Lidar and Sodar are used for assessing the energy yield of future wind park sites. The measured wind speed is typically collected and averaged over a period of some months up to one year in order to achieve sufficient statistical stability.

Here we show that data gaps due to occasional lack of detectable backscatter signal introduce a bias of the results which cannot be eliminated by extension of the measuring period.

The obvious reason for this bias is the correlation of wind speed with expected backscatter intensity and thus with gap frequency.

Since the quantitative relation between gap frequency and bias is hardly predictable, the gap frequency must be so low that the corresponding bias is negligible with sufficient confidence. This can be translated into a request for the system sensitivity defining the lowest detectable reflectivity, a key parameter of Lidar and Sodar systems.

In this study the systematic effect of data gaps due to weak backscatter signal has been revealed by offline analysis of original data, but with artificially decreased system sensitivity. The daily cycle of wind speed and availability for Sodar data at 140 m height with two system sensitivities (original and reduced by 15 dB) is shown in fig. 1.

The Lidar data availability follows also a daily cycle (not shown here), but its shape differs from fig.1 due to the different scattering mechanisms of sound- and light-waves respectively.

<table>
<thead>
<tr>
<th>System</th>
<th>Lidar</th>
<th>Sodar</th>
</tr>
</thead>
<tbody>
<tr>
<td>Type</td>
<td>Stream Line Halo Photoniccs</td>
<td>PCS.2000-64, Metek</td>
</tr>
<tr>
<td>Δz</td>
<td>30 m</td>
<td>20 m</td>
</tr>
<tr>
<td>Δt</td>
<td>10 min</td>
<td>15 min</td>
</tr>
<tr>
<td>Period</td>
<td>2013</td>
<td>2008</td>
</tr>
</tbody>
</table>

DWD boundary layer field site Falkenberg, Germany

Table 1: Data base

The sign of the slope of the red lines in fig. 2 (lowest height) differs from the other lines, obviously because the daily cycle of the wind speed close to ground shows a maximum at noon (see fig. 1) whereas a minimum occurs at greater heights. This is a general feature of the boundary layer over land in moderate latitudes.

**Note:** The axes in fig. 2 are normalized only for clearness of presentation. The true availability is < 100% for the original data and is decreasing with increasing height. The true bias \( b(\alpha_0) \) at true original availability differs from unity, but it is unknown.

**Attempts of Bias Correction**

If the bias versus availability \( b(\alpha) \)-functions would be universal, the bias could be derived immediately from the observed availability, and it could be corrected.

In order to test this approach, the annual data sets were divided in monthly sub-sets. The monthly \( b(\alpha) \)-functions are actually very different as demonstrated in fig. 3.

The request of universal \( b(\alpha) \)-functions can be relaxed by leaving parameters of the functions free. They can be derived from the normalized branch \( n(\alpha) \equiv b(\alpha)/b(\alpha_0) \) with \( \alpha \leq \alpha_0 \). By extrapolation to \( \alpha = 1 \) the bias can be estimated according \( b(\alpha_0) = 1/n(1) \).

Experiments with linear extrapolations show that 95% availability is necessary for keeping the uncertainty of the residual bias safely below 1%.