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Decadal signal of temperature to hiatus over the Tibetan Plateau

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Outline

1. Background

2. Scientific issues

3. Results and conclusions

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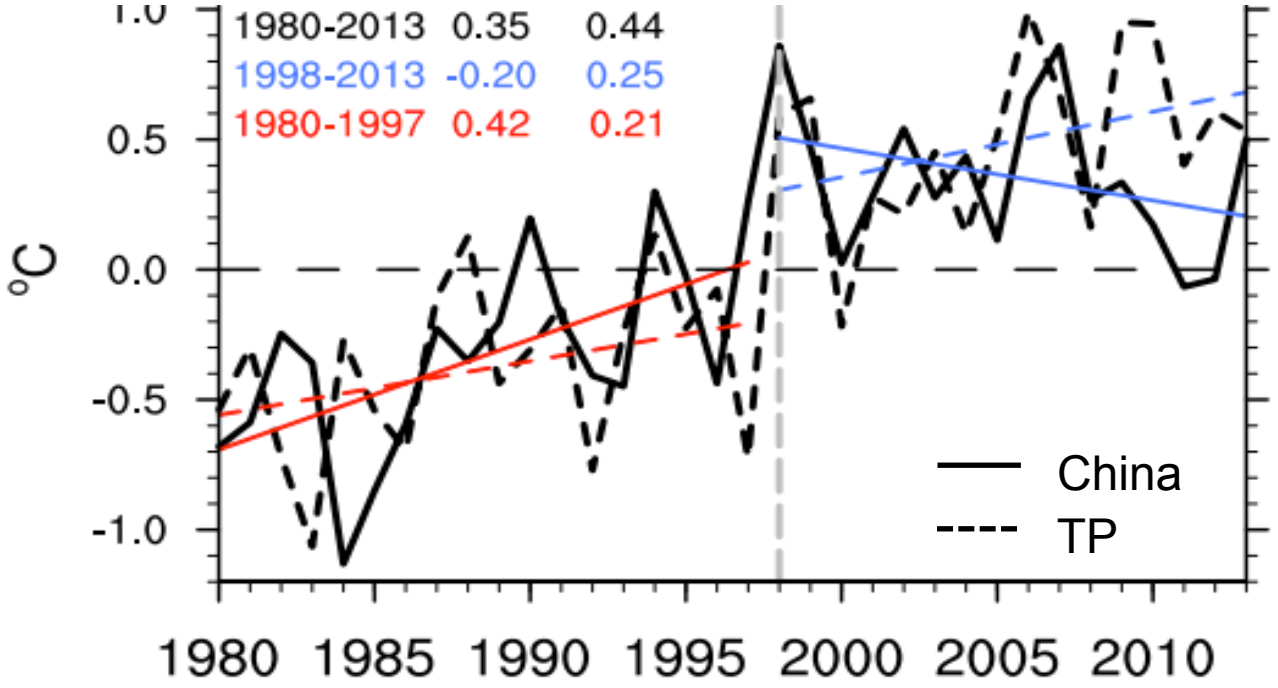
Background



Annual mean temperature in China and TP

- The rapid climate warming persisted over the TP during 1998-2013, which is different from warming in the rest of East Asia.
- The continuous warming over the TP affected the atmospheric circulation and Asian monsoon in China, East Asia and even the world.

(Bolch *et al.*, 2012, *Science*; Duan *et al.*, 2015, *Sci. Rep.*)

