

EGU2020-4065

<https://doi.org/10.5194/egusphere-egu2020-4065>

EGU General Assembly 2020

© Author(s) 2020. This work is distributed under the Creative Commons Attribution 4.0 License.



## Assessment of the Running Slope Difference (RSD) t-Test, a new statistical method for detecting climate trend turning

Bin Zuo<sup>1</sup>, Zhaolu Hou<sup>1</sup>, Fei Zheng<sup>2</sup>, Lifang Sheng<sup>1</sup>, Yang Gao<sup>3,4</sup>, and Jianping Li<sup>1,4</sup>

<sup>1</sup>Key Laboratory of Physical Oceanography/Institute for Advanced Ocean Studies/Frontiers Science Center for Deep Ocean Multispheres and Earth System (DOMES), Ocean University of China, Qingdao 266100, China.

<sup>2</sup>State Key Laboratory of Numerical Modeling for Atmospheric Sciences and Geophysical Fluid Dynamics, Institute of Atmospheric Physics, Chinese Academy of Sciences, Beijing 100029, China

<sup>3</sup>Key Laboratory of Marine Environment and Ecology, Ministry of Education/Institute for Advanced Ocean Study, Ocean University of China, Qingdao 266100, China

<sup>4</sup>Laboratory for Ocean Dynamics and Climate, Pilot Qingdao National Laboratory for Marine Science and Technology, Qingdao 266237, China.

Global mean surface air temperature (GMT) rose roughly 0.85 °C from 1880 to 2012 (IPCC 2013), attributing mainly to an increase in atmospheric greenhouse gases. For different decadal timescale periods in the past 100 years, the warming rate of different periods may significantly differ. For example, IPCC AR1 (1990) point out that GMT between 1910-1940 and 1975-1990 are significantly warming, meanwhile GMT stay nearly constant between 1940 and early 1970. The phenomenon of two nearby periods showing significantly different trends is known as trend turning, this phenomenon is common in climate time series and crucial when climate change is investigated. However, the available detection methods for climate trend turnings are relatively few, especially for the methods which have the ability of detecting multiple trend turnings. We propose a new methodology named as the running slope difference (RSD) t-test to detect multiple trend turnings. This method employs a t-distributed statistic of slope difference to test the sub-series trends difference of the time series, thereby identify the turning-points. We compare the RSD t-test method with some other existing trend turning detection methods with an idealized time series case and several climate time series cases. And we also report the Monte Carlo simulation used to evaluate this method's detection ability. Results show that the RSD t-test method is an effective tool for detecting trend turning in time series, and this method has three major advantages: ability to detect multiple turning-points, capacity to detect all three types of trend turning, and great performance of avoiding false alarm.