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New challenges in forecasting thermal convection using the equivalent isothermal layer method

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The aim of this study is to assess in a new approach the use of the method developed by the U.K. meteorologist Gold to forecast the thermal convection in fair weather conditions used extensively by glider pilots to stay airborne.

Gold assessed the impact of the solar warming on the surface atmospheric layer in terms of the depth of the isothermal layer equivalent with the real layer transformed into an adiabatic one as a function of the local time and the month in the year and he expressed the respective values for U.K. in a tabular form.

Therefore, the first goal of the study was to find the corresponding values of the depths of the equivalent isothermal layer for Romania. The main data used for such a calculus were the national radiosoundings from Bucharest and the half-hourly weather parameters contained in the METAR messages at the Bucharest-Otopeni Airport, located relatively close to the radiosounding site, for the period from January 2017 to May 2018.

Then, a simple regression analysis was applied on the equivalent isothermal layer depth values found for Romania, as well as for the values found by Gold for U.K., in order to determine the relationship between those values and the local time for each month in the year. The function relating to the depth of the equivalent isothermal layer $\boldsymbol{D}$ (hPa) and the local time $\boldsymbol{t}$ (hours), $\boldsymbol{D}$=f($\boldsymbol{t}$), is a cosinusoidal function of the form $\boldsymbol{D}$=a+bcos(c$\boldsymbol{t}$+d) with a,b,c independent constants that are specific for each month in the year. This function was validated and can offer new opportunities to improve the forecasting of thermal convection in fair weather conditions, at any time and location of interest during the day. Moreover, taking into account that today, with an appropriately equipped drone, vertical profiles of temperature and humidity in the planetary boundary layer (PBL) are available at reasonable costs. Therefore, the use of equivalent isothermal layer method might be a cheap and handy method to be used for high accuracy forecasts on thermal convection, particularly for soaring flight.