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Equivalence of Non-Equilibrium Ensembles and Representation of Friction in Turbulent Flows: The Lorenz 96 Model VALERIO LUCARINI, University of Hamburg, Hamburg, Germany, GIOVANNI GALLAVOTTI, Sapienza University of Roma — We construct different equivalent non-equilibrium ensembles in the Lorenz '96 model of atmospheric turbulence. The vector field can be decomposed into an energy-conserving, time-reversible part, plus a non-time reversible part, including forcing and dissipation. We construct a modified version of the model where viscosity varies with time, so that energy is conserved, and the dynamics is time-reversible. The statistical properties of the irreversible and reversible model are in excellent agreement, if in the latter the energy is kept constant at a value equal to the time-average realized with the irreversible model. The average contraction rate of the phase space of the time-reversible model agrees with that of the irreversible model, where it is constant by construction. We show that the phase space contraction rate obeys the fluctuation relation, and we interpret its finite time corrections. A local version of the fluctuation relation is explored and successfully checked. The equivalence between the two ensembles extends to the Lyapunov exponents.These results have relevance in motivating the importance of the chaotic hypothesis. in explaining that we have the freedom to model non-equilibrium systems using different but equivalent approaches.

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