Abstract Details

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Organization: Kyoto University
Category: Interdisciplinary Working Groups
Paper ID: 57-IWG-A1418
Title: (IWG7) Temperature trends estimated with finite-length datasets and evaluation of their significance with some idealized models

Abstract:
Increase of green house gases for these years causes climate changes, and some linear trends are determined in global or local measures. However, the earth's climate system has natural interannual variability that may exist even under constant external conditions. In such a case with natural variability, a spurious linear trend may exist, if the length of archived data is not long enough. In this study, we investigate statistical nature of such spurious trends with some idealized theoretical and numerical models. The observational datasets used in this study are the NCEP/NCAR reanalysis data from 1981 to 2000 and the Berlin stratospheric data form 1963 to 2001 (courtesy of Professor K. Labitzke). Numerical datasets obtained by 10 ensembles of 1,500-year integrations with a simple global circulation model same as Taguchi and Yoden (2002) are also used for the argument of statistical significance of the observed trends. The standard deviation of the probability distribution function (PDF) of spurious trend for data length decreases in proportion to . This is another independent derivation of the dependence on obtained by Weatherhead et al. (1998) in their basic trend evaluation. Statistical significance of linear trends obtained from observed data can be estimated by the t-test when , where is the kurtosis of the PDF of the natural variability. A cooling trend in the summer stratosphere in mid-latitudes is shown to be highly significant with the t-test. In the other cases when is not long enough for the t-test (e.g. in the winter polar region), we have to know the PDFs to test the statistical significance. Though the observed data of several decades is not long enough to examine the PDFs, they can be examined by a numerical experiment under a perfect model assumption. References [1] M. Taguchi and S. Yoden, J. Atmos. Sci. 59, 3037 (2002). [2] E.C. Weatherhead, G.C. Reinsel, G.C. Tiao, X.-L. Meng, D.Choi, W.-K. Cheang, T. Keller, J. DeLuisi, D.J. Wuebbles, J.B. Kerr, A.J. Miller, S.J. Oltmans and J.E. Frederick, J. Geophys. Res. 103, 17149 (1998).

Presentation Mode: Oral

Keywords: linear trend; spurious trend; internal variability; data length; PDF.

Status: Pending.

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