The scaling properties of meteorological analyses and numerical models of the atmosphere

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Between the outer planetary scale and inner (viscous) dissipation scale, the basic equations of the atmosphere have no characteristic lengths. We therefore expect that the corresponding numerical models will be scaling (i.e. have statistics such as spectra which are power law functions of space-time scales). In the last few years, the models have become large enough (cover wide enough range of scales) that their scaling properties can be fairly easily determined using a variety of analysis techniques. Since the empirical scaling characteristics of the atmosphere are often well-known, this allows us to perform statistical evaluations of model performance. This overcomes many of the problems of inadequate data which plague attempts to evaluate performance on individual realizations. Indeed, by systematically studying the scaling characteristics of the empirical data, the analyses, and then the model integrations, we can examine the "stochastic coherence" of the data assimilation and model system.