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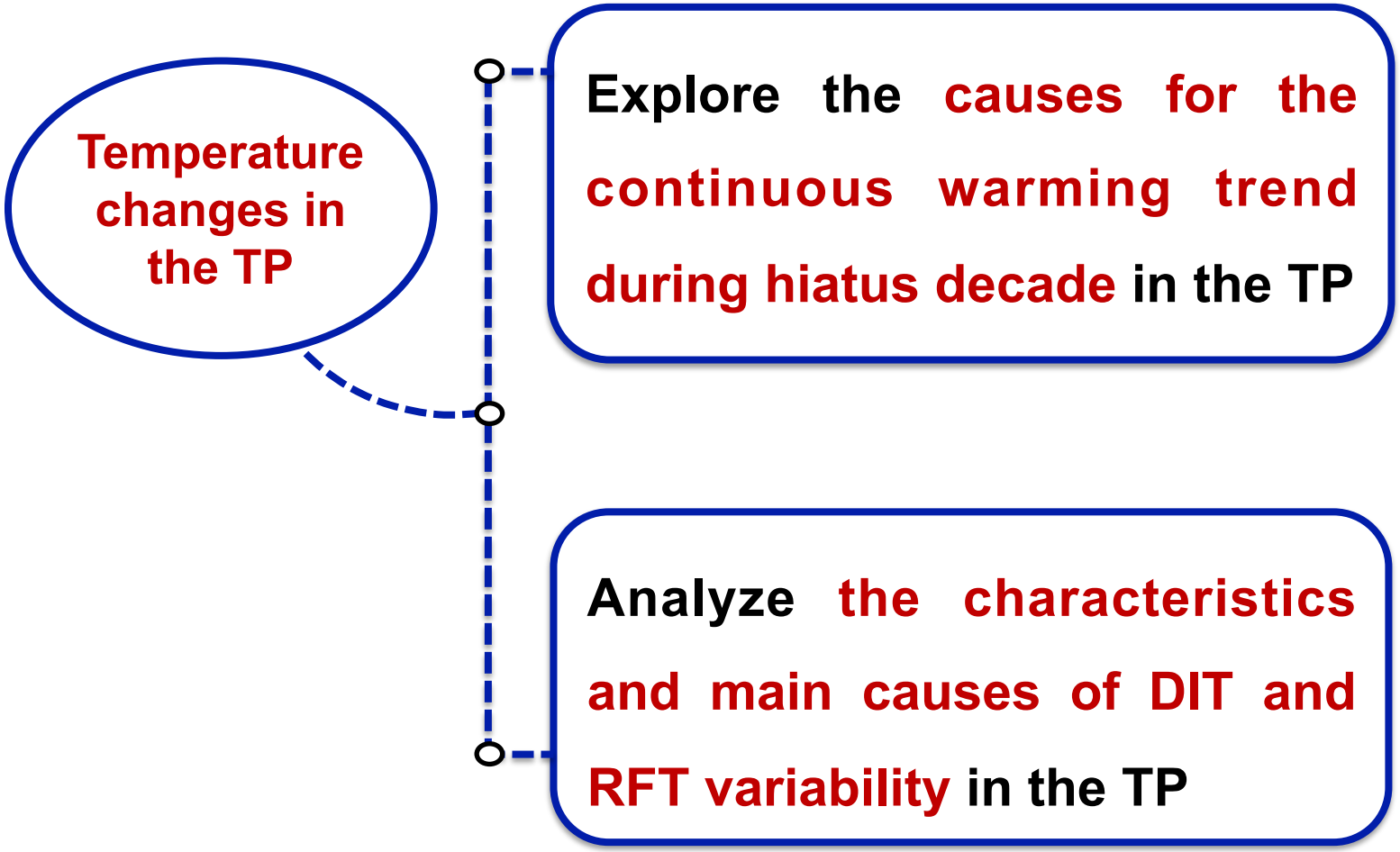
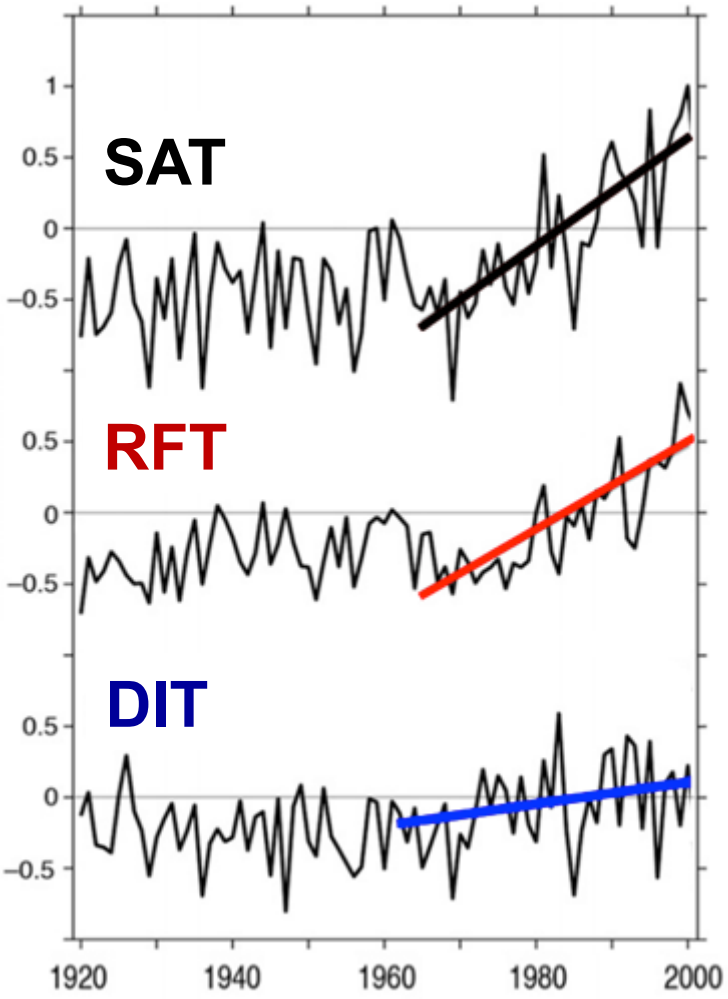
Scientific issues

- Temperature is one of the worthy indicator of climate variability



Method

- **Dynamical adjustment methodology**



SAT=RFT+DIT

RFT: radiatively-forced temperature, associated with the build-up of GHGs, O3, volcanic eruptions, aerosol emissions, anthropogenic forcing.

