

Continuous PBL measurements of the project ROM during the MAP SOP: sodar and ultrasonic data

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Introduction

During the MAP SOP, a phased array sodar (Remtech PA2) and an ultrasonic anemometer (Metek USA-1) have been operated continuously at a waste deposite near Lustenau in the Austrian Rhine Valley, about 5 km south of the Lake of Constance. Statistics are calculated for the wind data observed at the 20 sodar levels (50 m averages) between 50 and 1000 m above ground. The performance of the sodar during Foehn and the signal of Foehn in the heat flux measurements are discussed in this contribution. Both data sets are used to detect Foehn events at this particular site.

Results

The sodar renders a surprisingly high number of valid data during Foehn periods. Most valuable half hourly wind data were recorded between 250 and 350 m above ground. Above 200 m above ground, more sodar data was valid during Foehn periods than during no Foehn periods (Fig.1). Since the Foehn often does not reach the ground in this area, strong shear layers are persisting, favourable for a good Sodar performance.

Wind roses of all Foehn and no Foehn cases are depicted in Figure 2. Averaged for all Foehn cases, the maximum average wind speeds of 7 m/s is found at southwesterly directions. The wind statistics of all other cases also shows maximum wind speeds at this wind direction (down-valley flow) with lower average wind speeds (6 m/s).

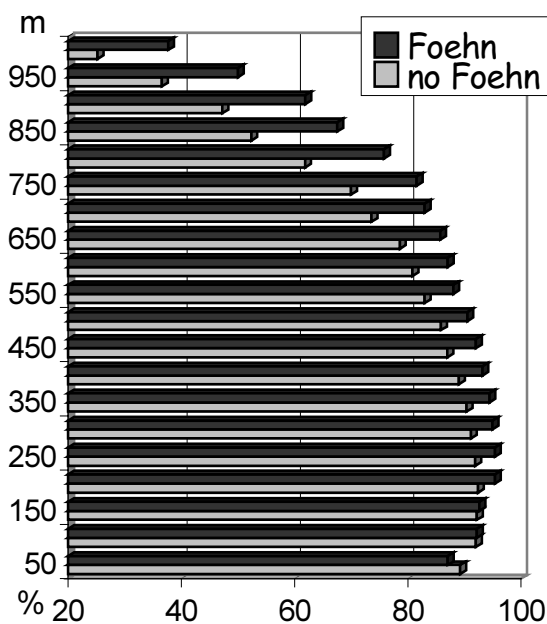


Figure 1: Percentage of available data at sodar levels (in m above ground) for all Foehn (black) and all no Foehn (grey) cases.

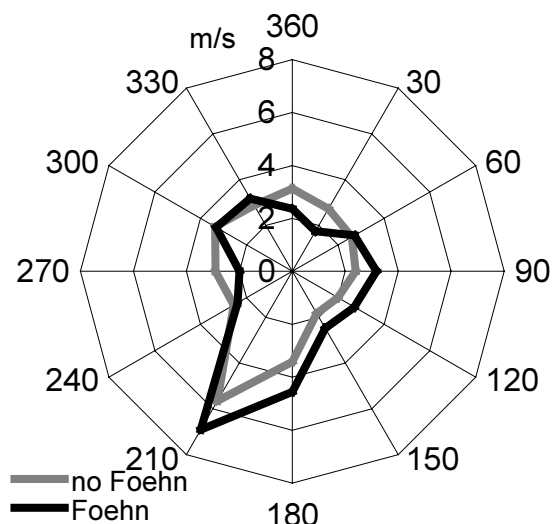


Figure 2: Wind-roses at 250 m above ground for all Foehn (black) and all no Foehn (grey) cases.

Furthermore, as shown in Figure 2, easterly winds are on average stronger during Foehn periods. Comparisons to tether sonde and wind profiler data reveal that the sodar wind direction data is less reliable at higher wind speeds (Piringer et al., 2000). This becomes obvious during intense Foehn episodes at the site as observed on October 24 (Fig.3): unexplainable easterly winds are recorded by the sodar between 13 and 16 UTC when maximum wind speeds were prevailing. These erroneous sodar wind direction measurements may occur when background noise is too high due to gusty wind.

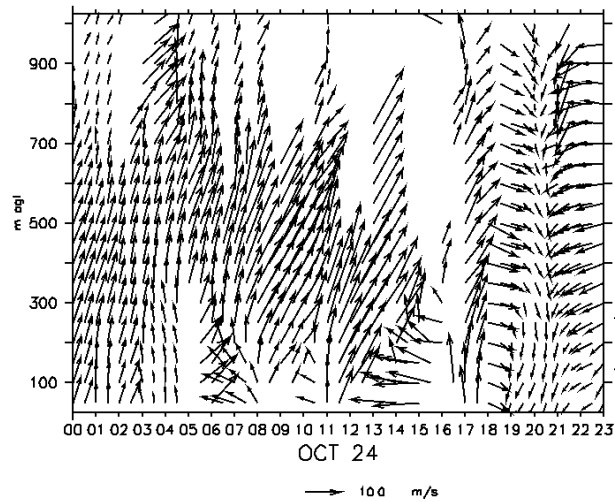


Figure 3: Diurnal evolution of the sodar horizontal wind profile on October 24, 1999 (half hour averages).

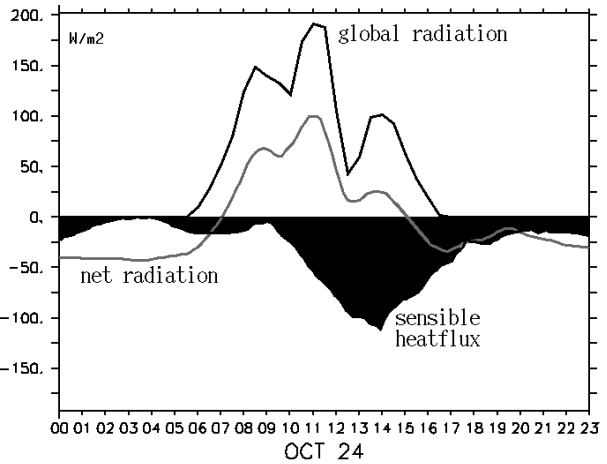


Figure 4: Diurnal course (smoothed) of global-, net radiation and sensible heat flux at Lustenau on October 24, 1999.

The advection of warm air over a cool surface caused a strong negative (ground-directed) - sensible heat flux during the Foehn as is well seen in the right picture of Figure 4. Therefore, values of the sensible heat flux less than -60 and -90 W/m^2 measured with the ultrasonic anemometer were evaluated as indicator for Foehn air reaching the ground. During the strong SOP Foehn cases in September and October, the Foehn flow almost always reached the ground at Lustenau (for sometime during the event). During the Foehn events in November no clear signal of the Foehn flow was recorded by the instruments at Lustenau.

References

Piringer, M., K. Baumann, U. Pechinger, S. Vogt, 2000: Objectives and first results of the Rhine valley ozone study within MAP. submitted to Meteorologische Zeitschrift.

Acknowledgements.

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