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Development of UAS-based measurement network for routine atmospheric vertical profiling

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According to a survey by the *World Meteorological Organization* (WMO) there is a serious lack of data from measurements describing the vertical characteristics of the atmosphere. This, besides the insufficient determination of the current state, also affects the accuracy of meteorological forecasts. WMO sees the use of *Uncrewed Aircraft Systems* (UAS) for atmospheric measurement as a possible solution to this problem. Therefore, WMO coordinates a global campaign in 2024 to demonstrate the capabilities of UAS measurements as a possible operational data source. From Hungary, *MouldTech Systems* (MTS) is the only registered participant so far, and they started the development of an UAS-based measurement network for routine atmospheric vertical profile measurements. The measuring UAS was designed and manufactured at MTS considering the operational weather limits of the flights to approach the level of applicability as radiosondes. The flyability of UAS was validated using ECMWF ERA5 reanalysis fields. The average values of applicability are between 90-95% at the planned measurement sites. MTS as a drone operator organization has already obtained operational authorization from the national competent authority for three different locations in Hungary to perform the profiling operation. During this operation, the drone can climb up to 2500 m AMSL to cover the height of the planetary boundary layer regardless of seasons. In accordance with the WMO's expectations the redundantly installed sensors measure the temperature, the humidity, and the pressure. Besides these variables, the wind vectors are calculated from the telemetry data provided by UAS. All the meteorological information is collected in our data server in real-time via LoRa communication. On an experimental basis, the measured data are assimilated into our numerical weather prediction model to gather as much experience as possible to estimate the effective range of the data assimilation in our NWP domain and determine the ideal spatial density of the measurement sites. In summary, in our presentation, besides the achieved outcomes of the development and the bridged obstacles, we would like to introduce the UAS itself, the complete functionality of the measurement network, and the related future challenges of normal operation.