DIT: dynamically induced temperature, associated with changes in atmospheric circulation patterns.

Wallace *et al*., 2012, *Proc. Natl. Acad. Sci.*

Guan *et al*., 2015, *Sci. Rep.*

Guo, **Guan*** *et al*., 2017, *Int. J. Climatol.*

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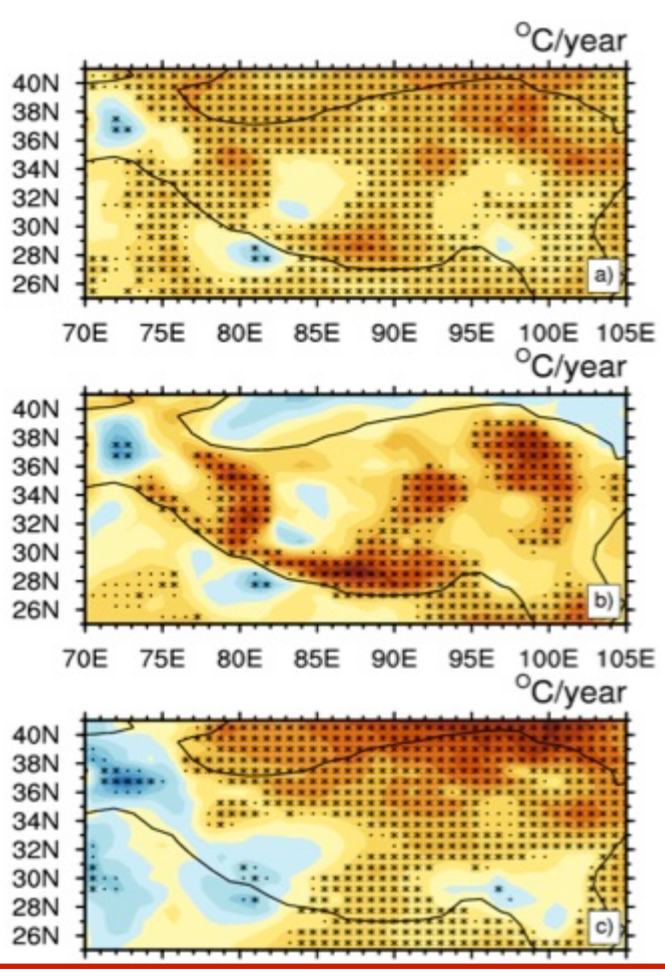
Results

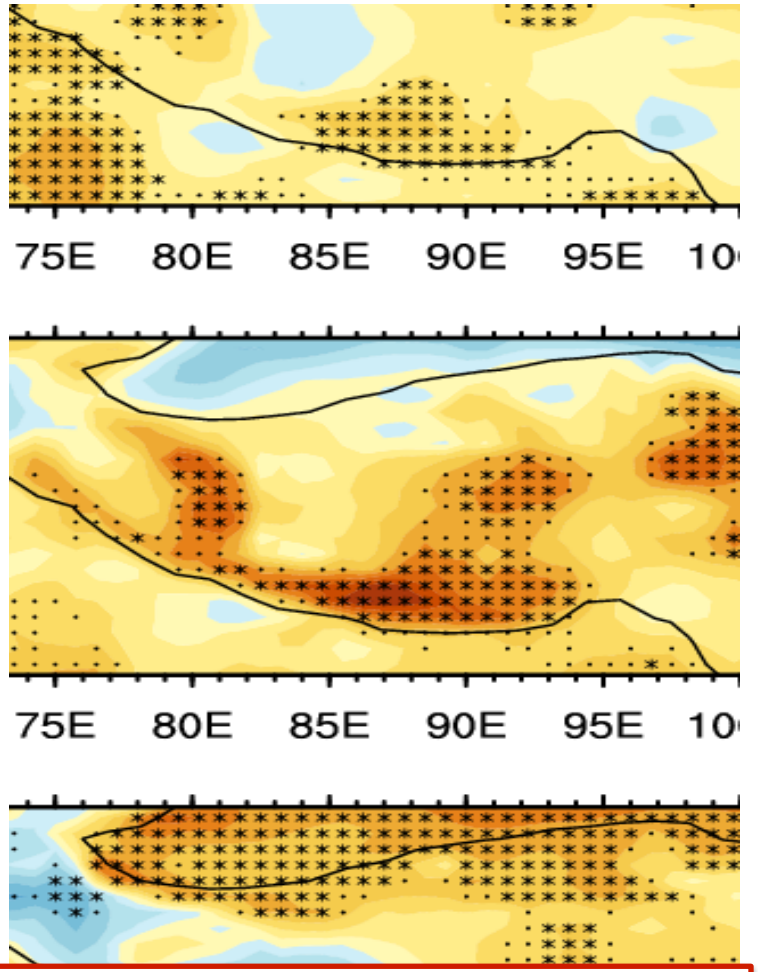
- **Trends of temperature changes during 1980-2012 and hiatus period**



