

# Diurnal temperature range trend over rural and urban regions of the world and its human induced effects on climate

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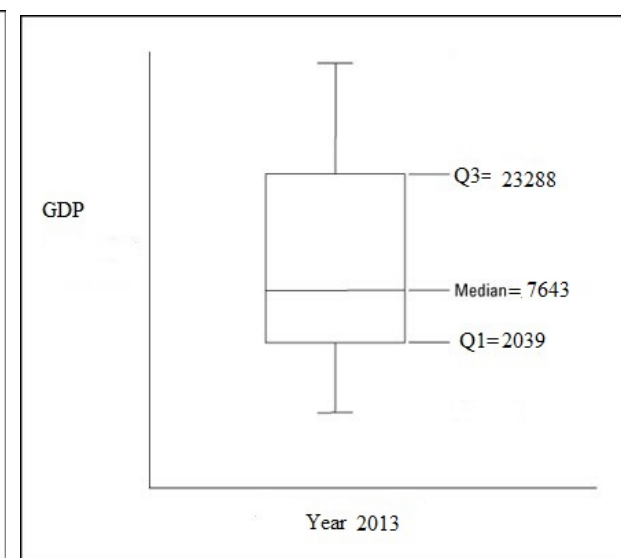
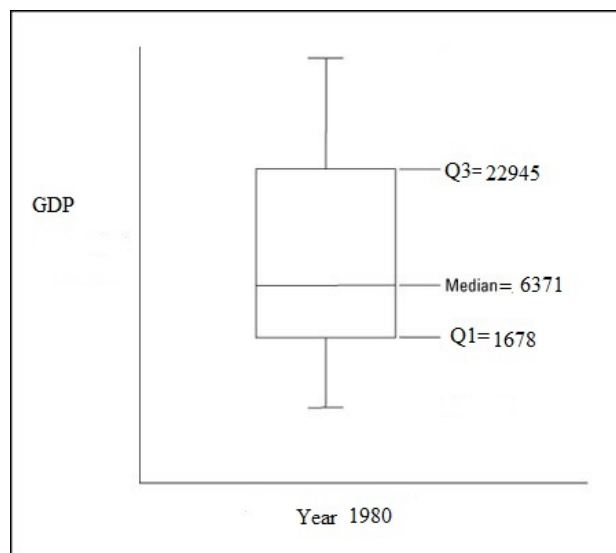
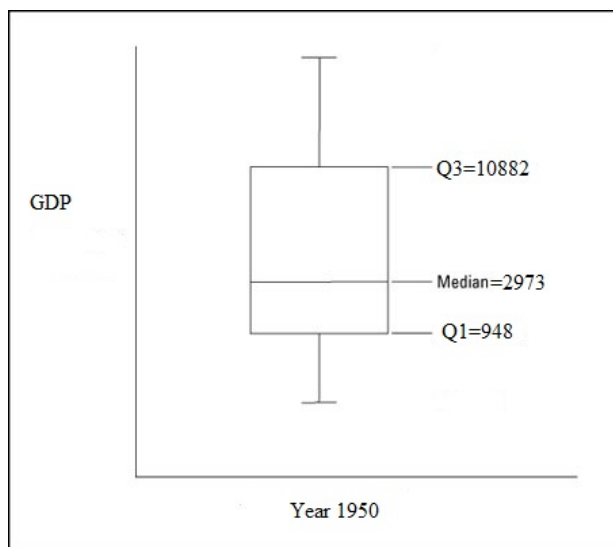
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# INTRODUCTION

- DTR (Diurnal Temperature Range)= $T_{\text{max}}-T_{\text{min}}$ .
- DTR, An important parameter in terms of assessing the long term climate change of surface temperature.
- Both  $T_{\text{max}}$  and  $T_{\text{min}}$  is being increased due to global warming.
- The global mean surface air temperature has risen about  $0.5^{\circ}\text{C}$  during the 20th century.
- Minimum temperature increasing at a faster rate or decreasing at a slower rate than the daily maximum, resulting in a decrease in the DTR for many parts of the world.

# Data and Methodology

- Climate Research Unit (CRU) Gridded data monthly for Tmax, Tmin, DTR
- Period from year 1950-2013
- Long term spatial trend analysis with statistically significant areas using Man Kendal Test
- Gridded Global GDP yearly data during 1950-2013
- Different economic regions over the globe have been classified on the basis of gridded GDP Per capita data during the long term period.
- Grids were divided into rural (Poor), Urban (Rich) and Transition regions (Rural to urban).
- We used the quartiles obtained from whisker and box plot and thus classifying the global grid in terms of rich (Urban), poor (Rural) and transition areas (Rural to Urban).



