Biometeorology of Asthma in South Florida: From Statistical Analysis to Mathematical Modeling

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Abstract

Biometeorology has emerged as an interdisciplinary field dedicated to the study of the mutual influence between living things and the surrounding environment. Within this field, the study of the weather – human interaction is of great importance. In this scenario, respiratory disorders, in particular asthma, constitute a subject of particular interest from both, science and health management. Asthma is linked to an out-of-control reaction from the immune system triggered by a diversity of pathways. The inner working of asthma triggering is still under debate and waiting for a proper quantitative description. In this communication, starting from medical records provided by the Department of Health of Florida through the BRACE project and the Florida Asthma coalition, a time series of Emergency Department (ED) visits due to asthma for Miami Dade and Broward Counties is analyzed in details, in such a way that some mathematical models of asthma triggering may be advanced. From thermal stress – epidemic induced asthma to neuro-endocrine-immune interaction models of this disease, a variety of mathematical methods are discussed, which includes: dynamical systems, feedback loops, self-organized criticality, chaos, and synchronization and entrainment in binary trees. Additionally, asthma is a disorder showing all attributes of complex systems behavior. Such integration may raise the interest of both undergraduate and graduate students interested in research projects connecting medicine and mathematics.