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Turbulent Cascade of the Lithosphere Deformation in the Tibetan Plateau

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Recently, multiscale statics is found to be relevant in description of the lithosphere deformation of the Tibetan Plateau (Jian et al, Phys. Rev. E, 2019). More precisely, a dual-power-law behavior is observed respectively on the spatial scale range of $50 \leq r \leq 500$km and $500 \leq r \leq 2000$km, which coincidently agrees well with the one reported for the atmospheric movement (Nastrom et al., Nature, 1984). The corresponding high-order scaling exponents demonstrated a nonlinear shape, showing multifractality nature of the underlying dynamics. To diagnose further whether the lithosphere deformation is turbulent or not, the third-order longitudinal structure-function $S_{LLL}(r)=<\Delta u_L(r)^3>$ is estimated, where r is the modulus of the distance vector **r**, and Δu_L is the velocity component that paralleling with **r**. Due to the finite sample size, the experimental $S_{LLL}(r)$ is not reliable when $r \leq 200$km. The measured $S_{LLL}(r)$ is scaled as $-r^{4\pm0.2}$ on the spatial scale range of $500 \leq r \leq 2000$km, indicating the existence of a turbulent cascade. Because of the complexity of the geodynamics, e.g., Coriolis force, mantle convection, India-Eurasia collision, to list a few, the exact force balance is remained unknown. Therefore, the full interpretation of the current observation is not feasible.

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