From Whisker and box plot

1950 >>>>> Quartile 1, Q1=948

Q3=10882

Median=2973

1980 >>>>> Quartile 1, Q1=1678

Q3=22945

Median=6371

2013 >>>>>>> Quartile 1, Q1=2039

Q3=23288

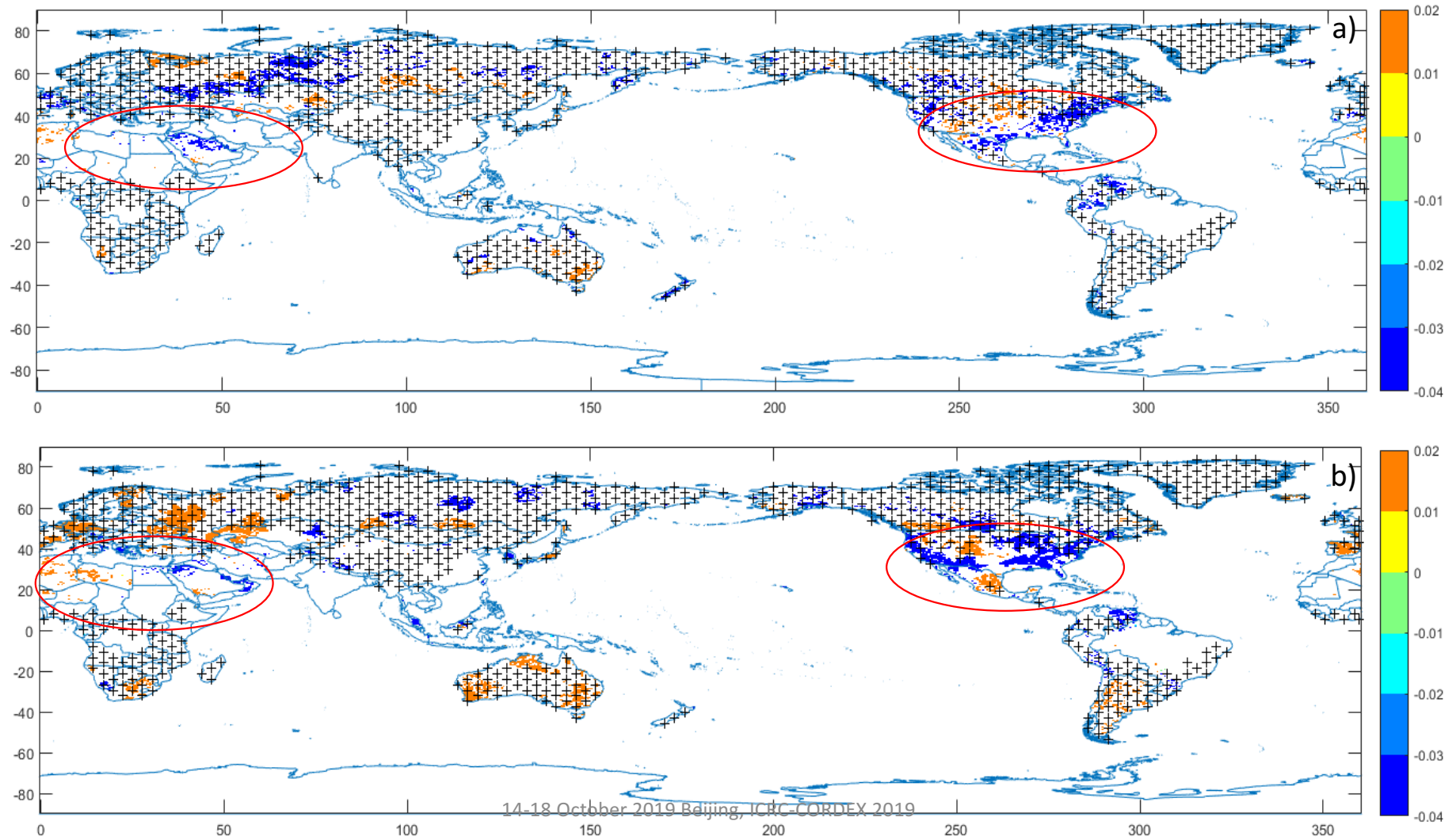
Median=7643

- Now new classification is Q1: lower 25%, Q2, median, Q3 higher 25%
- Type 1 (rich type): 1950 higher than Q3 (not Q1), 1980 higher than Q3
- Type 2 (transition type): 1950 lower than Q1, and 1980 between Q1 and Q3, 1980 higher than Q3, 1950 between Q1 to Q3
- Type 3: (poor type): 1950 lower than Q1, 1980 lower than Q1