Annual

Winter

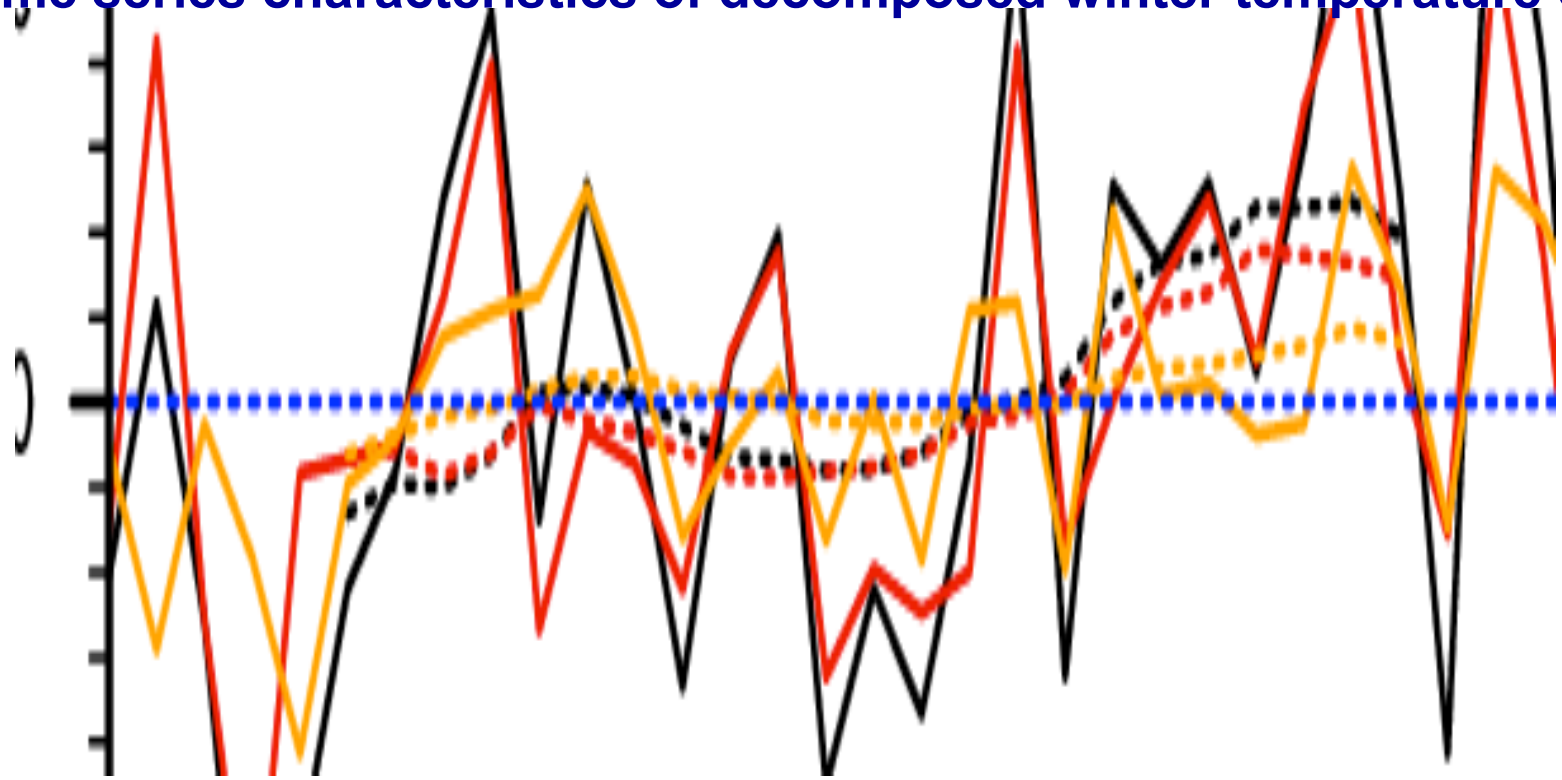
Summer



SAT increased in most areas in TP during 1980-2012, particularly in the hiatus decade, and the warming was obvious in winter.

