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Measurement of temperature and humidity profiles on a cable car as a tool for the determination of atmospheric stability

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The purpose of this contribution is to asses the potential of meteorological data collected from a cable car for the development of atmospheric stability indices in the lower troposphere. This research is conducted within the EvaSim-Project (Coupled Traffic and Hydraulic Simulation to Aid in Emergency Response Planning) which is part of the research program "Rescue and Protection of Humans" founded by the German Federal Ministry of Education and Research (BMBF). The central point of the project is the increase of the safety of the population in urban areas during floods. The main interest from the viewpoint of hydrology is focused on extreme rainfall events and flooding of urban areas and transportation infrastructure, dam failure or flash floods. One of the investigation areas of this project is located in the south-eastern German Alps close to the Austrian boarder. This is a small alpine catchment for which is prone to flash floods and therefore a reliable forecast for such floods mostly caused by convective rainfall events is important.
Commonly, weather balloons with radiosondes are used for the analysis of vertical atmospheric layering. These weather balloons reach high altitudes and atmospheric layering can be determined for the entire troposphere. On the other hand, these balloon ascents are expensive, require the appropriate equipment and permissions and cannot be conducted several times a day on an operational basis. Therefore, a cable car in the study area was equipped with meteorological instruments which provide continuous data during the operating hours. The meteorological parameters that are measured on the cable car are atmospheric pressure, humidity and air temperature. This data is used for the derivation of further meteorological variables (e.g. specific humidity, vapour pressure, dew point temperature, etc.) which are relevant for atmospheric layering. Although the measurement range is limited to 1100 m of vertical elevation between the valley and the summit station of the cable car, it is one aim of this research work to evaluate how these data can be used to determine small-scale vertical air layering in this catchment area and if tendencies for convective thunderstorm events can be recognized. If this proves successful, these cable car measurements could be implemented in a (real-time) thunderstorm forecasting system in this small alpine catchment and thus extend the forecast lead time.