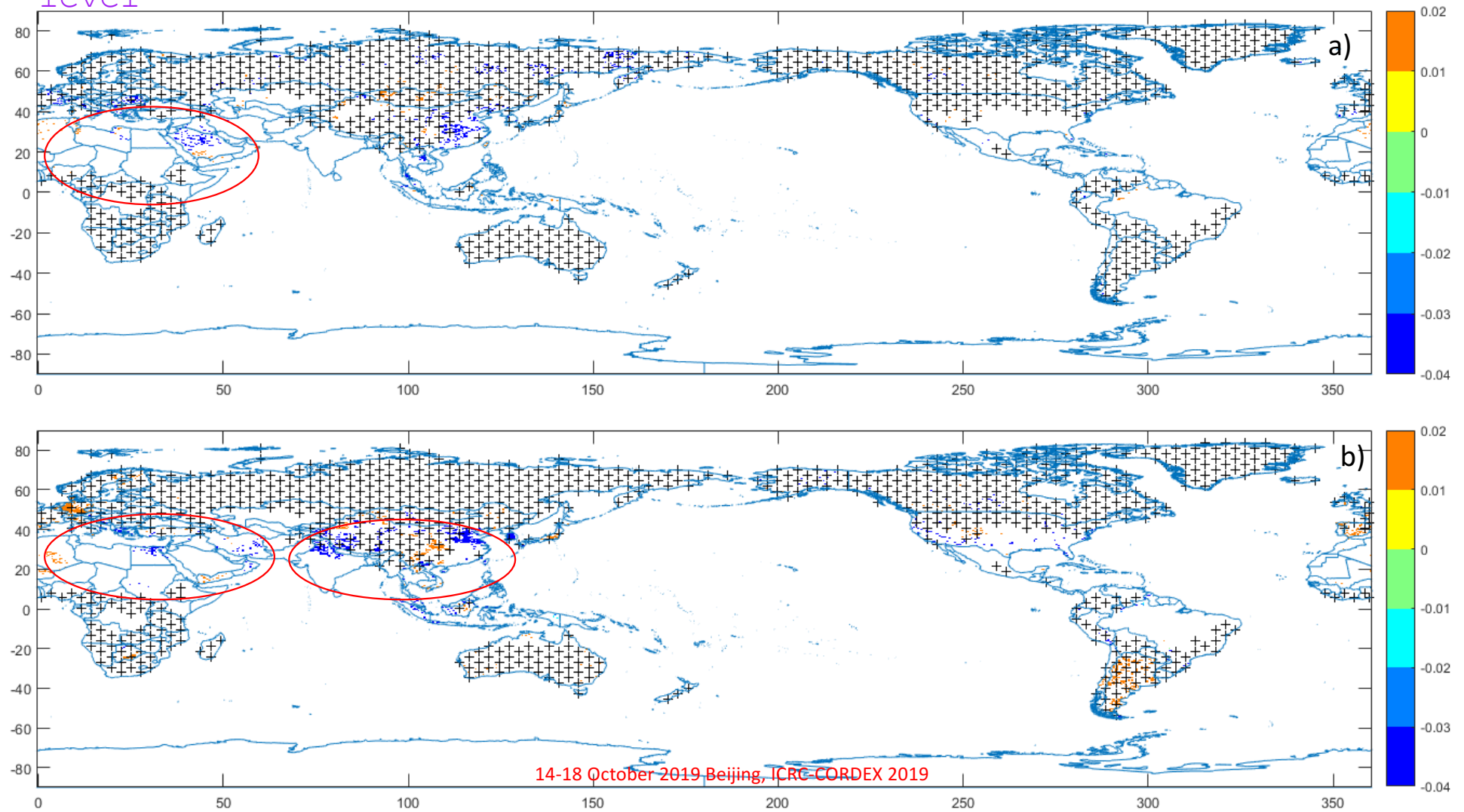
# Summer

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DTR Trend from a) 1950-1980 b) 1980-2013 during Summer Jun-Aug over Type 1 Rich, Over region in which  $T_{max} > 30$ : 90 % significance level