Results

- **Time series characteristics of decomposed winter temperature of TP**



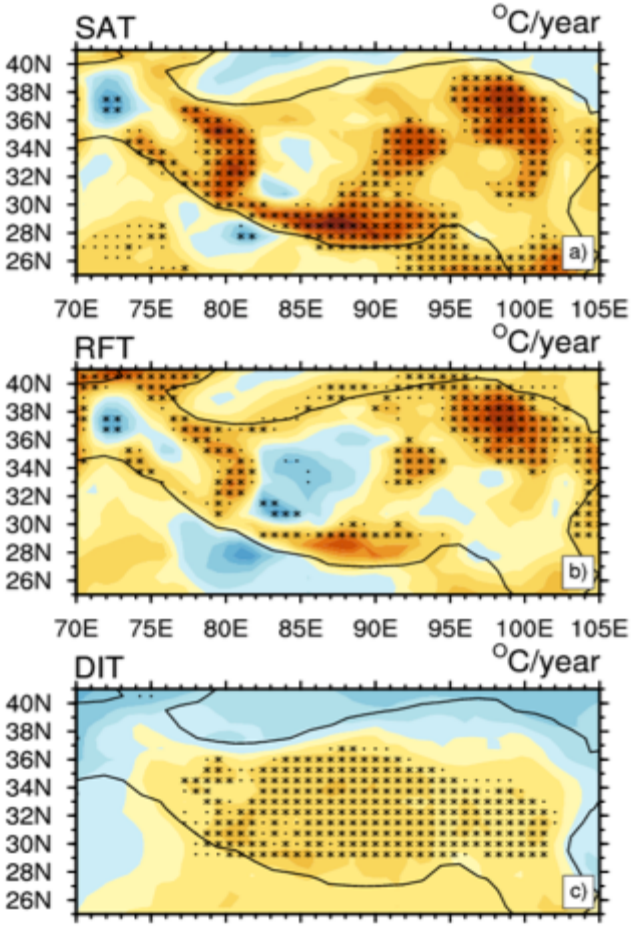
Time series of decomposed winter temperature of the TP. Black lines for SAT; red lines for RFT; and orange lines for DIT

Compared with the previous decade, the warming rate seemed stronger during hiatus decade, and the variability of RFT are similar to that of SAT.

Ma, **Guan** *et al.*, 2017, *Sci. Rep.*

Results

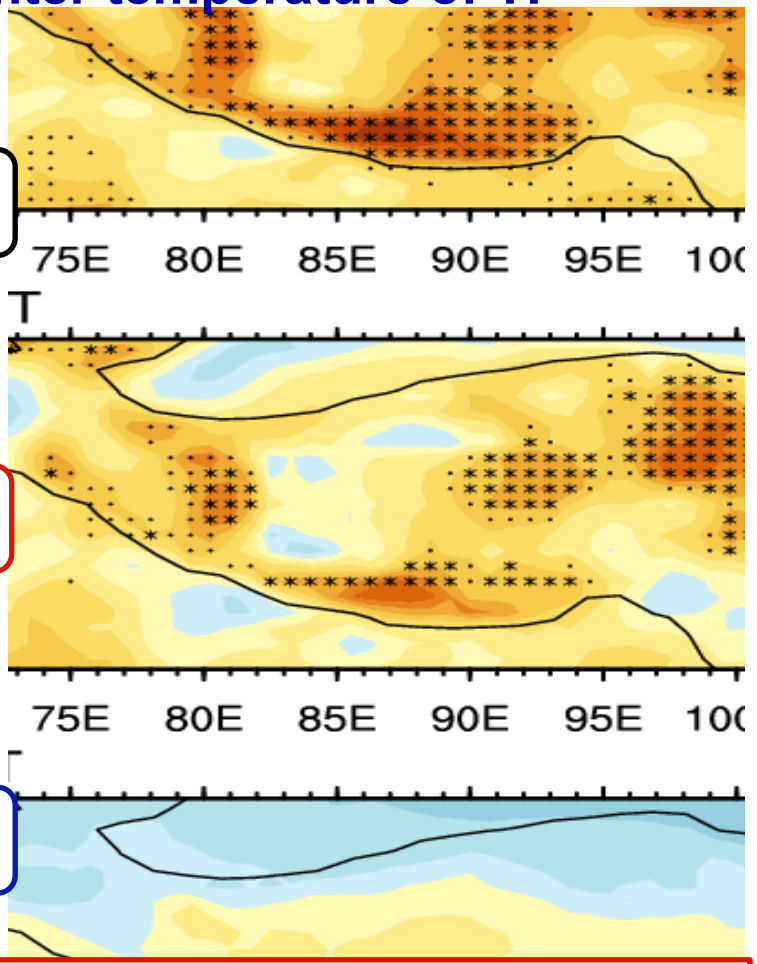
- **Spatial difference of decomposed winter temperature of TP**



