Exploring the Tropospheric Response to Stratospheric Variability Using Lagged Quantile Regression

Kathrin Finke and Abdel Hannachi  
Department of Meteorology, Stockholm University, Stockholm, Sweden

Stratospheric variability has become increasingly popular due to its potential impact on the tropospheric circulation. Extreme states of the stratospheric polar vortex have been associated with reoccurring tropospheric weather patterns more than 2-3 weeks after the initial stratospheric signal. Standard linear regression methods used to assess the statistical stratosphere-troposphere connection estimate the distribution's mean effect of a stratospheric variable as a predictor on a tropospheric response variable. However, supplementary information of the impact of extreme stratospheric behavior is hidden in the tails of the distribution, revealing a different behavior than the mean. Therefore, we use quantile regression, a method that enables us to model the complete conditional distribution of the response variable. This presentation explores various quantiles of the conditional distribution to investigate the impact of stratospheric variability on the tropospheric circulation using the ERA5 reanalysis dataset. Comparison between (lagged) linear and (lagged) quantile regression reveals significant differences making the latter method a neat tool that offers valuable information about the statistical connection between the stratosphere and the troposphere.