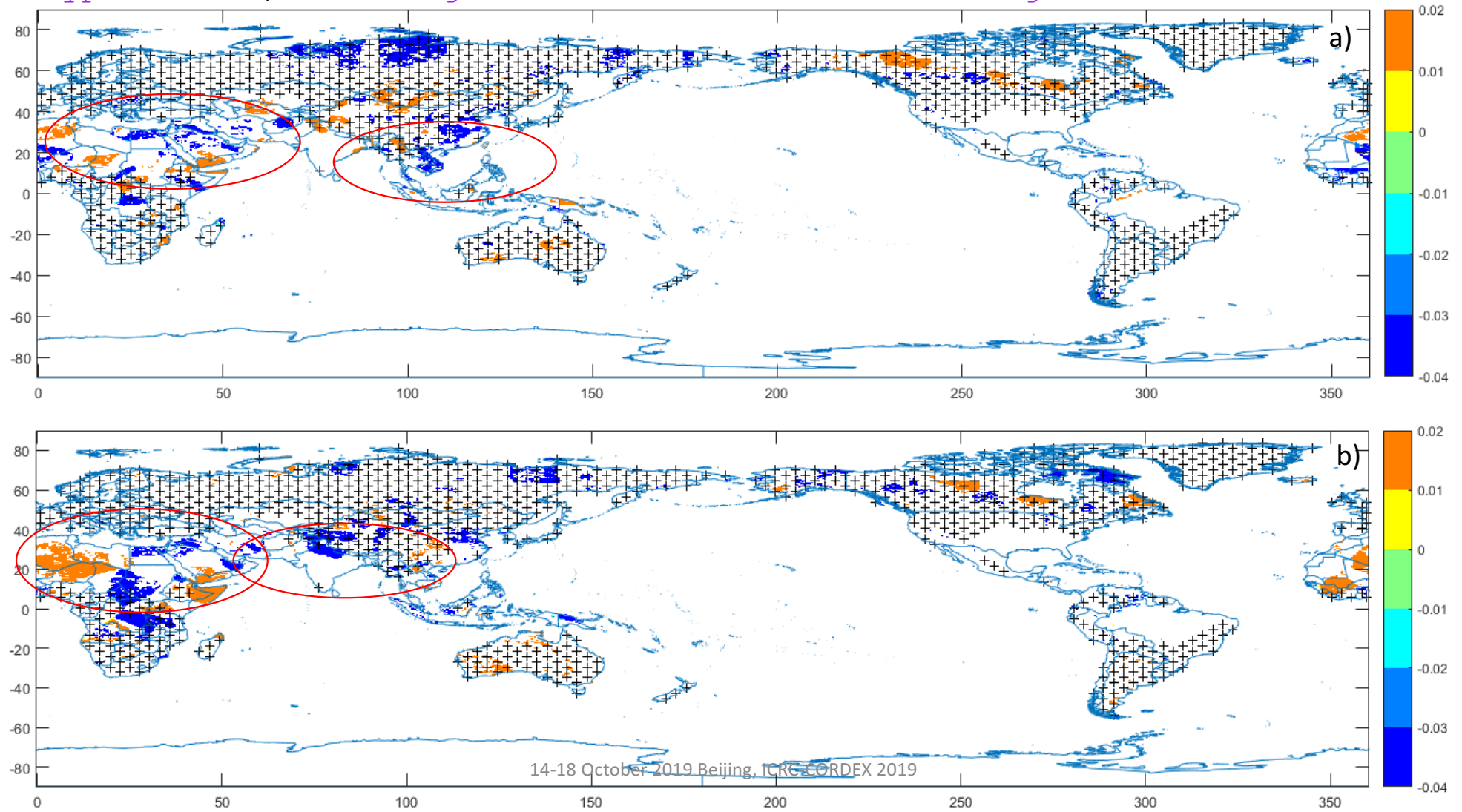


DTR Trend from a) 1950-1980 b) 1980-2013 during Summer Jun-Aug over Type 2 Transition, Over region in which Tmax>30:90 % significance level





DTR Trend from a) 1950-1980 b) 1980-2013 during Summer Jun-Aug over Type 3 Poor, Over region in which  $T_{max} > 30:90$  % significance level

