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Universal Spectrum for Atmospheric Aerosol Size Distribution: Comparison with PCASP-B Observations of VOCALS 2008

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Abstract: Atmospheric flows exhibit scale-free fractal fluctuations. A general systems theory based on classical statistical physical concepts visualizes the fractal fluctuations to result from the coexistence of eddy fluctuations in an eddy continuum, the larger scale eddies being the integrated mean of enclosed smaller scale eddies. The model predicts (i) the eddy energy (variance) spectrum and corresponding eddy amplitude probability distribution are quantified by the same universal inverse power law distribution incorporating the golden mean. (ii) The steady state ordered hierarchical growth of atmospheric eddy continuum is associated with maximum entropy production. (iii) Atmospheric particulate size spectrum is derived in terms of the predicted universal inverse power law for atmospheric eddy energy spectrum. Model predictions are in agreement with observations. Universal inverse power law for power spectra of fractal fluctuations rules out linear secular trends in meteorological parameters. Global warming related climate change, if any, will be seen as intensification of fluctuations of all scales manifested immediately in high frequency fluctuations. The universal aerosol size spectrum may be computed for any location with two measured parameters, namely, the mean volume radius and the total number concentration and may be incorporated in climate models for computation of radiation budget of earth-atmosphere system.

Keywords: *complex systems and statistical physics; general systems theory; maximum entropy principle; universal inverse power law spectrum; universal spectrum for atmospheric suspended particulates; fractal fluctuations; chaos and nonlinear dynamics.*

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