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One-dimensional space-discrete transport subject to Lévy perturbations

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We study a one-dimensional space-discrete transport equation subject to additive Lévy forcing. The explicit form of the solutions allows their analytic study. In particular we discuss the invariance of the covariance structure of the stationary distribution for Lévy perturbations with finite second moment. The situation of more general Lévy perturbations lacking the second moment is considered as well. We moreover show that some of the properties of the solutions are pertinent to a discrete system and are not reproduced by its continuous analogue.