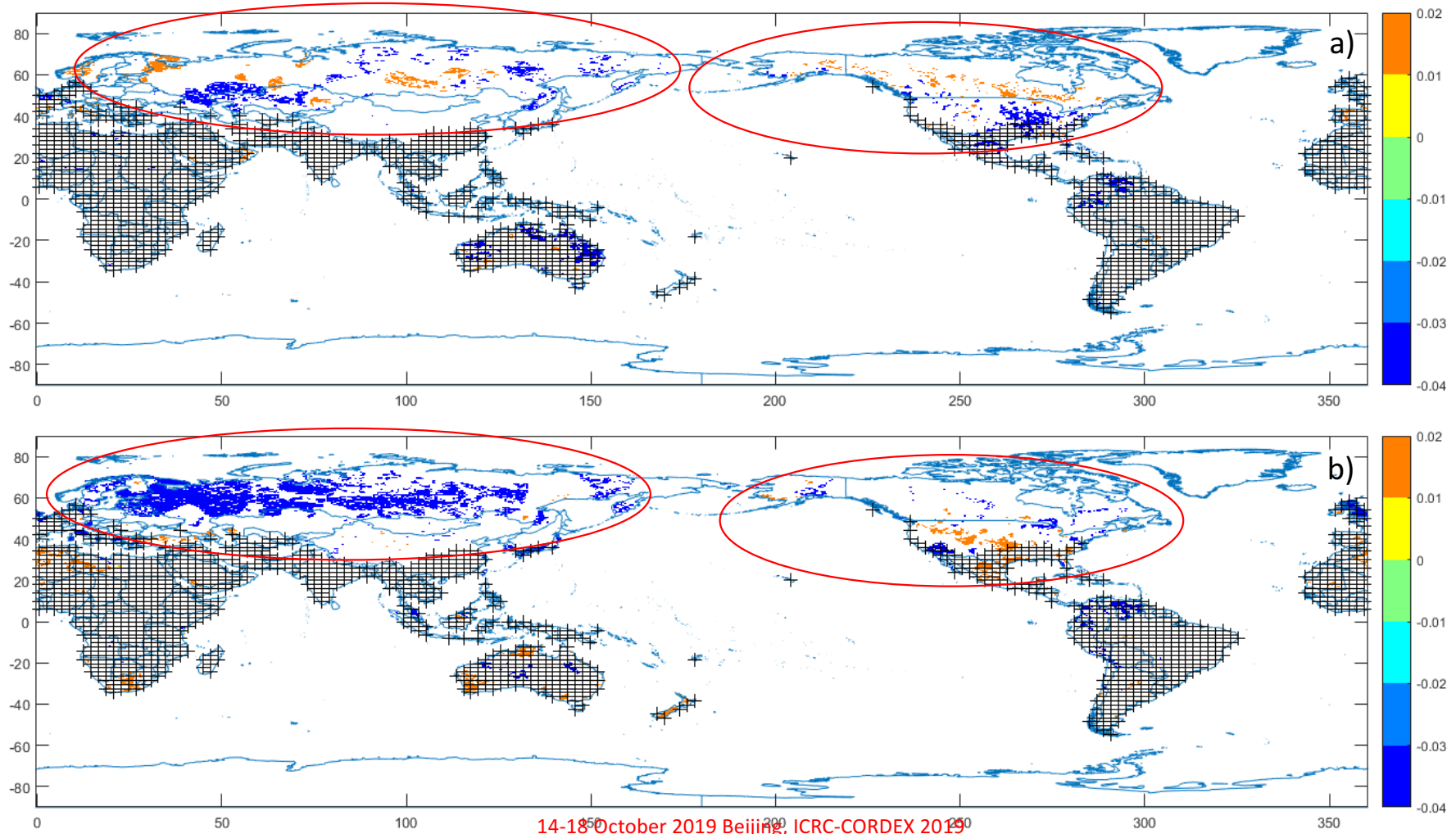




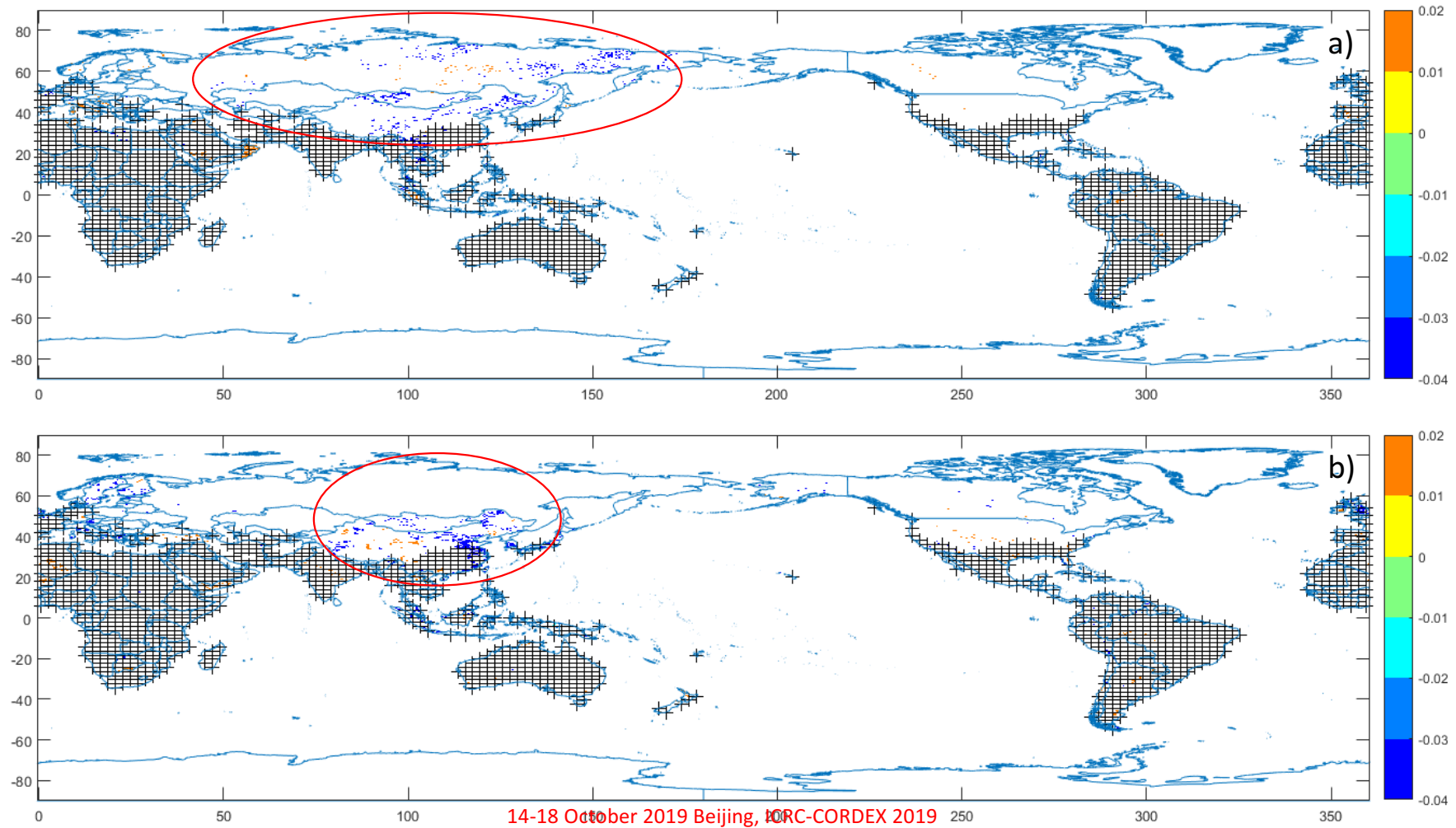
# Winter

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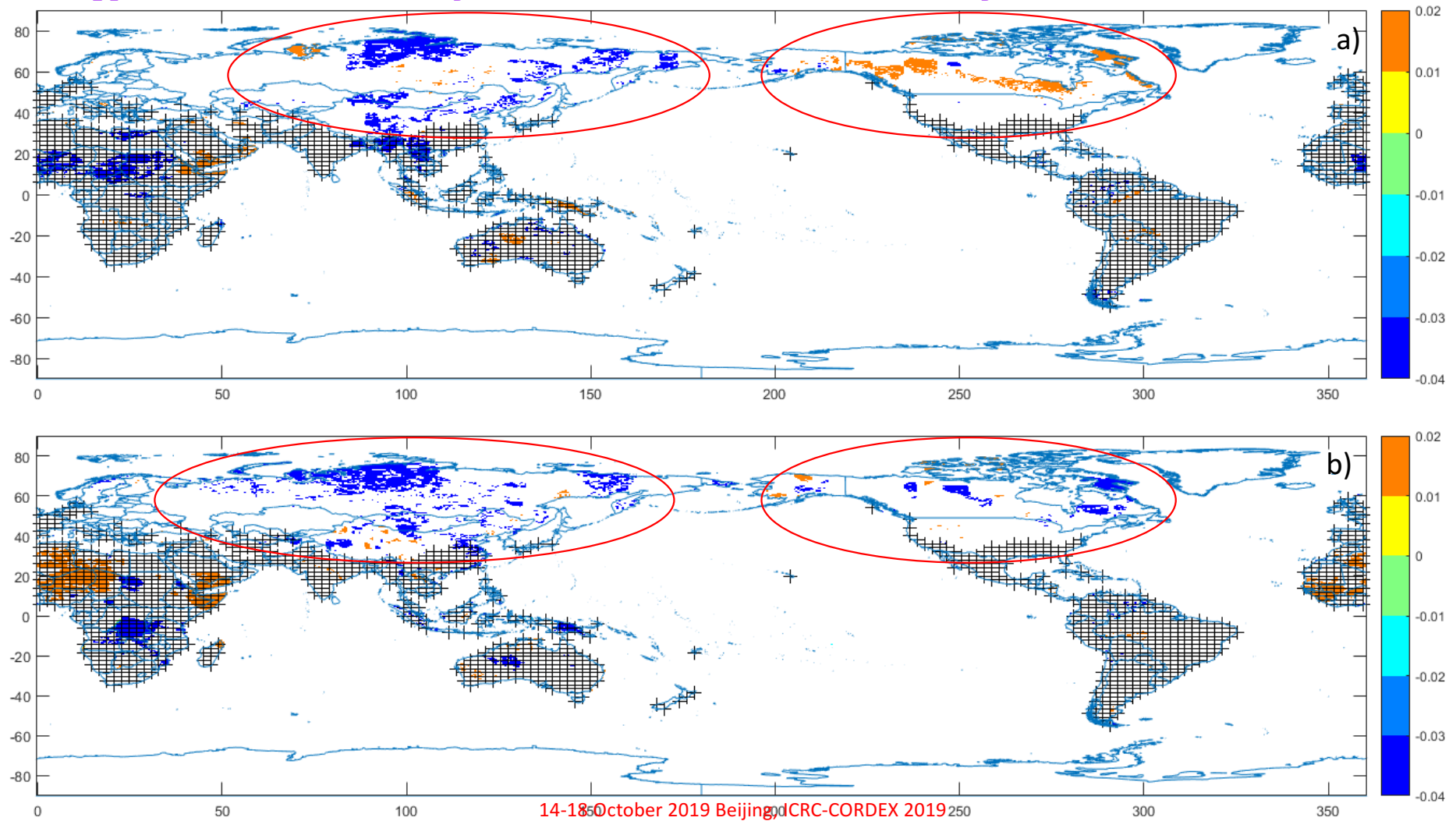
DTR Trend from a) 1950-1980 b) 1980-2013 during Winter Dec-Jan over Type 1 Rich, Over region in which  $T_{min} < 0$ : 90 % significance level

