

## **Abstract**

Conditions for the formation and development of weak-forcing derechos play a crucial role in operational meteorology for their successful forecasting. Therefore, this master thesis is focused on studying the convective environment where derechos evolve. The motivation for writing this thesis is the fact that in Europe there is no complex and robust study that deals with the conditions during the evolution of weak-forcing derechos, despite the fact that these very severe and widespread storms cause considerable damage in Europe in the summer season. A total of 1453 proximity soundings or pseudo-soundings from the ERA5 reanalysis were analysed in relation to 48 weak-forcing derechos occurring in central Europe between 2000 and 2023. The values of 37 characteristics representing the convective environment averaged for the whole derecho damage path were calculated, and the relationship between these characteristics was examined. The preconvective environments were studied according to their intensity and during the life cycle of derechos. The ability of different characteristics of the convective environment to discriminate between categories of intensity and the life cycle of derechos was then evaluated using a non-parametric Mann-Whitney U test.

This thesis presents several key results of conditions during the evolution of weak forcing derechos in Central Europe. It was found out that derechos in Central Europe form in environments with lower CAPE values than in the USA, but lower CAPE values are successfully compensated by higher values of deep layer vertical wind shear. Apart from this, derechos move from a relatively wetter environment near the frontal boundary to a relatively drier environment and dissipate mainly due to the small vertical temperature gradient near the surface. In contrast, the values of precipitable water, which is the most important characteristic for predicting the intensity of derechos in central Europe, were almost unchanged during the life cycle of derechos. Apart from these key results, the investigated derechos confirm other interesting features of the convective environment, such as the role of elevated convection on the dissipation of derechos or the fact that the characteristics of vertical wind shear and helicity have no significant influence on derecho intensity. The spatial characteristics of derechos indicated that derechos mostly started to develop at the northern base of the Alps and mostly dissipated over the Czech Highlands or over Slovakia.

**Keywords:** Derecho, squall line, proximity sounding, instability, vertical wind shear