Wave-mean flow interaction, forced triads, and recharge-discharge Processes as noncanonical Hamiltonian Systems

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We consider recharge-discharge processes in a forced wave-mean flow interaction model and in a forced Rossby wave triad. Such processes are common in atmospheric dynamics and are typically modelled by nonlinear oscillators, for example for mid-latitude storms by Ambaum and Novak (2013) and for convective cycles by Yano and Plant (2012). A similar behaviour can be seen in the simulation of a forced wave number triad by Lynch (2009). Here we construct noncanonical Hamiltonian and Nambu representations in three-dimensional phase space for available and prescribed conservation laws during the recharge and discharge regimes. Divergence in phase space is modelled by a pre-factor. The approach allows the design of conservative and forced dynamical systems.