

ENSO-induced changes in the Northern winter stratosphere revisited

Masakazu Taguchi^{1*}

¹Aichi University of Education

Using the JRA-25/JCDAS reanalysis and JMA hindcast (HC) data, this study re-examines the ENSO-induced changes in the Northern winter stratosphere.

This study seeks to better understand the observed changes in the time mean states and variability (such as occurrence of stratospheric sudden warmings, or SSWs): it is widely accepted that the polar vortex is weaker and warmer on average for warm ENSO years than for cold years, whereas occurrence of highly disturbed situations of the vortex such as SSWs is more frequent (or as frequent) for cold ENSO years. For this purpose, we utilize the reanalysis and also the HC data. The HC experiments were conducted by the JMA using March, 2011 version of the 1-month ensemble prediction system. The ensemble predictions were made from each of the 10th, 20th, and last day of each month for 1979-2009, with an ensemble size of five.

In the analysis data (real world), we first confirm the existing results that the polar vortex changes in the time mean states and variability with ENSO. Then, we find that the frequent occurrence of disturbed situations for cold ENSO years is mainly contributed by a couple of SSWs (e.g., those in 1984/85 and 2005/06 winters). These SSWs occur with moderate upward propagation and marked poleward propagation of wave activity under the easterly condition of the QBO.

In the HC data, we further show that, when initialized about 10 to 20 days before the SSWs, the data only roughly reproduce such propagation features and underestimate (or miss) the deceleration of the polar night jet. These features of the wave propagation are therefore the key for the HC data to well reproduce the SSWs, and hence the ENSO induced changes in the stratospheric variability as observed.

Keywords: stratosphere, ENSO-induced changes, stratospheric sudden warming, QBO