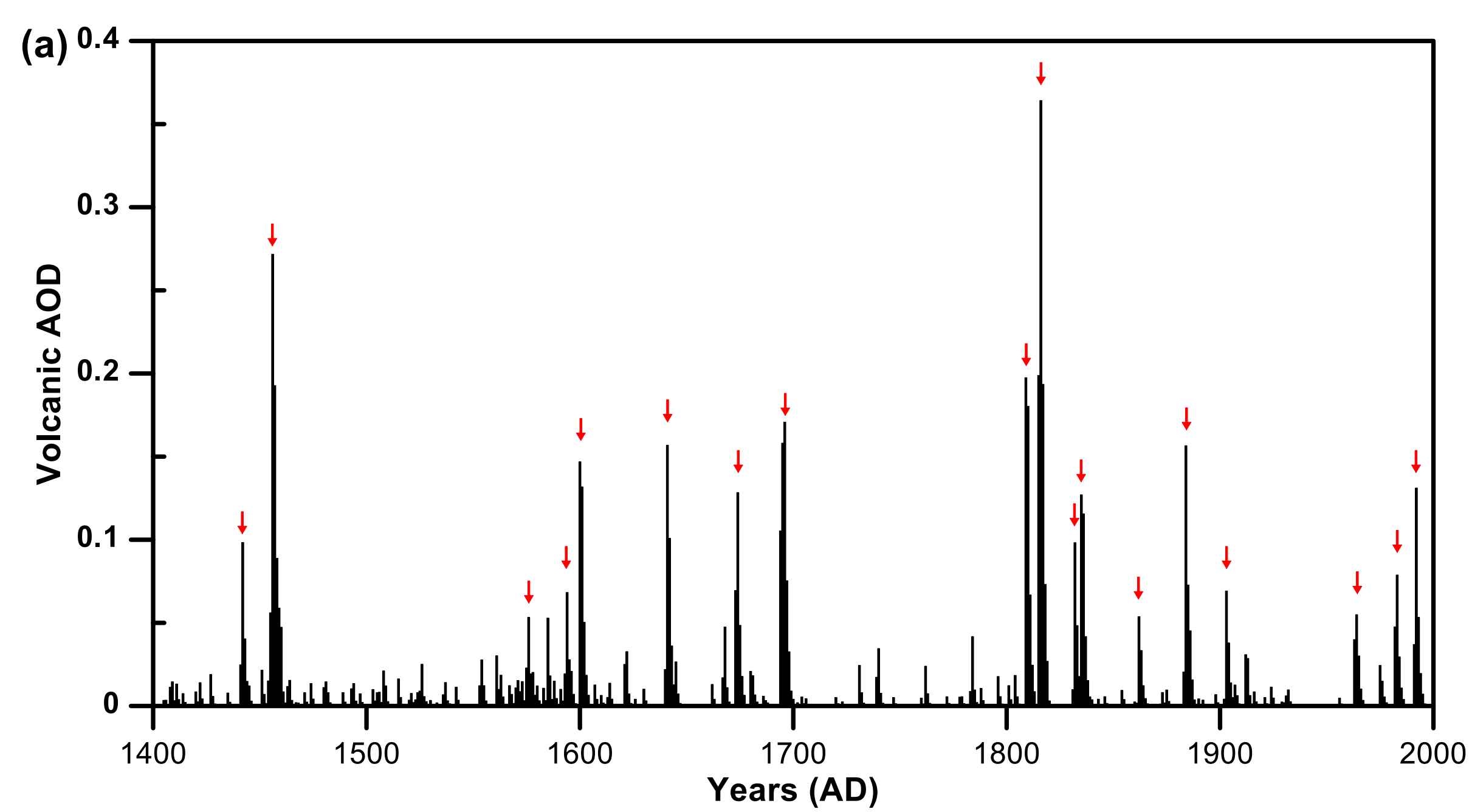
Data and method

Model

HadCM3 and CESM

Simulation

Impose only transient