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Spatial Statistics of atmospheric particulate matter in China

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In this work, the spatial dynamics of the atmospheric particulate matters (resp. PM_{10} and $PM_{2.5}$) are studied using turbulence methodologies. The hourly concentrations of particulate matter were released by the Chinese government (http://www.cnemc.cn). We first processed these data into daily average concentrations. Totally, there are 305 monitor stations with an observations period of 425 days. It is found experimentally that the spatial correlation function $\rho(r)$ shows a log-law on the mesoscale range, i.e., $50 \leq r \leq 500\,\text{km}$, with an experimental scaling exponent $\beta = 0.45$. The spatial structure function shows a power-law behavior on the mesoscale range $90 \leq r \leq 500\,\text{km}$. The experimental scaling exponent $\zeta(q)$ is convex, showing that the intermittent correction is relevant in characterizing the spatial dynamics of particulate matter. The measured singularity spectrum $f(\alpha)$ also shows its multifractal nature. Experimentally, the particulate matter is more intermittent than the passive scalar, which could be partially due to the mesoscale movements of the atmosphere, and also due to local sources, such as local industry activities.