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A simple model for space-time correlation in compressible isotropic turbulence DONG LI, LI GUO, XING ZHANG, GUOWEI HE, LNM, Institute of Mechanics, Chinese Academy of Sciences — Space-time correlation is fundamental to describe turbulent fluctuations in both space and time. Kraichnan proposes the sweeping model for space-time correlations in incompressible isotropic turbulence. Taylor's model for turbulent shear flows is broadly used although it is limited to the frozen-flow assumption. The extension of Taylor's model to non-frozen flows can be achieved by including the eddy distortion with experimental validation. However, these models don't apply to compressible turbulent flows. Lee et al (1992) develop a model for the compressible components of compressible flows. In this study, we will develop a model for space-time correlations of velocity fluctuations which contain both compressible and incompressible components. The model reveals two dynamic processes of turbulent fluctuations in compressible turbulence: (1) the compressible component propagates at the sound speed relative to local flow; (2) the local flow is convected by energy-contained eddies. The model is supported by direct numerical simulation of compressible isotropic turbulence in the sense of that all curves of the normalized time correlations for different wavenumbers collapse into a single one and their envelope is governed by the attenuation term in the present model.

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