volcanic forcing



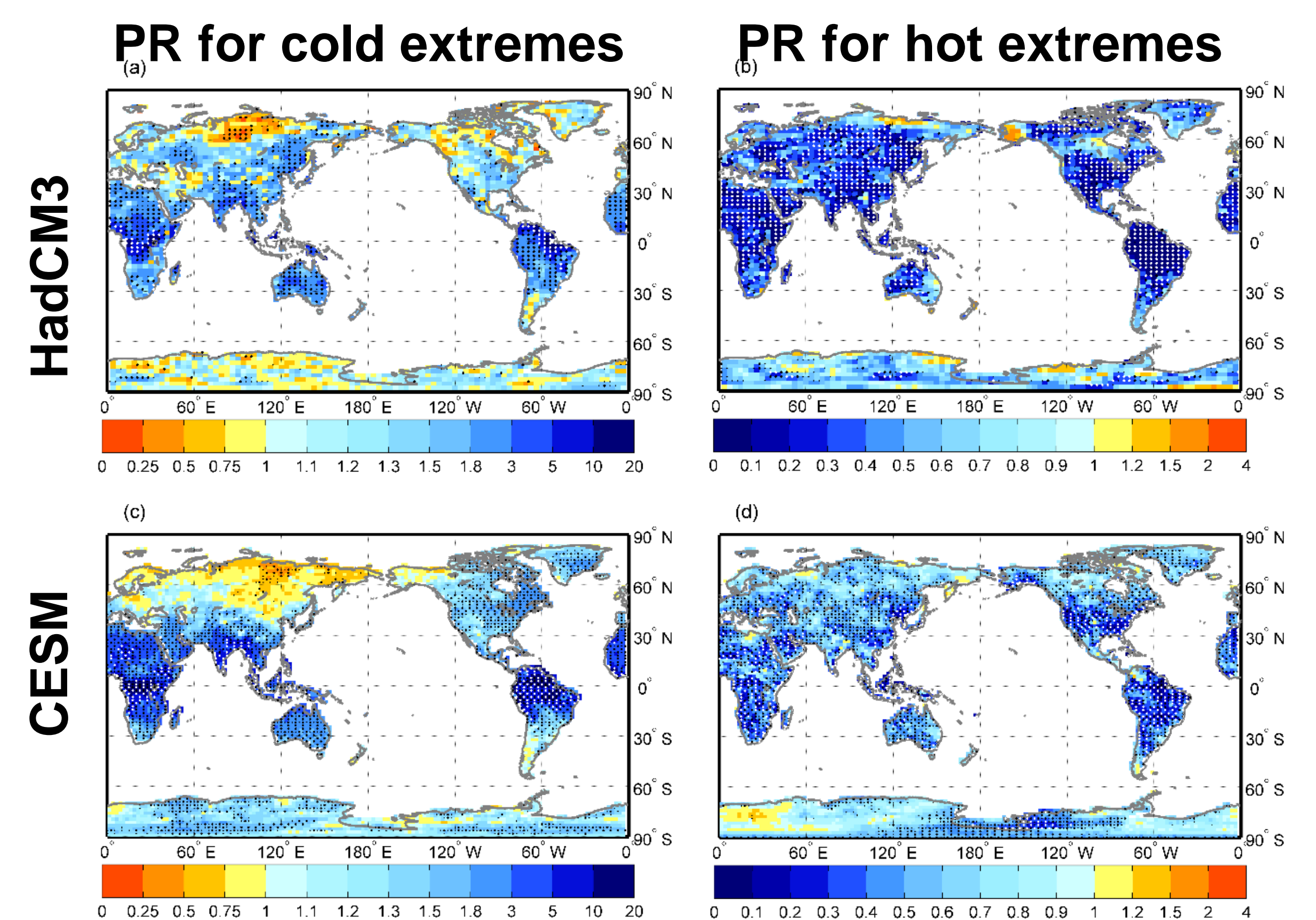
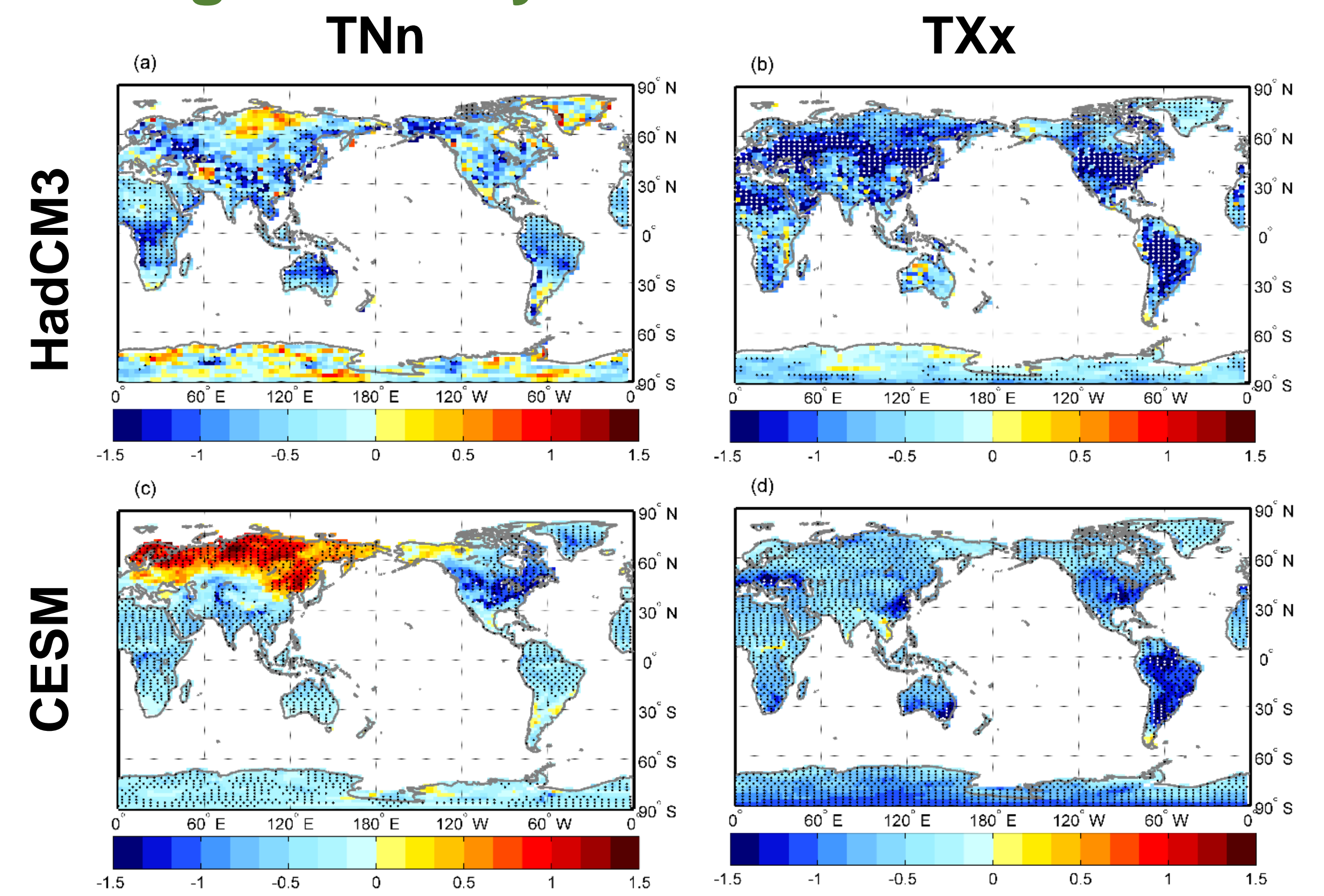
Global averaged volcanic forcing for (a) HadCM3 and (b) CESM. Analyzed SVEs in this study are marked using red arrows.

