Evaluation and forecasting of convective events with the Dynamic State Index (DSI)

T. Schartner, P. Névir, G.C. Leckebusch, and U. Ulbrich

Freie Universität Berlin, Berlin, Germany

Extreme weather events such as thunderstorms, hail and heavy rain can pose a threat to human life and to considerable tangible assets. The weather prediction of such events is one of the most difficult tasks for meteorologists. Over the last 50 years a lot of parameters, derived from soundings, were developed for the description of thunderstorms. Based on the energy-vorticity theory a new parameter was created in order to visualize convective extreme events. This parameter called Dynamic State Index (DSI) shows the deviation from an adiabatic, dry, inviscid and stationary atmosphere. In other words the DSI shows important atmospheric phenomena associated with diabatic and non stationary processes. In the physical sense the index combines the conservation of energy with the conservation of Ertel's potential enstropy.

Former results indicate a remarkable connection between the novel index and precipitation. A new application concerning the forecast of thunderstorms and lightning occurrence is developed in the frame of RegioExAKT, funded by the Federal Ministry of Education and Research (BMBF). In this contribution the ability to predict thunderstorms, using DSI, CAPE and the combination of both is shown. In this approach the DSI is handled as an activation parameter and CAPE as an availability parameter. This combination of both parameters gives a more reliable forecast than a single parameter. On the basis of case studies and statistical investigations the relationship between lightning events and DSI is revealed. For computing the DSI the operational limited area high resolution model COSMO-DE (2.8 km, 51 layer) of the German Weather Service is used. The lightning data are provided by nowcast GmbH. The area under investigation is southern Germany and the period of study is May to September 2007. The study aims to develop an optimized nowcasting procedure, which will be initially tested at Munich Airport.