Geophysical Research Abstracts, Vol. 9, 05207, 2007
SRef-ID: 1607-7962/gra/EGU2007-A-05207

A nonlinear model of the tropical hurricane full life cycle

N.S. Erokhin, N.N. Zolnikova and L.A. Mikhailovskaya

Space Research Institute of RAS, Moscow, Russia (nerokhin@mx.iki.rssi.ru / Phone: 7-496-3334100)

The elaboration of simplified mathematical models to describe a full life cycle of powerfull atmospheric vortices like tropical hurricanes is of the great interest, for example, to study features of a regional large-scale cyclogenesis, to investigate the role of solar-terrestrial relationships in the dynamics of crisis processes in geophysics and to analyze the influence of tropical cyclones on large-scale atmospheric circulations. Early it was suggested the nonlinear model of a hurricane development which takes into account the energy pumping in ocean-atmosphere system, the threshold conditions on system parameters necessary for powerful vortice forming and the hurricane interaction with an environment. The system of coupled nonlinear equations obtained for the wind maximum velocity and the ocean surface temperature in hurricane demonstrates realistically enough the temporal behaviour of vortice generation and its quasistationary stage. In the present paper it is considered the generalization of nonlinear model mentioned above. The generalized model allows to describe the full life cycle of hurricane including its damping stage conditioned by the vortice passage to a land or into an ocean region with more cold water. To take into account the hurricane damping stage a some parameter of environment has been choosen to be a time-dependent function. So this governing parameter decrease below its threshold value results to the hurrricane damping. Numerical calculations performed have confirmed that the generalized model reproduces realistically enough the temporal dynamics of tropical hurricanes full life cycle including the system evolution to the nonequilibrium state with following hurricane development and the vortice damping under the governing parameter change to its subcritical value. The choice of model free parameters allows to control the duration stages of hurricane life cycle, the maximum of wind velocity in it and so on. The generalized model will be of the interest for various geophysical

problems, in particular, it may be used to study the tropical cyclogenesis relationships with the solar activity, to elaborate the nonlinear analytical models of a large-scale regional cyclogenesis, to analyze its statistical properties and, possible, to develope some forecasting models.