SAT

RFT

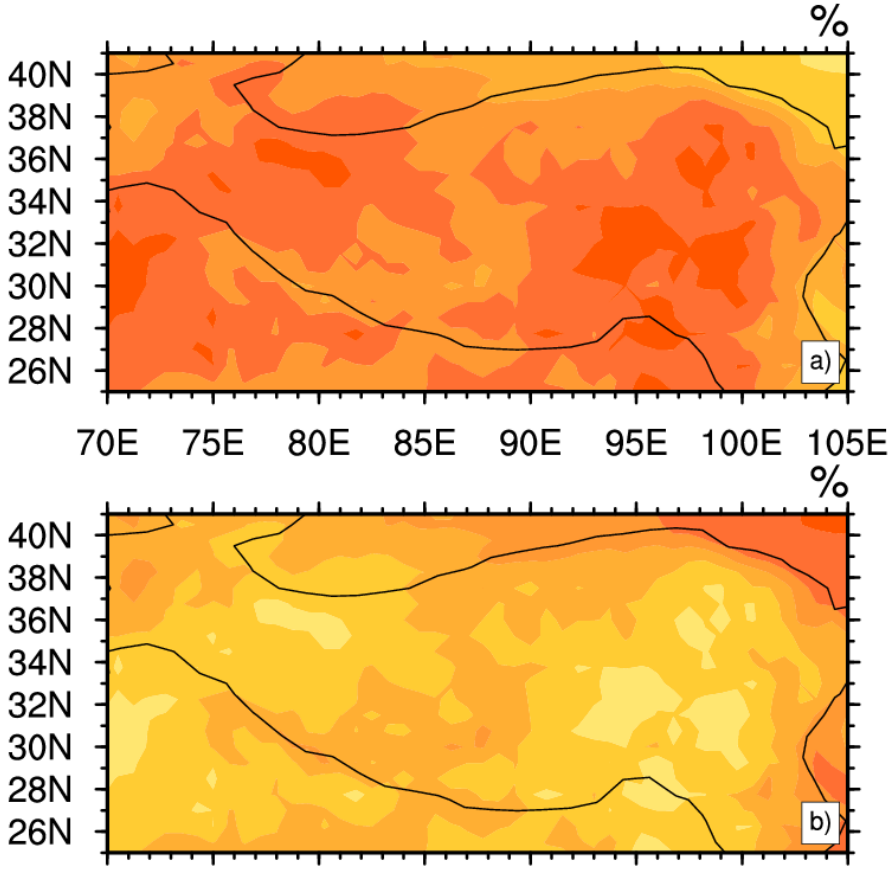
DIT



RFT had a similar spatial pattern as SAT. DIT showed a slightly warming trend almost in the whole TP.