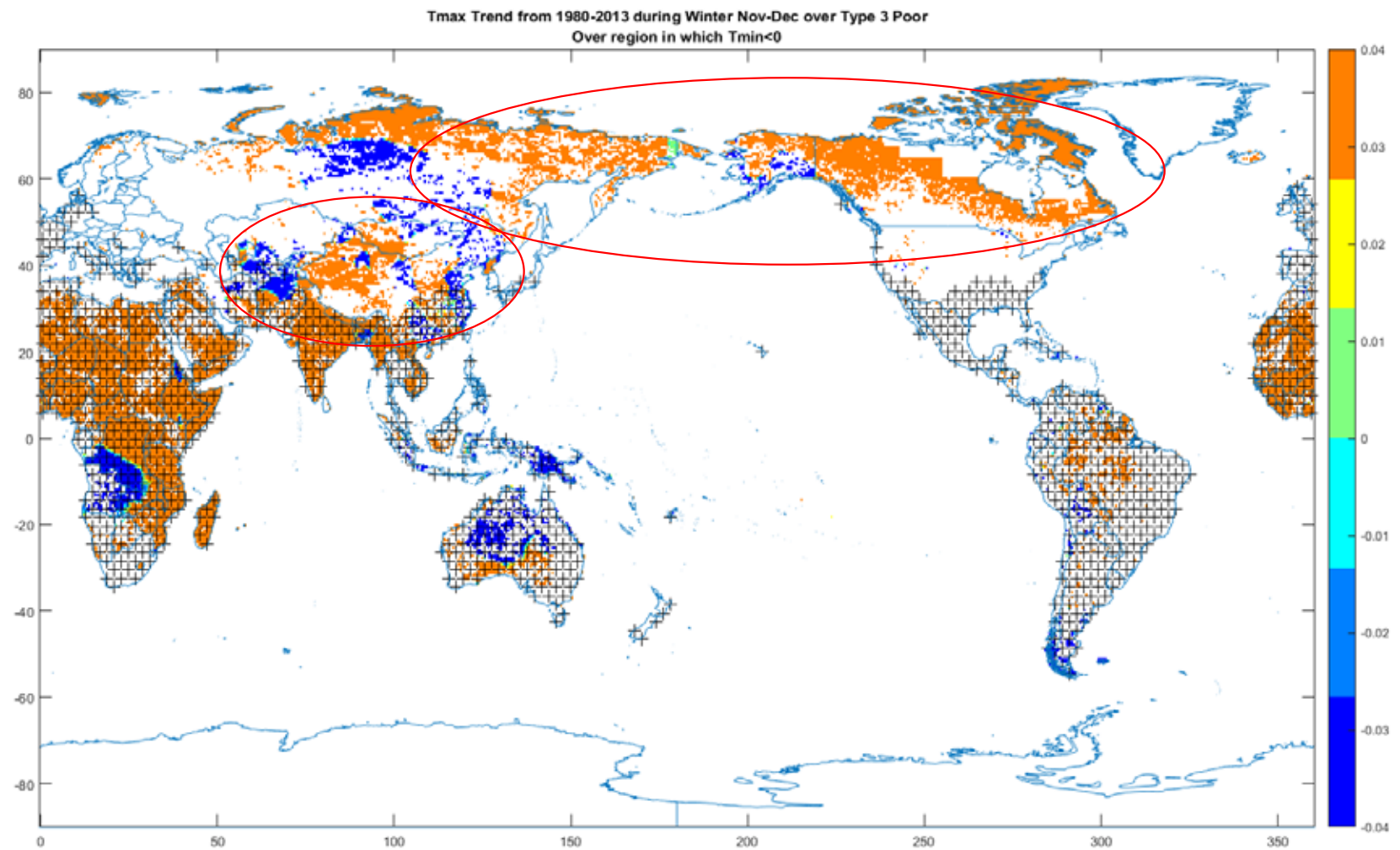


DTR Trend from a) 1950-1980 b) 1980-2013 during Winter Dec-Jan over Type 2 Transition, Over region in which  $T_{min} < 0$ : 90 % significance level



