Bayesian Detection of Trends in the Vertical Structure of the Atmosphere

S S Leroy (Jet Propulsion Laboratory, California Institute of Technology, 4800 oak Grove 1 Dr., Pasadena, California, 91109; ph. 818-354-4515; e-mail: Stephen.S.Leroy@jpl.nasa.gov)

Optimal fingerprinting is derived using Bayesian statistics and is used to demonstrate how future vertical stratospheric data might be organized to attribute causes to climate signals. Bayesian analysis is applied by assuming that (1) the climate covariance statistics are Gaussian and known, (2) the forms of the climate signals are known absolutely but (3) their amplitudes are unknown. Thus the prior information is a model prediction of signal amplitudes as they might appear in a given data set. Without any prior information, the result is identically the same as optimal fingerprinting. In addition, *all* possible climate signals must be considered when even just one is sought after, and any errors in the prescribed forms for those signals can cause misattribution. In the future, Bayesian analysis can be used to quantify the impact of uncertainties in signal forms on the detectability of those signals.

The best evidence that global warming is the result of anthropogenic greenhouse gases is that its temporal pattern is rarely realized by unforced numerical models of the climate. Further evidence would be if remotely sensed long term trends in the vertical structure of the atmosphere are found to be similar to model predictions of the effects of anthropogenic greenhouse gases. The data required to measure such long term trends must be easily repeatable and free of calibration error. Two such data types are possible: radio occultations of the Earth's atmosphere using GPS and high-resolution interferometer spectra in the infrared. These two data types are probed for their utility in detecting changes in the vertical structure of the atmosphere in the framework of optimal fingerprinting.

American Geophysical Union Abstract Form

Reference# 0000
Session 0.00

1. 1997 Fall Meeting
2. Paper sponsored by G.R. North, 00118060.
3. (a)
   Stephen Leroy
   Jet Propulsion Laboratory
   California Institute of Technology
   MS 183-335
   4800 Oak Grove Drive
   Pasadena, CA 91109 USA
   (b) 818-354-4545
   (c) 818-393-6516
   (d) Stephen.S.Leroy@jpl.nasa.gov
4. A
5. (a) A02
   (b) 1600, 1610.
6. N/A
7. 50% J. Climate
8. $50
   Stephen Leroy, 818-354-4515
   VISA
   4128 0037 5399 8320
   exp. 07/99, zip code 91106
9. 1. Program chair: G R North
10. No special instructions
11. Regular author

Date received: 25 JUL 95
Date formatted: August 27, 1997
Form version: 1.3