Results

- **Relative contributions of decomposed winter temperature of TP**



Contributions of RFT to SAT: 60.9%

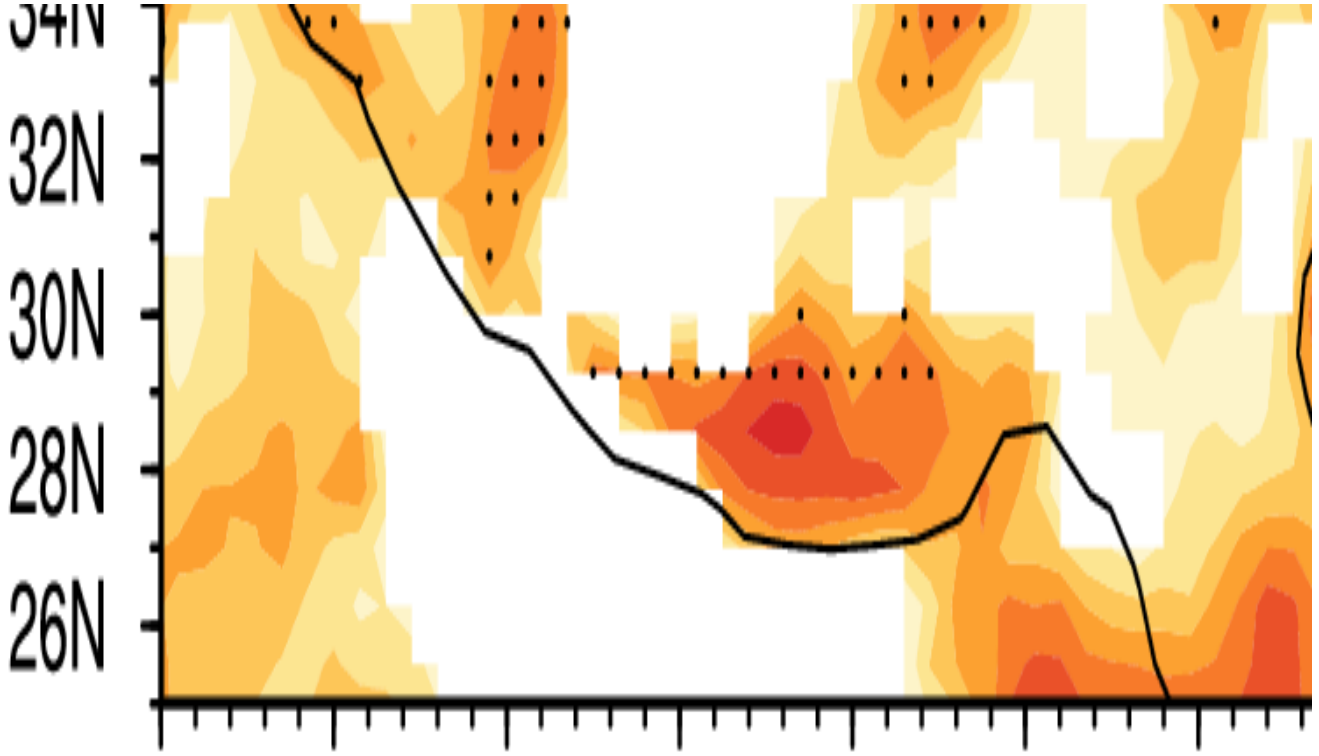
Contributions of DIT to SAT: 39.1%

SAT was mostly determined by RFT, and the dominant RFT had a warming effect on SAT in the TP.

Ma, **Guan** *et al.*, 2017, *Sci. Rep.*

Results

- **The relation between radiative factors and RFT**



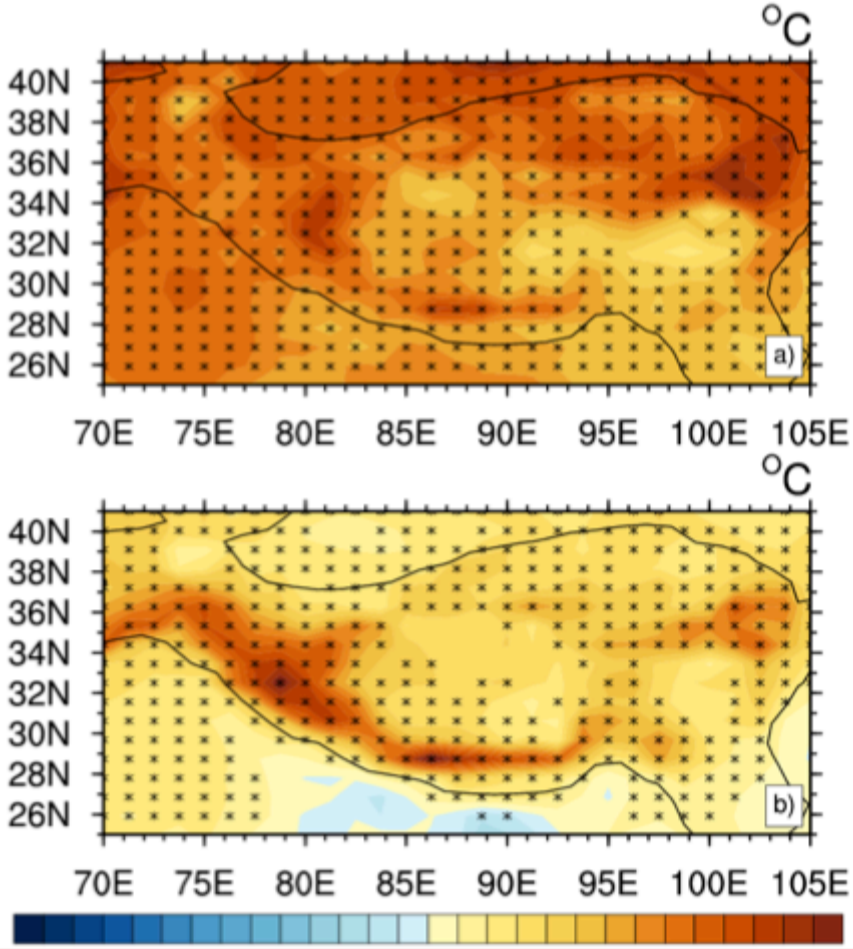
Correlation coefficients between RFT and CO2 in winter

CO_2 as one of the important greenhouse gases, the increased CO_2 emission had a major contribution to the RFT over the TP.

