

## ***Interactive comment on* “Technical Note: Long-term memory effect in the atmospheric CO<sub>2</sub> concentration at Mauna Loa” by C. Varotsos et al.**

**Anonymous Referee #2**

Received and published: 9 December 2006

Using detrended fluctuation analysis (DFA) to long time series of different data became very popular last several years. The idea to use DFA to study a long-term persistence of the atmospheric CO<sub>2</sub> concentration looks simple but promising. The main result of the paper is finding that the fluctuations of the CO<sub>2</sub> concentrations shows 1/f type long-range persistence from the Mauna Loa data. Obtained correlation patterns will add new view to other studies concerned the long-range memory in atmosphere and climate behavior and can help to verify the future climate and weather models. However in Conclusion would be interesting if authors can discuss how this result can help in recognition of anthropogenically induced changes caused by increased CO<sub>2</sub> emissions to the atmosphere on the background of natural atmosphere changes. Will be useful to discuss the mechanisms responsible for obtained feature in details and ex-

Full Screen / Esc

Printer-friendly Version

Interactive Discussion

Discussion Paper

pand discussion on positive application of received results for climate models and other corresponding issues.

It is surprising why authors limited themselves by discussion the Mauna Loa data only. I'd propose authors to compare the DFA-results of Mauna Loa data against South Pole CO<sub>2</sub> observation 1957-2006 time series, for example. That will help to make more general conclusions and estimate (or avoid) the local Mauna Loa conditions. That seems very useful because South Pole data show much less seasonal dependence (see for example <http://cdiac.ornl.gov/trends/co2/sio-spl.htm>).

At the start of paragraph 2 authors explained that at Mauna Loa "four air samples are collected each hour and are analyzed by infrared spectroscopy for CO<sub>2</sub> concentrations", however for analysis "the averaged mean monthly values of the CO<sub>2</sub> concentrations are analyzed". Why authors don't use all or daily mean data and how it could change the results in this case would be interesting.

At the last paragraphs of Introduction authors partly explained why they used DFA analysis and didn't apply Fourier analysis or wavelet technique. However it is not very clear especially for this small sequence of data (about 550 observations as follows from the text). To confirm obtained results authors should in detail discuss this matter and show the advantages and disadvantages of the DFA application for that number of time series. The deseasonality process has to be explained in details to confirm effective removal of the seasonality as well. On the Fig. 2 better to plot the results of DFA-2 to DFA-5 (or at least DFA-2 and DFA-5) in other case reader has to believe authors that alpha-value changed from 0.98 to 1.08.

Other notes: Page 11960 lines 14-18: would be interesting to know how authors excluded influences of vegetation and of volcanic vents. How authors use 1958 data (incomplete year)? Page 11962, line 5 and 8: not clear explanation what means the variable "tau"? Page 11962 lines 13-14: what means "a correctly rescaled subset of the original time series resembles the original time series", especially word "a cor-

Full Screen / Esc

Printer-friendly Version

Interactive Discussion

Discussion Paper

rectly"? Page 11963 lines 1-3: sentence "a tendency an increase in the CO<sub>2</sub> concentration to be followed by another increase in the CO<sub>2</sub> concentration at a different time in a power-law fashion" not clear, and what authors mean - "concentrations" or "fluctuations of concentration"? Page 11963 lines 8-10: I disagree with the sentence "the value of the CO<sub>2</sub> concentration in the "following time interval" (up to 11 years) will be the same as in the corresponding "current time interval""? or authors mean "fluctuations"? And what about other history periods, for example in the past (<http://cdiac.esd.ornl.gov/trends/co2/vostok.htm>)? Page 11969 Fig. 2: if we carefully look at the data sequence one can see three periods of  $\Delta t$  (0.5-1.2, 1.2-1.6 and 1.6-2.1) with different  $\alpha$ . What is that physically mean, not all periods expose 1/f type persistence? Page 11970 Fig. 3: the data sequence (circles) finished at  $\Delta t$  less than 2, which means the interval less than 9 years. What happened with 11 years?

In conclusion I'll support the paper after corrections. The paper is interesting, promising and present some new results within the scope of ACP. The paper good structured. Quality of references are appropriate, however the reference list is too long. Authors have to check it to avoid cross-references.

#### Technical corrections:

Page 11958, lines 18-21: the sentence looks too general. Page 11958, line 25: "Hein et al., 2001" - not in References list Page 11960, line 26 and page 11962, line 23: "DFA-/" has to be "DFA-I", "order /" has to be "order I". Page 11960, line 20: "The averaged mean monthly values" - I would propose "The monthly mean values". Page 11962, line 29: "(e.g., Talkner and Weber, 2000; Talkner and Weber, 2000)" - one "Talkner and Weber, 2000" has to be removed.. Page 11962, line 29: " $\alpha$  not equal 1/2" and " $\alpha = 1/2$ " 1/2 should be changed to 0.5. Page 11963 line 9: after word "concentration" need to add "in". Page 11963 line 21: probably after word "uncorrelated" has to be mentioned Fig.3, because not mentioning of Fig. 3 in the text. Page 11965, line 25: need to correct word ".uctuation", has to be "fluctuation". Page 11965, line 33 to page 11966 line 5: authors have to check and make correct order with this

two references. I suppose that here has to be one (same) reference with corresponding corrections in the main text. Page 11966, line 6: the word "and" has to be replaced before "Schellnhuber". Page 11966, line 13: this reference has to be moved after "Schulz" in alphabet order. Page 11966, line 17: instead "et al." has to be added other authors. Page 11967, line 1: put comma after "2002" and full stop after "Environ", "R" has to be "Res.". Page 11967, line 3-4: make correct order with this reference - space after "C.:", lower-case letters, full stop after "Sci" and "Pollut". Page 11967, line 6: remove space in "21 109-21 121". Page 11967, line 14: remove space in "I ayer" and delete brackets. Page 11967, line 17: "60 degrees S-60 degrees N" has to be "60 S-60 N" like in reference.

---

Interactive comment on Atmos. Chem. Phys. Discuss., 6, 11957, 2006.

Full Screen / Esc

Printer-friendly Version

Interactive Discussion

Discussion Paper