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Wind profile correction algorithm based on Atmospheric Boundary Layer stability profile

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In recent years, the use of radar wind profilers (RWP) at airports has grown significantly with the aim of supporting decision makers to maintain the safety of aircraft landings and takeoffs.

The RWP provide vertical profiles of averaged horizontal wind speed and direction and vertical wind velocity for the entire Atmospheric Boundary Layer (ABL) and beyond. In addition, RWP with Radio-Acoustic Sounding System (RASS) are able to retrieve virtual temperature profiles in the ABL.

RWP data evaluation is usually based on the so-called Doppler Beam Swinging method (DBS) which assumes homogeneity and stationarity of the wind field. Often, transient eddies violate this homogeneity and stationarity requirement. Hence, incorrect wind profiles can relate to transient eddies and present a problem for the forecast of high-impact weather phenomena in airports. This work intends to provide a method for removing outliers in such profiles based on historical data and other variables related to the Atmospheric Boundary Layer stability profile in the study region.

For this study, a dataset of almost one year retrieved from a RWP LAP3000 with RASS Extension is used for a wind profile correction algorithm development.

The algorithm consists of the detection of outliers in the wind profiles based on the thermodynamic structure of the ABL and the generation of the corrected profiles.

Results show that the algorithm is capable of identifying and correcting unrealistic variations in speed caused by transient eddies. The method can be applied as a complement to the RWP data processing for better data reliability.

Keywords: atmospheric boundary layer; stability profile; wind profile