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THE WIND PROFILE WITHIN THE SURFACE BOUNDARY LAYER MEASURED BY IN SITU (anemometric tower) and REMOTE SENSING (mini-sodar) TECHNIQUES

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The knowledge of the wind profile within the surface boundary layer is very important for different reasons like air quality dispersion, wind energy studies, etc. The wind profile from the surface up to 200 m height has been measured in a coastal tropical (2 ˚S) site in Brazil by two different techniques: in situ wind tower (a 70 m height and with 6 levels (6, 10, 16, 28, 43 and 70m) of wind measurements made by an aerovane R. M. Young, USA) and remote sensing (4500 MHz mini sodar measuring the acoustic signals with 5 m height interval by ASC, USA). The measurements from the wind tower were made each 5 s and its average/standard deviation were computed and saved. Initially the two instruments were collocated close together (100 m of distance) and later they have been separated (by 6 km) in order to study the spatial variation of the atmospheric flow at this site. The data set consist of 3 month of data splitter in 10 min time interval. The climatology shows winds from moderate to strong (in the range from 6.0 – 8.0 m/s) and wind direction from NE (45 degrees). Although this site is at a coastal area, there is no signal of a secondary thermal circulation (sea breeze) as the local winds (trade winds) are very strong and dominate the pattern. The analysis was done considering all data and divided by daytime (06-18 h local time) and nighttime (18 – 06 h) to study its dependence on atmospheric stability. There is no significance difference between the measurements comparing daytime/nighttime as the windspeed is very strong (higher than 6 m/s) and the thermal stability is approximately near-neutral most of the day (95% of the time the stability parameter lies between the range -0.02 up to +0.02). Consequently the windspeed profile obeys the logarithmic law (a statistical correlation showed a value of 0.927) and turbulence parameters (friction windspeed (u*) and roughness parameter (z0) were obtained. These turbulence parameters estimations (both tower and mini-sodar) ranged from 0.5-0.6 m/s for u* and 0.3-0.4 m for z0. The scatter plot (with 11850 pairs of values) between windspeed data shows that the in situ measurements tends to be higher (by 1-2 m/s) than the remote sensing and there is a wind direction difference around 5 degrees. The windspeed data at 70 m (level 6 of the tower) correlates very well not only with 70 m as well as 50, 60, 80 and 90 m from minisodar. This is due to the fact the the momemtum is very well mixed within the surface layer, especially between 50-200 m, so the winds (both windspeed and direction) are constant in the vertical. The windspeed temporal variability (indicated by the standard deviation) was also studies for both instruments and its shows values around 1,5 m/s: the in situ measurement shows lower variability than the mini-sodar.