THE UNIVERSITY OF CHICAGO

Department of Statistics
MASTER'S THESIS PRESENTATION

ADAM SUN

Department of Statistics
The University of Chicago

Constructing and Examining Simultaneous Confidence Bands Measuring Their Performance through Simulation Studies and Using Them to Deliver New Insights on Global Temperature Trends

WEDNESDAY, MAY 13, 2020, at 2:30 PM
ZOOM Meeting, 5747 S. Ellis Avenue

ABSTRACT

In this paper, I analyze the empirical coverage rates of stochastic confidence bands (SCBs) for data which come from models with a range of error structures. Previous research has demonstrated that these SCBs are asymptotically accurate for data coming from models with stationary errors processes. We verify this assertion through a simulation study and further conclude that SCBs are superior to "SCBs" generated with point-wise confidence intervals derived from the least squares regression sense (using data generated from processes where the underlying trend has a linear form). Furthermore, we verify previous research that - conditional on the bandwidth used for a non-parametric trend estimate (e.g. local linear regression) being relatively small (<0.15 of the series length) - SCBs will generally produce nominally accurate coverage rates for series with non-linear error structures (that are stationary). We then extend this research to demonstrate that performance worsens more quickly as bandwidths increase.

95% coverage SCBs are then constructed for the seasonal Central England temperature series spanning from 1660 to present day. Our findings from analyzing the SCBs of not only yearly temperatures averaged across all seasons but also yearly temperatures for each season separately provide additional insights around the behaviors of global temperatures since 1850. While these results can be broadly pointed to as further evidence of the global warming phenomenon, nuances in the significance of warming trends across different seasons suggests that global warming

temperatures have different impacts depending on which season. The implications of these results are discussed more in-depth in the conclusion, where key areas for further research are also mentioned.