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The PBL and other thermodynamic indices for the study of climate change

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The height of the planetary boundary layer is strongly influenced by the surface of the earth since it is directly in contact with it. In this study we want to discuss the correlation between global warming and PBL variation. This is addressed using both the boundary layer height and other thermodynamic indices. In this study we want to highlight how the variation in the height of the PBL, together with other thermodynamic indices, represent an indication of climate change. PBL variations are therefore analyzed both in the daytime and in the night case, by means of radiosonding profiles from the Global Integrated Archive (IGRA) at the mid-latitudes in the range [30 °; 50 °] N. Data from the European Center for Medium-Range Weather Forecasting (ECMWF) and all the GRUAN station in the same latitude belt station GCOS Upper-Air Network (GRUAN) are used as a comparison dataset for atmospheric parameter uncertainties.

The study reports a statistical analysis over 40 years, in order to have an evolution of thermodynamic variables both on monthly, seasonal averages and also annual. In general, a good agreement is found for the nighttime data compared between IGRA and ERA5, while during the day, the boundary layer height estimates in Europe with ERA5 are characterized by lower spatial homogeneity than those obtained with IGRA.

Finally, the comparison between the Lindenberg data as processed at high-resolution by GRUAN and as provided to IGRA at a lower resolution, shows the significant impact of using high-resolution data in the determination of the boundary layer height. [1,2]

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