Method

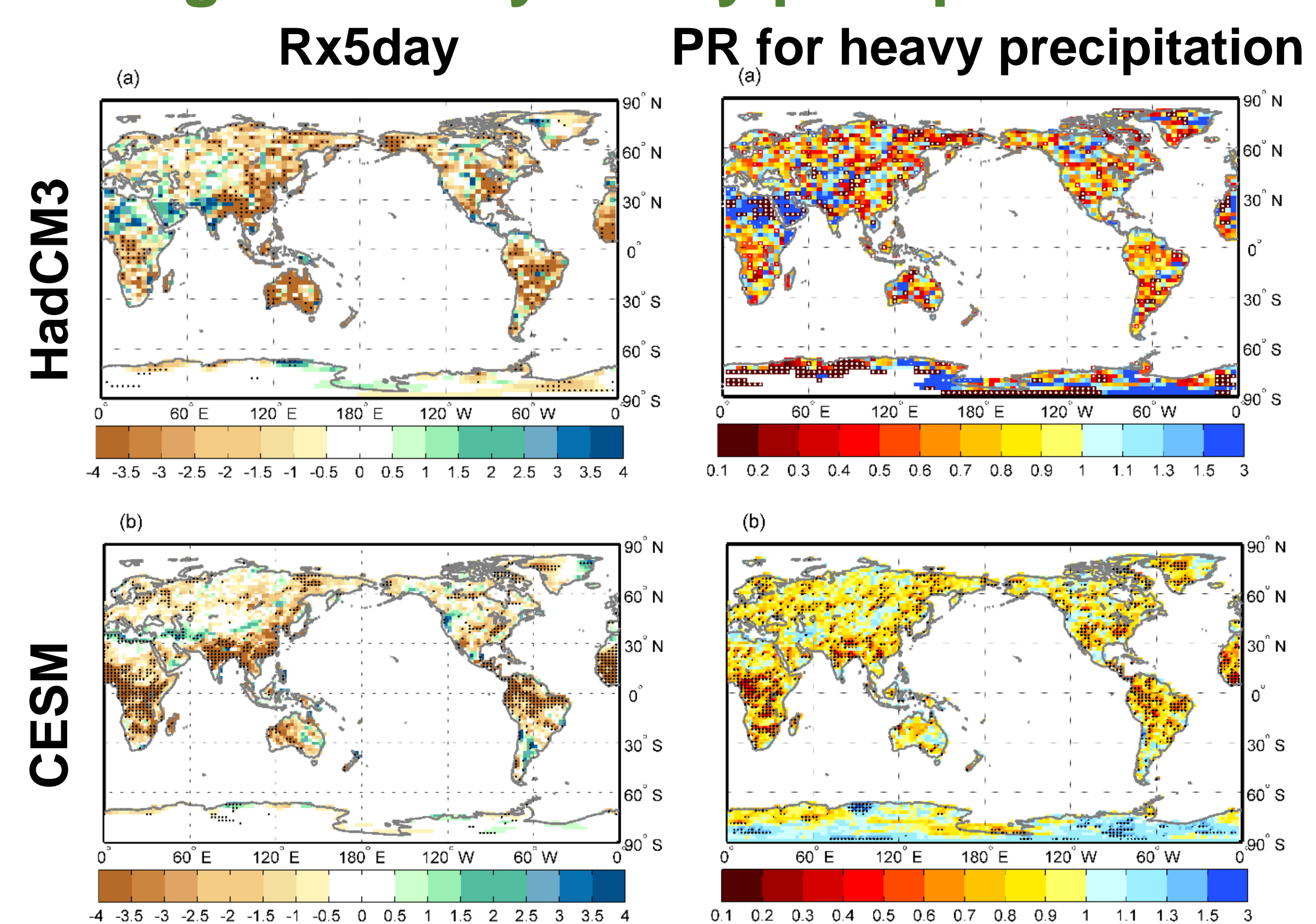
- we mainly examine the responses of climate extremes and related changes in mean climate in the peak forcing years relative to the periods without volcanic forcing.
- To investigate changes in the intensity and frequency of climate extremes during the years of peak volcanic forcing, six indices were used in this study. **In terms of the intensity** of extreme climate, the annual warmest day (TXx) and coldest night (TNn), as well as the maximum 5-day consecutive precipitation amount (Rx5day), are examined. **In terms of frequency**, the probability ratio (PR) is defined as $P1/P0$, where $P0$ is the probability of exceeding the threshold during no volcanic forcing years and $P1$ is the probability of exceeding the same threshold during peak forcing years.

Results

Changes in daily cold/hot extremes



Changes in daily heavy precipitation extremes



Conclusion

- The occurrences of daily hot extremes and daily heavy precipitation extremes decrease over most parts of the world in the peak forcing years of SVEs.
- A cold extreme event expected once every 3 years under non-volcanic conditions can be expected every 1.5 years on average in the peak forcing years.
- The probability and intensity of daily heavy precipitation extremes both decrease over most monsoon areas.

Wang et al., 2021: Influence of strong tropical volcanic eruptions on daily temperature and precipitation extremes. *Journal of Meteorological Research*, 35, 469–484.