Geophysical Research Abstracts
Vol. 12, EGU2010-13210, 2010
EGU General Assembly 2010
© Author(s) 2010

Investigating the Occurrence of Sudden Stratospheric Warmings with Non-linear Statistical Methods

Christian Blume (1), Katja Matthes (1,2), Illia Horenko (3), and Ulrike Langematz (1)

(1) Free University of Berlin, Institute for Meteorology, Germany (christian.blume@met.fu-berlin.de), (2) Helmholtz Centre Potsdam, German Centre for Geosciences (GFZ), Potsdam, Germany, (3) Free University of Berlin, Institute for Mathematics, Berlin, Germany

Sudden stratospheric warmings are prominent examples of dynamical wave-mean flow interactions in the Arctic polar stratosphere during Northern Hemisphere winter. They are characterised by a strong increase in temperature and a rapid change of zonal wind in the middle stratosphere on time scales of a few days. Since their discovery in Berlin in 1952 they are well observed but their frequency of occurrence and their prediction remains a difficult task. Observations show a significant dependence of the warming events on various forcings, such as 11-year solar cycle variations, the Quasi-Biennial Oscillation, the El Nino-Southern Oscillation as well as the Northern Annular Mode or the North Atlantic Oscillation. The relatively short length of existing stratospheric observations of about 50 years makes it difficult to statistically isolate the influence of these factors on the frequency of stratospheric warmings. Additionally, non-linear interactions between the forcing factors occur that are difficult to extract with linear time series analysis. In this work we present results from non-linear, multi-dimensional time series analysis. The non-linear contributions of various forcing factors to the occurence of sudden stratospheric warmings are subject of investigation. In particular, the behaviour of temperature and wind data in the polar stratosphere obtained from observation as well as chemistry climate model simulations are studied to obtain a better understanding of frequency and intensity of sudden stratospheric warming events.