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Interactive comment on "Quasi-geostrophic turbulence and generalized scale invariance, a theoretical reply" *by* D. Schertzer et al.

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I would just like to re-iterate my own point of view in order avoid any further misunderstandings:

1) The quasi-geostrophic (QG) theory is developed under an asymptotic expansion of the primitive equation system with particular time and spatial scales in mind. However, here, subtilities of asymptotic expansion must be well understood at the very conceptual level. Those readers who have not done so are highly recommended to read the basic textbooks such as Olver (1974) and Bender and Orszag (1978). The actual range of validity of asymptotic expansion is far from trivial, but it often works well beyond the range of a formal validity of asymptotic expansion. Many cases presented in Bender and Orszag (1978) well demonstrate this point. A more particular example is found

in Fig. 6 of Yano (1992). Here, an asymptotic expansion is essentially (without going into the details) made assuming a smallness of s. The plots show that the asymptotic–expansion solutions (solid curve) fits well the full numerical solutions (dashed curves) for the whole range of s.

2) The QG theory is, by its design, constructed without regard of the scaling law. In this very respect, it is pointless to criticize that QG is *inconsistent* with the scaling behavior of the atmosphere. All the theories have limitations, so does QG. In this respect, it is rather remarkable that the QG theory can explain the k^{-3}-law, in spite of the fact that is not designed to do so, as the authors correctly point out. This point must be highly complimented. It is also emphasized that the contributing authors do not point out any *self-inconsistency* of the QG theory.

3) Importance of the power law in atmospheric physics has to be clearly demonstrated in a manner convincing for majority of meteorologists. Unless, this situation is changed, most of meteorologists would decide to continue to neglect the power behavior the atmospheric processes, though the evidence may appear to be overwhelming to the present authors.

References

Bender, C. M., and S. A. Orszag, 1978: *Advanced Mathematical Methods for Scientists and Engineers*, McGraw–Hill, New York, 593pp.

Olver, F. W. J., 1974: *Asymptotics and Special Functions*, Academic Press, 572pp.

Yano, J.-I., 1992: Asymptotic theory of thermal convection in the rapidly rotating systems, *J. Fluid Mech.*, **243**, 103-131.

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