Ma, **Guan** *et al.*, 2017, *Sci. Rep.*

Results

- **The relation between radiative factors and RFT**



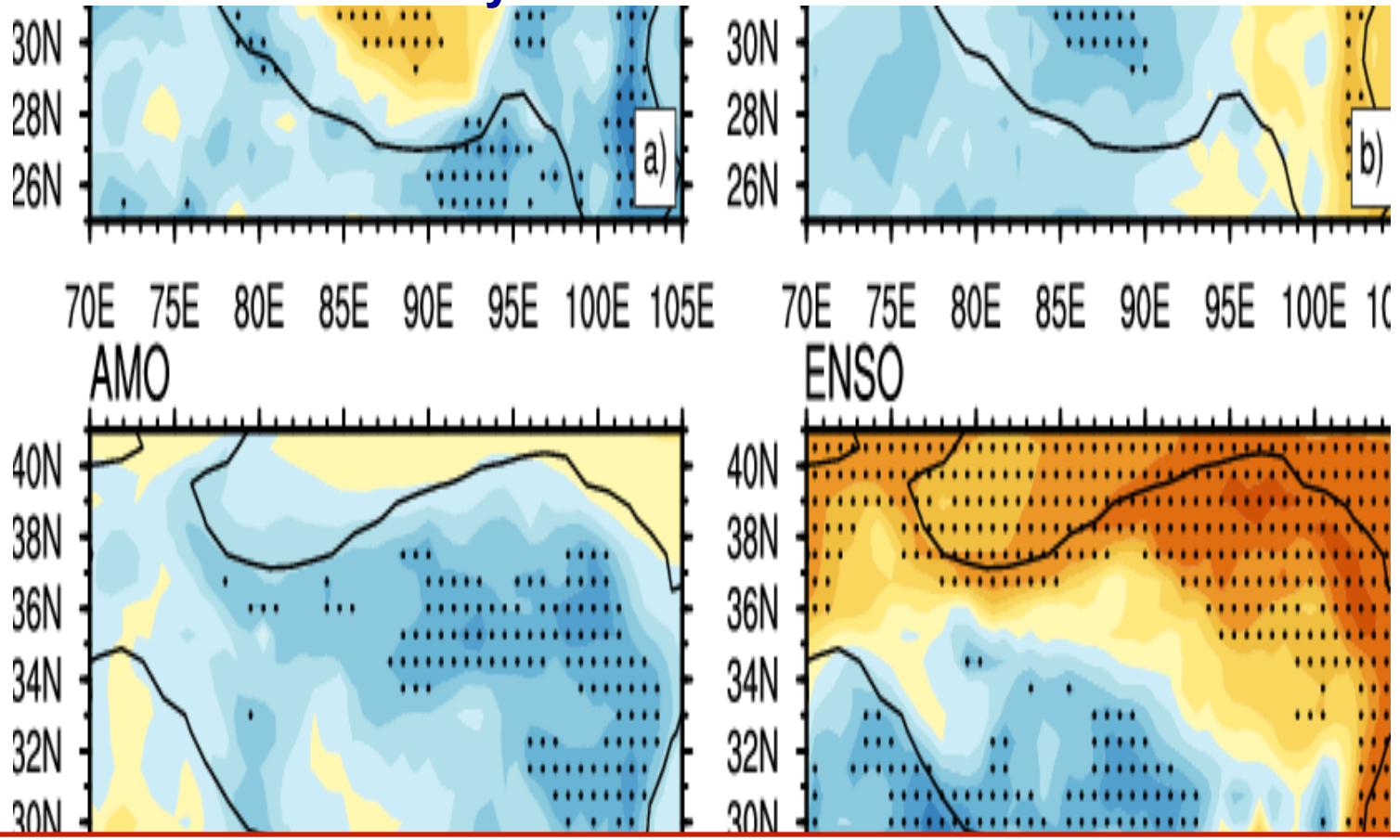
Temperature difference due to CO2 forcing

Temperature difference due to BC forcing

CO_2 dominated the RFT warming over the TP; BC emission amplified the warming at the high elevation.

Results

- **The relation between dynamic factors and DIT**



NAO, PDO, AMO, and ENSO had relatively uniform warming effects on DIT in the whole TP.

Ma, **Guan** *et al.*, 2017, *Sci. Rep.*

Conclusions

1. The surface air temperature increased in most areas over the TP during the period of 1980-2012, particularly in the hiatus decade compared to the previous decade.

2. The continuous warming in the TP was a result of uniform DIT warming over a large scale and enhanced RFT warming at a regional scale. RFT effect in the TP warming played a dominant role.

3. NAO, PDO, AMO, and ENSO had close relationship with DIT and had relatively uniform warming effects on DIT in the whole TP.

4. An obvious warming in the TP was induced by the CO2 warming effect, and BC exhibited an amplifying effect on the warming at high elevation


Thank you


Thank you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