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Horizontal wind estimation within the planetary boundary layer by sounding with unmanned aerial systems

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Measurements of wind speed and wind direction with conventional equipment and remote sensing methods are often limited with respect to the three-dimensional range. For that reason, unmanned aerial systems (UAS) were introduced about 15 to 20 years ago to measure meteorological variables such as air-temperature, humidity and wind, besides ground based remote sensing techniques.
However, there are still challenges when measuring the wind components speed and direction due to the complexity of measuring the airspeed of UAS. In addition to the fact that devices such as five hole probes are expensive and fragile, the limited take-off-weight is another reason for these challenges.
Thus, wind estimation from GPS data by using the Best-Curve-Fitting (BCF) method is presented in this poster. The BCF method was first introduced by Bonin et al. (2013) and has been modified for the purposes of this research. The method enables us to calculate wind direction and wind speed with respect to differences between headwind GPS speeds and tailwind GPS speeds of UAS. It has to be shown that estimated wind data is valid and can be compared to traditional methods of wind measurements. For that reason, wind estimations using the BCF method were compared to a SODAR-RASS and to a measurement flight with a manned microlight aircraft. The gained data has got a high vertical resolution. Furthermore, the quality of these estimations is shown during the interpretation of datasets from an international field campaign and other measurement campaigns.