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Instability indices as an indicator of thunderstorms in East Bulgaria - preliminary results based on discriminant analyses

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The work is directed to test the ability of some instability indices to be used as an indicator of lightning from convective clouds. Three instability indices (CAPE, Lifted Index and K Index) are calculated using environmental conditions of 78 days with precipitation over the east of Bulgaria from May – September 2006. The data at the surface necessary for the calculations of the instability indices are taken from synoptic stations of National Institute of Meteorology and Hydrology (NIMH) located in four cities in eastern Bulgaria. Two of the stations (Varna and Burgas) are situated along the coast, while the others (Dobrich and Razgrad) are inland stations. Aerological sounding at 0000 UTC and 1200 UTC for the station near the storm development, obtained by the numerical model GFS are used. The cases have been divided into two samples – precipitation with lightning (82) and precipitation without lightning (109).

The analysis of mean values of instability indices show that thunderstorms in the east of Bulgaria developed predominantly at lower values of CAPE, LI and K index than in the USA. The results also reveal that although there is a significant difference between the mean values of the studied indices in both samples, none of the used instability indices alone is able to discriminate between precipitating clouds with lightning and precipitating clouds without lightning.

Using calculated three instability indices with aerological sounding at 0000 UTC and 1200 UTC two different classification function are obtained, based on discriminant analysis. The results show that using aerological sounding in 0000 UTC, 68.6% of the cases are correctly classified (66.9% of the precipitation without lightning and 70.7% of the precipitation with lightning). Using aerological sounding in 1200 UTC 71.7% of the cases are correctly classified (68.8% for precipitation without lightning and 75.6% for precipitation with lightning). This result suggests that instability indices can be used as additional (to other forecasting tools) indicators for thunderstorms. One can expect that classification function with better forecasting ability may be obtained using data from larger number of years and stations. Additionally the improvement may be obtained if classification functions for the coastal stations and the inland stations are derived separately.