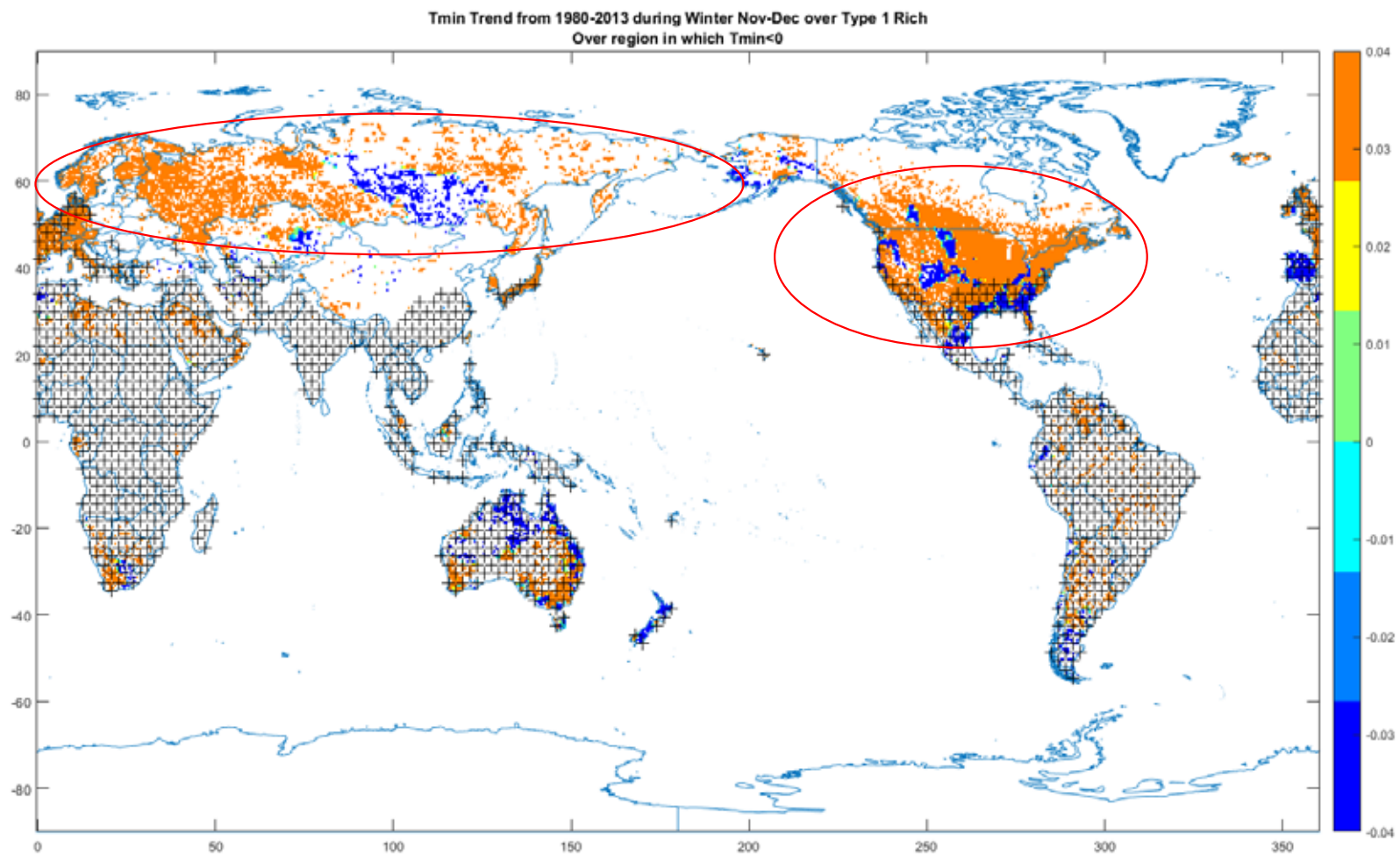
DTR Trend from a) 1950-1980 b) 1980-2013 during Winter Dec-Jan over Type 3 Poor, Over region in which  $T_{min} < 0$ : 90 % significance level





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# Summary

- During summer period, the Type 1 Rich, Type 2 transition region and Type 3 poor grids exhibit decreasing trend for DTR over gulf, Indian region and south China region over the areas where  $T_{max} > 30$  degree due to the human induced cooling during the hottest summer period using air coolers.
- During winter period rich grids exhibit decreasing trend for DTR over the cool regions due to the urban heat effect and anthropogenic heating and transition regions show an increasing trend for DTR.
- Poor (rural) grids show a decreasing trend for DTR and in Canada region during first half it is showing increasing trend.
- The rate of the  $T_{min}$  trend increasing is more rapid compared to the  $T_{max}$  trend so that ultimately DTR is decreasing as a whole and the increasing of  $T_{min}$  can be attributed to global warming as well as the human induced heating which affects the minimum temperature to increase.



THANK YOU FOR YOUR TIME