



## Theories on tornado and waterspout formation in ancient Greece and Rome

Bogdan Antonescu (1,3,4), David M. Schultz (2), Hugo M. A. M. Ricketts (2), Dragoş Ene (1,4)

(1) Remote Sensing Department, National Institute of Research and Development for Optoelectronics INOE 2000, Măgurele, Romania, (2) Centre for Atmospheric Science, School of Earth and Environmental Sciences, The University of Manchester, Manchester, United Kingdom, (3) European Severe Storms Laboratory, Wessling, Germany, (4) Romanian Association for Applied Meteorology and Education ARMAE, Bucharest, Romania

Tornadoes and waterspouts have long fascinated humankind as showed by the representations in myths and popular beliefs. Originally considered as having supernatural causes, weather phenomena were first explained through natural causes by the Greek natural philosophers. In "Meteorologica" (c. 340 BC), Aristotle was one of the first natural philosophers to speculate about the formation of tornadoes and waterspouts. For Aristotle, tornadoes and waterspouts ("typhon") were associated with the wind trapped inside the cloud and moving in a circular motion which later escaped carrying the cloud with him in a descending motion. Other Greek philosophers, such as Theophrastus and Epicurus, further developed the theory proposed by Aristotle to explain the formation of tornadoes and waterspouts. Roman natural philosophers were also influenced by Aristotle's ideas. For example, Lucretius, Seneca, and Pliny the Elder adopted Aristotle's explanations for the formation of tornadoes and waterspouts and also added their own speculations (e.g., tornadoes do not need a parent cloud). Ignored for a long period in Europe, "Meteorologica" was translated into Latin in the 12th century from an Arabic version. Over the next centuries "Meteorological" exerted a greater influence on the speculation about weather phenomena. A series of books published in the 17th century in Italy and France marks the beginning of the theoretical and observational studies on European tornadoes and waterspouts. In the 19th century, the early theories proposed by Greek and Roman natural philosophers on tornadoes and waterspouts were cited by researchers only as historical pieces, but core ideas of modern theories on these phenomena can be found in this early literature.